

APPENDIX F

TABLES

Table F2.1 Field Investigation Results of Flood Damage (May-June and October, 1998)

#1 Sr. No	Interview sheet No.	Date	Time	GPS locat ion code	location								Altitude by GPS (m)	#2 Land Use	Site or Village	Resident Name	Interviewed age	Occupation	Inundat ion Exp (0-No, 1=Yes)	Yearly Inundat ion times (/year)	Today W.L. (m)
					N	E	S	W	N	E	S	W									
109	-	17-Oct-98	-	-	-	-	-	-	-	-	-	-	305	2	Hargai (Sardar Garhi)	-	-	-	0	-	-
110	-	19-Oct-98	-	-	-	-	-	-	-	-	-	-	306	2	Kukur (near Kasapa)	-	-	-	1	3.5	-
111	-	19-Oct-98	-	-	-	-	-	-	-	-	-	-	304	2	Babi	-	-	-	1	?	-
112	-	19-Oct-98	-	-	-	-	-	-	-	-	-	-	297	2	Titahra	-	-	-	0	-	-
113	-	19-Oct-98	-	-	-	-	-	-	-	-	-	-	312	4	Kurvi (near Kudvi)	-	-	-	1	1	-
114	-	19-Oct-98	18:00	-	-	-	-	-	-	-	-	-	290	1	Nowshera City (Left Bank)	-	-	-	1	0	0.7

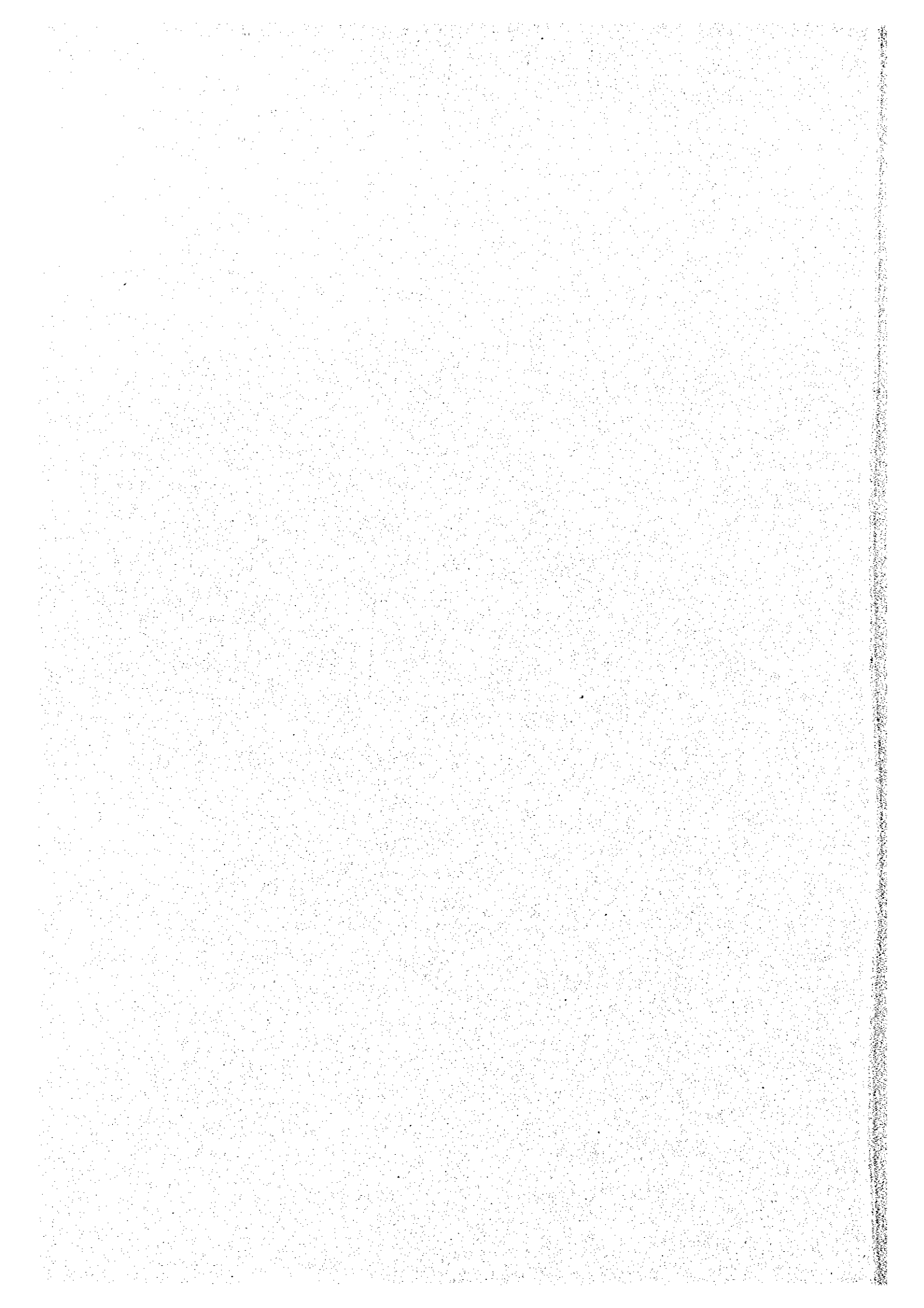
Note:

#1 Serial number matches location shown in Figure 3.5.1 and Figure F2.1.

#2 Land Use: 1=City, 2=Village, 3=Paddy, 4=Farm Field, 5=forest, 6=Grassland, 7=Wilderness, 8=others

#3 Crops : 1=vegetables, 2=fruit, 3=sugarcane, 4=wheat, 5=rice, 6=others

#4 Civil Construction : 1=embankment, 2=bank-protection, 3=spur-dyke, 4=intake, 5=head-gate, 6=DiversionWeir, 7=Canal, 8=others



**Table F2.2 List of Schemes Completed as of December 31, 1997
Flood Protection Sector Project/Kabul river**

Scheme No.	Name of Scheme	Completion Cost (Rs. Million)
CORE PROJECT (TRIBUTARY OF KABUL RIVER)		
N-KN-01-01	Flood Management of Kalpani Nallah Mardan	83.32
	Subtotal	83.32
SUBPROJECT (KABUL RIVER)		
N-KR-05-01	Protection of Agricultural lands and civil abadies of Piari Bala and other villages from erosion/spilling of Adezai River	10.21
N-KR-05-02	Protection of Banoor Shah and Ajun Qila villages against flood action and erosion of Adezai River	4.34
N-KR-05-03	Prot. Of Rashkai & Dalazak villages from flood action of Adezai River	5.62
N-KR-05-04	Protection of villages abadies ans agricultural land of Shahgai against flood action of Adezai River	0.93
N-KR-05-05	Protection of agricultural land and abadies of Mamu Banda from flood action of Adezai River	3.00
N-KR-05-06	Repair and improvement to flood protection work at village Hajizai at left bank of Adezai River	6.22
N-KR-05-07	Protection of village abadies and agricultural lands of Koodai from flood action of Adezai River	10.33
N-KR-05-08	Protection of village abadi and agricultural lands of Garhi Muhkam Shah from flood action of Adezai River	5.31
N-KR-05-09	Protection of Dang Lakhti village by providing spur for flood action of Naguman River	4.06
N-KR-05-12	Protection of agricultural lands, village abadies of Chandan Garhi against flood action in Naguman River	3.94
N-KR-05-14	Protection of houses/cultivated land of Kararrai village against flood action in Naguman River	5.15
N-KR-05-15	Prot. & extension of protection scheme for village abadies & Agricultural land of Village Jala-Bela against flood action in	2.47
N-KR-05-16	Protection of agricultural land villages abadi/tubewell and road for flood action of Shah Alam River	6.76
N-KR-05-17	Training of River Kabul from Momin Garhi to Nowshera, i)Momin Garhi Village, ii)Camp Karoona, iii)Khat Killi	35.38
N-KR-05-18	Protection of Banda Sheikh Ismail and Banda Mulahan against the erosive/inundation action of Kabul River	5.13
N-KR-05-19	Protection of lands and village abadies of Banda Mohib from flood action of Kabul River	20.97
N-KR-05-20	F/prot. Scheme of village Dagai on Khiyali River Distt. Charsadda	6.91
N-KR-05-21	Flood protection scheme of village Shahi Kulali on Khiyali River District Charsadda	6.88
N-KR-05-22	Flood protection scheme of village Utmanzai on Jindi Nallah District Charsadda	2.08
N-KR-05-23	Flood protection scheme of village Adazai on Khiyali River District Charsadda	2.01
N-KR-05-24	Flood protection scheme of village Khattozai on Khiyali/Swat River District Charsadda	1.18
N-KR-05-25	Flood protection scheme of village Mula Khela on Khiyali/Swat River District Charsadda	0.64
N-KR-05-26	Flood protection scheme of village Bela No.4 on Khiyali/Swat River District Charsadda	2.53
	Sub-Total	152.05
	Kabul River Total	235.37

Reference : Quarterly Progress Report Ending December,1997,FLOOD PROTECTION SECTOR PROJECT "

Table F2.3 (3/3) Details of Losses/Damages due to Flood/Rains in N.W.F.P.(1997)

District	50,000 Rs		30,000 Rs		5,000 Rs		7,000 Rs		4,000 Rs		5,000 Rs		2,500 Rs		500 Rs		1,000 Rs				
	No. of Dead Persons (Family-wise)		No. of Permanently Disabled/Crippled Persons		No. of Houses fully collapsed		No. of Houses partially damaged		Cattle Perished		Goat, Sheep, Donkey		Cow, Buffalo, Horse & camel		Total						
	Bread Winner	N.Bread Winner	No.	Comp.(Rs)	No.	Comp.(Rs)	Pacca	Kacha	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)			
	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)	No.	Comp.(Rs)			
1 PESHAWAR	1	35	-	-	-	-	-	-	-	95	87,500	-	-	-	-	-	-	87,500			
2 CHARSADDA	-	-	-	60,000	2	10,000	4	28,000	71	284,000	24	120,000	35	87,500	3	1,500	1	1,000	592,000		
3 NOWSHERA	28	477	-	90,000	4	20,000	26	182,000	42	168,000	14	70,000	391	977,500	1	500	-	1,508,000			
4 MAROAN	49	1,608	2	100,000	6	180,000	22	154,000	62	248,000	64	320,000	1,451	3,627,500	5	2,500	7	7,000	4,639,000		
5 SWABI	36	203	5	250,000	9	270,000	2	14,000	12	48,000	19	95,000	53	132,500	-	-	4	4,000	843,500		
6 BANNU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0		
7 LAKKI	10	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25,000		
8 D.I.KHAN	35	2,257	-	-	-	-	-	193	772,000	-	-	-	-	213	592,500	-	-	-	1,304,500		
9 TANK	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0		
10 ABBOTTABAD	-	-	5	250,000	6	180,000	6	42,000	16	64,000	113	565,000	445	1,112,500	-	-	14	14,000	2,257,500		
11 MANSEHRA	8	12	17	850,000	57	1,710,000	28	140,000	55	220,000	186	930,000	859	2,147,500	130	65,000	90	90,000	6,250,500		
12 BATAGRAM	-	-	1	50,000	2	60,000	5	25,000	1	7,000	5	25,000	67	167,500	34	17,000	7	7,000	394,500		
13 HARRIPUR	-	-	2	100,000	10	300,000	13	65,000	8	56,000	732	3,660,000	3819	9,547,500	40	20,000	18	18,000	13,778,500		
14 KOHISTAN	-	-	-	-	-	-	-	-	6	24,000	-	-	6	15,000	-	-	-	-	39,000		
15 SWAT	-	52	-	-	7	210,000	5	25,000	14	56,000	14	70,000	20	50,000	-	-	4	4,000	457,000		
16 DIR	-	-	4	200,000	2	60,000	3	15,000	-	-	-	-	-	-	-	-	-	-	275,000		
17 CHITRAL	10	155	2	100,000	1	30,000	-	-	80	320,000	-	-	100	250,000	45	22,500	21	21,000	743,500		
18 BUNER	-	-	1	50,000	3	90,000	2	10,000	-	-	4	20,000	2	5,000	10	5,000	11	11,000	191,000		
19 SHANGLAPAR	12	210	2	100,000	4	120,000	11	77,000	51	204,000	2	10,000	21	52,500	32	16,000	9	9,000	598,500		
20 MALAKAND	-	-	-	-	1	30,000	2	10,000	-	-	3	15,000	133	332,500	-	-	-	-	387,500		
21 KOHAT	-	-	1	50,000	-	-	-	-	-	-	4	20,000	-	-	-	-	-	-	70,000		
22 KARAK	10	2	-	-	2	60,000	-	-	7	28,000	28	140,000	41	102,500	18	9,000	14	14,000	353,500		
23 HANGU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0		
NWFP, Total	199	5,021	42	2,100,000	115	3,450,000	78	390,000	100	700,000	621	2,484,000	1,212	6,060,000	7,701	19,252,500	318	159,000	200	200,000	34,795,500

Reference : "District-wise details of Losses/Damages Caused by Flood/Rains in 1995", Provincial Relief Commissioner, Board of Revenue, NWFP.
 "Details of Losses/Damages Due to Rains/Floods 1997, Reported by Relief Department of NWFP", Flood Relief Cabinet Division, Islamabad, GOP

Table F3.1 Frequency of Flood Type (Hydrograph pattern) at Nowshera (Kabul R.) over 3,200 m³/s daily runoff, and Influence due to Warsak (Kabul-R) and Munda H/W or Chakdara (Swat River) from 1964 to 1997.

Type of Flood Hydrograph Pattern	Kabul River	Kabul River	Swat River	Frequency of flood type at Nowshera over 3,200 m ³ /s											
	at Nowshera	at Warsak	at Chakdara or Munda H/W	64	65	66	67	68	69	70	71	72	73	74	75
Type-A	big	big	big	0	0	0	0	0	-	-	-	-	-	-	1
Type-B	big	big	small	2	4	1	2	4	-	-	-	-	-	-	0
Type-C	big	small	big	0	0	0	1	0	-	-	-	-	-	-	1
Annual Maximum Daily Discharge at Nowshera (m ³ /s) (Occur Season/Month)				3,622 Jul	6,169 May	4,528 Jun	4,585 Apr	498 Dec	2,943 Jul	1,922 Jun	2,171 Jul	-	-	2,244 Jul	4,613 Aug

Type of Flood Hydrograph Pattern	Kabul River	Kabul River	Swat River	Frequency of flood type at Nowshera over 3,200 m ³ /s													
	at Nowshera	at Warsak	at Chakdara or Munda H/W	76	77	78	79	80	81	82	83	84	85	86	87	88	
Type-A	big	big	big	1	-	0	-	-	-	-	-	0	-	-	-	0	
Type-B	big	big	small	0	-	3	-	-	-	-	-	1	-	-	-	0	
Type-C	big	small	big	0	-	0	-	-	-	-	-	0	-	-	-	1	
Annual Maximum Daily Discharge at Nowshera (m ³ /s) (Occur Season/Month)				3,113 Aug	2,683 Jul	4,670 Jul	-	2,533 Jun	3,085 Jul	2,159 Aug	2,739 Aug	3,141 Jun	2,434 Jul	3,056 Aug	2,649 Jun	3,453 Jul	

Type of Flood Hydrograph Pattern	Kabul River	Kabul River	Swat River	Frequency of flood type at Nowshera over 3,200 m ³ /s											Total
	at Nowshera	at Warsak	at Chakdara or Munda H/W	89	90	91	92	93	94	95	96	97	98		
Type-A	big	big	big	-	0	1	-	-	0	0	-	-	-	3 (11%)	
Type-B	big	big	small	-	1	1	-	-	1	0	-	-	-	20 (71%)	
Type-C	big	small	big	-	0	0	-	-	1	1	-	-	-	5 (18%)	
Annual Maximum Daily Discharge at Nowshera (m ³ /s) (Occur Season/Month)				2,473 Jul	3,306 May	4,173 Jun	-	-	3,372 Jul	4,039 Jul	-	-	-	-	

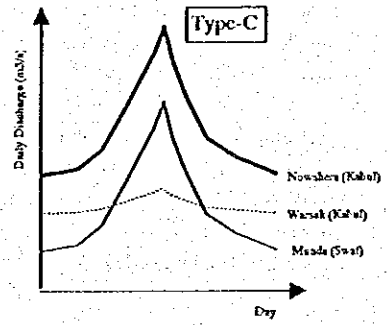
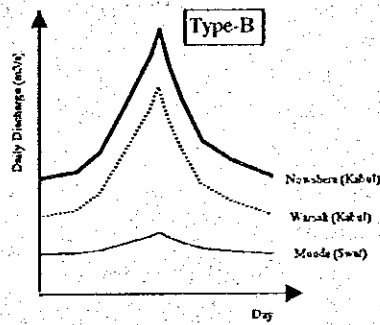
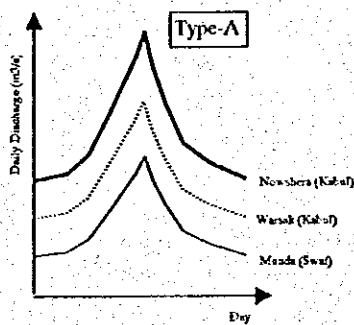


Table F4.1 Comparison between Flood Discharges at Warsak and Munda H/W

No.	Date of Flood Occurred ^{*1}	Warsak (Kabul River) W ^{*2}	Munda H/W (Swat River) M ^{*3}	Percent of Munda Q =M/(W+M) ^{*4}	Flood Type ^{*5}
1	16-Jul-88	1,392	1,440	50.9%	C
2	24-Jul-88	1,201	1,698	58.6%	C
3	31-Jul-89	1,183	1,440	54.9%	A
4	21-Mar-90	482	1,811	79.0%	C
5	21-May-91	2,046	1,238	37.7%	A
6	14-Jul-91	2,536	1,440	36.2%	A
7	06-Apr-94	605	1,811	74.9%	C
8	02-Jul-94	2,054	1,440	41.2%	C
9	11-Jul-94	2,078	1,023	33.0%	C
10	15-Jul-94	1,737	1,440	45.3%	C
11	11-Aug-94	1,272	1,023	44.6%	C
12	25-Mar-95	557	1,336	70.6%	A
13	19-Apr-95	968	1,023	51.4%	A
14	26-Jul-95	1,861	1,336	41.8%	C
15	04-Aug-95	1,329	1,023	43.5%	A
16	05-Aug-95	1,436	840	36.9%	A
Average=				50.0%	

*1 : Date of flood occurred is the date when peak discharge occurred at Munda Headwork of Swat river for the floods over 2000 m³/s at Nowshera station.

*2 : Daily discharge (Source : WAPDA)

*3 : Daily discharge (Source : Irrigation Dep.,NWFP.)

*4 : $=\text{Munda}/(\text{Warsak} + \text{Munda})$

*5 : The type of flood over 2000 m³/s at Noushera station.

Type-A: Munda=flooded, Warsak=flooded

Type-B: Munda=not flooded, Warsak=flooded

Type-C: Munda=flooded, Warsak=not flooded

Table F5.1 Flood Damage Estimation for the Flood Affected Area

8

CCA (%)	CROP		May	June	July	August	
11.8	Maize	Yield Loss (%)	30	40	50	100	
		Damages/acre crop (Rs)	1,314	1,314	1,519	1,862	
		Damages/acre flooded (Rs)	47	62	90	220	
1.2	Fodder	Yield Loss (%)	85	80	75	55	
		Damages/acre crop (Rs)	3,070	3,719	4,214	4,770	
		Damages/acre flooded (Rs)	31	36	38	31	
46.6	Sugarcane	Yield Loss (%)	60	50	40	30	
		Damages/acre crop (Rs)	6,791	6,985	7,822	8,957	
		Damages/acre flooded (Rs)	1,899	1,628	1,458	1,252	
0.2	Orchards	Yield Loss (%)	100	100	100	100	
		Damages/acre crop (Rs)	16,281	16,281	16,281	16,281	
		Damages/acre foded (Rs)	33	33	33	33	
0.93	Vegetables	Yield Loss (%)	100	100	100	100	
		Damages/acre crop (Rs)	8,049	8,049	9,486	9,974	
		Damages/acre flooded (Rs)	75	75	88	93	
0.9	Pulses	Yield Loss (%)	100	100	100	100	
		Damages/acre crop (Rs)	2,811	2,811	3,703	3,714	
		Damages/acre flooded (Rs)	25	25	33	33	
38.4	Other Area (Un Cultivated)	Yield Loss (%)	0	0	0	0	
		Damages/acre crop (Rs)	0	0	0	0	
		Damages/acre flooded (Rs)	0	0	0	0	
Total (%)	100.0						
Total Damages/acre flooded/month (Rs)			2,109	1,858	1,740	1,662	
Flood Occur Frequency from May to August			11%	26%	44%	19%	100%
Total Weighted Damages (Rs/acre)			232	483	765	316	1,796
Total Weighted Damages (Rs/ha)			573	1,194	1,891	780	4,439

Notes:

- 1 Yield loss estimates by crop by month reflect estimates derived for each crop accordingly to flood depth over 0.9 m (3 feet) and 10 days runoff period.
- 2 Damages/acre reflect net potential flood loss estimates by crop by month as detailed in Pre-F/S report where yield loss is not total, damages reflect net loss in income (losses in gross revenue less saving in harvesting, transport, marketing and artisans).
- 3 Estimates are weighted according to cropping pattern within the flooded area.
- 4 Total damages/acre flooded are a summation of individual crop damages.
- 5 Total weighted damages reflect the probability of the flood occurring in May (0.11), Junr (0.26), July (0.44), August (0.19) within this reach.

CCA: Cultivable Command Area

Table F5.2 Village Wise House Hold Size Observed through Site Survey

in June 1998 and October 1998

*3

Household Size = 6.5 (Persons/Unit House)

*1 Sr. No	location						*2 Land Use	Site or Village	Total(1998)		Village Area (km ²)	Density of House per Village are (Houses/km ²)
	N			E					Populati on	House		
	°	'	"	°	'	"						
25	34	17	47.1	71	39	11.1	1	Tangi		8,500	2.00	4,250
30	34	9	05.0	71	43	40.8	1	Charsada	40,000	6,154	3.25	1,893
39	34	2	42.0	71	56	30.8	1	Nowshera (Kalan)		15,000	3.25	4,615
AVERAGE (CITY AREA)												3,586

11	34	13	25.5	71	34	20.3	2	Shabqadar City		100	0.75	133
2	34	19	19.9	71	35	20.1	2	Abazai	20,000			
3	34	17	05.9	71	36	58.9	2	Turlandai	180	28	0.02	1,231
5	34	8	01.9	71	41	36.5	2	Sardaryab village		40	0.02	1,778
10	34	11	10.4	71	39	59.0	2	Amba Dher		500	0.25	2,000
13	34	14	14.7	71	38	06.9	2	Mathra Purana		500	0.10	5,000
14	34	13	08.3	71	39	09.9	2	Kharahe Dispensary		-	0.25	
15	34	13	26.4	71	37	49.9	2	Bacha Garhi		250	0.15	1,667
16	34	12	08.4	71	36	05.3	2	Kangra		1500	0.50	3,000
17	34	10	27.1	71	39	04.7	4	Sandasar		100	2.75	218
18	34	18	51.8	71	34	32.2	2	Solgharhi		500		
19	34	17	07.0	71	35	42.4	2	Sadar Garhi		100	0.06	1,667
20	34	17	10.7	71	35	44.5	2	Kotozai	1,000	154	0.40	385
21	34	17	57.7	71	35	49.0	2	Bela No.4	1,000	300	0.04	7,500
22	34	15	11.4	71	37	15.3	2	Mandezai	?	?		
23	34	15	43.1	71	35	18.7	2	Nazar Garhai	?	?		
24	34	17	27.8	71	36	41.0	2	Mian Walai		60	0.20	300
26	34	15	15.0	71	39	13.1	2	Mirzu Dher		500	0.25	2,000
27	34	14	50.1	71	38	57.7	2	Garhi Dildai		1,200	0.15	8,000
28	34	13	11.3	71	40	41.9	2	Tarnab	3,300	800	0.44	1,818
31	34	7	50.4	71	43	38.6	2	Shahbra		400	0.15	2,667
32	34	10	15.5	71	41	27.5	2	Shaikhan		160	0.05	3,200
33	34	11	47.3	71	41	10.9	2	Nawa Kalle	?	?		
34	34	12	19.5	71	40	12.0	2	Shahai Kulali		200	0.08	2,500
42	34	3	44.4	71	46	57.1	2	Muhib Banda		3,000	1.00	3,000
13'	34	13	08.4	71	39	10.6	2	Kharakai Dispensary		400	0.20	2,000
21'	-	-	-	-	-	-	2	Mulla Khel		120	0.16	762
AVERAGE (LOCAL VILLAGES)												2,535

Note:

*1 Serial number ; refer to Table F2.1.

*2 Land Use:1=City,2=Village,3=Paddy,4=Farm_Field,5=forest,6=Grassland,7,Wilderness,8=oyhers

*3 Household Size : Charsadda 1980 from NWFP 1980 CENSUS.

Table F5.3 Damage Houses Ratio for Total City/Village Houses

	City Tangi	Village Bela No.4
No. of Total Village/Town Houses	8,500	300
No. of Total Damaged Houses in 1995	403	60
	5%	20%

Source : "List of Flood Affectees of Village (translate from Urdu)",
Head Vernacular Clerk (HVC), Dupty Commissioner, Charsadda.

Table F5.4 Damaged Houses Due To Flood/Rains in Charsadda District (1995)

Year	No. of Houses Fully Collapsed			No. of Houses Partially Damaged			Damaged House
	Pacca (Baked house)	Kacha (Unbaked house)	Total	Pacca (Baked house)	Kacha (Unbaked house)	Total	
	No.	No.	No.	No.	No.	No.	No.
1992			100			199	299
1995	3	255	258	41	1,979	2,020	2,278
1996	1	119	120	35	429	464	584
1997	4	71	75	24	35	59	134
'95-97	2.7	148.3	151.0	33.3	814.3	847.7	998.7
Average	0.3%	14.9%	15.1%	3.3%	81.5%	84.9%	100.0%

Reference :

"District-wise details of Losses/Damages Caused by Flood/Rains in 1997", Provincial Relief Commissioner, Board of Revenue, NWFP"

Table F5.5 Damage Cost for Houses

Area Density of Total Houses		Note
City/Town (Urban) areas	3,556 houses/km ²	*1
Local Villages	2,535 houses/km ²	*1
Damaged Houses		
Damage Houses Ratio for Total City/Village Houses		
City/Town (Urban) areas	5% damages of Total Houses	*2
Local Villages	20% damages of Total Houses	*2
Fully/Partially Damage Ratio for Total Damaged Houses		
Fully Collapsed (Destroyed)		
- Unbaked (Kutcha)	14.9%	*3
- Baked (Pucca)	0.3%	*3
Partially Damaged		
- Unbaked (Kutcha)	81.5%	*3
- Baked (Pucca)	3.3%	*3
No. of Damaged Houses		
City/Town (Urban) areas		
Fully Collapsed (Destroyed)	170.0 houses/km ²	
- Unbaked (Kutcha)	25.7 houses/km ²	
- Baked (Pucca)	25.3 houses/km ²	
Partially Damaged	0.5 houses/km ²	
- Unbaked (Kutcha)	144.3 houses/km ²	
- Baked (Pucca)	138.6 houses/km ²	
- Baked (Pucca)	5.7 houses/km ²	
Local Villages		
Fully Collapsed (Destroyed)	506.9 houses/km ²	
- Unbaked (Kutcha)	76.6 houses/km ²	
- Baked (Pucca)	75.3 houses/km ²	
Partially Damaged	1.4 houses/km ²	
- Unbaked (Kutcha)	430.3 houses/km ²	
- Baked (Pucca)	413.3 houses/km ²	
- Baked (Pucca)	16.9 houses/km ²	
Housing Cost per unit		
- Unbaked (Mad) House (Kutcha)	51,200 Rs/unit house	*5
- Baked (brick) House (Pucca)	231,400 Rs/unit house	*4
Adjusting Conversion Factor for Damage Levels		
Fully Collapsed (destroyed)		
- Unbaked (Kutcha)	100%	
- Baked (Pucca)	100%	
Partially Damaged		
- Unbaked (Kutcha)	30%	*6
- Baked (Pucca)	15%	*6
Damaged Houses Cost		
City/Town (Urban) areas		
Fully Collapsed (Destroyed)	3,724,500 Rs/km ²	
- Unbaked (Kutcha)	1,398,200 Rs/km ²	
- Baked (Pucca)	1,293,100 Rs/km ²	
Partially Damaged	105,100 Rs/km ²	
- Unbaked (Kutcha)	2,326,600 Rs/km ²	
- Baked (Pucca)	2,129,600 Rs/km ²	
- Baked (Pucca)	197,000 Rs/km ²	
Local Villages		
Fully Collapsed (Destroyed)	11,104,500 Rs/km ²	
- Unbaked (Kutcha)	4,168,200 Rs/km ²	
- Baked (Pucca)	3,855,000 Rs/km ²	
Partially Damaged	313,200 Rs/km ²	
- Unbaked (Kutcha)	6,936,300 Rs/km ²	
- Baked (Pucca)	6,349,000 Rs/km ²	
- Baked (Pucca)	587,300 Rs/km ²	

Note: Baked (Pucca) House defined as one where the outside walls are bounded with cement unbaked (Kutcha) House is made by mud.

- *1 Estimated by the results of flood damage field survey on June & October 1998 by JICA Study Team
- *2 No. of damaged houses at Trug (City) and Bela No.4 (Village) on 1995 Flood Data from "List of Flood Affected of Village (translate from uldo)", Head Vernacular Clerk (HVC), Deputy Commissioner, Charsadda.
- *3 Details of flood damages of Charsadda District, 1995-97 average, source: "District-wise details of Losses/Damages Caused by Flood Rains on 1995, 96, 97", Provincial Relief Commissioner, Board of Revenue, NWFP"
- *4 Unit housing cost for baked (brick) house at the Swat river basin was shown in "Malitan Hydropower Project F/S final report", vol 3, Environmental Assessment, Feb 1996, GONWFP, Sahad Hydrel Development Organisation) which was 0.2 million. For the estimation of the 1999 price, the method of increasing 1996 price by using trend of rising cost from 1996 to 1999. Estimated unit house (Pucca) cost in 1999 price is 260,000 Rs./Unit house. Adjusted by Conversion Factor =0.89.
- *5 Unit house cost of Kutcha (unbaked house) is estimated by 1992 price of Rs.10,500/unit for Kutcha house and Rs.47,500/unit for Pucca house (1992 unit house cost: "Flood Protection Sector Project", GOP, Federal Flood Commission, Nepal, Haza, Zafar & Associates.)
- *6 Based on "Technical Standard for River and Sabo Works", MOC, Japan. the damage ratio of properties for houses (foundation depth above the floor: 50-200cm, ground slope: 1/1000-1/500, ratio=0.126-0.306)

Table F5.6 Road Inventory Corrected Up To 30 June 1996

Administration (District)	Length in km							
	Black Topped (Asphalt Paved)		Shingled (Gravel road)		Earthen (Unpaved)		Total	
	Actual	converted	Actual	converted	Actual	converted	Actual	converted
Peshwar	319.530	662.004	46.121	57.590	-	-	365.651	719.594
Nowshera	334.544	538.560	49.890	59.870	-	-	384.434	598.430
Charsadda	378.264	660.697	-	-	-	-	378.264	660.697
Total	1,032.338	1,861.261	96.011	117.460	-	-	1,128.349	1,978.721

Source: GONWFP. Communication and Works Department, Chief Engineer Central Design Office, Peshawar. (Data corrected in Jun 1998).

Administration (District)	Area (km ²)	Density in km/km ²							
		Black Topped (Asphalt Paved)		Shingled (Gravel road)		Earthen (Unpaved)		Total	
		Actual	converted	Actual	converted	Actual	converted	Actual	converted
Peshwar	1,182	0.270	0.560	0.039	0.049	-	-	0.309	0.609
Nowshera	1,823	0.184	0.295	0.027	0.033	-	-	0.211	0.328
Charsadda	996	0.380	0.663	-	-	-	-	0.380	0.663
Total	4,001	0.258	0.465	0.024	0.029	-	-	0.282	0.495

Note : District area from "Important District-Wise Socio-Economic Indicators NWFP, 1995&1996", Bureau of Statistics Planning, Environment&Development Dep. GONWFP.

Table F5.7 Road Damage Factors

Type of Road	Density (km/km ²)	Damaged Density (km/km ²)	Unit Repair ⁽³⁾ (Cost Rs)	Adjusting ⁽⁴⁾ Conversion Factor	Damage Cost (Rs/ha)
Metalled Road	0.380 ⁽¹⁾	0.053 ⁽²⁾	518,100	0.89	244
Unmetalled Road	0.178 ⁽²⁾	0.089 ⁽²⁾	90,915	0.89	72
Road Drainage Factor	-	-	-	-	282

* Adjusted by Conversion Factor of Rs. = 0.89

Ref. : (1) Density from Charsadda district June 1996 converted road density.

(Source: GONWFP. Communication and Works Department, Chief Engineer Central Design Office, Peshawar).

(2) "Munda Dam Multipurpose Project, Pre-Feasibility Report", IRR NWFP, WAPDA, NESPAK, November 1992

(3) Information from High Way Division Charsadda (1998).

(4) Based on economic survey results by Munda Dam JICA Study Team.

Table F5.8 Flood Damage Factors

Class	Flood Damage Factor for Inundated Each Landuse Area	
	[Rs/ha]	[Rs/km ²]
Crops	4,439	443,900
Private Housing		
in City/Town (Urban) areas	37,248	3,724,800
in Local Village areas	111,045	11,104,500
Road Linkage	282	28,160
Other Direct Damages 30% ^{*1}	-	-
Indirect Damages 20% ^{*2}	-	-

Note:

- *1 : Other direct loss including damages to irrigation channels and Kathas, Livestock, stored grain, electrical distribution system, telecommunication, etc. are estimated assuming a ratio of crop/housing/road damages to total direct damages of 1:1.3.
- *2 : Indirect damages due to suspension of irrigation supplies and traffic as well as the emergency costs, associated with such a flood include economic and physical linkages are estimated at 20% of the total direct damages within the flood plain area.

Table F6.1 Flood Inundation Area (km²)

1929 Flood

Name of River due to flood	Stretch	Land Use							Inundated Area (km ²)	
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)		
		1	2	3	4	5	6	7		
A	Swat	Mainly Swat River from Munda H/W to Swat&Kabul confluence	119.75	0.00	20.75	6.00	0.00	35.75	6.50	188.75
B-1	Kabul	Kabul River from Warsak Dam to Influence line of Swat river backwater	128.75	1.25	40.00	0.00	2.50	44.75	10.00	227.25
B-2	Kabul	Kabul River from Influence line of Swat river backwater to confluence	63.75	0.00	19.00	0.00	0.00	27.75	2.00	112.50
C	Kabul	Kabul River from Swat&Kabul confluence to Nowshera	84.00	0.00	10.25	9.25	6.50	33.25	26.00	169.25
		Total	396.25	1.25	90.00	15.25	9.00	141.50	44.50	697.75

1995 Flood

Name of River due to flood	Stretch	Land Use							Inundated Area (km ²)	
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)		
		1	2	3	4	5	6	7		
A	Swat	Mainly Swat River from Munda H/W to Swat&Kabul confluence	48.00	0.00	10.00	1.50	0.00	29.75	6.50	95.75
B-1	Kabul	Kabul River from Warsak Dam to Influence line of Swat river backwater	71.50	1.25	23.25	0.00	1.75	44.00	7.75	149.50
B-2	Kabul	Kabul River from Influence line of Swat river backwater to confluence	52.00	0.50	15.00	0.00	0.00	27.75	2.00	97.25
C	Kabul	Kabul River from Swat&Kabul confluence to Nowshera	42.00	0.00	4.25	2.00	2.00	33.00	22.50	105.75
		Total	213.50	1.75	52.50	3.50	3.75	134.50	38.75	448.25

Normal Year Flood

Name of River due to flood	Stretch	Land Use							Inundated Area (km ²)	
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)		
		1	2	3	4	5	6	7		
A	Swat	Mainly Swat River from Munda H/W to Swat&Kabul confluence	19.25	0.00	3.75	0.50	0.00	28.25	5.75	57.50
B-1	Kabul	Kabul River from Warsak Dam to Influence line of Swat river backwater	16.50	0.50	4.25	0.00	1.25	42.50	7.00	72.00
B-2	Kabul	Kabul River from Influence line of Swat river backwater to confluence	18.75	0.00	3.00	0.00	0.00	27.00	2.00	50.75
C	Kabul	Kabul River from Swat&Kabul confluence to Nowshera	6.75	0.00	1.25	1.50	1.50	33.00	20.00	64.00
		Total	61.25	0.50	12.25	2.00	2.75	130.75	34.75	244.25

No Damage Flood (only River Zone)

Name of River due to flood	Stretch	Land Use							Inundated Area (km ²)	
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)		
		1	2	3	4	5	6	7		
A	Swat	Mainly Swat River from Munda H/W to Swat&Kabul confluence	0.00	0.00	0.00	0.00	0.00	28.25	5.75	34.00
B-1	Kabul	Kabul River from Warsak Dam to Influence line of Swat river backwater	0.00	0.00	0.00	0.00	0.00	42.50	7.00	49.50
B-2	Kabul	Kabul River from Influence line of Swat river backwater to confluence	0.00	0.00	0.00	0.00	0.00	27.00	2.00	29.00
C	Kabul	Kabul River from Swat&Kabul confluence to Nowshera	0.00	0.00	0.00	0.00	0.00	33.00	20.00	53.00
		Total	0.00	0.00	0.00	0.00	0.00	130.75	34.75	165.50

Table F6.2 (a) Total Flood Damage Cost of the Swat River Flood Plain Area ("A")

1929 Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		119.75km ²	0.00km ²	20.75km ²	6.00km ²	0.00km ²	35.75km ²	6.50km ²	
Crops	443,900	Rs.53,157,025							53.16
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.22,348,800				22.35
in Local Village areas	11,104,500			Rs.230,418,375					230.42
Road Linkage	28,160	Rs.3,372,129	Rs.0	Rs.584,315	Rs.168,958	Rs.0			4.13
Other Direct Damages 30% ^{*1}									93.01
Indirect Damages 20% ^{*2}									80.61
									483.68

1995 Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		48.00km ²	0.00km ²	10.00km ²	1.50km ²	0.00km ²	29.75km ²	6.50km ²	
Crops	443,900	Rs.21,307,200							21.31
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.5,587,200				5.59
in Local Village areas	11,104,500			Rs.111,045,000					111.05
Road Linkage	28,160	Rs.1,351,667	Rs.0	Rs.281,597	Rs.42,240	Rs.0			1.68
Other Direct Damages 30% ^{*1}									41.88
Indirect Damages 20% ^{*2}									36.30
									217.80

Normal Year Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		19.25km ²	0.00km ²	3.75km ²	0.50km ²	0.00km ²	28.25km ²	5.75km ²	
Crops	443,900	Rs.8,545,075							8.55
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.1,862,400				1.86
in Local Village areas	11,104,500			Rs.41,641,875					41.64
Road Linkage	28,160	Rs.542,075	Rs.0	Rs.105,599	Rs.14,080	Rs.0			0.66
Other Direct Damages 30% ^{*1}									15.81
Indirect Damages 20% ^{*2}									13.70
									61.23

No Damage Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		0.00km ²	0.00km ²	0.00km ²	0.00km ²	0.00km ²	28.25km ²	5.75km ²	
Crops	443,900	Rs.0							0.00
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.0					0.00
Road Linkage	28,160	Rs.0	Rs.0	Rs.0	Rs.0	Rs.0			0.00
Other Direct Damages 30% ^{*1}									0.00
Indirect Damages 20% ^{*2}									0.00
									0.00

Note:
^{*1}: Other direct loss including damages to irrigation channels and Kailas Livestock, stored grain, electrical distribution system, telecommunication, etc. are estimated assuming a ratio of crop/housing/road damages to total direct damages of 1:1:3.
^{*2}: Indirect damages due to suspension of irrigation supplies and traffic as well as the emergency costs, associated with such a flood include economic and physical linkages are estimated at 20% of the total direct damages within the flood plain area.

Table F6.2 (b) Total Flood Damage Cost of the Kabul River Flood Plain Area ("B-1")

1929 Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		128.75km ²	1.25km ²	40.00km ²	0.00km ²	2.50km ²	44.75km ²	10.00km ²	
Crops	443,900	Rs.57,152,125							57.15
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.444,180,000					444.18
Road Linkage	28,160	Rs.3,625,566	Rs.35,200	Rs.1,126,389	Rs.0	Rs.70,399			4.86
Other Direct Damages 30% ¹									151.86
Indirect Damages 20% ²									131.61
									789.66

1995 Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		71.50km ²	1.25km ²	23.25km ²	0.00km ²	1.75km ²	44.00km ²	7.75km ²	
Crops	443,900	Rs.31,738,850							31.74
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.258,179,625					258.18
Road Linkage	28,160	Rs.2,013,421	Rs.35,200	Rs.654,714	Rs.0	Rs.49,280			2.75
Other Direct Damages 30% ¹									87.80
Indirect Damages 20% ²									76.09
									456.57

Normal Year Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		16.50km ²	0.50km ²	4.25km ²	0.00km ²	1.25km ²	42.50km ²	7.00km ²	
Crops	443,900	Rs.7,324,350							7.32
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.47,194,125					47.19
Road Linkage	28,160	Rs.464,636	Rs.14,080	Rs.119,679	Rs.0	Rs.35,200			0.63
Other Direct Damages 30% ¹									16.55
Indirect Damages 20% ²									14.34
									66.04

No Damage Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		0.00km ²	0.00km ²	0.00km ²	0.00km ²	0.00km ²	42.50km ²	7.00km ²	
Crops	443,900	Rs.0							0.00
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.0					0.00
Road Linkage	28,160	Rs.0	Rs.0	Rs.0	Rs.0	Rs.0			0.00
Other Direct Damages 30% ¹									0.00
Indirect Damages 20% ²									0.00
									0.00

Note:

¹ : Other direct loss including damages to irrigation channels and Kattas, livestock, stored grain, electrical distribution system, telecommunication, etc. are estimated assuming a ratio of crop/using/total damages to total direct damages of 1:1.3.

² : Indirect damages due to suspension of irrigation supplies and traffic as well as the emergency costs, associated with such a flood include economic and physical linkages are estimated at 20% of the total direct damages within the flood plain area.

Table F6.2 (c) Total Flood Damage Cost of the Kabul River Flood Plain Area ("B-2")

1929 Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		63.75km ²	0.00km ²	19.00km ²	0.00km ²	0.00km ²	27.75km ²	2.00km ²	
Crops	443,900	Rs.28,298,625							28.30
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.210,985,500					210.99
Road Linkage	28,160	Rs.1,795,183	Rs.0	Rs.535,035	Rs.0	Rs.0			2.33
Other Direct Damages 30% ¹									72.48
Indirect Damages 20% ²									62.82
									376.92

1995 Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		52.00km ²	0.50km ²	15.00km ²	0.00km ²	0.00km ²	27.75km ²	2.00km ²	
Crops	443,900	Rs.23,082,800							23.08
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.166,567,500					166.57
Road Linkage	28,160	Rs.1,464,306	Rs.14,080	Rs.422,396	Rs.0	Rs.0			1.90
Other Direct Damages 30% ¹									57.47
Indirect Damages 20% ²									49.80
									298.82

Normal Year Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		18.75km ²	0.00km ²	3.00km ²	0.00km ²	0.00km ²	27.00km ²	2.00km ²	
Crops	443,900	Rs.8,323,125							8.32
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.33,313,500					33.31
Road Linkage	28,160	Rs.527,995	Rs.0	Rs.84,479	Rs.0	Rs.0			0.61
Other Direct Damages 30% ¹									12.67
Indirect Damages 20% ²									10.98
									65.91

No Damage Flood

Class	Flood damage Factor [Rs./km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Farm)	Orchard or Green area	Village	Town/City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		0.00km ²	0.00km ²	0.00km ²	0.00km ²	0.00km ²	27.00km ²	2.00km ²	
Crops	443,900	Rs.0							0.00
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.0					0.00
Road Linkage	28,160	Rs.0	Rs.0	Rs.0	Rs.0	Rs.0			0.00
Other Direct Damages 30% ¹									0.00
Indirect Damages 20% ²									0.00
									0.00

Note:

¹ : Other direct loss including damages to irrigation channels and Kothas, livestock, stored grain, electrical distribution system, telecommunication, etc. are estimated assuming a ratio of crop/housing/road damages to total direct damages of 1:1.3.

² : Indirect damages due to suspension of irrigation supplies and traffic as well as the emergency costs, associated with such a flood include economic and physical linkages are estimated at 20% of the total direct damages within the flood plain area.

Table F6.2 (d) Total Flood Damage Cost of the Kabul River Flood Plain Area ("C")

1929 Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		84.00km ²	0.00km ²	10.25km ²	9.25km ²	6.50km ²	33.25km ²	26.00km ²	
Crops	443,900	Rs.37,287,600							37.29
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.34,454,400				34.45
in Local Village areas	11,104,500			Rs.113,821,125					113.82
Road Linkage	28,160	Rs.2,365,418	Rs.0	Rs.288,637	Rs.260,478	Rs.183,038			3.10
Other Direct Damages 30% ^{*1}									56.60
Indirect Damages 20% ^{*2}									49.05
									294.31

1995 Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		42.00km ²	0.00km ²	4.25km ²	2.00km ²	2.00km ²	33.00km ²	22.50km ²	
Crops	443,900	Rs.18,643,800							18.64
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.7,449,600				7.45
in Local Village areas	11,104,500			Rs.47,194,125					47.19
Road Linkage	28,160	Rs.1,182,709	Rs.0	Rs.119,679	Rs.56,319	Rs.56,319			1.42
Other Direct Damages 30% ^{*1}									22.41
Indirect Damages 20% ^{*2}									19.42
									116.54

Normal Year Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		6.75km ²	0.00km ²	1.25km ²	1.50km ²	1.50km ²	33.00km ²	20.00km ²	
Crops	443,900	Rs.2,996,325							3.00
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.5,587,200				5.59
in Local Village areas	11,104,500			Rs.13,880,625					13.88
Road Linkage	28,160	Rs.190,078	Rs.0	Rs.35,200	Rs.42,240	Rs.42,240			0.31
Other Direct Damages 30% ^{*1}									6.83
Indirect Damages 20% ^{*2}									5.92
									35.53

No Damage Flood

Class	Flood damage Factor [Rs/km ²]	Land Use-Wise Inundated Area (km ²)							Total Losses (Flood Damage Cost) (Million Rs.)
		Cultivated area (Firm)	Orchard or Green area	Village	Town City	Wasteland (not used)	River (Surface Water)	River area (Flood Area)	
		0.00km ²	0.00km ²	0.00km ²	0.00km ²	0.00km ²	33.00km ²	20.00km ²	
Crops	443,900	Rs.0							0.00
Private Housing									0.00
in City/Town (Urban) areas	3,724,800				Rs.0				0.00
in Local Village areas	11,104,500			Rs.0					0.00
Road Linkage	28,160	Rs.0	Rs.0	Rs.0	Rs.0	Rs.0			0.00
Other Direct Damages 30% ^{*1}									0.00
Indirect Damages 20% ^{*2}									0.00
									0.00

Note:

*1: Other direct loss including damages to irrigation channels and Kattas, livestock, stored grain, electrical distribution system, telecommunication, etc. are estimated assuming a ratio of crop/housing/road damages to total direct damages of 1:1.3.

*2: Indirect damages due to suspension of irrigation supplies and traffic as well as the emergency costs, associated with such a flood include economic and physical linkages are estimated at 20% of the total direct damages within the flood plain area.

Table F7.1 Pre Munda Dam Probability of Exceedence Calculation

(WITHOUT PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 0

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)	
1.5	0.6667	730	730	0.00	1.00	0.1667	0.17	
2	0.5000	1,050	1,050	2.00	44.39	0.3000	13.32	
5	0.2000	2,050	2,050	86.78	116.00	0.1000	11.60	
10	0.1000	2,740	2,740	145.22	173.30	0.0500	8.67	
20	0.0500	3,410	3,410	201.38	210.87	0.0100	2.11	
25	0.0400	3,630	3,630	220.35	251.82	0.0200	5.04	
50	0.0200	4,370	4,370	283.28	310.39	0.0100	3.10	
100	0.0100	5,010	5,010	337.49	367.43	0.0050	1.84	
200	0.0050	5,720	5,720	397.38	435.19	0.0030	1.31	
500	0.0020	6,610	6,610	473.01	501.34	0.0010	0.50	
1,000	0.0010	7,280	7,280	529.68	646.99	0.0009	0.58	
10,000	0.0001	10,050	10,050	764.30				
Total Annual Average Damage (Million Rupees)							48.22	
							(1999 Prices)	

Table F7.2 (a) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 1

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	990	0.00	40.52	0.3000	12.16
5	0.2000	2,050	1,990	81.05	110.34	0.1000	11.03
10	0.1000	2,740	2,630	139.64	167.59	0.0500	8.38
20	0.0500	3,410	3,340	195.53	204.77	0.0100	2.05
25	0.0400	3,630	3,560	214.00	245.59	0.0200	4.91
50	0.0200	4,370	4,300	277.17	304.37	0.0100	3.04
100	0.0100	5,010	4,940	331.56	361.56	0.0050	1.81
200	0.0050	5,720	5,650	391.57	429.45	0.0030	1.29
500	0.0020	6,610	6,550	467.33	495.71	0.0010	0.50
1,000	0.0010	7,280	7,220	524.08	641.42	0.0009	0.58
10,000	0.0001	10,050	9,990	758.75			
Total Annual Average Damage (Million Rupees)							45.74
(1999 Prices)							

Table F7.2 (b) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 10

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	720	0.00	23.49	0.3000	7.05
5	0.2000	2,050	1,580	46.97	75.72	0.1000	7.57
10	0.1000	2,740	2,260	104.48	131.64	0.0500	6.58
20	0.0500	3,410	2,900	158.80	168.27	0.0100	1.68
25	0.0400	3,630	3,130	177.74	209.13	0.0200	4.18
50	0.0200	4,370	3,870	240.51	267.45	0.0100	2.67
100	0.0100	5,010	4,500	294.38	322.74	0.0050	1.61
200	0.0050	5,720	5,170	351.11	389.16	0.0030	1.17
500	0.0020	6,610	6,070	427.22	455.70	0.0010	0.46
1,000	0.0010	7,280	6,740	484.17	602.00	0.0009	0.54
10,000	0.0001	10,050	9,530	719.83			
Total Annual Average Damage (Million Rupees)							33.52

Table F7.2 (c) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 20

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	640	0.00	10.42	0.3000	3.13
5	0.2000	2,050	1,270	20.84	47.60	0.1000	4.76
10	0.1000	2,740	1,910	74.37	100.60	0.0500	5.03
20	0.0500	3,410	2,530	126.83	136.12	0.0100	1.36
25	0.0400	3,630	2,750	145.41	176.19	0.0200	3.52
50	0.0200	4,370	3,470	206.96	232.24	0.0100	2.32
100	0.0100	5,010	4,070	257.51	287.42	0.0050	1.44
200	0.0050	5,720	4,780	317.33	355.00	0.0030	1.07
500	0.0020	6,610	5,660	392.67	420.86	0.0010	0.42
1,000	0.0010	7,280	6,330	449.05	567.18	0.0009	0.51
10,000	0.0001	10,050	9,120	685.31			
Total Annual Average Damage (Million Rupees)							23.56
							(1999 Prices)

Table F7.2 (d) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 50

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	520	0.00	0.00	0.3000	0.00
5	0.2000	2,050	740	0.00	4.74	0.1000	0.47
10	0.1000	2,740	1,140	9.49	32.00	0.0500	1.60
20	0.0500	3,410	1,670	54.51	62.68	0.0100	0.63
25	0.0400	3,630	1,860	70.85	98.56	0.0200	1.97
50	0.0200	4,370	2,520	126.26	150.51	0.0100	1.51
100	0.0100	5,010	3,090	174.77	203.05	0.0050	1.02
200	0.0050	5,720	3,760	231.34	265.60	0.0030	0.80
500	0.0020	6,610	4,570	299.86	327.62	0.0010	0.33
1,000	0.0010	7,280	5,220	355.38	472.99	0.0009	0.43
10,000	0.0001	10,050	8,000	590.60			
Total Annual Average Damage (Million Rupees)							8.74
							(1999 Prices)

Table F7.2 (e) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME (Million m³)= 75

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	420	0.00	0.00	0.3000	0.00
5	0.2000	2,050	620	0.00	0.00	0.1000	0.00
10	0.1000	2,740	790	0.00	5.47	0.0500	0.27
20	0.0500	3,410	1,160	10.93	17.55	0.0100	0.18
25	0.0400	3,630	1,310	24.17	48.36	0.0200	0.97
50	0.0200	4,370	1,880	72.55	95.78	0.0100	0.96
100	0.0100	5,010	2,430	119.02	144.94	0.0050	0.72
200	0.0050	5,720	3,050	170.86	203.79	0.0030	0.61
500	0.0020	6,610	3,820	236.72	263.60	0.0010	0.26
1,000	0.0010	7,280	4,460	290.48	404.66	0.0009	0.36
10,000	0.0001	10,050	7,150	518.83			
Total Annual Average Damage (Million Rupees)							4.34
							(1999 Prices)

Table F7.2 (f) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME (Million m³)= 100

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	320	0.00	0.00	0.3000	0.00
5	0.2000	2,050	520	0.00	0.00	0.1000	0.00
10	0.1000	2,740	650	0.00	0.00	0.0500	0.00
20	0.0500	3,410	840	0.00	0.00	0.0100	0.00
25	0.0400	3,630	940	0.00	15.26	0.0200	0.31
50	0.0200	4,370	1,390	30.52	50.33	0.0100	0.50
100	0.0100	5,010	1,860	70.14	94.17	0.0050	0.47
200	0.0050	5,720	2,420	118.21	149.69	0.0030	0.45
500	0.0020	6,610	3,170	181.18	206.96	0.0010	0.21
1,000	0.0010	7,280	3,780	232.73	344.97	0.0009	0.31
10,000	0.0001	10,050	6,430	457.21			
Total Annual Average Damage (Million Rupees)							2.25
							(1999 Prices)

Table F7.2 (g) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 150

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	120	0.00	0.00	0.3000	0.00
5	0.2000	2,050	320	0.00	0.00	0.1000	0.00
10	0.1000	2,740	460	0.00	0.00	0.0500	0.00
20	0.0500	3,410	590	0.00	0.00	0.0100	0.00
25	0.0400	3,630	640	0.00	0.00	0.0200	0.00
50	0.0200	4,370	820	0.00	1.58	0.0100	0.02
100	0.0100	5,010	1,070	3.17	20.19	0.0050	0.10
200	0.0050	5,720	1,470	37.20	63.42	0.0030	0.19
500	0.0020	6,610	2,090	89.63	111.55	0.0010	0.11
1,000	0.0010	7,280	2,600	133.47	239.63	0.0009	0.22
10,000	0.0001	10,050	5,110	345.79			
Total Annual Average Damage (Million Rupees)							0.63
							(1999 Prices)

Table F7.2 (h) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 200

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	0	0.00	0.00	0.3000	0.00
5	0.2000	2,050	120	0.00	0.00	0.1000	0.00
10	0.1000	2,740	260	0.00	0.00	0.0500	0.00
20	0.0500	3,410	400	0.00	0.00	0.0100	0.00
25	0.0400	3,630	440	0.00	0.00	0.0200	0.00
50	0.0200	4,370	590	0.00	0.00	0.0100	0.00
100	0.0100	5,010	720	0.00	0.00	0.0050	0.00
200	0.0050	5,720	930	0.00	11.70	0.0030	0.04
500	0.0020	6,610	1,300	23.41	40.14	0.0010	0.04
1,000	0.0010	7,280	1,700	56.88	154.56	0.0009	0.14
10,000	0.0001	10,050	4,010	252.24			
Total Annual Average Damage (Million Rupees)							0.21
							(1999 Prices)

Table F7.2 (i) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 250

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	0	0.00	0.00	0.3000	0.00
5	0.2000	2,050	0	0.00	0.00	0.1000	0.00
10	0.1000	2,740	60	0.00	0.00	0.0500	0.00
20	0.0500	3,410	200	0.00	0.00	0.0100	0.00
25	0.0400	3,630	240	0.00	0.00	0.0200	0.00
50	0.0200	4,370	390	0.00	0.00	0.0100	0.00
100	0.0100	5,010	520	0.00	0.00	0.0050	0.00
200	0.0050	5,720	670	0.00	0.00	0.0030	0.00
500	0.0020	6,610	890	0.00	3.82	0.0010	0.00
1,000	0.0010	7,280	1,120	7.65	88.97	0.0009	0.08
10,000	0.0001	10,050	3,040	170.30			
Total Annual Average Damage (Million Rupees)							0.08
							(1999 Prices)

Table F7.2 (i) Post Munda Dam Probability of Exceedence Calculation
(WITH PROJECT)

FLOOD CONTROL VOLUME [Million m³]= 300

Return Period (Years)	Probability (Frequency)	Flood Peak Inflow Discharge (m ³ /s)	Flood Peak Outflow Discharge (m ³ /s)	Flood Damage (Million Rs.)	Average Damage (Million Rs.)	Frequency Interval	Average Annual Damage (Million Rs.)
1.5	0.6667	730	0	0.00	0.00	0.1667	0.00
2	0.5000	1,050	0	0.00	0.00	0.3000	0.00
5	0.2000	2,050	0	0.00	0.00	0.1000	0.00
10	0.1000	2,740	0	0.00	0.00	0.0500	0.00
20	0.0500	3,410	0	0.00	0.00	0.0100	0.00
25	0.0400	3,630	50	0.00	0.00	0.0200	0.00
50	0.0200	4,370	200	0.00	0.00	0.0100	0.00
100	0.0100	5,010	330	0.00	0.00	0.0050	0.00
200	0.0050	5,720	470	0.00	0.00	0.0030	0.00
500	0.0020	6,610	650	0.00	0.00	0.0010	0.00
1,000	0.0010	7,280	800	0.00	51.10	0.0009	0.05
10,000	0.0001	10,050	2,240	102.20			
Total Annual Average Damage (Million Rupees)							0.05
							(1999 Prices)

