TABLES AT THE BACK OF REPORT

Table 4.1.1 River Water Quality

Location No.	Date of Sampling	Time Hrs	Sampling Location	Flow Rate (m^3/sec)	Temp (℃)	pH	DO (mg/l)	Cond (μS/cm)	Odor (TON)	Turb. (NTU)	Color (TCU)	BOD_5 (mg/l)	COD (mg/l)	TSS (mg/l)	O&G (mg/l)	T-N (mg/l)	E-Coli (MPN/100ml)	As (ppb)	Cu (ppm)	Cr (ppm)	Cd (ppm)	Pb (ppm)	Zn (ppm)
			National Environmental Quality Standards		40.0	6.0 to 9.0						80.0	150.0	200.0	10.0			1,000.0	1.0	1.0	0.1	0.5	5.0
1	04/04/00	1230	F-8/2 Before Fatima Jinnah Park,	0.1	25.4	7.3	3.8	560.0	64.0	49.0	70.0	60.1	101.3	16,154.0	ND	12.3	18+						
2	04/04/00	1400	E-8 Near Navy House Karakuram Road	0.5	18.2	7.4	5.7	210.0	4.0	13.7	0.0	6.8	25.6	4,041.0	ND	ND	18+						
3	04/05/00	1000	F-6/2 Near Alkhizar Mosque Margalla Road	0.1	16.0	7.4	5.8	200.0	1.0	9.3	0.0	17.0	18.4	107.0	ND	ND	0.0						
4	04/05/00	1100	F-5/2 Near Azad Jamun Kashmir Secretariat	0.1	18.8	7.6	4.6	230.0	4.0	11.4	1.0	12.2	20.9	42.0	ND	ND	18+						
5	04/06/00	1000	Near American Embassy	0.5	17.5	7.8	6.5	590.0	1.0	4.0	10.0	16.3	19.3	47.0	ND	ND	18+						
6	04/06/00	1145	Peshawar Road	0.1	22.3	7.6	2.2	850.0	16.0	6.4	70.0	31.3	58.2	146.0	ND	1.7	18+						
7	04/07/00	1100	I-10 Pirwadhai crossing, Nullah 1	2.1	20.8	7.9	0.5	930.0	16.0	6.4	70.0	57.6	83.7	358.0	ND	10.1	18+	<10.0	<0.5	<0.5	<0.1	<0.2	<0.2
8	04/07/00	1200	I-10 Pirwadhai crossing, Nullah 2	7.1	20.4	7.4	0.8	910.0	16.0	18.5	70.0	59.5	114.3	89.0	ND	3.4	18+	<10.0	<0.5	<0.5	<0.1	<0.2	<0.2
9	04/07/00	1300	I-10 Pirwadhai crossing, 200M after Joining	2.7	20.3	7.6	0.1	960.0	16.0	17.0	70.0	34.2	81.0	210.0	ND	5.1	18+	<10.0	<0.5	<0.5	<0.1	<0.2	<0.2
10	04/07/00	1500	Chattar Park	0.8	20.8	8.1	6.1	600.0	1.0	0.5	0.0	14.2	34.8	43.0	ND	ND	18+						
11	04/10/00	1330	Nallah Leh Near Guwalmondi Bridge.	10.8	23.8	7.1	0.3	1,320.0	64.0	41.5	70.0	139.1	357.5	284.0	ND	6.7	18+	<10.0	<0.5	<0.5	<0.1	<0.2	0.3
12	04/10/00	1445	Jahanda Chichi, Air Port Road	7.8	24.4	7.1	0.1	1,340.0	64.0	65.1	70.0	139.3	215.4	272.0	ND	5.6	18+						
13	04/11/00	1025	Nallah Leh before joining River Swan	9.6	24.2	7.6	2.1	1,590.0	64.0	59.3	50.0	81.7	147.1	255.0	ND	51.0	18+	11.0	3.0	<0.5	<0.1	0.3	0.3
13*	04/11/00		Nallah Lai before joining River Swan								PCSIR→	256.0	1676.0	253.0	0.4	0.2	NUST→	<0.5ppm	<0.1	<0.5	<0.5	<0.5	<1.0
14	04/11/00	1245	River Swan before Swan Bridge	10.1	26.3	8.2	7.6	770.0	4.0	6.1	20.0	26.9	45.6	94.0	ND	ND	18+						
15	04/11/00	1130	Mix of Swan and Nallah Lai	10.5	25.4	7.6	5.4	1,140.0	16.0	43.5	20.0	42.6	68.7	22.0	ND	5.0	18+	<10.0	0.5	<0.5	<0.1	0.2	0.2
16	04/13/00	1220	Rawal Dam	1.2	19.8	7.8	6.0	410.0	1.0	2.6	10.0	ND	7.0	106.0	ND	ND	18+						
17	04/12/00	1300	Stream water Korang Nallah Lehtrar road	1.9	26.9	7.6	2.4	58.0	4.0	22.6	70.0	10.9	15.8	77.0	ND	ND	18+						
18	04/13/00	400	E-7 Hill Side Road opp St:16	0.0	20.5	7.7	0.7	760.0	16.0	9.9	10.0	58.0	89.3	50.0	ND	18.5	18+						
19	04/12/00	1015	Nallah Kura, Shahrahe-Islamabad	1.2	27.6	8.1	4.8	680.0	2.0	7.7	0.0	16.0	18.4	36.0	ND	ND	18+	<10.0	<0.5	<0.5	<0.1	<0.2	<0.2
19*	04/12/00		Nallah Kura, Stahrahe-Islamabad								PCSIR→	12.5	31.6	15.0	0.4	0.1	NUST→	<0.5ppm	<1.0	<0.5	<0.5	<.5	<0.5
20	04/13/00	1045	Nallah Leh at Gulistan Colony line-1	8.6	30.0	7.3	1.9	1,260.0	64.0	64.5	70.0	118.8	209.6	127.0	ND	37.5	18+						

Source : 3 cities investigation of Air & Water Quality June 2001
Pakistan Environmental Protection Agency, Japan International Cooperation Agency

Remark : Water quality is andized at HBP's Environmental Monitoring Laboratory. (HBP: Hagler Bailly Pakistan)
But in 13*, 19*, water quality is analized by Laboratories of PCSIR or NUST.
PCSIR : Pakistan Concil of Scientific and Industrial Research
NUST : National University of Science and Technology

ND : Not detected

Table 5.1.1 Availability of Rainfall Data in Lai Nullah Basin

Data Item	Station	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	00	01
Daily Rainfall	Chaklala (Islamabad International Airport)	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Islamabad (NAMC)																																								A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	RAMC																																														A	A	A	A	A	A	A	A	A	A	A	A	A
	Saidpur																																																			P	A		P	A	A	A	A
3-hourly Rainfall	Chaklala (Islamabad International Airport)																											A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	Islamabad (NAMC)																																								P	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	RAMC																																																										p
	Saidpur																																																										
Hourly Rainfall during Flood Times	Chaklala (Islamabad International Airport)														P	P	A	A	P	P	A	A	P	A	P	P	P				A	P	P	A	P	P	P	A																					
	Islamabad (NAMC)																																																										P
	RAMC																																														X	X	X	X	X	X	X	X	X	X	X	X	X
	Saidpur																																																										

A : Fully available P: Partially available C: Record chart is fully available X: Record chart is partially available

Table 5.1.2 Availability of Short-time Rainfall Data during Main Rainstorms

Year	Date	Chaklala		Islamabad		RAMC		Saidpur	
		3-Hourly	Hourly	3-Hourly	Hourly	3-Hourly	Hourly	3-Hourly	Hourly
1970	13-Aug	A							
1970	24-Aug	A							
1971	26-Aug	A							
1972	16-Sep	A							
1972	9-Dec	A							
1973	26-Jul	A							
1974	15-Jul	A	A						
1975	4-Jul	A							
1975	18-Jul	A							
1976	2-Sep	A	A						
1977	6-Jul	A							
1978	30-Jun	A							
1979	15-Sep	A							
1980	21-Mar	A	A						
1981	14-Jul	A							
1982	10-Aug	A							
1983	26-Aug	A							
1984	28-Jun	A		A					
1984	8-Jul	A		A					
1984	17-Jul	A		A					
1985	8-Jul	A		A					
1985	14-Jul	A		A					
1986	10-Feb	A		A					
1986	11-Jul	A		A					
1986	18-Jul	A		A					
1986	14-Aug	A		A					
1987	13-Aug	A		A					
1987	18-Aug	A		A					
1987	24-Aug	A		A					
1988	1-Aug	A		A					
1988	14-Aug	A		A					
1989	30-Jul	A		A		A	A		
1989	20-Aug	A		A		A	A		
1990	9-Aug	A		A					
1990	29-Aug	A		A					
1991	9-Aug	A		A					
1991	6-Sep	A		A					
1992	10-Sep	A		A					
1993	24-Mar	A		A					
1993	10-Aug	A		A					
1994	3-Jul	A		A					
1994	10-Aug	A		A					
1995	24-Jul	A		A					
1996	29-Jul	A		A					
1996	8-Aug	A		A					
1996	16-Aug	A		A					
1997	27-Aug	A		A		A	A		
1998	24-Feb	A		A					
1998	16-Jul	A		A		A	A		
1998	3-Aug	A		A					
1998	10-Aug	A		A		A	A		
1999	17-Jul	A		A					
1999	29-Sep	A		A					
2000	21-Aug	A		A					
2001	23-Jul	A		A	A	A		A	

A: Available

Table 5.1.3 Annual Maximum Basin Mean Rainfall

Serial	3-hourly rainfall			6-hourly rainfall			9-hourly rainfall			12-hourly rainfall		
	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking	Date and Time (PST)	Rainfall (mm)	Ranking
1	1970/8/24 2:00	51.8	25	1970/8/13 8:00	69.3	21	1970/8/13 8:00	70.6	23	1970/8/13 11:00	71.9	24
2	1971/8/26 11:00	115.6	5	1971/8/26 11:00	132.3	7	1971/8/26 14:00	133.6	10	1971/8/26 17:00	133.6	11
3	1972/9/16 5:00	46.2	30	1972/9/16 8:00	48.3	31	1972/9/16 11:00	48.3	32	1972/9/16 14:00	48.3	32
4	1973/7/26 2:00	104.1	8	1973/7/26 5:00	105.9	13	1973/7/26 8:00	105.9	15	1973/7/26 11:00	105.9	15
5	1974/7/15 8:00	128.6	4	1974/7/15 11:00	143.8	5	1974/7/15 14:00	155.2	7	1974/7/15 14:00	160.5	6
6	1975/7/19 8:00	58.4	21	1975/7/4 20:00	59.7	24	1975/7/4 23:00	67.3	24	1975/7/5 2:00	67.3	26
7	1976/9/2 14:00	101.6	10	1976/9/2 17:00	114.0	10	1976/9/2 20:00	118.0	13	1976/9/2 23:00	118.0	14
8	1977/7/6 8:00	81.3	13	1977/7/6 8:00	133.6	6	1977/7/6 11:00	157.3	6	1977/7/6 14:00	157.3	7
9	1978/6/30 5:00	58.4	21	1978/6/30 8:00	68.6	22	1978/6/30 11:00	113.1	14	1978/6/30 14:00	129.6	12
10	1979/9/15 14:00	60.0	19	1979/9/15 17:00	62.0	23	1979/9/15 20:00	63.8	27	1979/9/15 23:00	63.8	28
11	1980/3/21 20:00	47.5	29	1980/3/21 23:00	59.2	25	1980/3/22 2:00	59.2	28	1980/3/22 5:00	59.2	29
12	1981/7/14 5:00	101.8	9	1981/7/14 8:00	123.8	9	1981/7/14 11:00	123.8	12	1981/7/14 14:00	123.8	13
13	1982/8/10 8:00	156.1	2	1982/8/10 8:00	179.2	2	1982/8/10 14:00	265.3	2	1982/8/10 14:00	288.4	2
14	1983/8/26 17:00	105.0	7	1983/8/26 20:00	155.8	4	1983/8/26 20:00	171.5	3	1983/8/26 20:00	173.5	4
15	1984/7/17 8:00	47.8	28	1984/7/17 14:00	57.5	27	1984/6/28 11:00	67.3	24	1984/6/28 14:00	74.9	21
16	1985/7/8 8:00	110.8	6	1985/7/8 8:00	128.2	8	1985/7/8 8:00	136.8	8	1985/7/8 8:00	140.5	9
17	1986/7/11 20:00	40.9	31	1986/7/11 23:00	49.4	30	1986/7/12 2:00	49.4	31	1986/7/12 5:00	49.4	31
18	1987/8/24 5:00	31.6	32	1987/8/24 14:00	45.0	32	1987/8/24 14:00	54.2	30	1987/8/24 14:00	85.8	18
19	1988/8/14 11:00	64.4	17	1988/8/14 11:00	85.1	16	1988/8/14 14:00	85.1	18	1988/8/14 17:00	85.1	19
20	1989/7/30 2:00	71.9	15	1989/8/20 8:00	79.6	17	1989/7/30 5:00	81.4	19	1989/7/30 8:00	84.9	20
21	1990/8/9 8:00	77.7	14	1990/8/9 8:00	113.1	11	1990/8/9 11:00	135.8	9	1990/8/9 14:00	136.7	10
22	1991/9/6 5:00	63.3	18	1991/9/6 5:00	72.5	19	1991/9/6 8:00	74.0	20	1991/9/6 11:00	74.0	22
23	1992/9/9 23:00	66.2	16	1992/9/9 23:00	104.0	14	1992/9/9 23:00	128.8	11	1992/9/9 23:00	153.7	8
24	1993/8/10 5:00	55.8	23	1993/8/10 8:00	57.2	28	1993/8/10 11:00	57.2	29	1993/8/10 14:00	57.2	30
25	1994/7/3 17:00	150.2	3	1994/7/3 17:00	164.3	3	1994/7/3 17:00	166.0	4	1994/7/3 20:00	166.5	5
26	1995/7/24 11:00	81.8	12	1995/7/24 14:00	89.4	15	1995/7/24 17:00	89.7	16	1995/7/24 20:00	89.7	16
27	1996/7/29 5:00	50.8	27	1996/7/29 8:00	77.2	18	1996/7/29 11:00	87.2	17	1996/7/29 14:00	87.2	17
28	1997/8/27 8:00	87.8	11	1997/8/27 8:00	111.4	12	1997/8/27 8:00	164.5	5	1997/8/27 8:00	192.1	3
29	1998/8/3 5:00	59.2	20	1998/8/3 8:00	59.2	25	1998/8/10 11:00	70.8	22	1998/2/24 20:00	73.7	23
30	1999/7/17 8:00	54.3	24	1999/7/17 8:00	71.3	20	1999/7/17 11:00	71.3	21	1999/7/17 14:00	71.3	25
31	2000/8/21 8:00	51.0	26	2000/8/21 11:00	55.8	29	2000/8/21 14:00	64.6	26	2000/8/21 17:00	64.6	27
32	2001/7/23 14:00	239.3	1	2001/7/23 14:00	349.4	1	2001/7/23 14:00	400.8	1	2001/7/23 17:00	444.3	1

Table 5.1.4 Estimation of Annual Maximum Basin Mean Daily Rainfall

Year	Date	Daily Rainfall (mm)				
		Saidpur	Islamabad	RAMC	Chaklala	Basin Mean
1944	1-Sep				120.7	120.7
1945	18-Aug				104.1	104.1
1946	25-Jul				88.9	88.9
1947	22-Aug				31.5	31.5
1948	6-Aug				150.6	150.6
1949	20-Sep				66.6	66.6
1950	23-Aug				96.3	96.3
1951	17-Aug				312.4	312.4
1952	28-Jul				80.5	80.5
1953	23-Aug				205.7	205.7
1954	10-Sep				69.6	69.6
1955	14-Sep				86.4	86.4
1956	8-Aug				223.5	223.5
1957	13-Aug				71.1	71.1
1958	14-Sep				90.7	90.7
1959	4-Jul				140.2	140.2
1960	18-Aug				69.3	69.3
1961	2-Sep				64.8	64.8
1962	10-Aug				90.9	90.9
1963	17-Aug				87.1	87.1
1964	29-Jul				71.6	71.6
1965	1-Apr				84.8	84.8
1966	26-Jul				73.9	73.9
1967	6-Aug				101.9	101.9
1968	12-Jul				87.4	87.4
1969	12-Aug				82.3	82.3
1970	13-Jul				69.1	69.1
1971	27-Aug				125.7	125.7
1972	18-Oct				53.3	53.3
1973	26-Jul				105.9	105.9
1974	15-Jul				133.9	133.9
1975	23-Aug				116.8	116.8
1976	3-Sep				120.0	120.0
1977	6-Jul				133.6	133.6
1978	30-Jun				113.1	113.1
1979	21-Feb				78.7	78.7
1980	22-Mar				60.0	60.0
1981	14-Jul				123.8	123.8
1982	10-Aug				181.3	181.3
1983	26-Aug		172.2		173.5	172.4
1984	28-Jun		81.8		112.5	86.4
1985	8-Jul		150.1		86.0	140.5
1986	11-Feb		54.0		58.1	54.6
1987	8-May		86.7		49.9	81.2
1988	21-Jul		135.9		62.2	124.8
1989	31-Jul		135.7	65.5	116.8	124.7
1990	9-Aug		120.4	74.1	76.7	110.0
1991	20-Aug		88.2	42.4	4.6	73.9
1992	10-Sep		207.7	192.3	223.4	207.3
1993	8-Jul		88.8	65.5	40.0	80.9
1994	4-Jul		174.8	177.4	115.0	169.2
1995	2-Aug	87.0	107.9	105.0	119.0	102.5
1996	29-Jul		62.0	114.0	163.0	78.9
1997	27-Aug	180.0	199.8	207.0	200.0	194.7
1998	15-Feb	97.5	81.5	80.0	64.5	84.3
1999	12-Aug	141.2	80.9	53.0	45.0	91.7
2000	1-Aug	52.5	66.2	65.0	70.0	62.4
2001	24-Jul	227.2	591.9	359.0	200.0	411.4
Tiessen Coefficient	4 Stations	0.30	0.47	0.12	0.11	1.00
	3 Stations		0.77	0.13	0.10	1.00
	2 Stations		0.85		0.15	1.00
	1 Station				1.00	1.00

Daily Rainfall : Total rainfall between 0800 PSTof the previous day and 0800 PST of the day

Table 5.2.1 (1/3) Land Use and Curve Number by Sub-basin (2001)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (CN=70)	Residential Area /Densely Populated (CN=90)	Residential Area /Ordinarily Populated (CN= 75)	Residential Area /Surburb (CN= 70)	Forest Area (CN=70, 65)	Green and Grass Area (CN=65)	Water Body (CN=100)	Total	
SB1	0.0	0.0	7.9	0.3	7.9	5.1	0.0	21.2	71
SB2	0.0	0.0	2.9	0.0	0.0	0.6	0.0	3.5	73
SB3	0.0	0.0	3.2	0.0	8.7	4.6	0.0	16.6	70
SB4	0.7	0.0	16.1	0.0	0.5	5.7	0.0	23.1	72
SB5	0.7	0.0	0.1	0.0	6.0	3.1	0.0	9.9	68
SB6	7.9	0.0	0.0	0.4	6.4	5.1	0.0	19.7	69
SB7	8.2	0.0	8.0	3.8	2.3	17.2	0.0	39.5	69
SB8	1.6	0.0	4.1	0.0	0.0	4.7	0.4	10.8	71
SB9	12.1	1.5	2.9	0.0	0.0	4.4	0.0	20.9	71
SB10	0.0	4.4	0.1	0.0	0.0	0.4	0.3	5.2	88
SB11	1.4	3.4	2.3	0.0	0.0	4.1	0.0	11.2	75
SB12	0.4	1.1	5.3	1.6	0.0	2.4	0.0	10.8	73
SB13	0.0	5.9	0.2	0.0	0.0	0.4	0.3	6.8	88
SB14	0.0	13.5	0.1	0.0	0.0	9.0	0.2	22.8	80
SB15	0.5	1.4	0.0	0.0	3.1	7.4	0.4	12.8	69
Total	33.6	31.2	53.2	6.0	35.0	74.3	1.6	234.8	72

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.1 (2/3) Land Use and Curve Number by Subbasin (2012)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (C=70)	Residential Area /Densely Populated (C=90)	Residential Area /Ordinarily Populated (C= 75)	Residential Area /Surburb (C= 70)	Forest Area (C=70, 65)	Green and Grass Area (C=65)	Water Body (C=100)	Total	
SB1	0.0	0.0	8.1	0.4	7.1	5.6	0.0	21.2	71
SB2	0.0	0.0	3.0	0.0	0.0	0.5	0.0	3.5	74
SB3	0.0	0.0	3.7	0.0	8.3	4.6	0.0	16.6	70
SB4	0.0	0.0	17.3	0.0	0.5	5.3	0.0	23.1	73
SB5	1.0	0.0	0.5	0.0	5.5	2.9	0.0	9.9	69
SB6	9.3	0.0	0.0	0.7	6.2	3.6	0.0	19.7	69
SB7	6.9	0.0	17.7	3.3	2.3	9.3	0.0	39.5	71
SB8	0.2	0.0	7.0	0.0	0.0	3.2	0.4	10.8	73
SB9	9.5	3.0	3.0	0.0	0.0	5.4	0.0	20.9	72
SB10	0.0	4.4	0.1	0.0	0.0	0.5	0.3	5.2	88
SB11	1.4	5.0	1.4	0.0	0.0	3.3	0.0	11.2	78
SB12	0.8	2.3	4.4	1.2	0.0	2.1	0.0	10.8	75
SB13	0.0	5.9	0.2	0.0	0.0	0.4	0.3	6.8	88
SB14	0.0	13.8	0.1	0.0	0.0	8.7	0.2	22.8	80
SB15	0.0	2.3	0.6	0.0	2.6	6.9	0.4	12.8	71
Total	29.1	36.6	67.1	5.6	32.5	62.4	1.6	234.8	73

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.1 (3/3) Land Use and Curve Number by Subbasin (2030)

Subbasin	Area by Land Use (km2)								Sub-basin Average Curve Number
	Agricultural Area (C=70)	Residential Area /Densely Populated (C=90)	Residential Area /Ordinarily Populated (C= 75)	Residential Area /Surburb (C= 70)	Forest Area (C=70, 65)	Green and Grass Area (C=65)	Water Body (C=100)	Total	
SB1	0.00	0.00	8.06	0.66	6.76	5.69	0.00	21.17	70.56
SB2	0.00	0.00	2.95	0.00	0.00	0.52	0.00	3.47	73.54
SB3	0.00	0.00	2.58	0.00	8.11	5.91	0.00	16.59	69.00
SB4	0.00	0.00	16.83	0.00	0.46	5.79	0.04	23.12	72.43
SB5	1.65	0.00	0.46	0.00	5.44	2.32	0.00	9.87	69.06
SB6	5.08	0.00	4.43	0.39	6.08	3.76	0.00	19.74	70.17
SB7	1.54	0.00	27.40	0.00	2.30	8.34	0.00	39.59	72.41
SB8	0.00	0.00	7.85	0.00	0.00	2.59	0.38	10.82	73.50
SB9	1.82	1.50	13.01	0.00	0.00	4.63	0.00	20.97	73.43
SB10	0.00	4.44	0.09	0.00	0.00	0.46	0.25	5.24	88.03
SB11	0.59	6.35	2.45	0.00	0.00	1.75	0.00	11.14	81.72
SB12	0.78	2.32	4.67	1.16	0.00	1.86	0.00	10.78	75.60
SB13	0.00	5.86	0.24	0.00	0.00	0.42	0.28	6.80	88.35
SB14	0.00	15.33	0.46	0.00	0.00	6.77	0.22	22.79	82.37
SB15	0.00	3.08	2.09	0.00	2.61	4.60	0.40	12.77	73.74
Total	11.46	38.89	93.56	2.20	31.76	55.42	1.58	234.87	73.65

Note: Under normal antecedent moisture condition (AMC II)

Table 5.2.2 (1/2) Estimated Flood Inundation Depth and Area (2001 Flood)

(km2)

Inundation Depth	Case 1-1 Reproduction of 2001 Flood			Case 1-2 after Completion of ADB		
	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total
0.3m - 1m	0.22	1.57	1.79	0.26	1.57	1.84
1m - 2m	0.35	2.20	2.54	0.30	1.54	1.84
2m - 3m	0.17	1.46	1.63	0.15	1.11	1.26
3m - 4m	0.14	1.09	1.23	0.13	0.81	0.94
greater than 4m	0.38	1.66	2.04	0.34	0.98	1.31
Total	1.25	7.98	9.23	1.18	6.01	7.18

Table 5.2.2 (2/2) Estimated Flood Inundation Depth and Area (Design Rainfall)

Inundation Depth	Case 2-1 100yr Flood			Case 2-2 50yr Flood			Case 2-3 25yr Flood		
	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total	Islamabad	Rawalpindi	Total
0.3m - 1m	0.32	1.67	1.98	0.12	0.92	1.04	0.13	0.68	0.81
1m - 2m	0.23	1.52	1.74	0.16	1.17	1.33	0.16	0.69	0.85
2m - 3m	0.17	1.20	1.37	0.16	0.77	0.93	0.08	0.45	0.53
3m - 4m	0.15	0.92	1.07	0.12	0.56	0.68	0.06	0.31	0.38
greater than 4m	0.26	1.17	1.42	0.09	0.48	0.58	0.00	0.03	0.03
Total	1.12	6.46	7.59	0.65	3.90	4.54	0.43	2.17	2.59

Table 6.2.1 List of Bridges to be Reconstructed and Reinforced through Proposed River Channel Improvement

N0.	Name of River	Name of Bridges	Location No.*	Bridge Type	Spans	Length (m)	Width (m)	Area (m^2)	Height (m)	Demolition (m^3)	
										Super-structure	Sub-structure
1	Lai Nullah	Chaklala Br.-d/s	RD 6 + 251	Concrete girder	3	103	19.1	1967.3	16.9	1104	2534
	Lai Nullah	Chaklala Br.-u/s		Brick arch	5	85	12.6	1072.7	15.6	602	1382
2	Lai Nullah	Railway Br.	RD 8 + 325	Steel girder	3	79	9.2	726.8	14.6	145	936
3	Lai Nullah	Murree Road Br.	RD 8 + 628	Concrete girder	3	50	26.4	1320.0	11.9	741	1700
4	Lai Nullah	City Sadar Br.	RD 10 + 790	Concrete girder	3	71	16.4	1164.4	12.7	653	1500
5	Lai Nullah	Ratta Amral Br.	RD 11 + 780	Concrete girder	4	53	9.0	477.0	9.4	268	614
6	Lai Nullah	Gunj Mandi Br.	RD 12 + 630	Concrete girder	3	62	11.5	713.0	10.2	400	918
7	Lai Nullah	Khayaban S.S.Br.	RD 14 + 100	Concrete girder	5	117	9.0	1053.0	9.6	591	1356
8	Lai Nullah	Parrian Br.	RD 16 + 178	Concrete girder	3	45	5.5	247.5	9.0	139	319
9	Lai Nullah	Kattarian Br.	RD 17 + 210	Concrete girder	3	49	9.0	441.0	11.2	247	568
10	Saidpur Kas	S1 Br.	d/s #3 - No.6	Concrete girder	2	32	10.4	332.8	8.6	187	429

Table 6.2.2 Typical Structural Types of Flood Infiltration Facilities

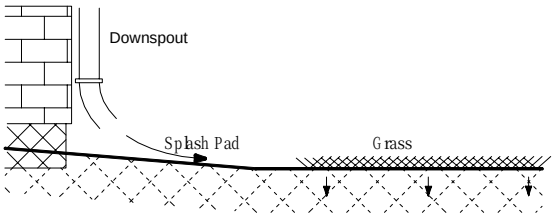
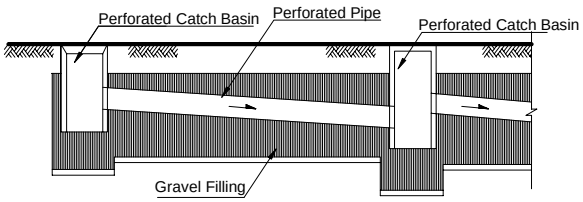
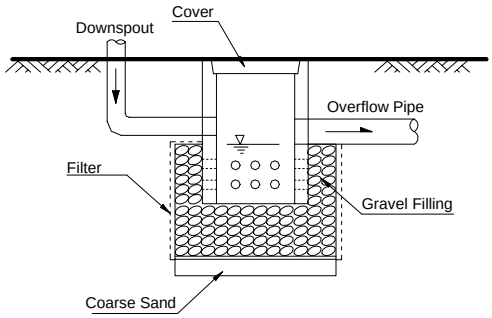
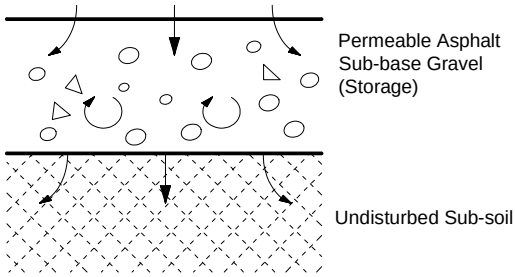
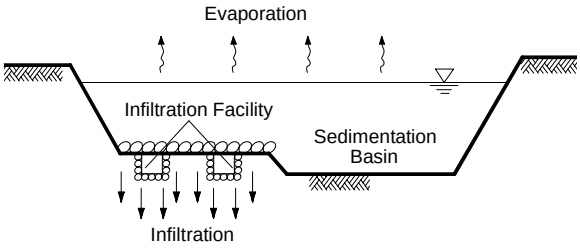
Facilities	Structural Concept
<u>Vegetative Surface</u> Infiltration of stormwater through green surface is the technique that comes closest to natural infiltration of rainwater. Direct discharge of roof runoff to grass lawns by using an ejector connected to the downspout and splash pad with a slope away from the building is one of the solutions in residential areas.	
<u>Infiltration Trench & Perforated Catch Basin</u> Subsurface infiltration structures, soakaways, are the most common types of infiltration systems. They are basically holes in the ground filled with rubble or stones. The stormwater is stored temporarily in the cavities between the stones while it slowly percolates into the surrounding soil. They are typically long and narrow to minimize the surface area at the bottom that is supposed to clog with fines after some time, and to maximize the ratio between the effective infiltration area (the sides) and the volume.	 
<u>Permeable Pavement</u> Road drainage through permeable asphalt and use of the sub-base for water storage has shown to be rather efficient in connection with roads for light traffic.	
<u>Retention Pond</u> During heavy rain stormwater can be stored in the basin, and slowly infiltrate through the soil layer and also slowly evaporate through water surface. This type of facilities frequently suffers severe clogging, so that proper and periodical maintenance is crucial.	

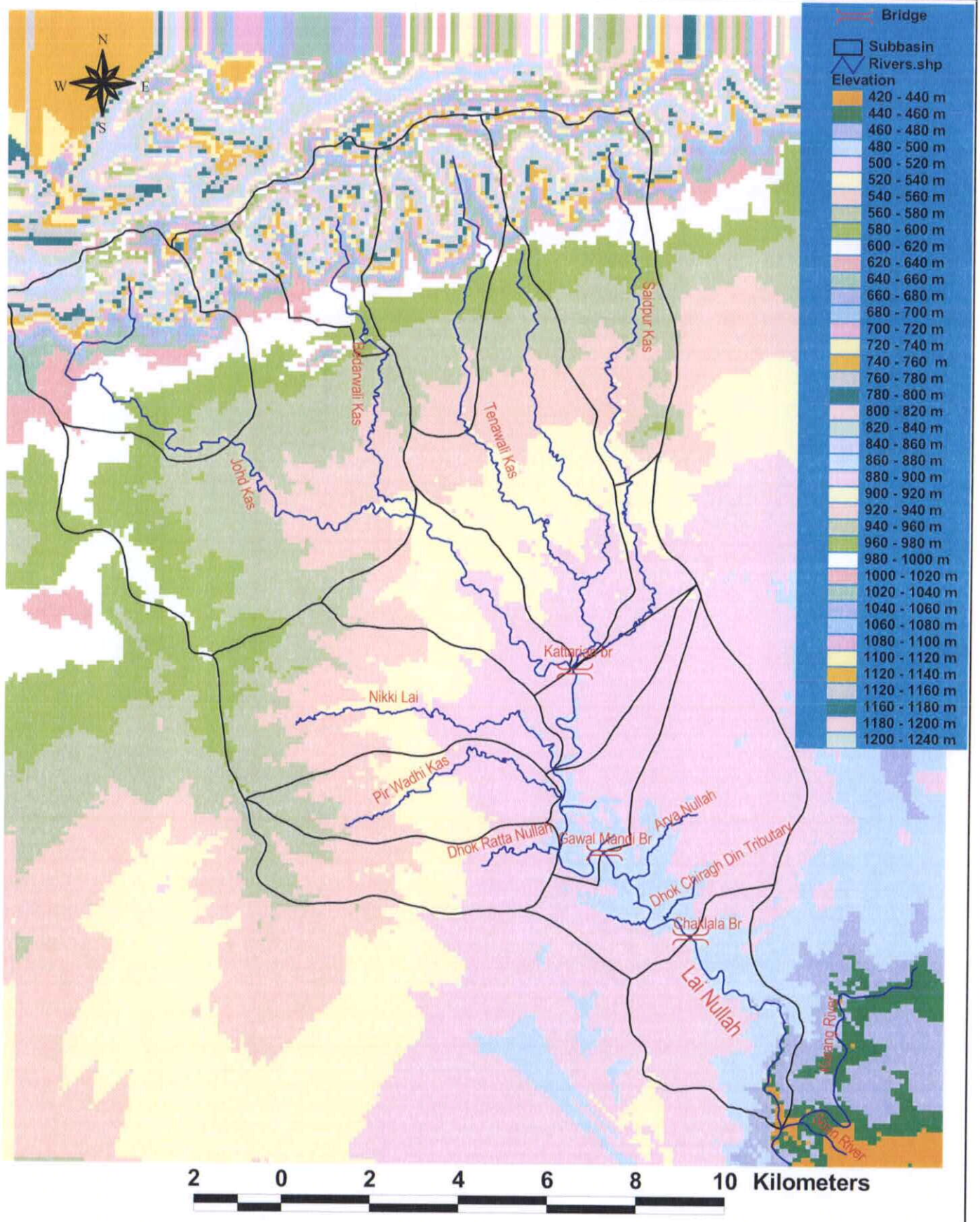
Table 6.4.1 Equipment of FFWS

Items		Supporting Equipment Included	Quantity (unit)
1.	**PMD Master Control Station**		
	(1) Telemetry Supervisory Equipment		1
	(2) Radio Equipment for 5.2 GHz Wireless LAN		2
	(3) Radio Equipment for 400MHz		1
	(4) Antenna System		1
	(5) Printer		1
	(6) PC type Operation Console		1
	(7) Processing System (FFWS Server)		1
	(8) Display System	Visual Display Unit, Plasma Display Unit, Web Server, Client PC, Laser Printer	1
	(9) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	1
	(10) Air Conditioner		2
2.	**Monitoring Station (FFC, WASA, Jinnah Park)**		
	(1) Radio Equipment for 5.2 GHz Wireless LAN		3
	(2) Antenna System		3
	(3) Display System	Visual Display Unit, Plasma Display Unit, Client PC, Laser Printer	3
	(4) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	3
	(5) Emergency Power Supply (Engine Generator)		3
	(6) Air Conditioner		6
3.	**Rawalpindi Warning Control Station**		
	(1) Warning Supervisory/Control System	Warning Supervisory/Control System, Operation Console, Serial Printer	1
	(2) Radio Equipment for 5.2 GHz Wireless LAN		1
	(3) Radio Equipment for 400MHz		1
	(4) Antenna System		1
	(5) Printer		1
	(6) PC type Operation Console		1
	(7) Display System	Visual Display Unit, Plasma Display Unit, Client PC	1
	(8) Uninterruptible Power Supply & Power Regulator	Uninterruptible Power Supply (UPS), Automatic Voltage Regulator (AVR), Insulated Transformer (IT)	1
	(9) Emergency Power Supply (Engine Generator)		1
	(10) Air Conditioner		2
4.	**Rainfall Gauging Station**		
	(1) Remote Terminal Unit (RTU)		5
	(2) Radio Equipment for 400MHz		5
	(3) Antenna System		5
	(4) Sensor Rainfall Gauge with Data Memory Pack		5
	(5) Uninterruptible Power Supply & Power Regulator	Photovoltaic Panel, Charge Controller, Storage Battery	5
5.	**Water Level Gauging Station**		
	(1) Remote Terminal Unit (RTU)		5
	(2) Radio Equipment for 400MHz		5
	(3) Antenna System		5
	(4) Sensor Water Level Gauge with Data Memory Pack		5
	(5) Uninterruptible Power Supply & Power Regulator	Photovoltaic Panel, Charge Controller, Storage Battery	5
6.	**Warning Post**		
	(1) Warning Equipment		10
	(2) Siren Equipment	Siren Control Board, Motor Siren	10
	(3) Audio Amplifier		10
	(4) Laud Speaker and Sound Collector	Loud Speaker, Speaker Junction Box	10
	(5) Radio Equipment for 400MHz		10
	(6) Antenna System		10
	(7) Uninterruptible Power Supply & Power Regulator	DC Power Supply, Insulated Transformer (IT)	10
7.	**Repeater Station (Telemetry System)**		
	(1) Repeater Equipment		1
	(2) Radio Equipment for 400MHz		2
	(3) Antenna System		1
	(4) Power Supply		1
8.	**Repeater Station (Wireless LAN)**		
	(1) Radio Equipment for 5.2 GHz Wireless LAN		4
	(2) Antenna System		2
	(3) Uninterruptible Power Supply & Power Regulator		2

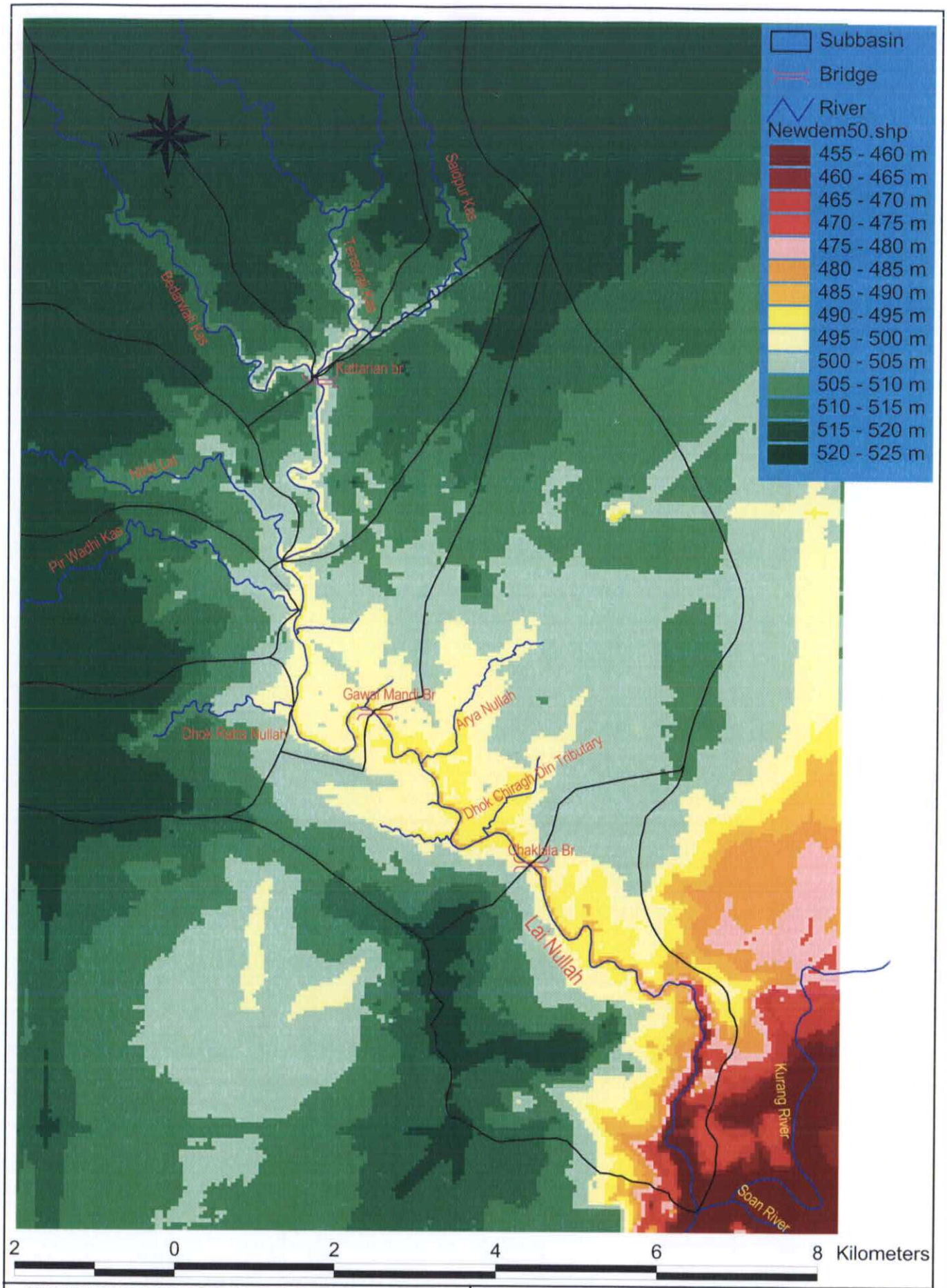
Table 7.3.1 Construction Schedule

	Item	2004	2005	2006	2007	2008	2009	2010	2011	2012
		1	2	3	4	5	6	7	8	9
		Urgent Project								
A	**FLOOD RETARDING BASIN (COMMUNITY POND) IN JINNAH PARK**									
	Mobilization									
	DIVERSION FACILITIES									
	Clearing and Grubbing									
	River Improvement									
	Fixed Weir (H=2.5m)									
	Diversion Weir with Orifice (H=5.2m)									
	Diversion Channel									
	Miscellaneous Works									
	DETENTION FACILITIES									
	Clearing and Grubbing									
	Detention Dam (H=20m)									
	Reservoir Excavation									
	Miscellaneous Works									
	FACILITIES FOR MULTIPLE USE OF COMMUNITY POND									
	Public Facilities									
	Sports and Recreation Facilities									
	Amenity and Landscape									
	Miscellaneous Works									
					Short and Long Term Project					
B	**DIVERSION CHANNEL**									
	Diversion Channel (Bedarawali Kas - Tenawali Kas)									
	Clearing and Grubbing									
	Fixed Weir									
	Diversion Weir									
	Diversion Channel (L=2,450m)									
	Bridge									
	Miscellaneous Works									
	Diversion Channel (Tenawali Kas - Saidpur Kas)									
	Clearing and Grubbing									
	Hydraulic Drop (Tenawali Kas)									
	Intake Weir (Tenawali Kas)									
	Hydraulic Drop (Kanitawali Kas)									
	Diversion Weir (Saidpur Kas)									
	Diversion Channel (L=2,150m)									
	Bridge									
	Miscellaneous Works									
	Diversion Channel (Saidpur Kas - Kurang River)									
	Clearing and Grubbing									
	Hydraulic Drop (Ojhri Kas 1)									
	Hydraulic Drop (Ojhri Kas 2)									
	Diversion Channel (L=5,126m)									
	Hydraulic Drop (Diversion Channel)									
	Bridge									
	Miscellaneous Works									
				Short Term Project						
C	**LAI NULLAH IMPROVEMENT**									
	SLOPE PROTECTION									
	Slope Protection									
	Drainage Outlet									
	Miscellaneous Works									
		Urgent Project								
	DOWNSTREAM RIVER IMPROVEMENT WITH SHORT CUT CHANNEL									
	Clearing and Grubbing									
	Excavation and Embankment Works									
	Slope Protection									
	Drainage Outlet									
	Miscellaneous Works									
D	**KURANG RIVER IMPROVEMENT**									
	Clearing and Grubbing									
	Excavation and Embankment Works									
	Slope Protection (Sodding)									
	Drainage Outlet									
	Miscellaneous Works									

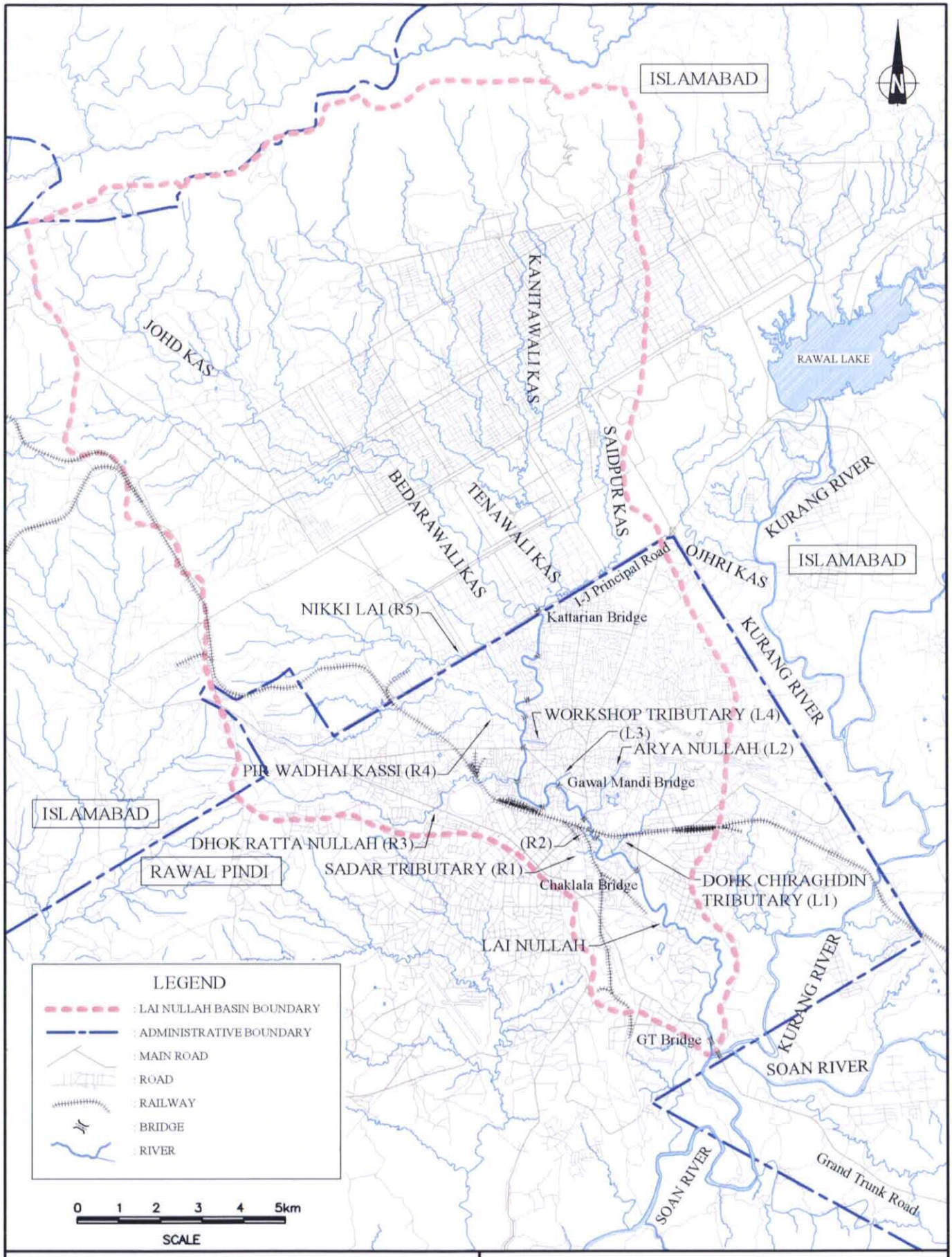
FIGURES AT THE BACK OF REPORT



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 2.1.1 Elevation Map of Lai Nullah Basin
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 2.1.2 Elevation Map of Flood Mapping Area
JAPAN INTERNATIONAL COOPERATION AGENCY	

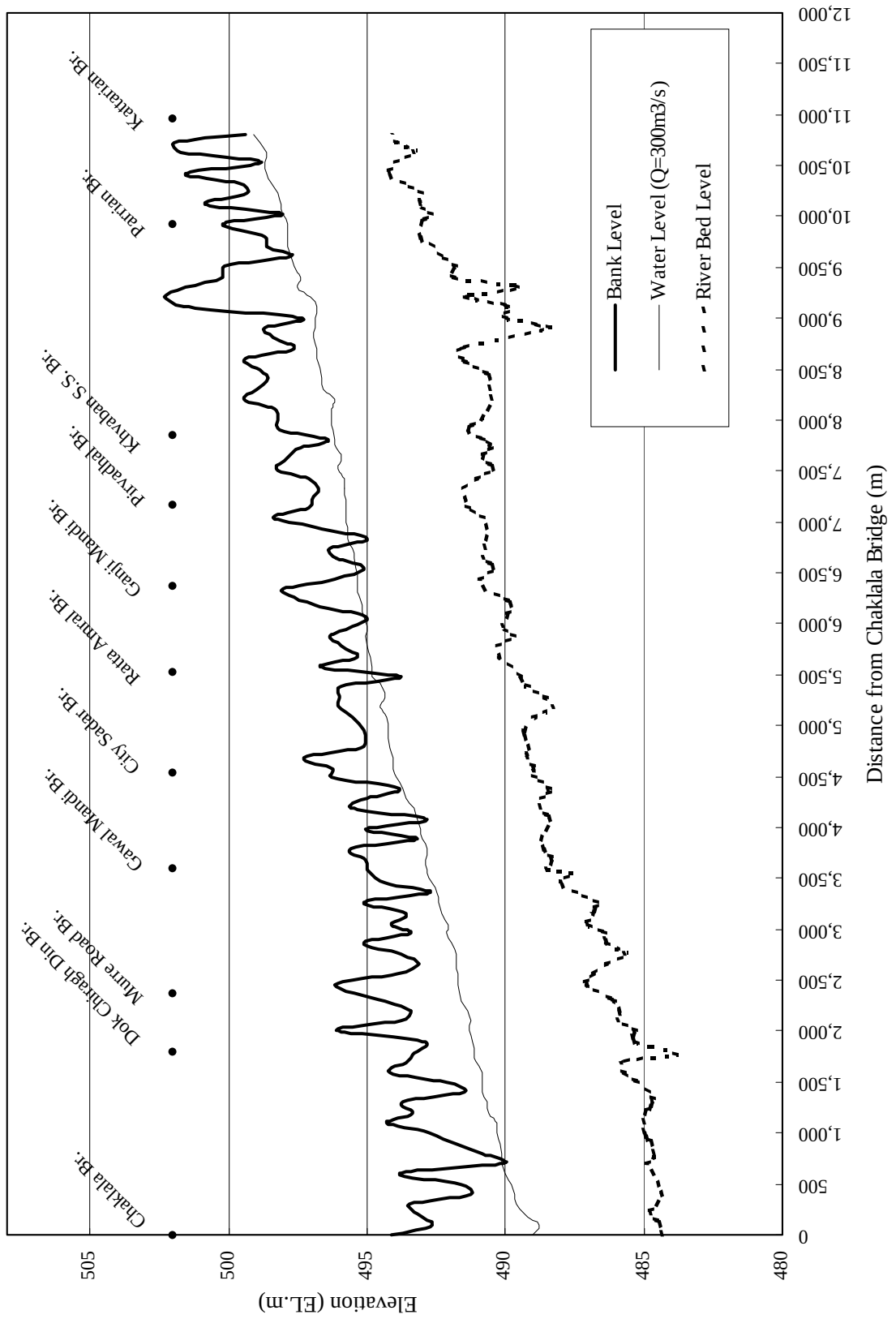


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

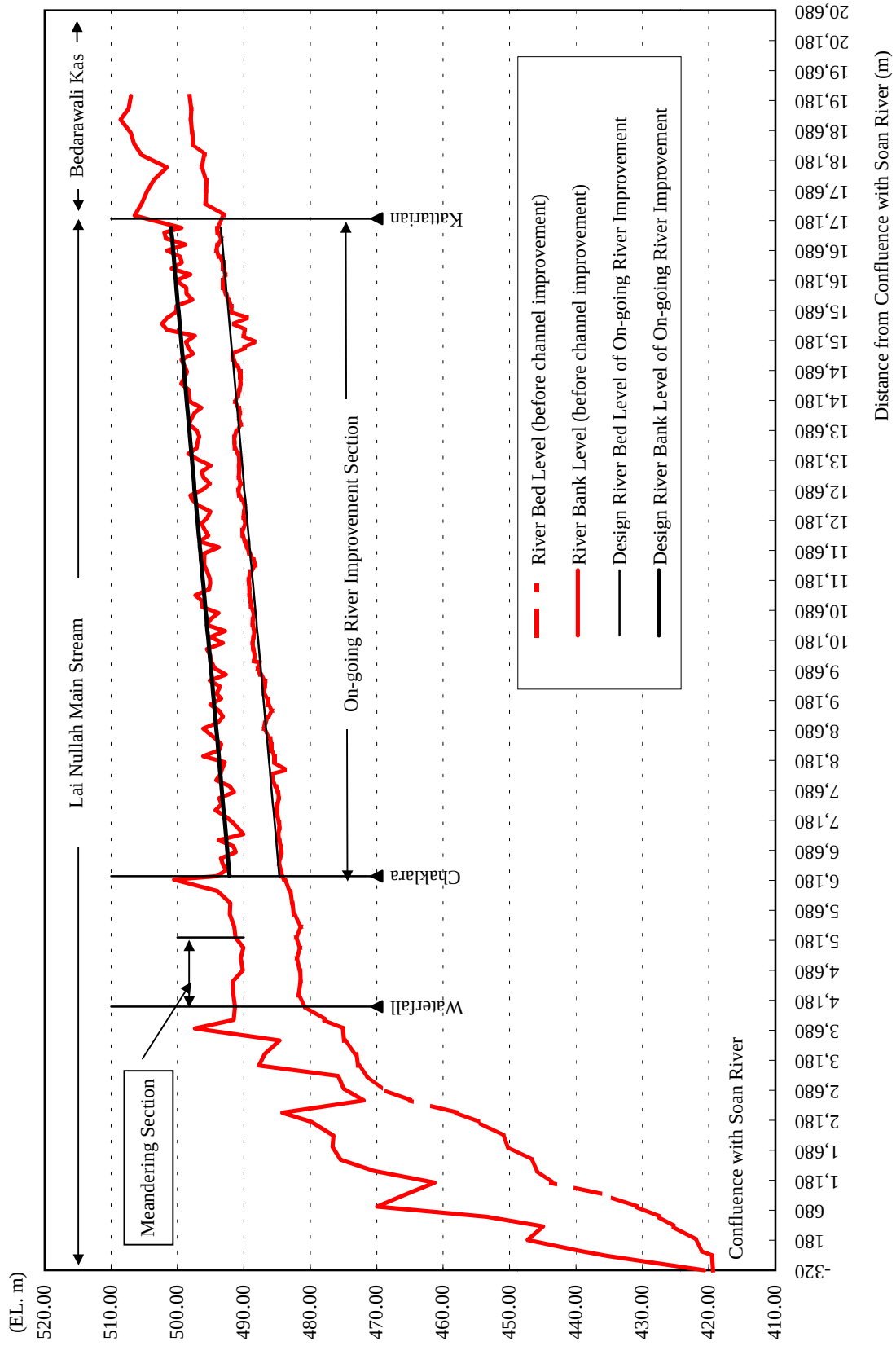
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 2.3.1

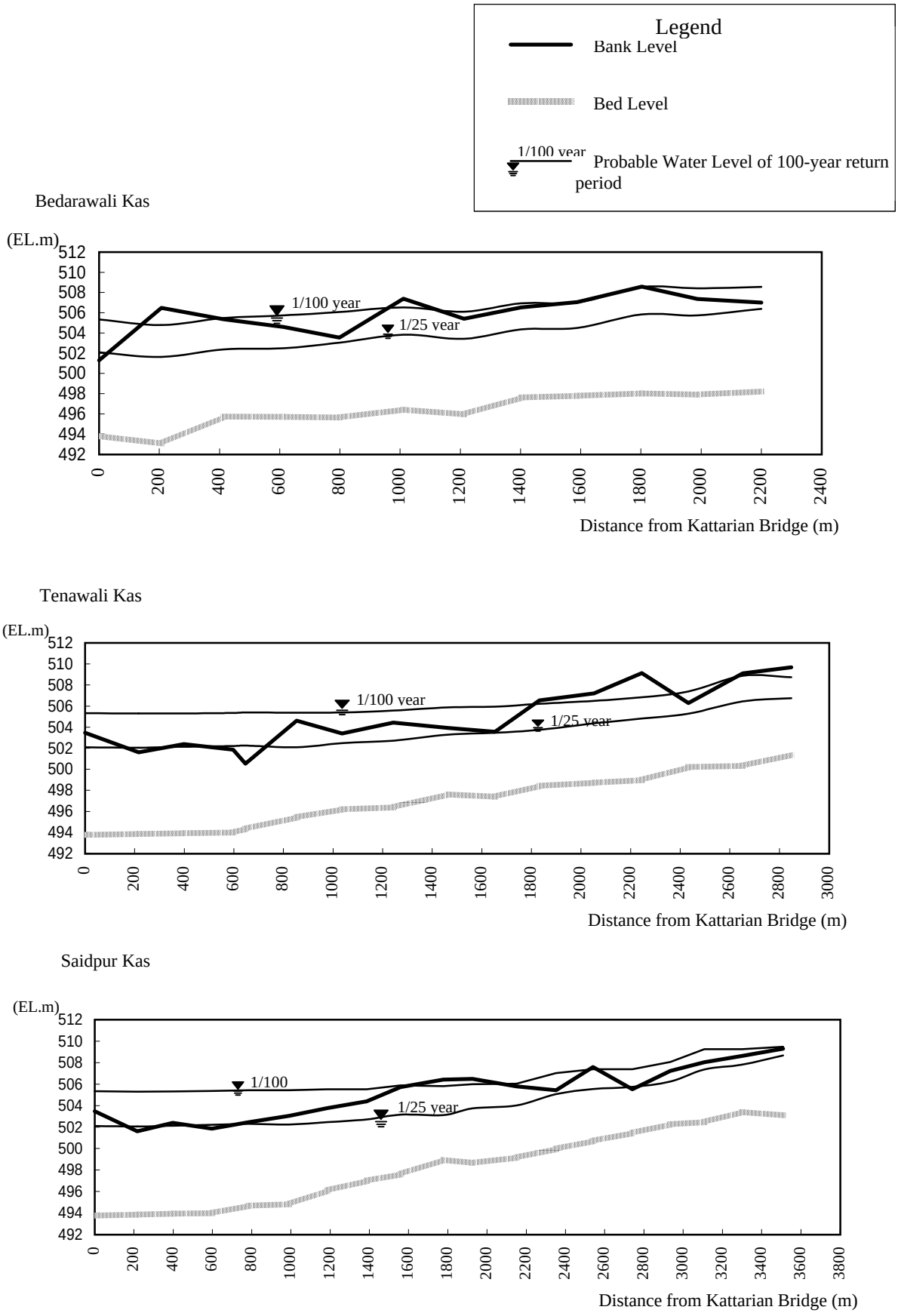
River System of Lai Nullah



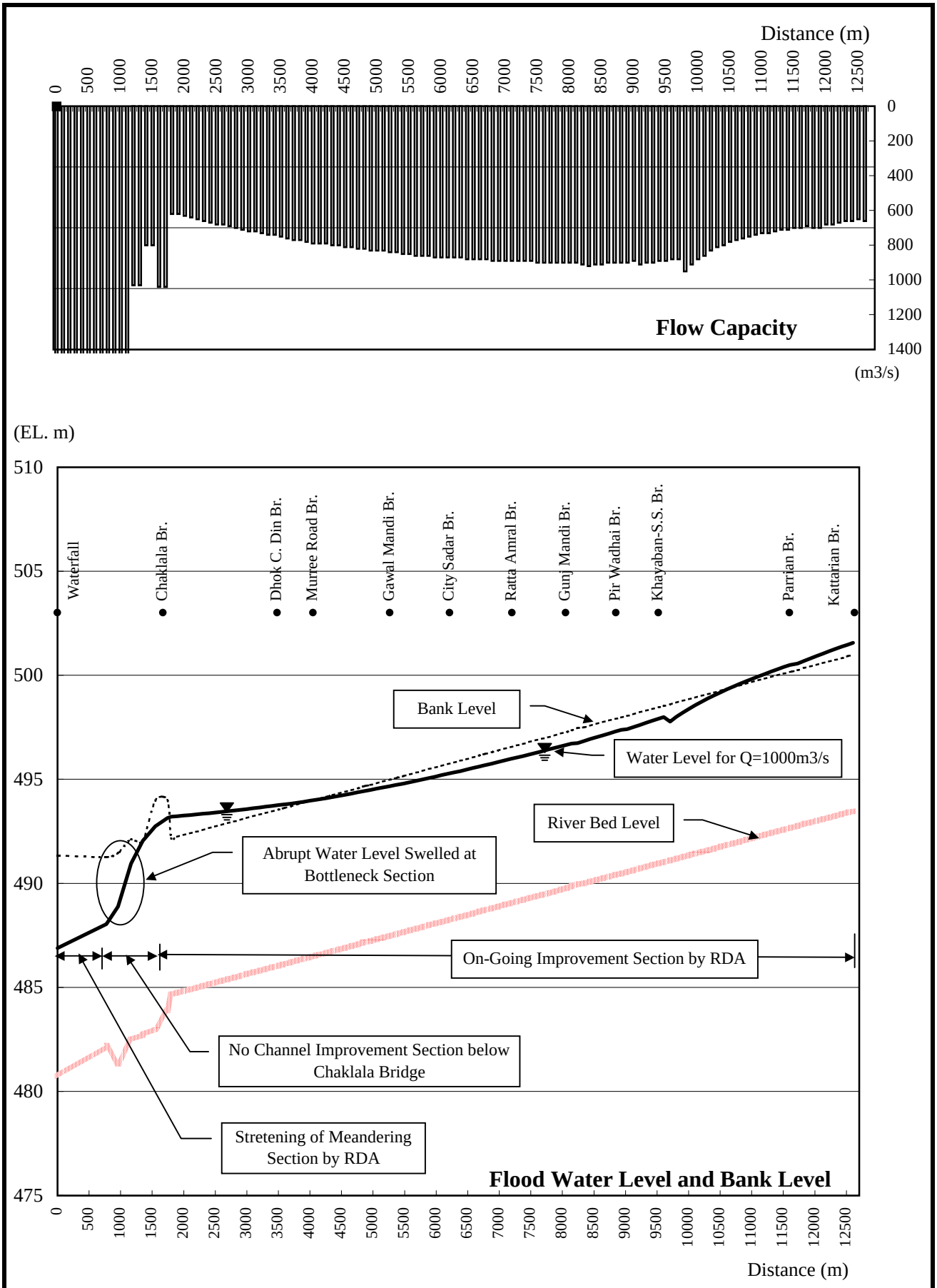
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 2.3.2 Longitudinal Profile of Lai Nullah before On-going River Improvement
JAPAN INTERNATIONAL COOPERATION AGENCY	



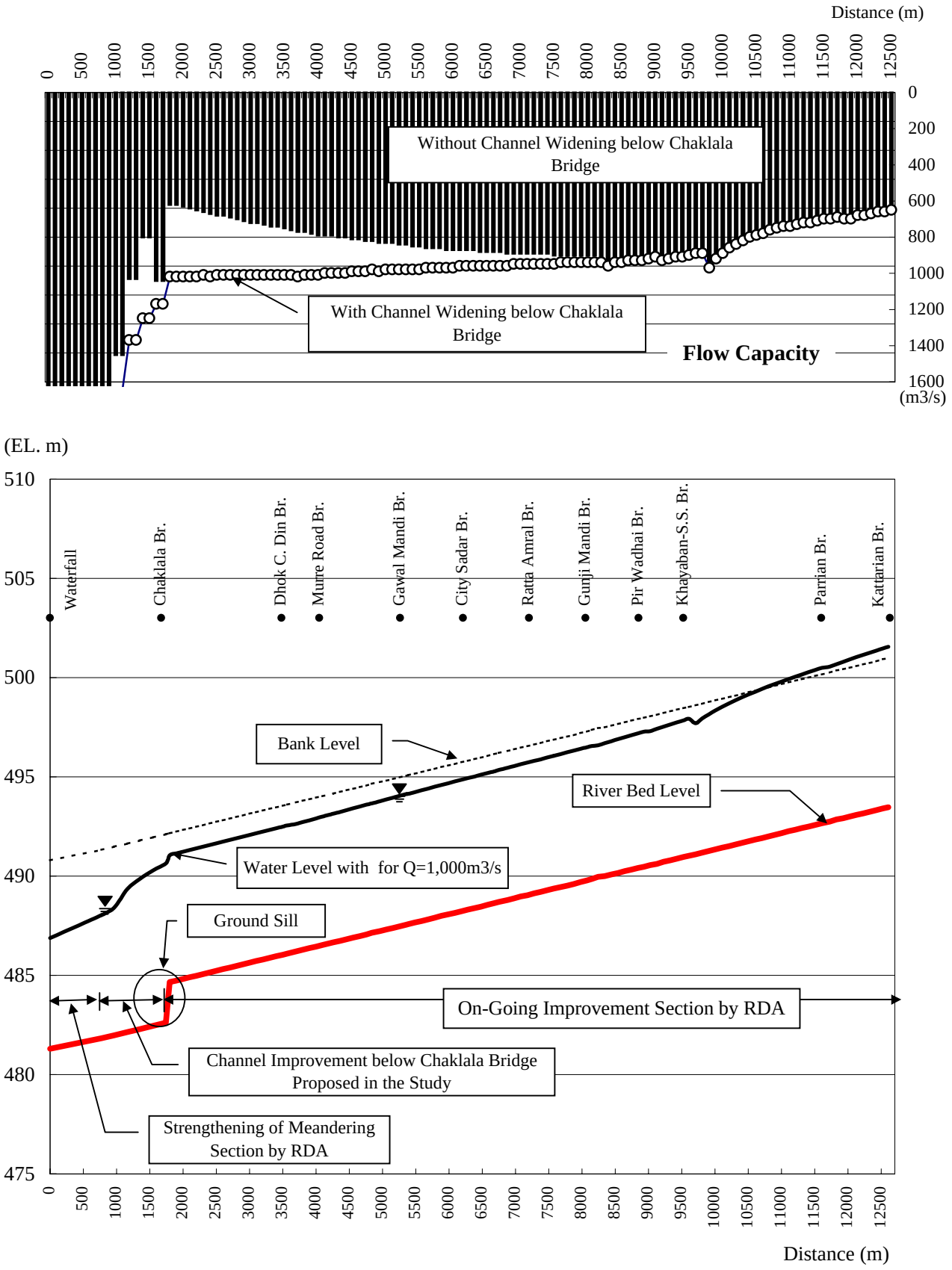
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.3.3 Longitudinal Profile of Lai Nullah



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 2.3.4
JAPAN INTERNATIONAL COOPERATION AGENCY	Comparison of Probable Water Levels and Existing Bank Levels of Bedarawali Kas, Tenawali Kas and Saidpur Kas



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 2.3.5 Channel Flow Capacity and Probable Water Level of Lai Nullah (Case of No Channel Improvement of Section below Chaklala Bridge)

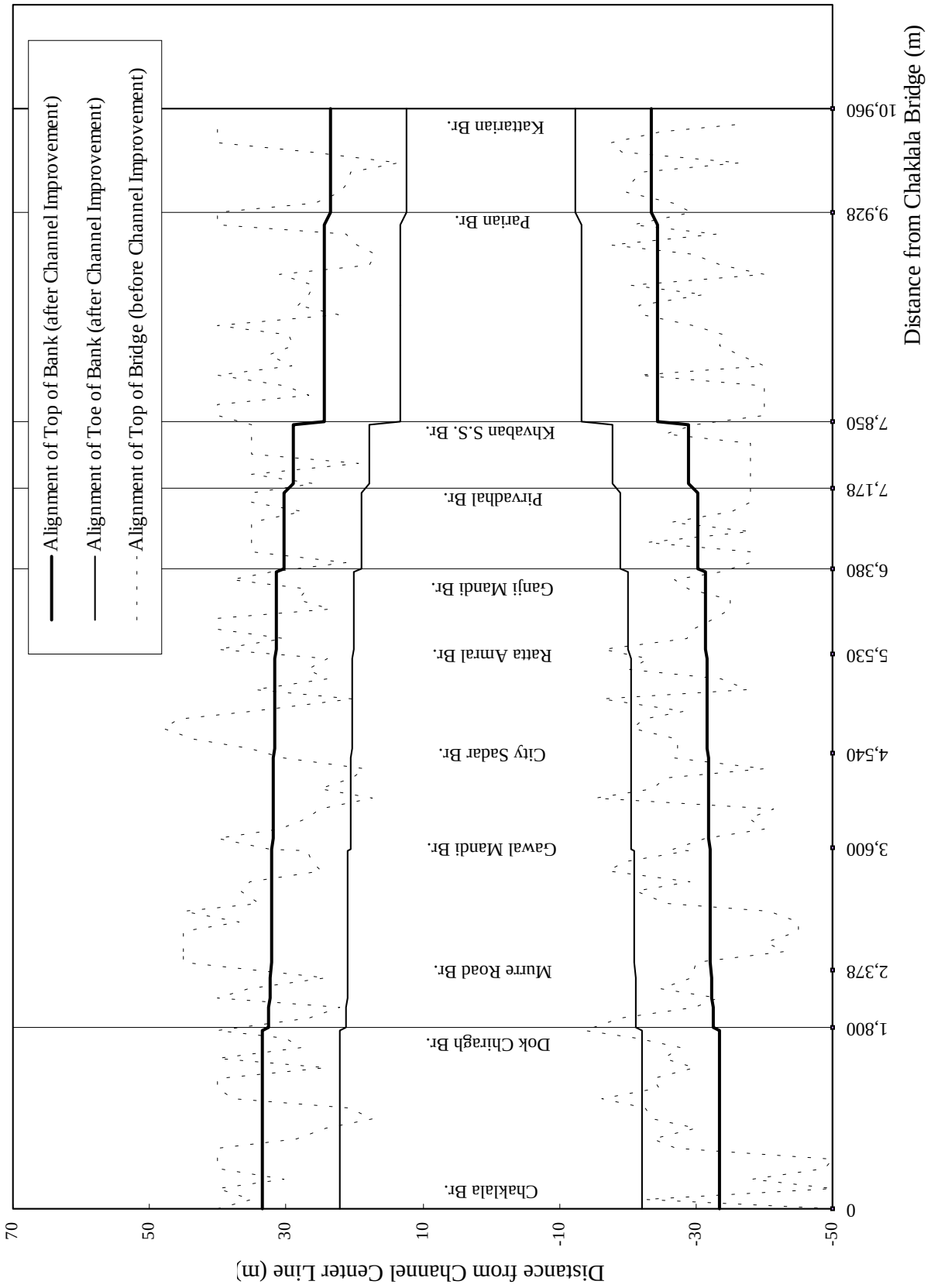


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

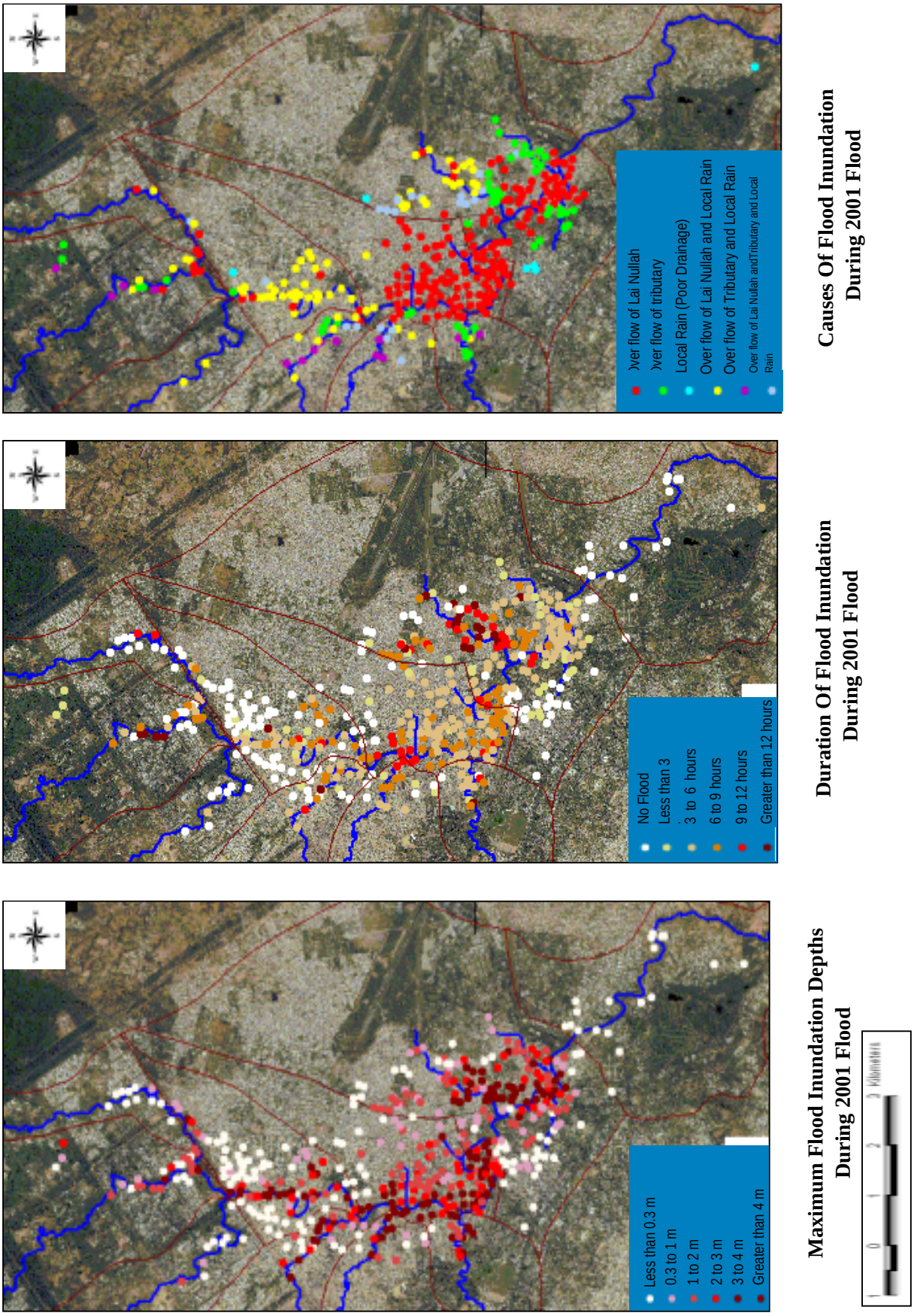
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 2.3.6

Channel Flow Capacity and Probable Water Level of Lai Nullah (Case of Channel Improvement of Section below Chaklala Bridge)



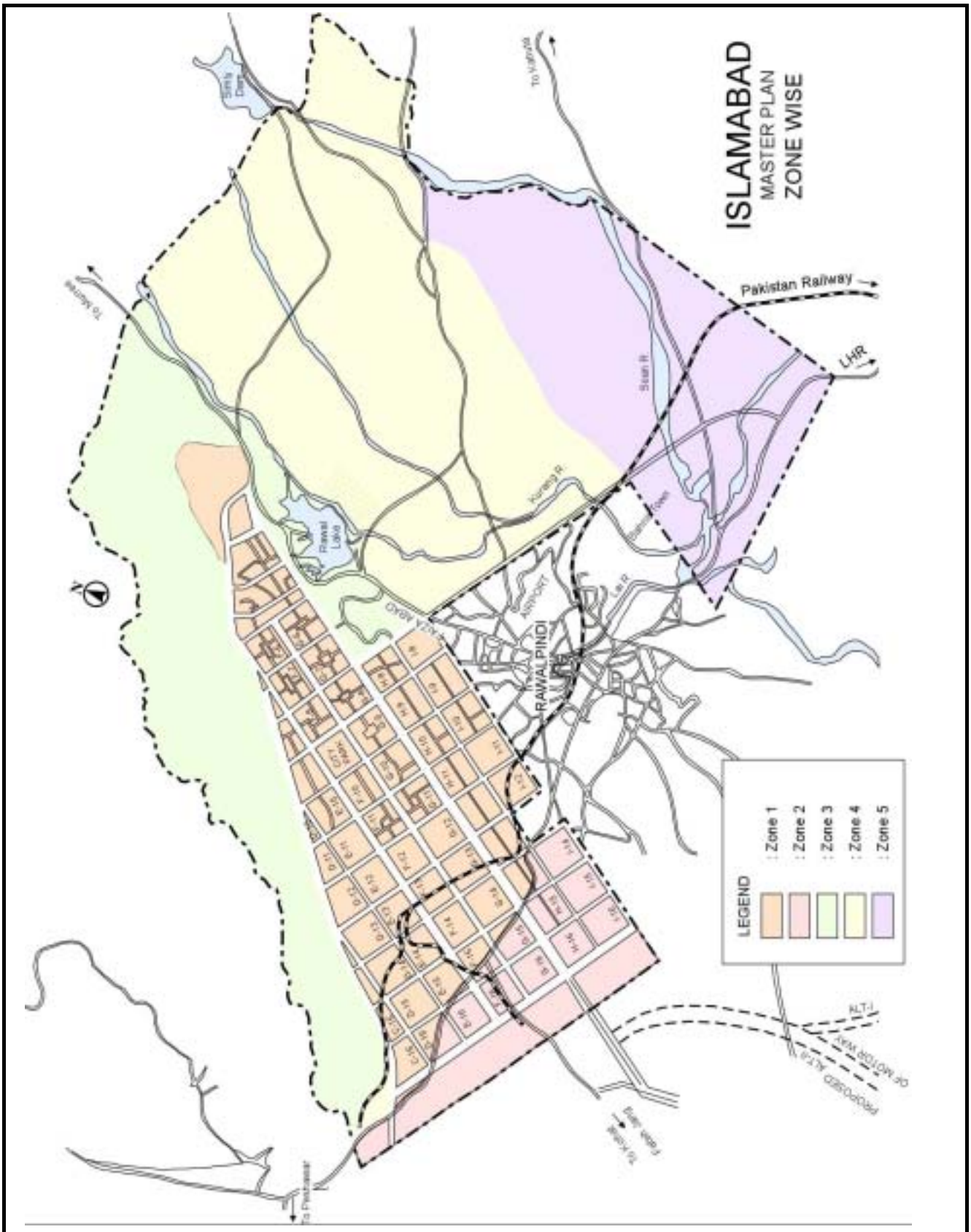
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 2.3.7
JAPAN INTERNATIONAL COOPERATION AGENCY	Channel Width of On-going River Improvement



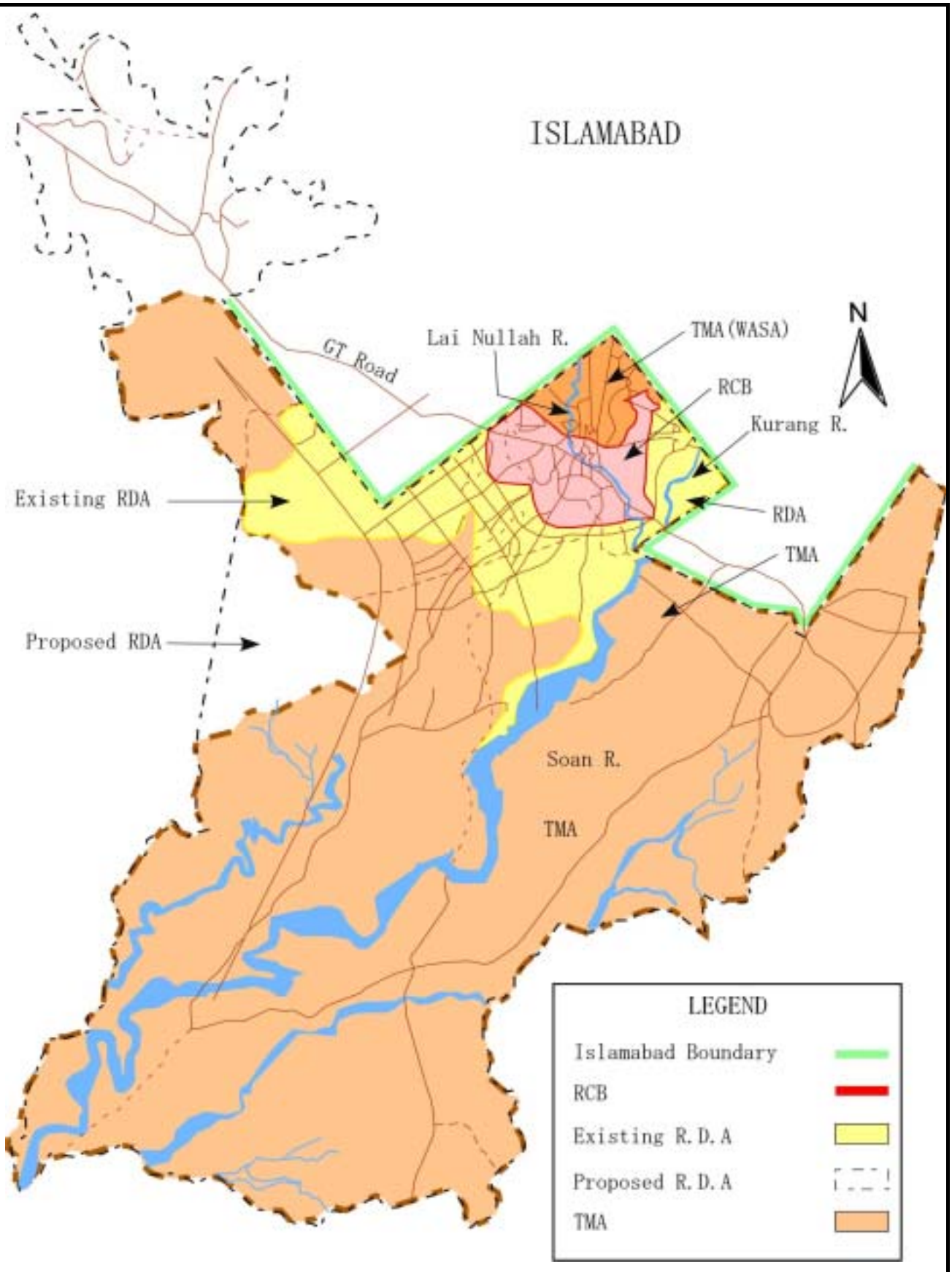
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION
AND ENVIRONMENT IMPROVEMENT PLAN
OF LAI NULLAH BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 2.5.1
Results of Flood Inundation Interview Survey



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 3.1.1. Islamabad Area of the Master Plan
JAPAN INTERNATIONAL COOPERATION AGENCY	

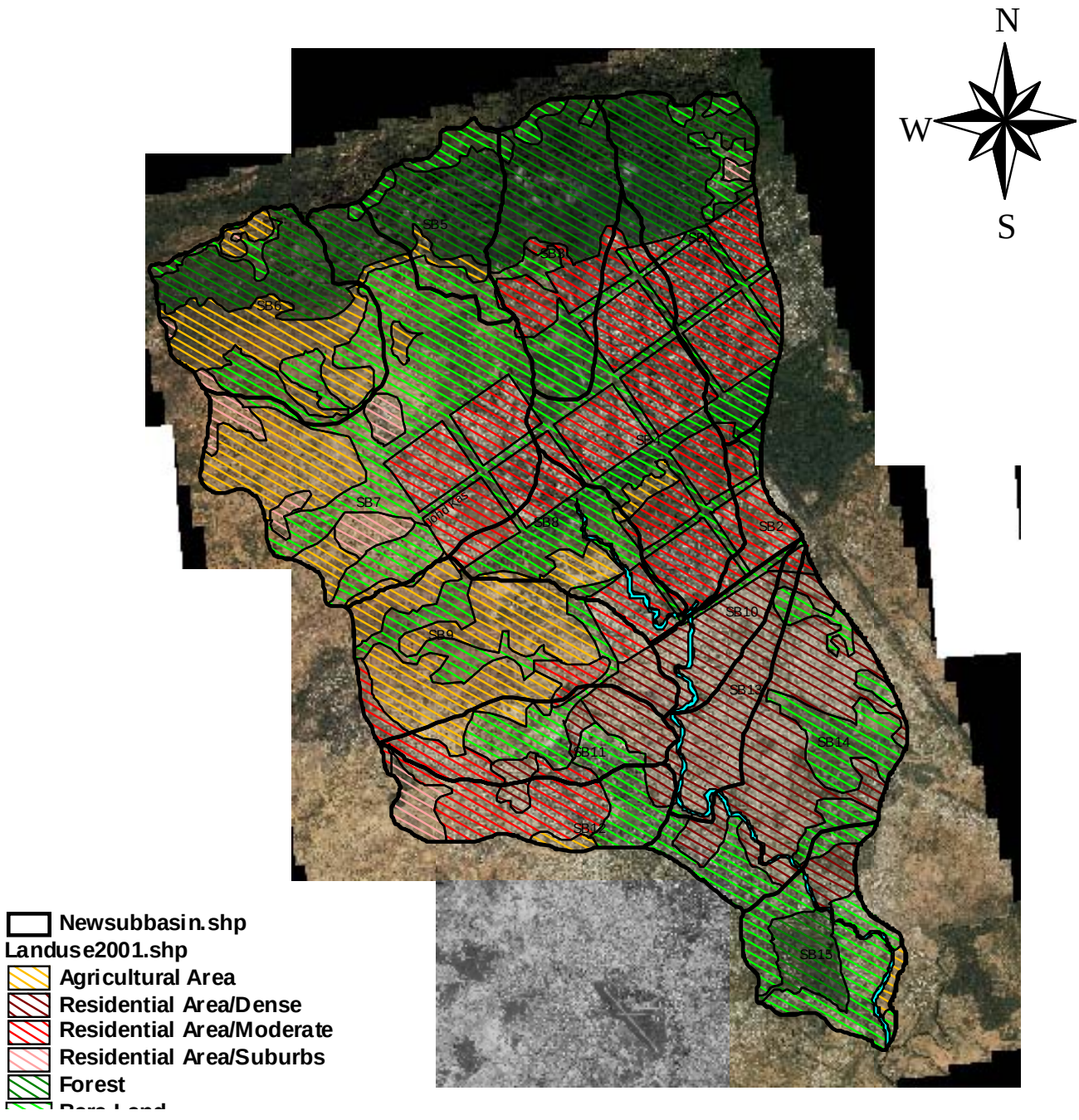


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

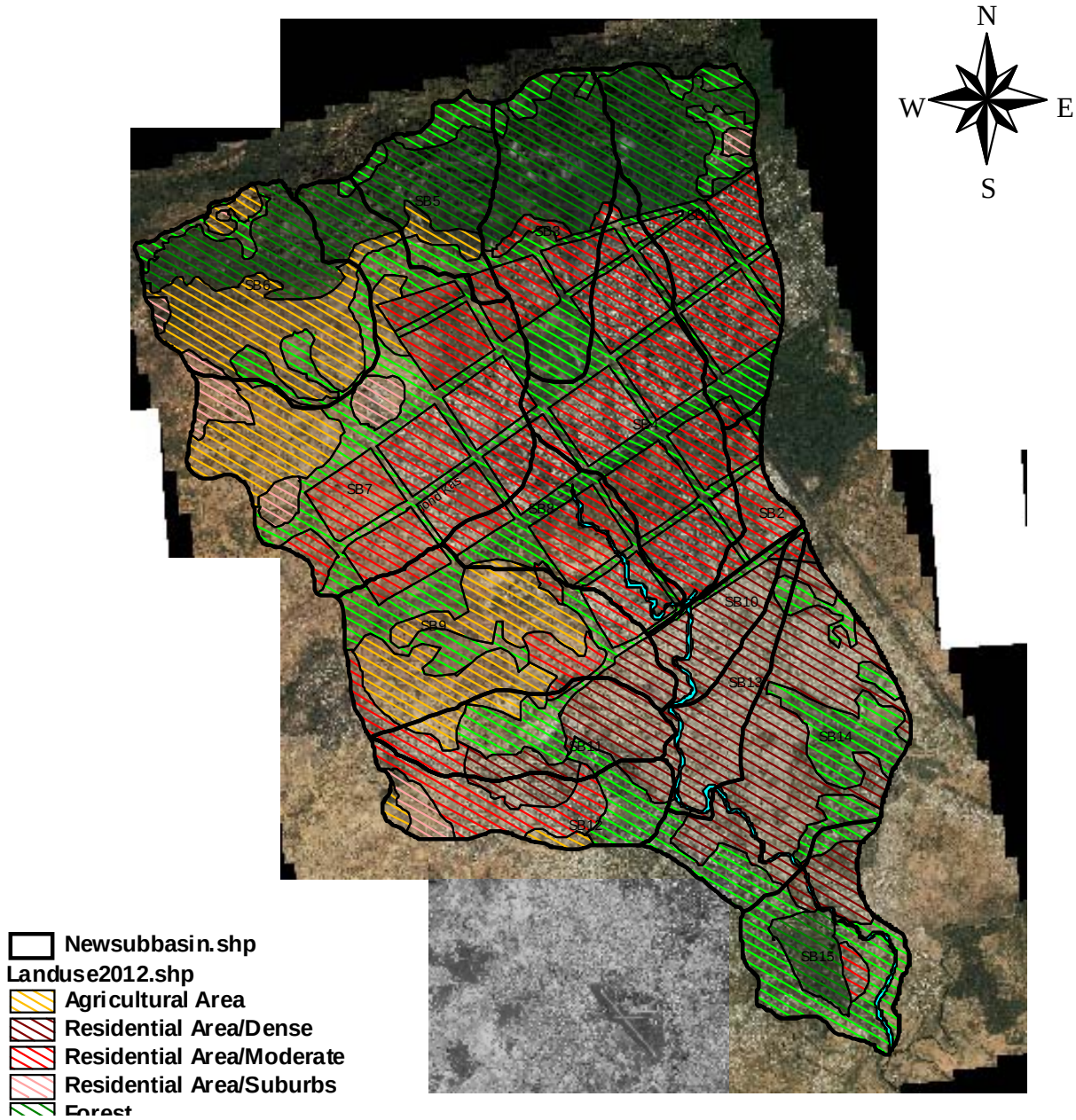
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.1.2.

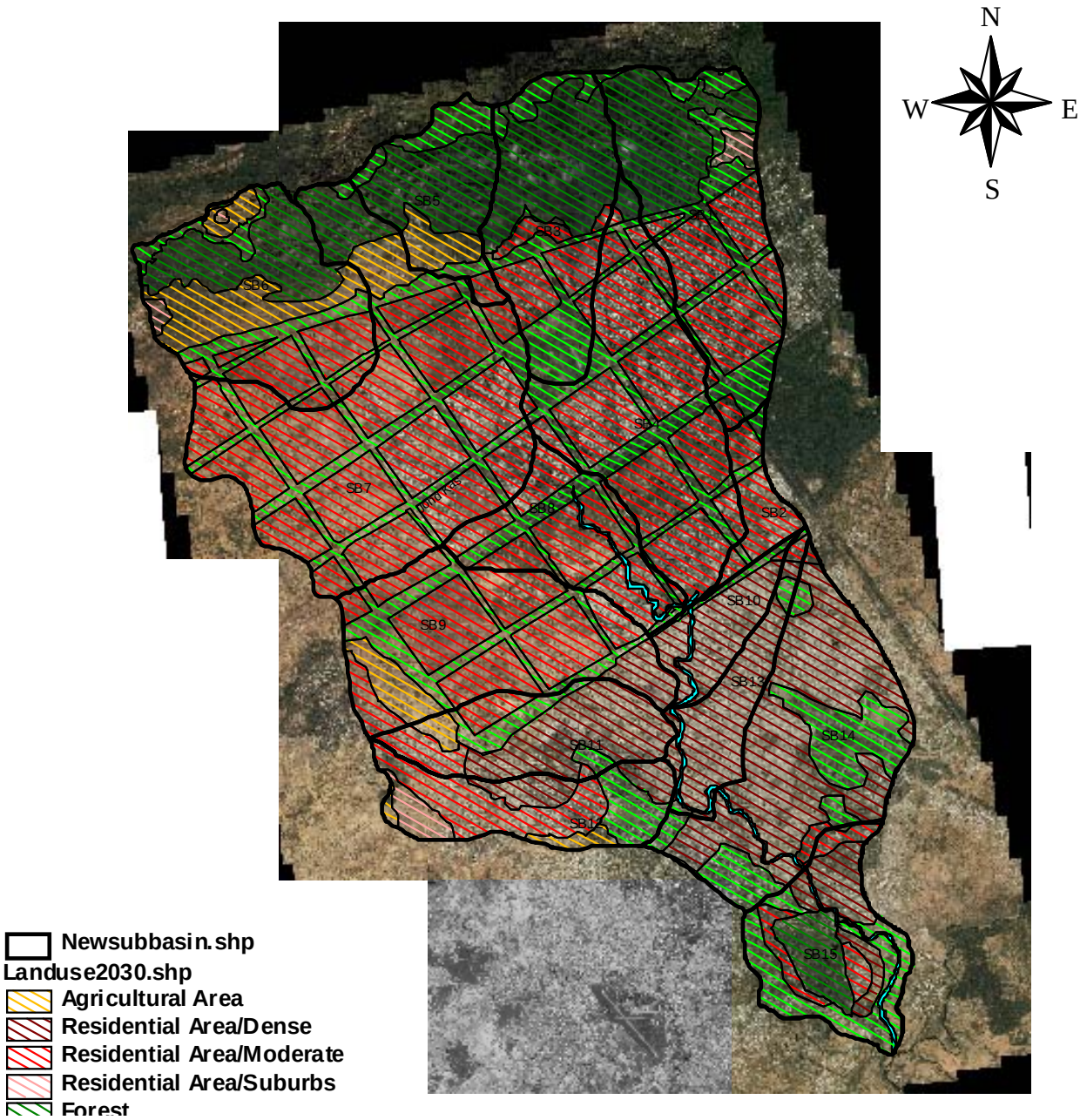
Jurisdiction and Administration of Rawalpindi



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 3.1.3
JAPAN INTERNATIONAL COOPERATION AGENCY	Land Use of the Study Area in 2001



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 3.1.4
JAPAN INTERNATIONAL COOPERATION AGENCY	Land Use of the Study Area in 2012

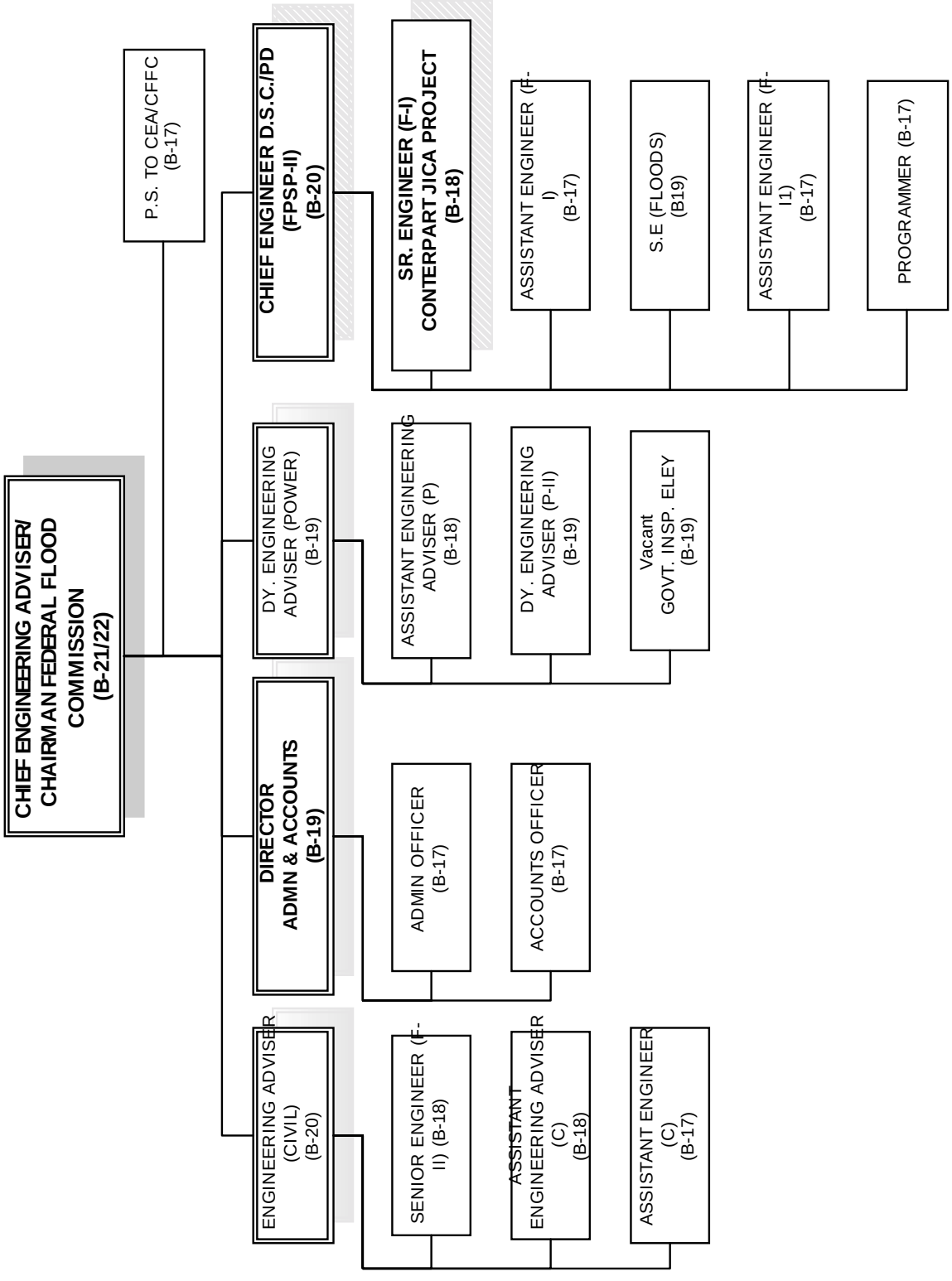


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig.3.1.5

Land Use of the Study Area in 2030



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.1

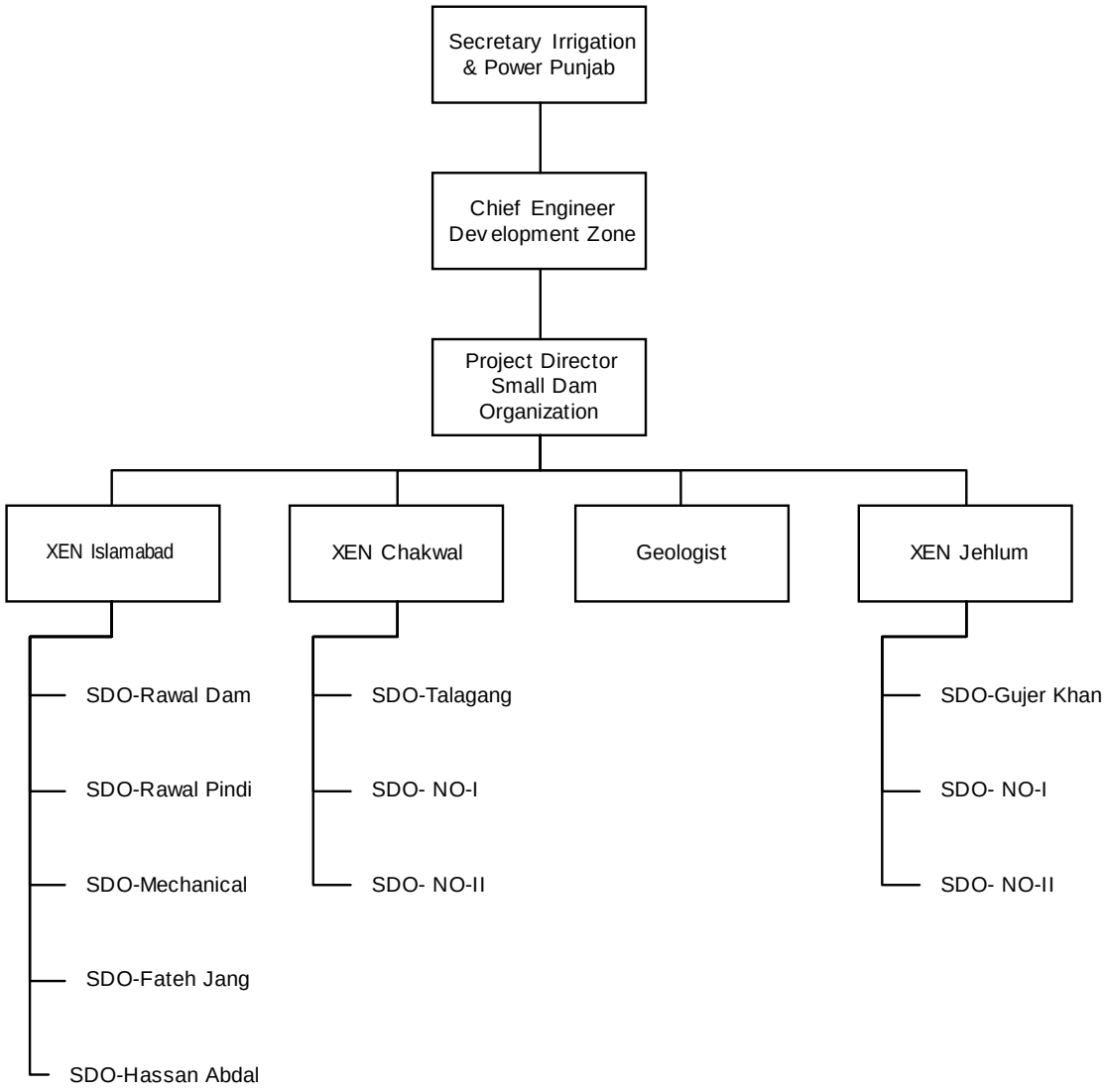
Organization Chart of Office of the Chief Engineering Adviser/Chairman Federal Flood Commission Minisitry of Water and Power

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.2

Organization Chart of Capital Development Authority (CDA)

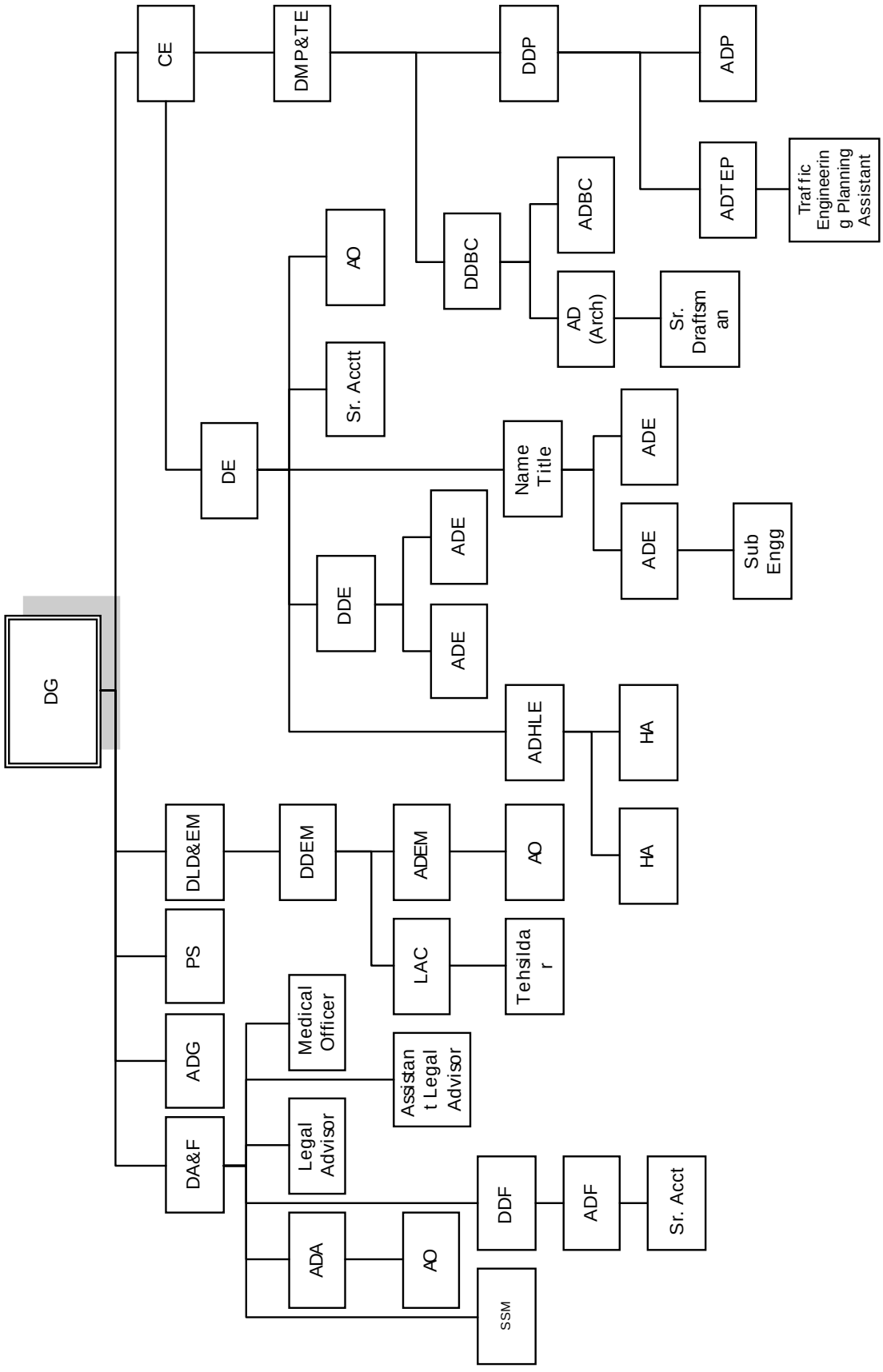


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.3

Organization Chart of Small Dams Organization (SDO)

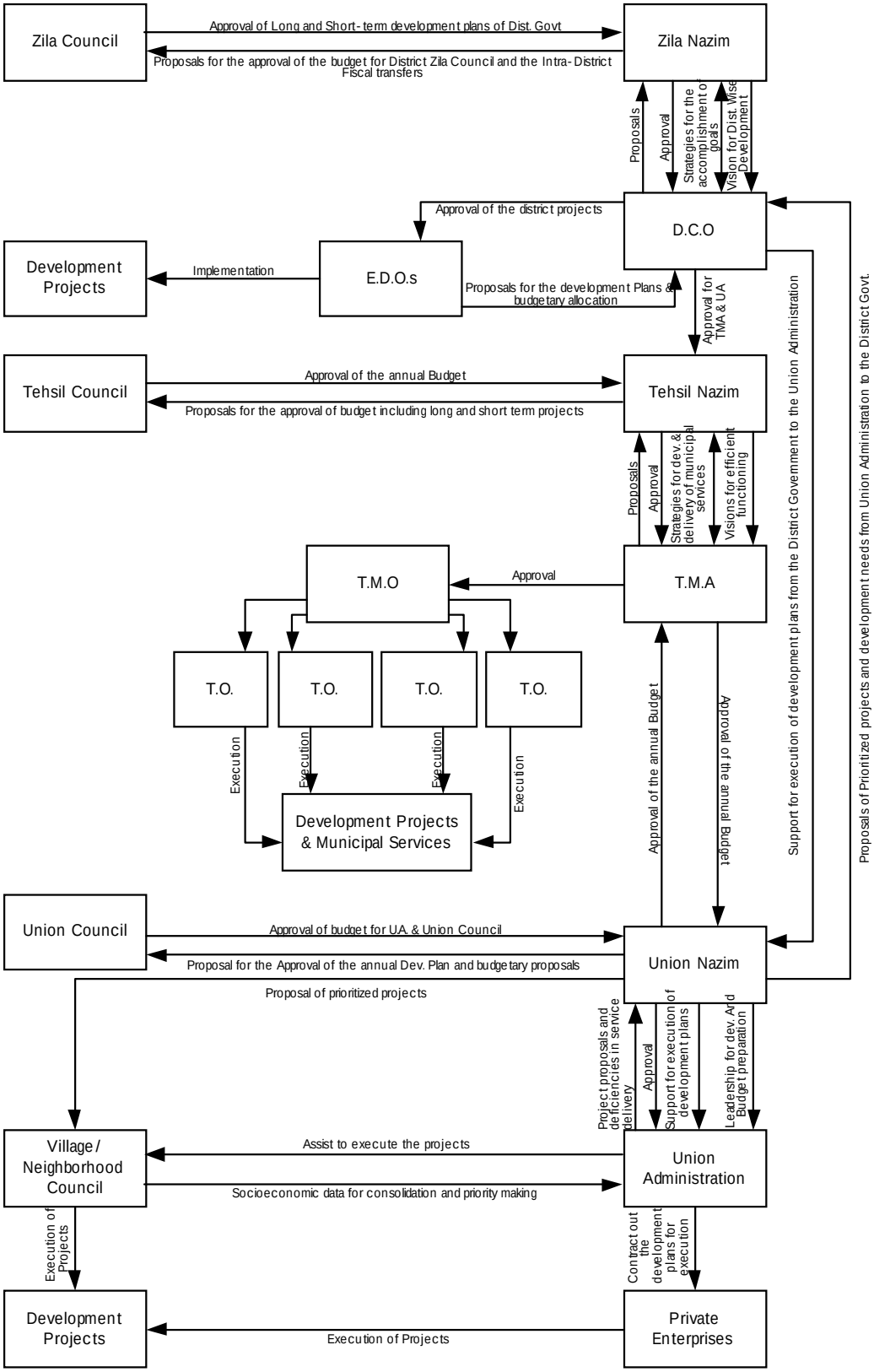


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.4

Organization Chart of Rawalpindi Development Authority (RDA) Urban Development Wing

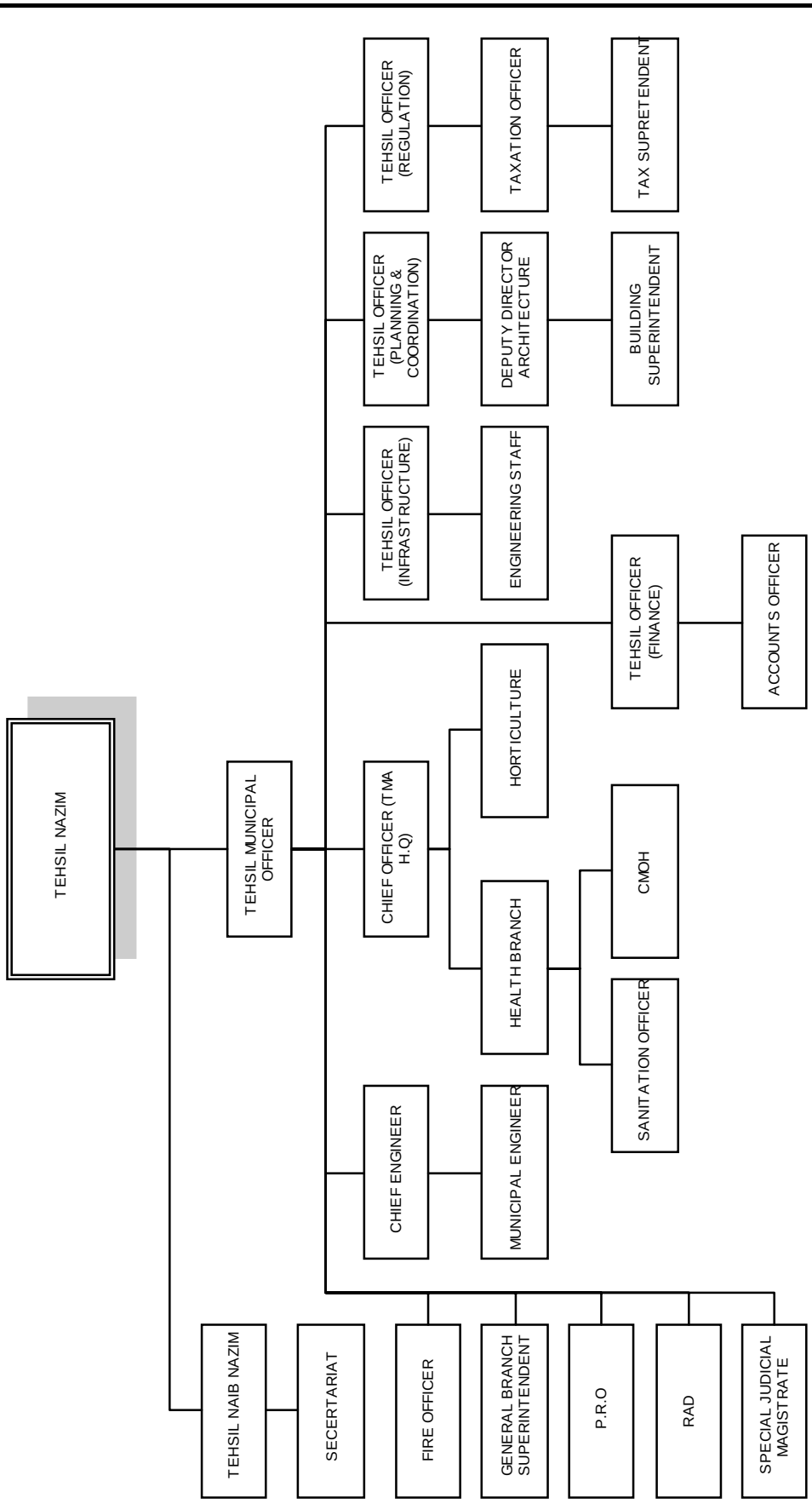


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.5

Organization Chart of District Tehsil and Union Administration

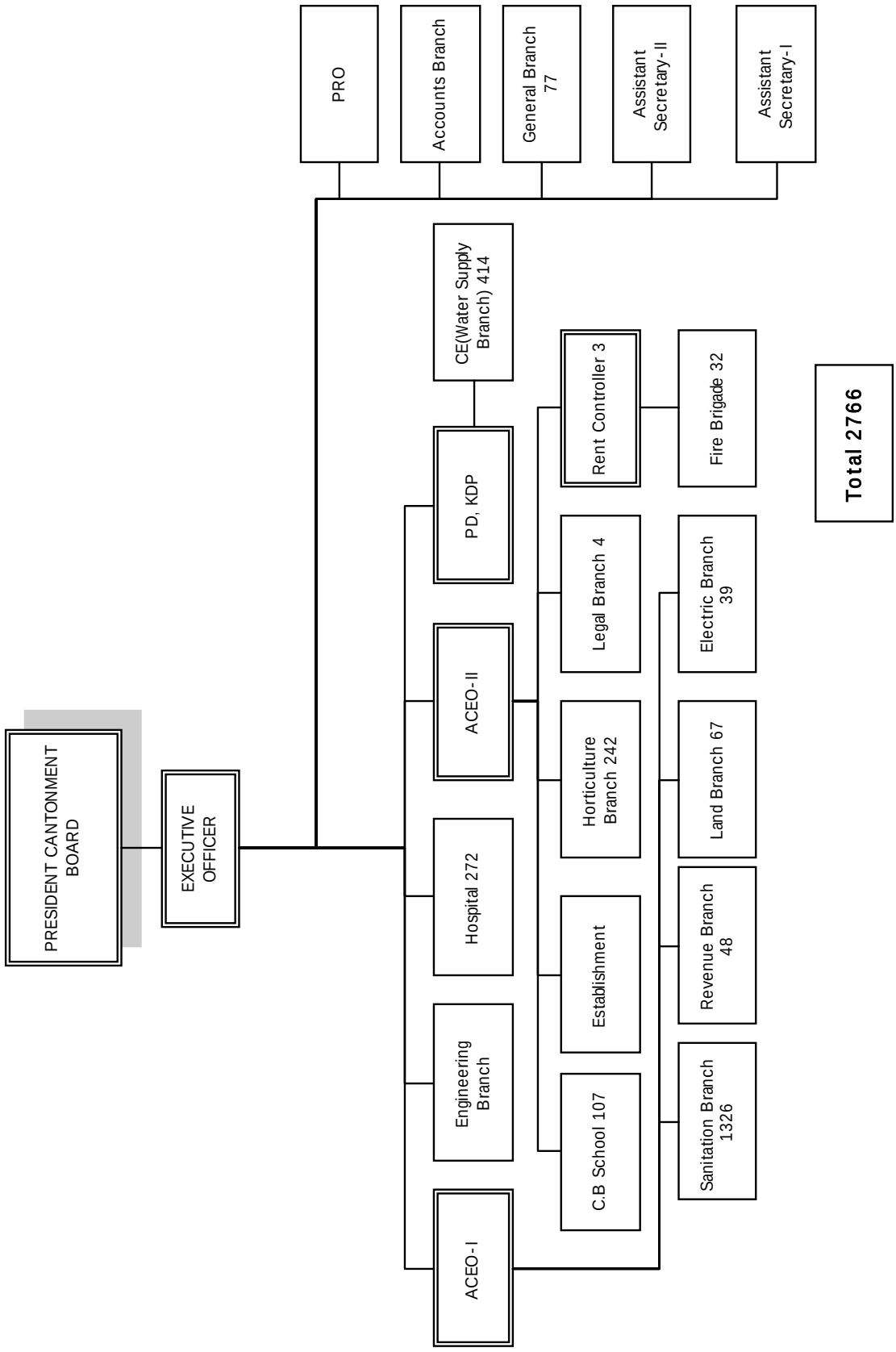


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.6

Organization Chart of Tehsil Municipal Administration Rawalpindi

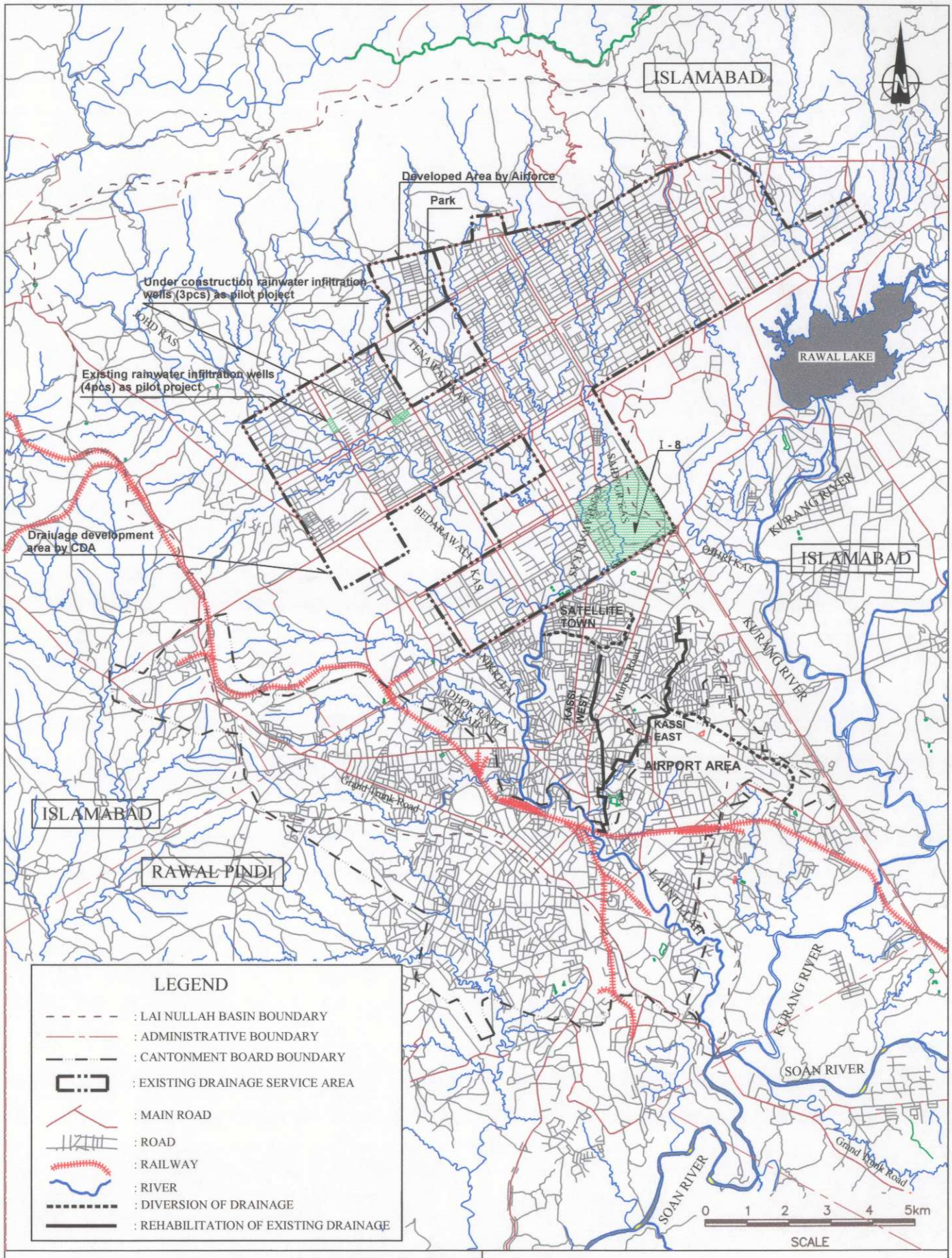


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 3.3.7

Organization Chart of Rawalpindi Cantonment Board



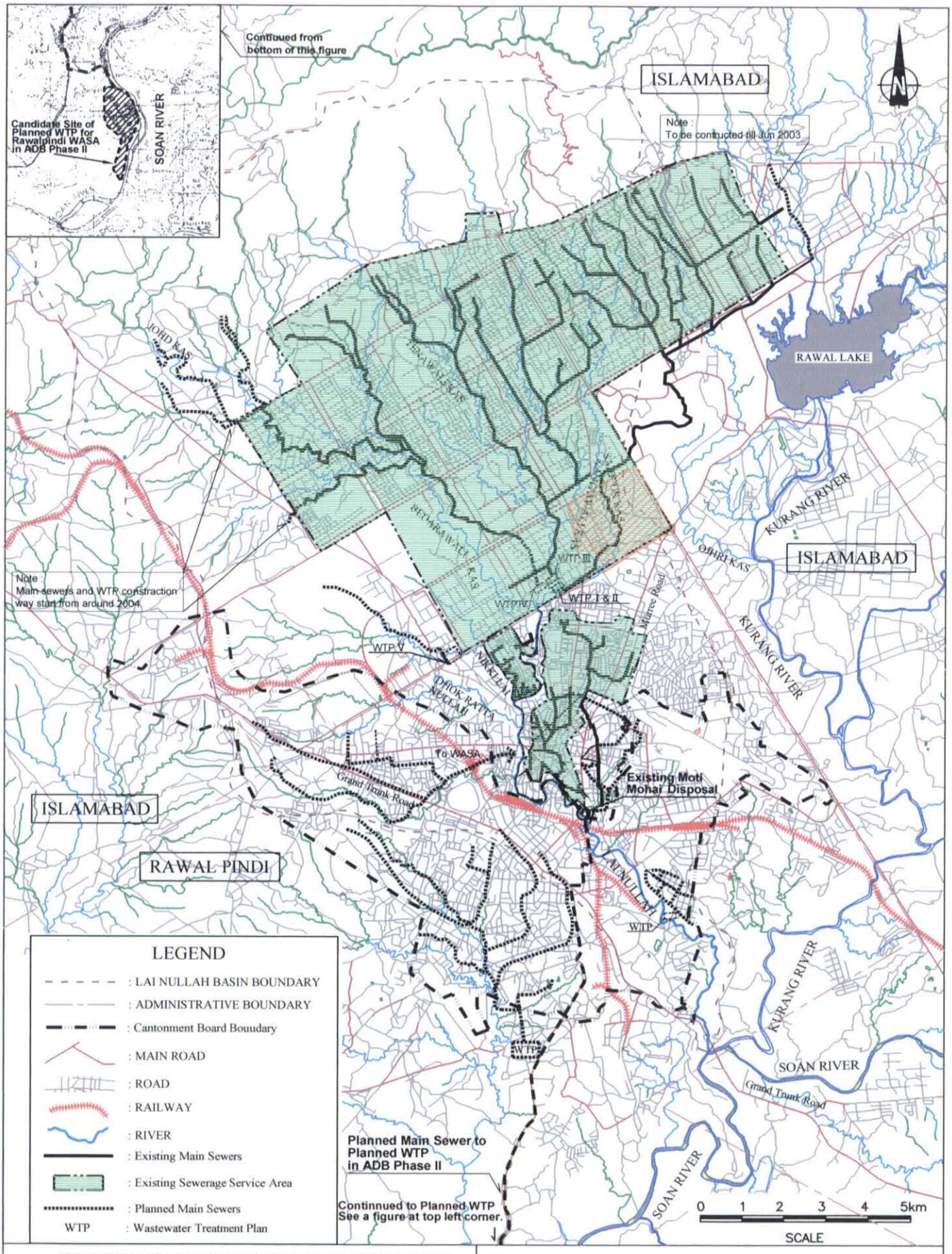
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1.1

Drainage System of the Study Area

26



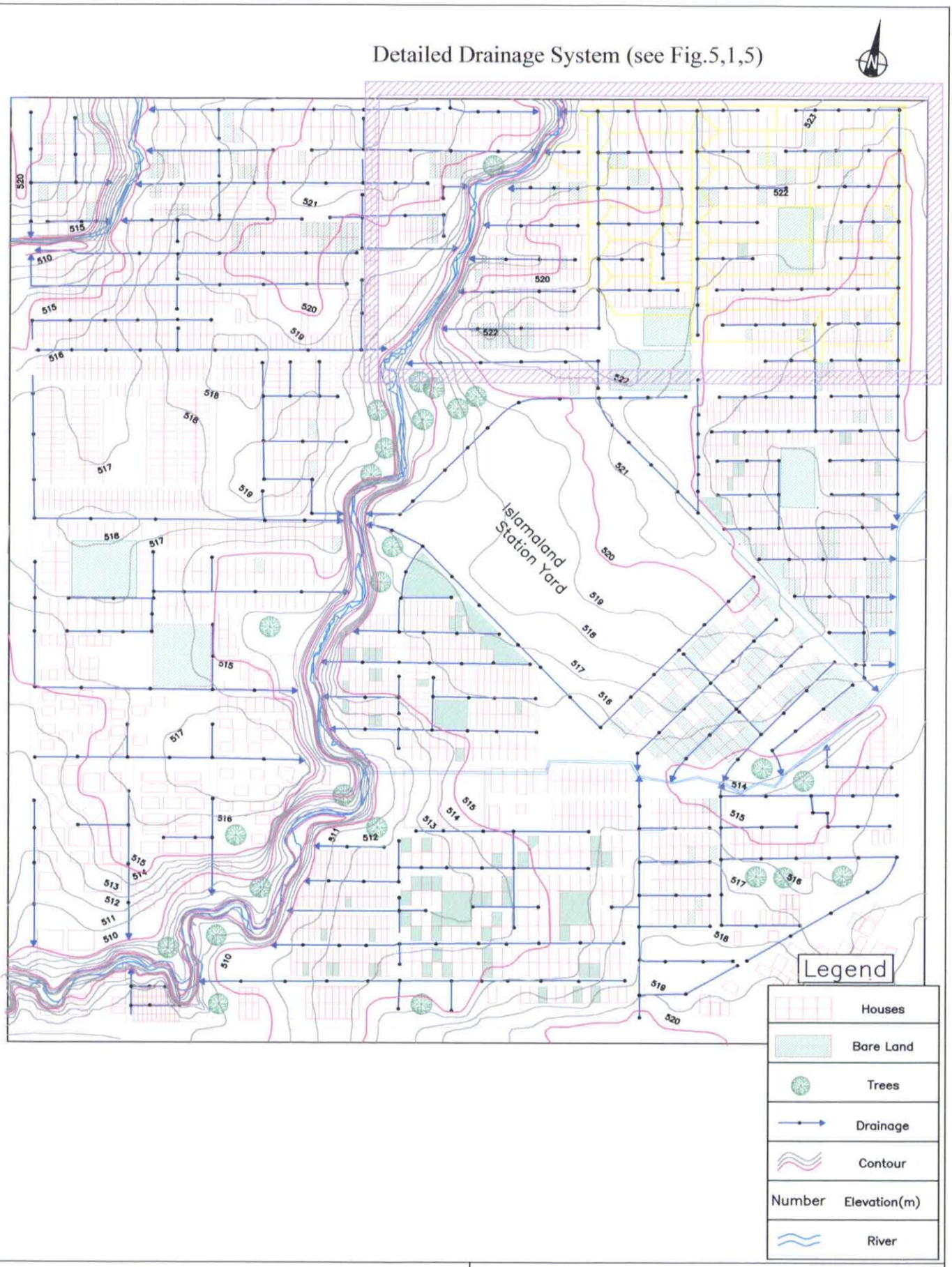
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1.2

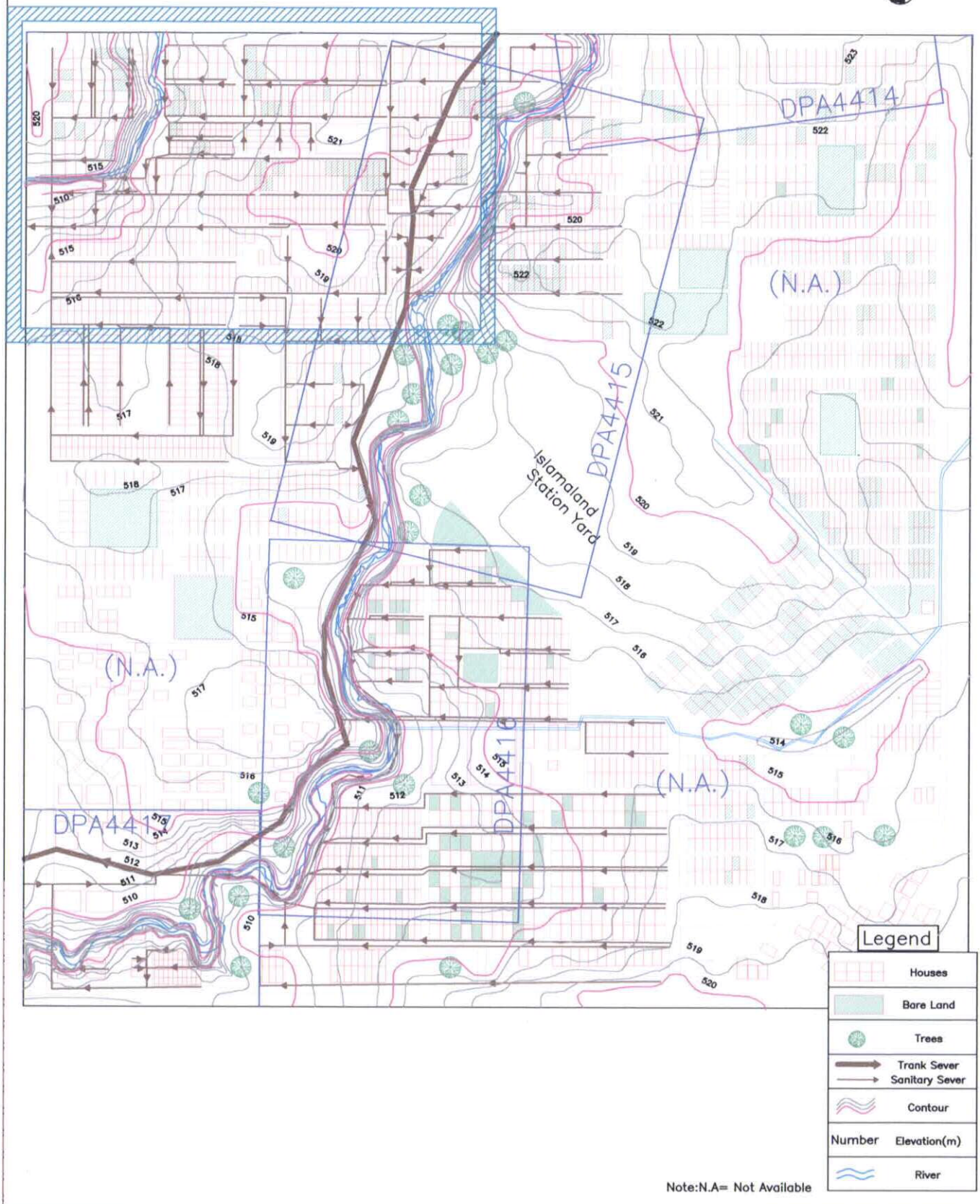
Sewerage System of the Study Area

27



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 4.1.3 Drainage System of Sector I-8, Islamabad
JAPAN INTERNATIONAL COOPERATION AGENCY	

Detailed Sewerage System (see Fig 5,1,6)



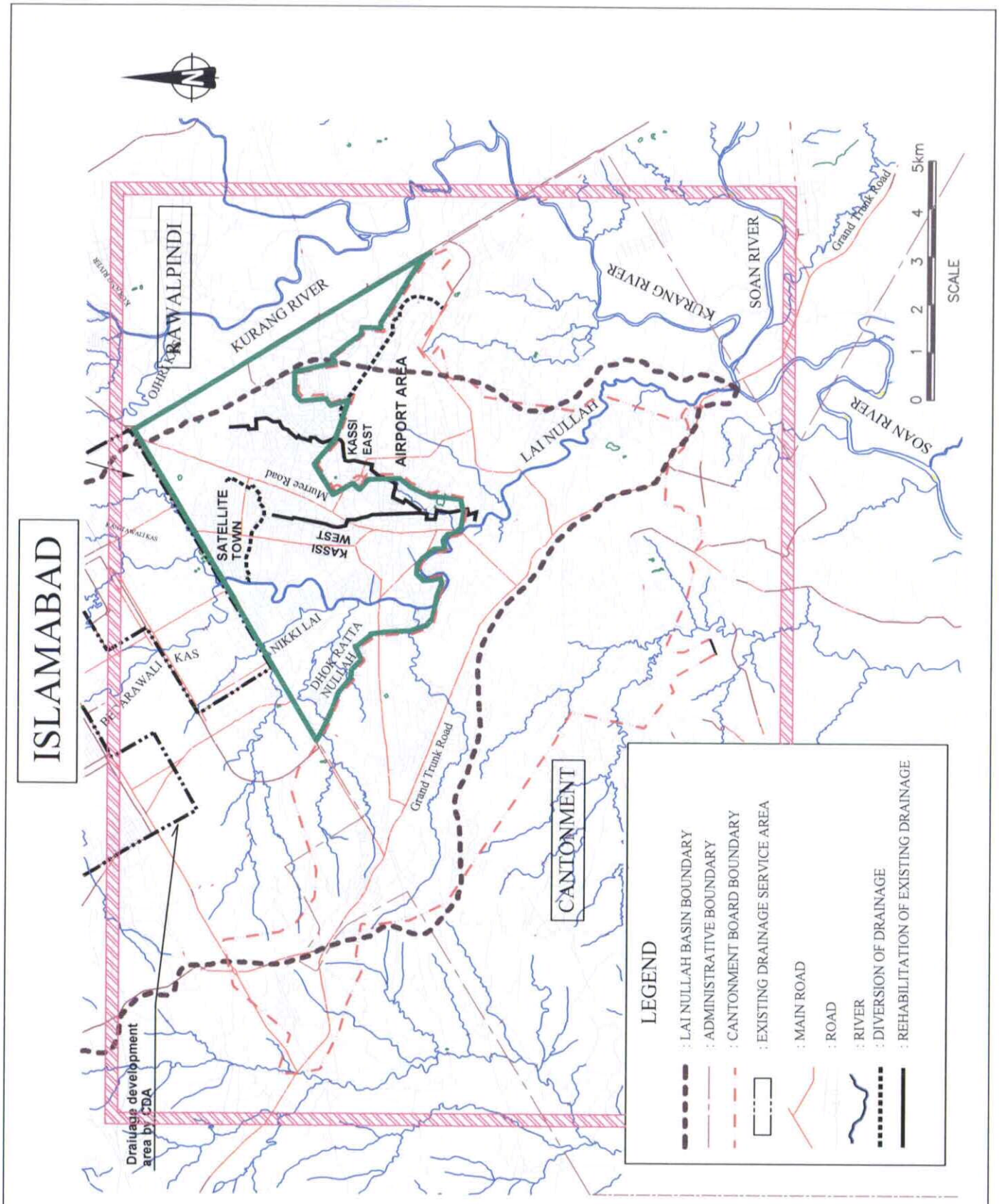
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1.4

Sewerage System in I-8, Islamabad

29



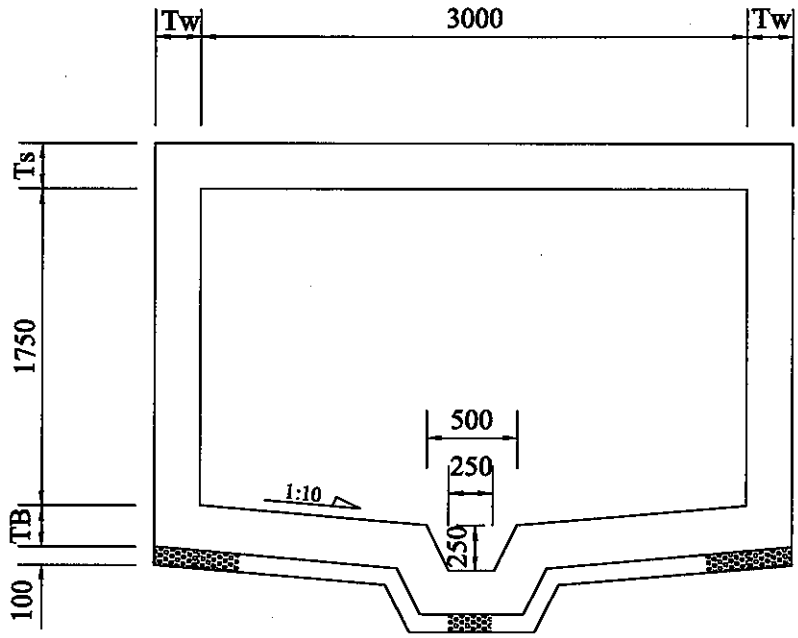
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1.5

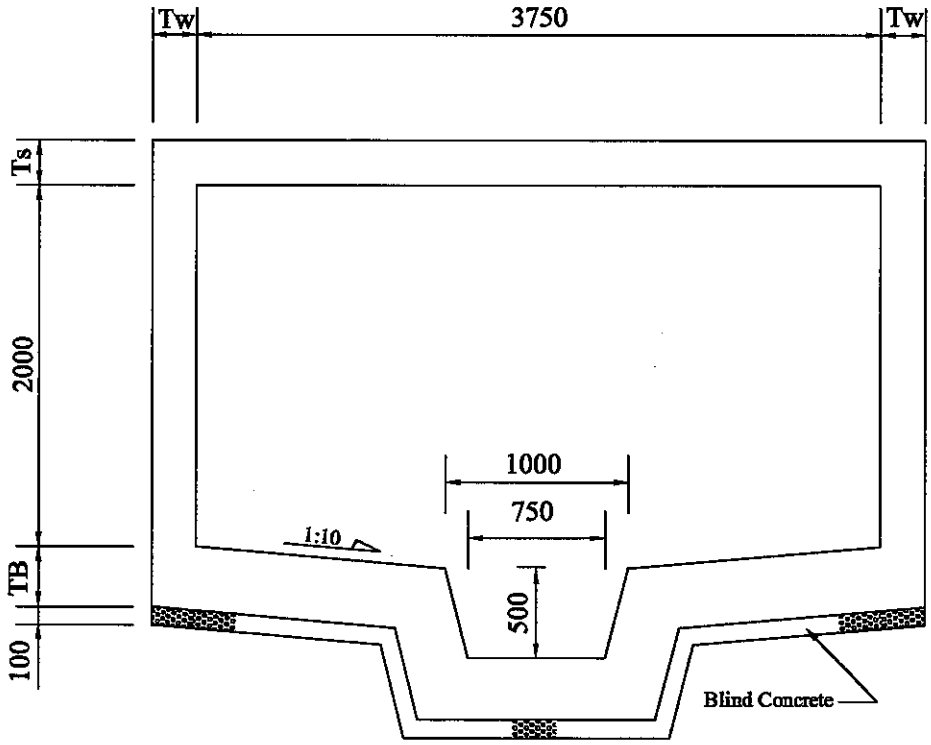
Drainage System in Rawalpindi

DW-02



TYPICAL SECTION TYPE"A"

SCALE-"A"

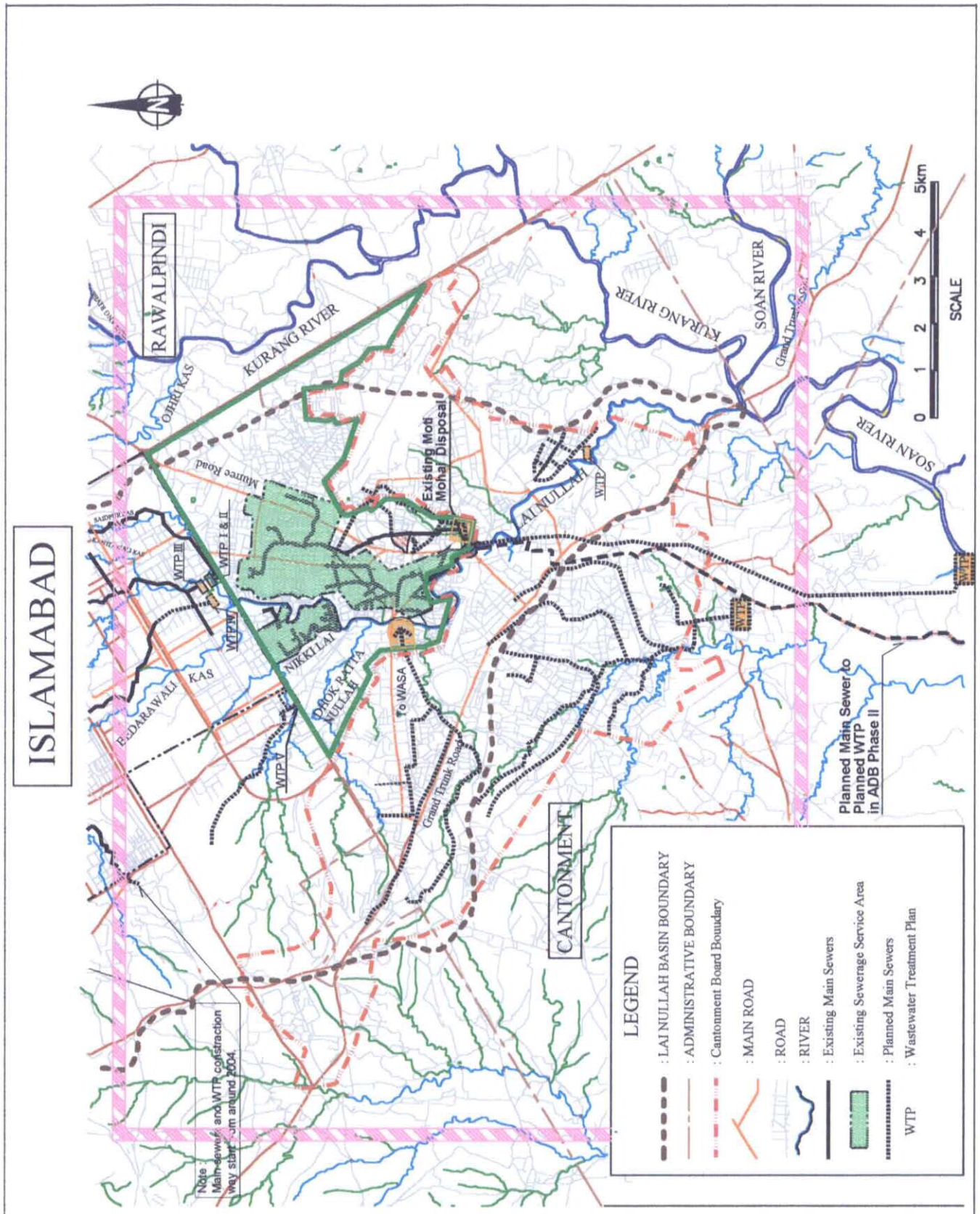


TYPICAL SECTION TYPE"B"

SCALE-"A"

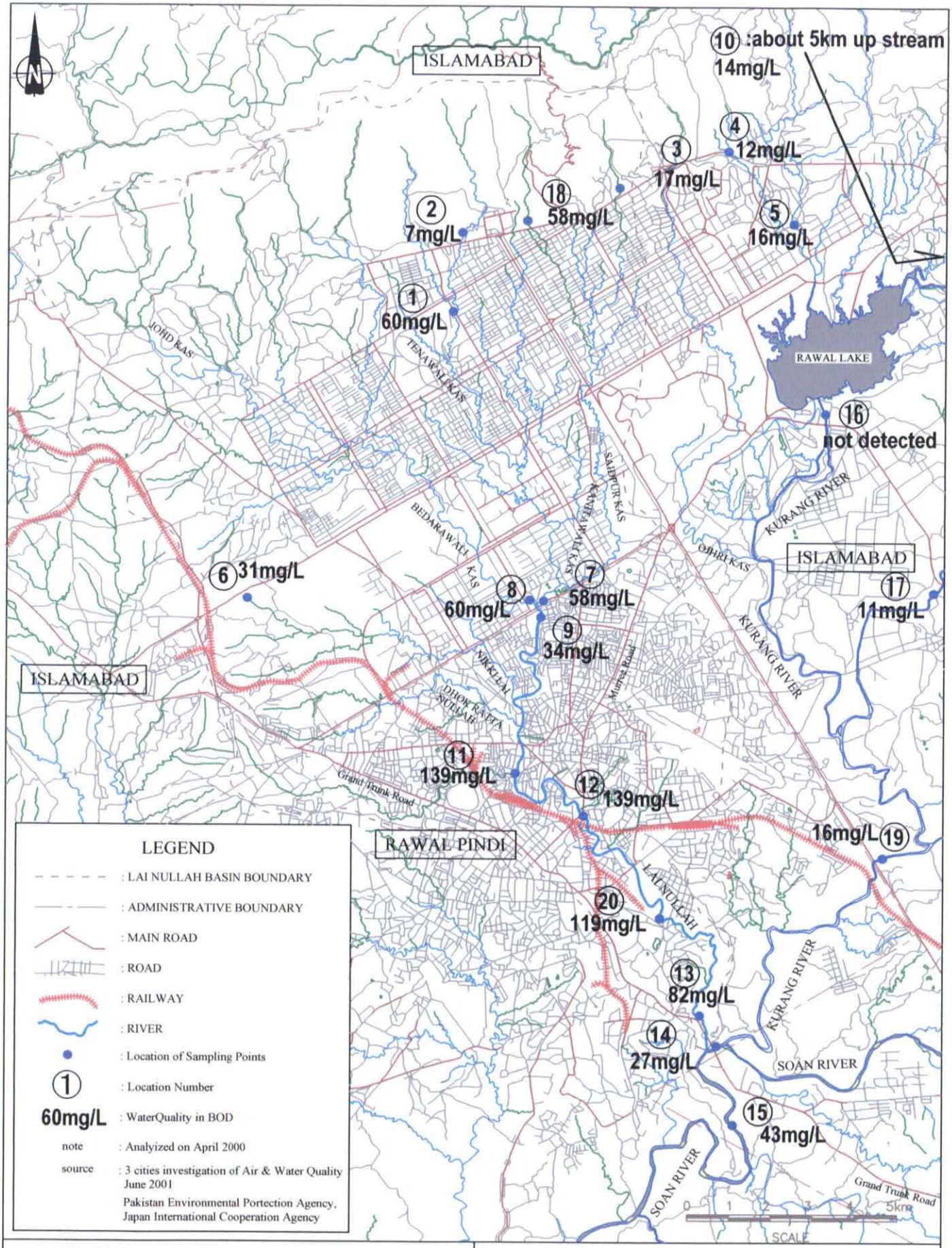
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 4.1.6 Cros-Section of Drainage Channel
JAPAN INTERNATIONAL COOPERATION AGENCY	

37



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 4.1.7
JAPAN INTERNATIONAL COOPERATION AGENCY	Sewerage System in Rawalpindi

38



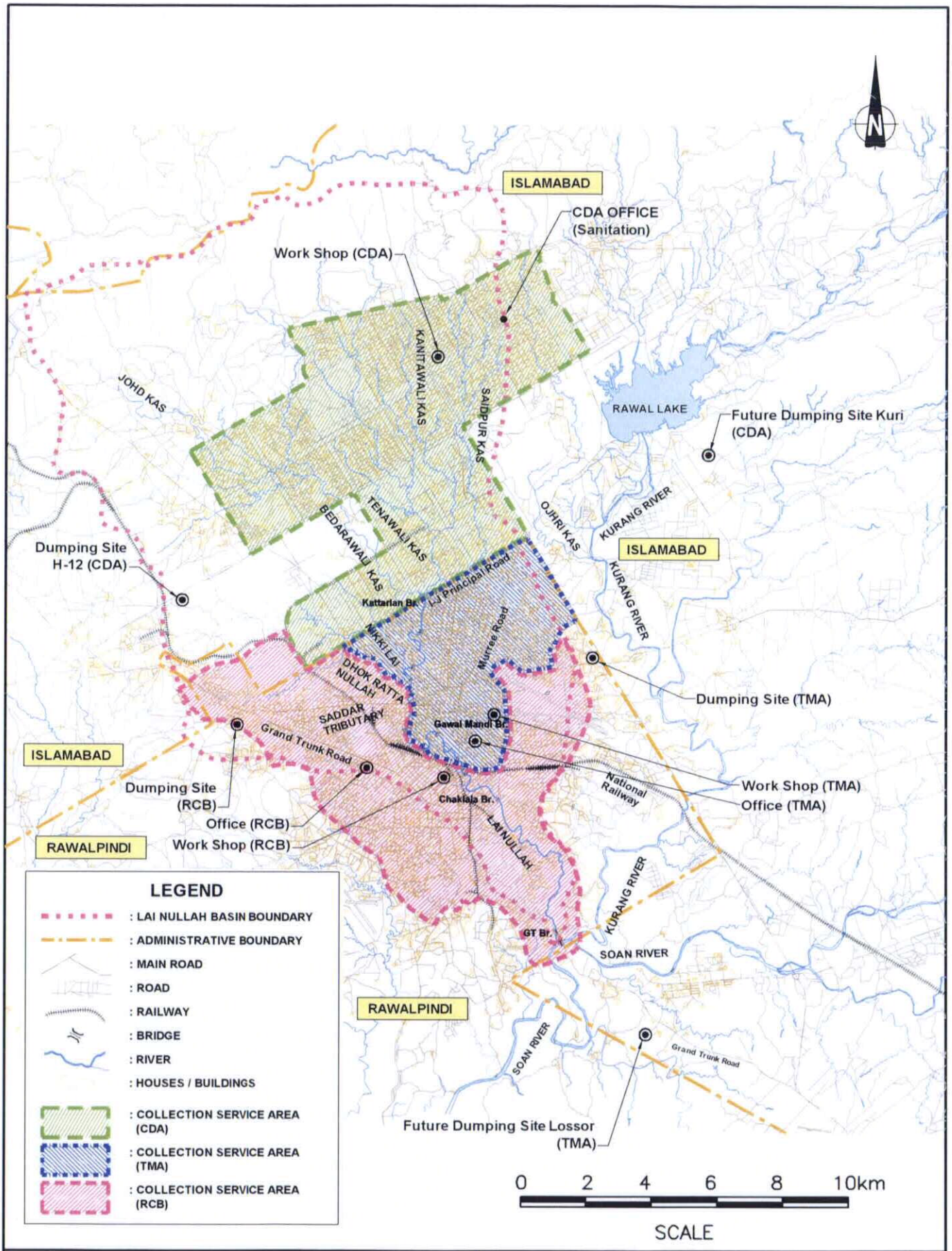
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.1.8

Location of Sampling Point and River Water Quality in BOD

39

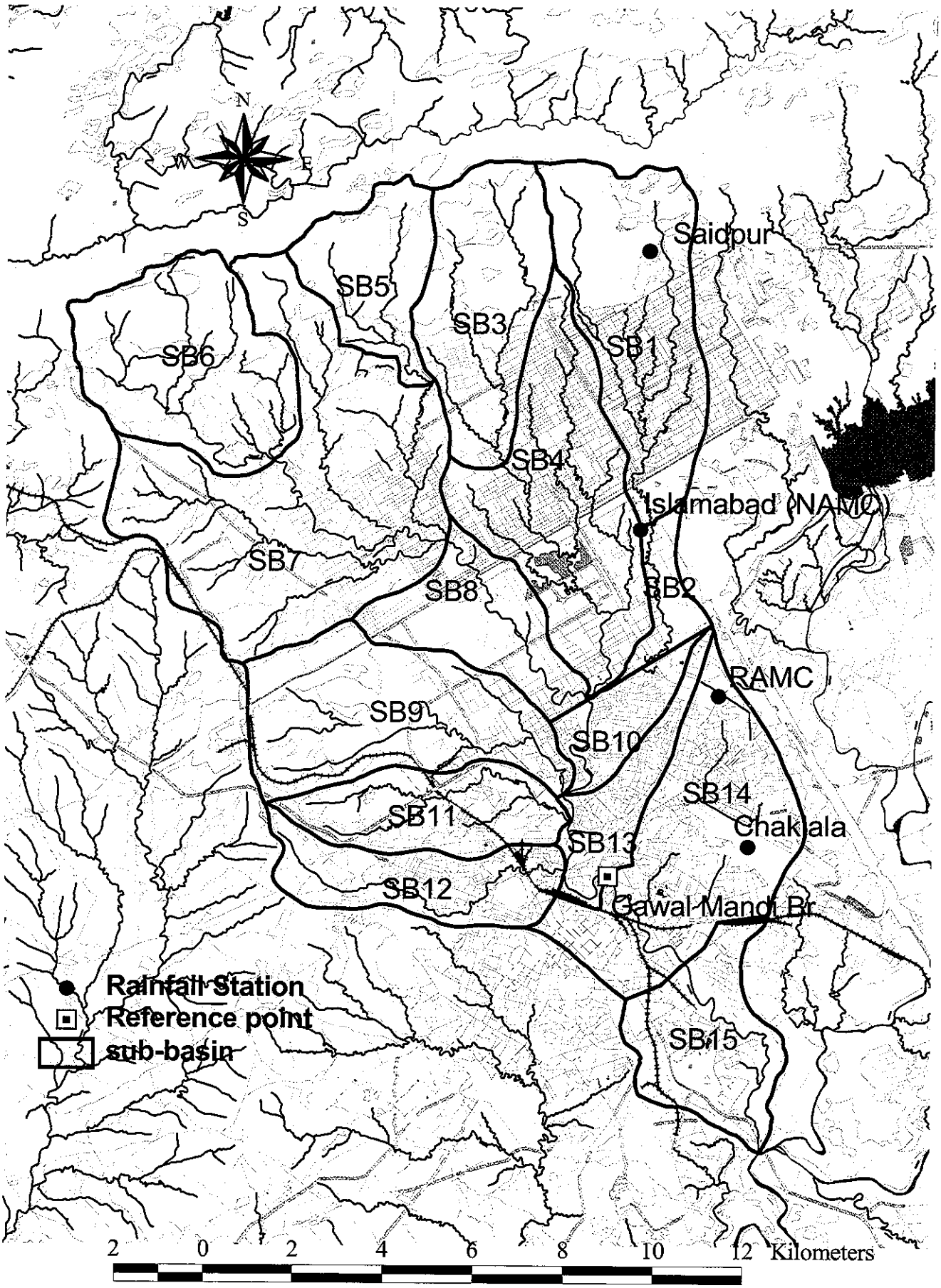


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 4.2.1

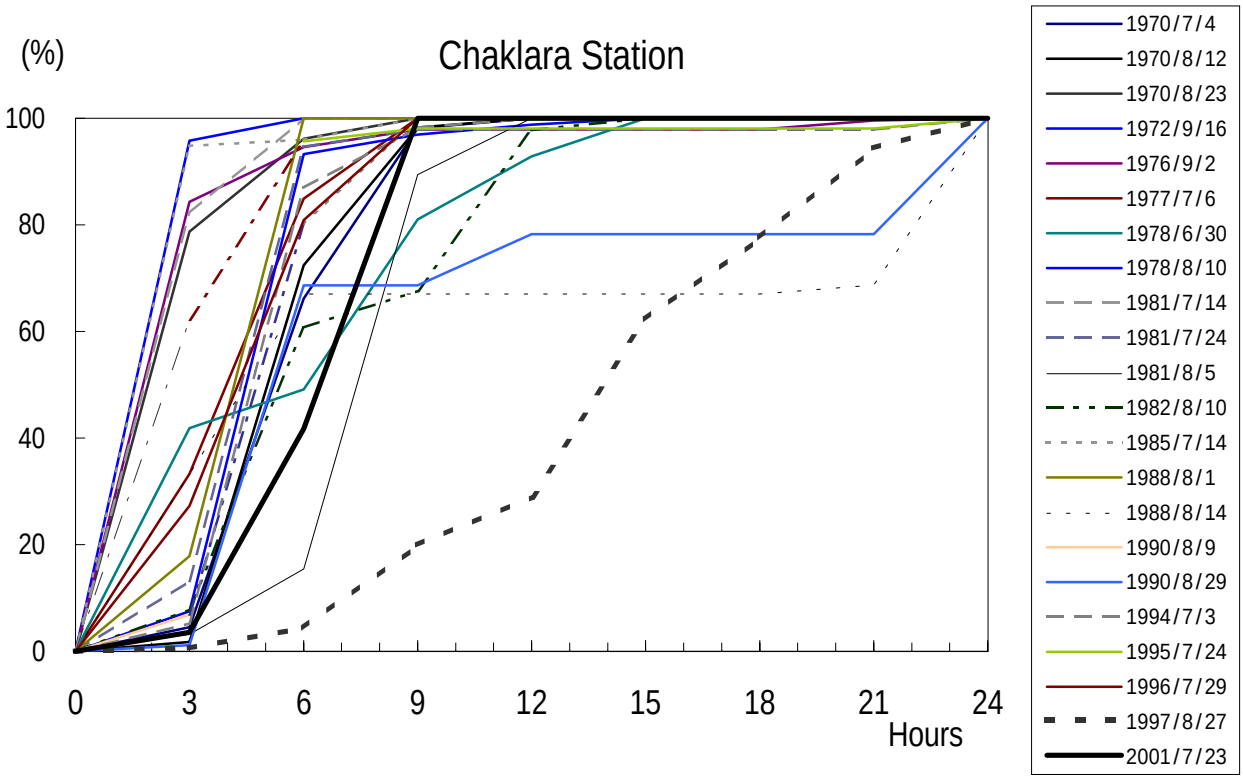
Location of Solid Waste Management Facilities

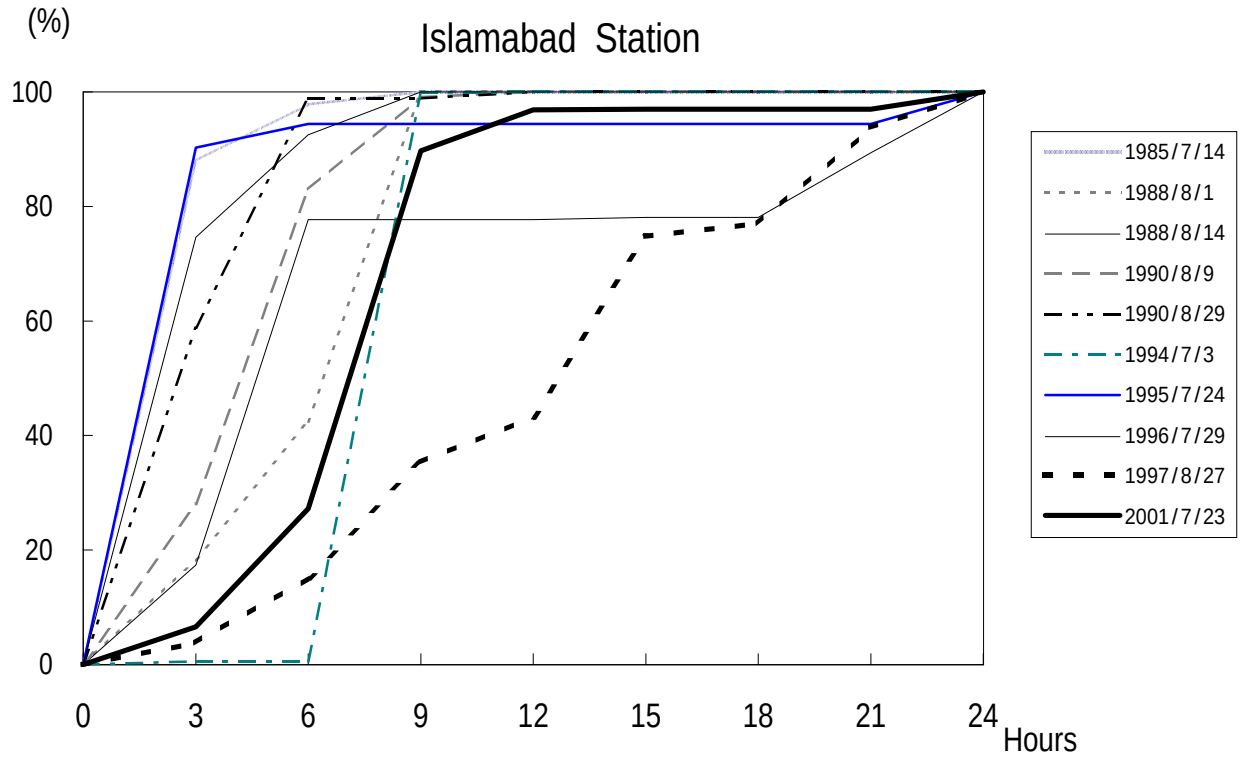


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.1.1
Sub-basin Division of Lai Nullah Basin and Location of Rain Gauges

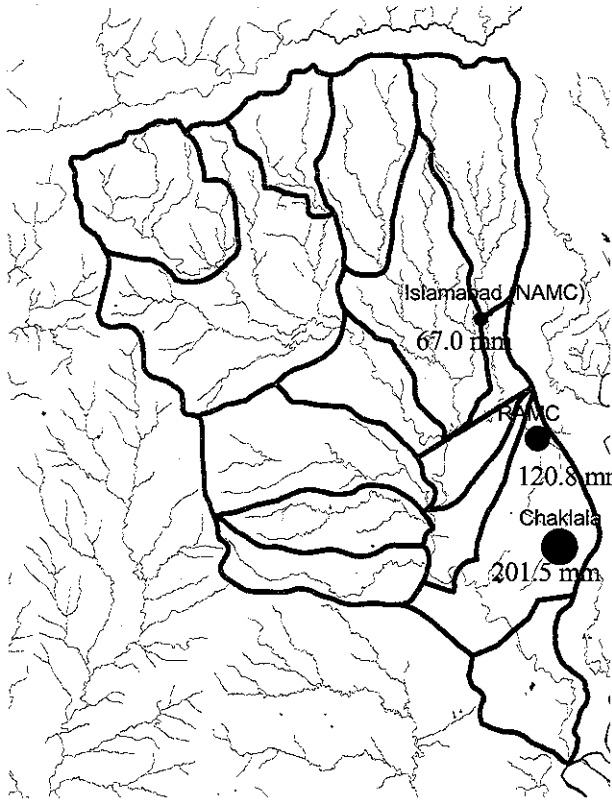




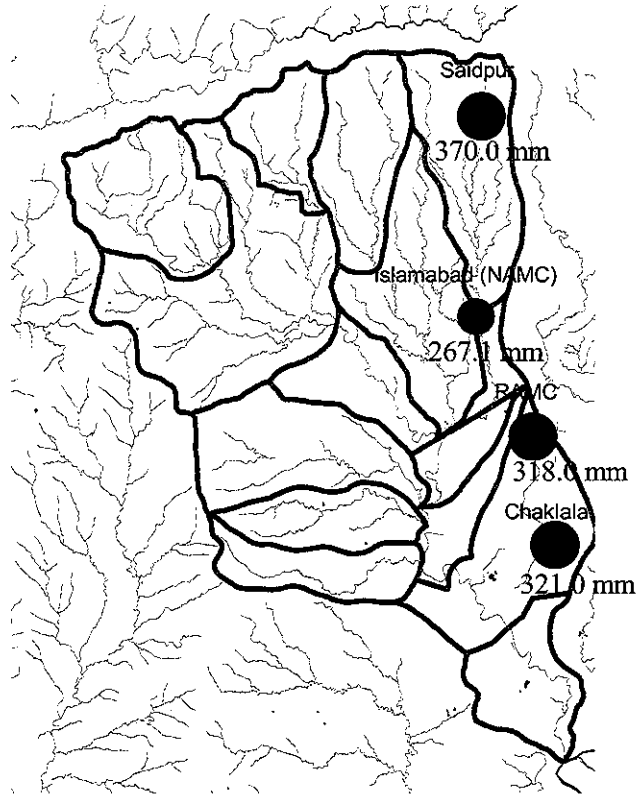
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

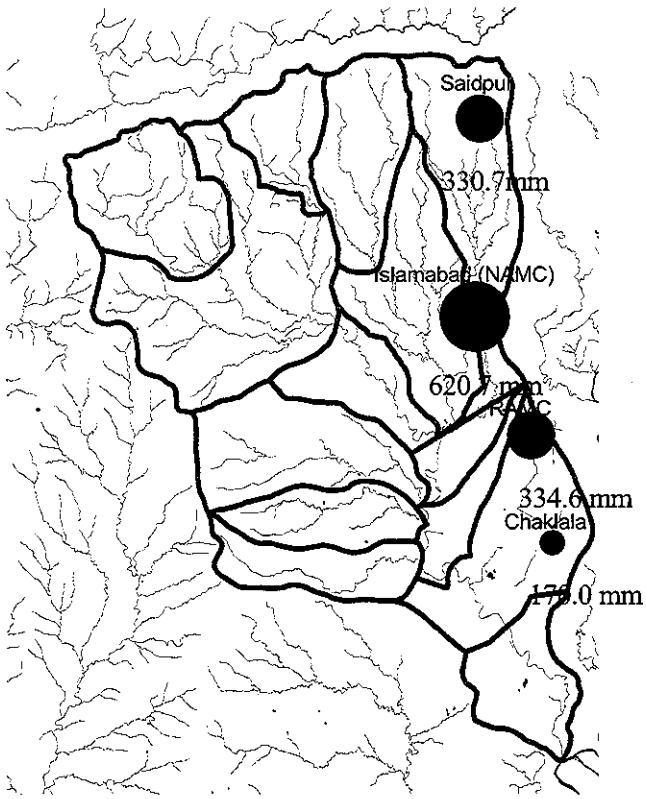
Fig. 5.1.2
Accumulative Rainfall Curve of Chaklala and Islamabad Stations



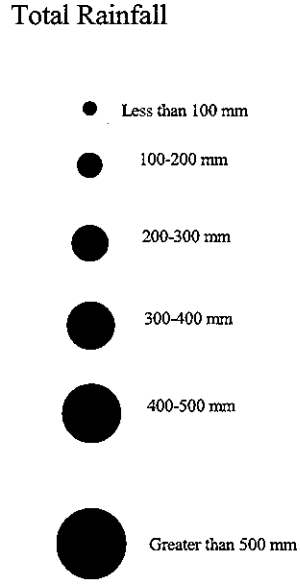
(a) 1996/7/29 Flood



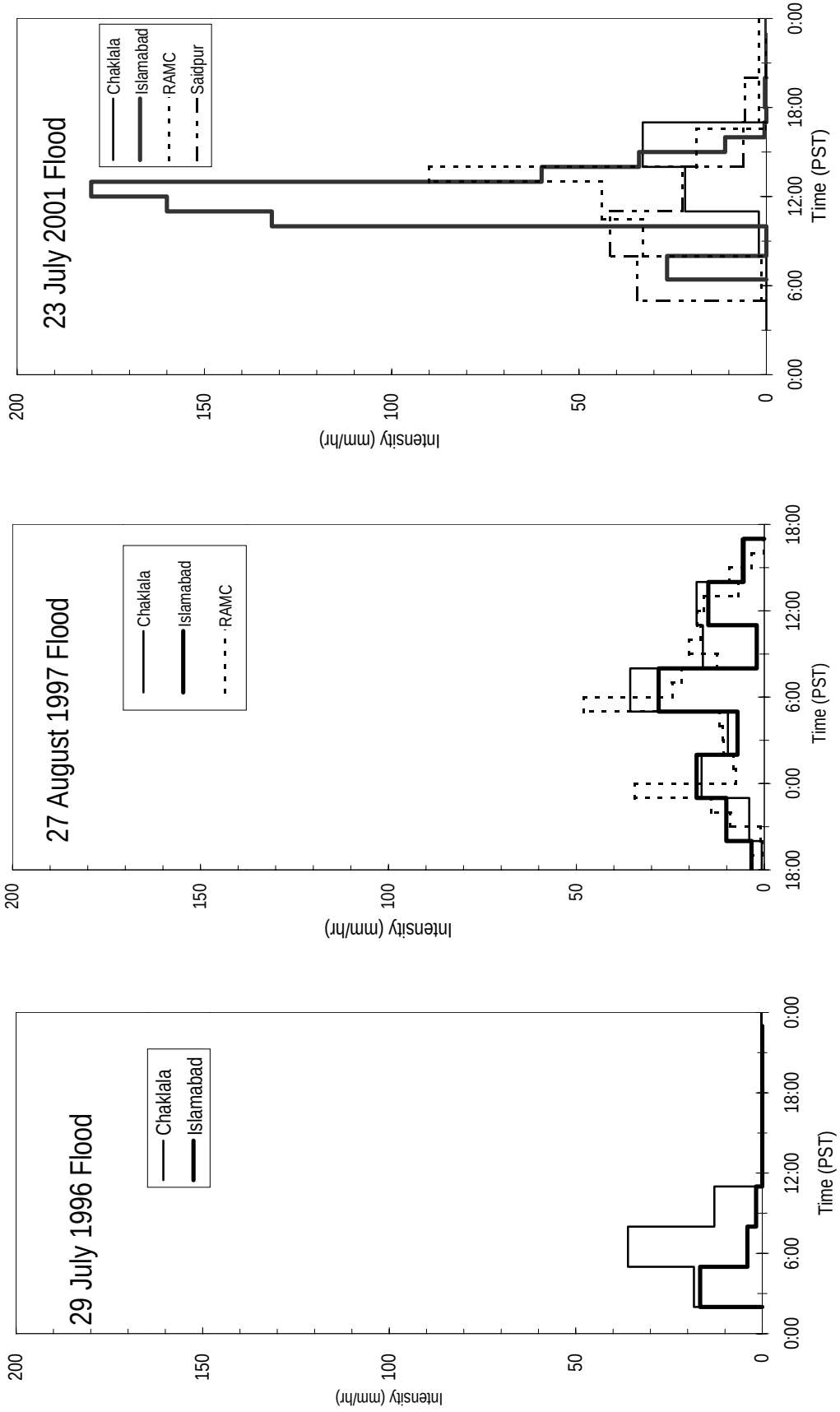
(b) 1997/8/27 Flood



(c) 2001/7/23 Flood



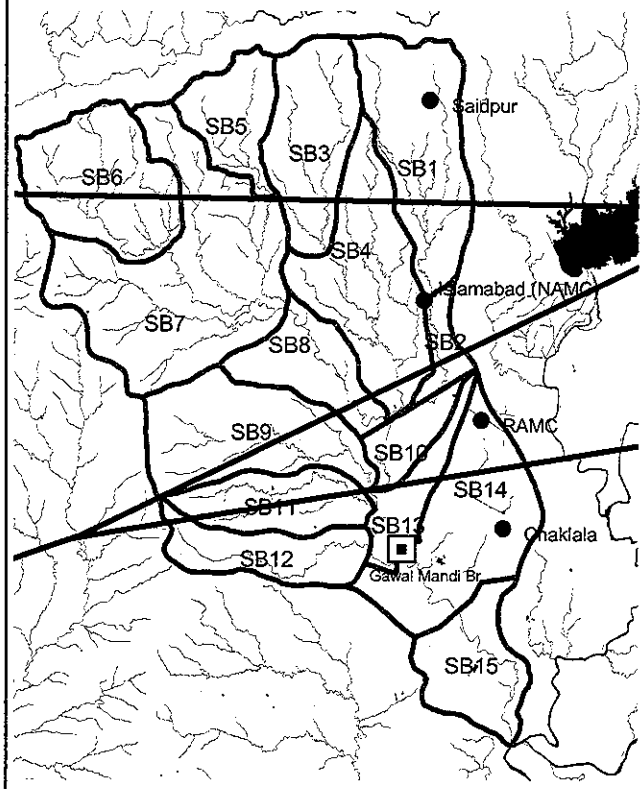
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 5.1.3 Total Rainfall Recorded during Recent Three Floods
JAPAN INTERNATIONAL COOPERATION AGENCY	



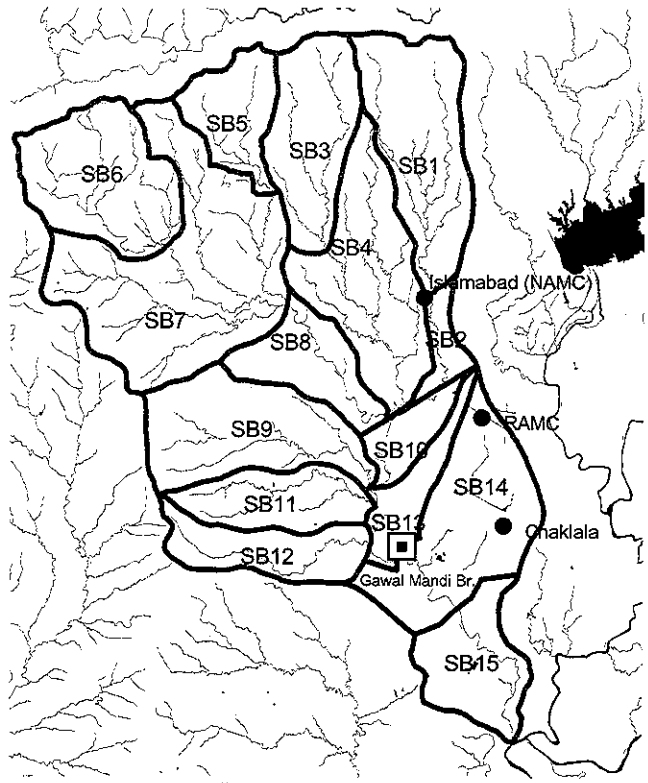
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

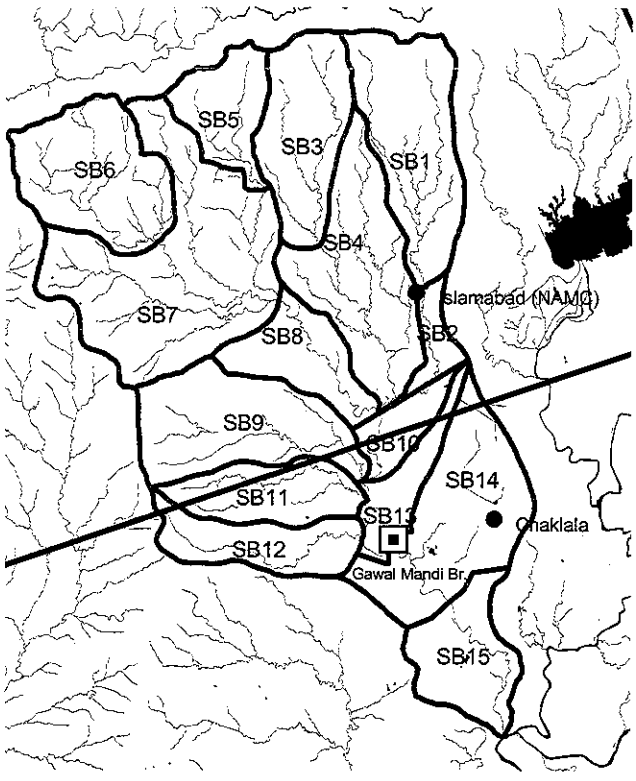
Fig. 5.1.4
Hyetographs during Recent Three Floods



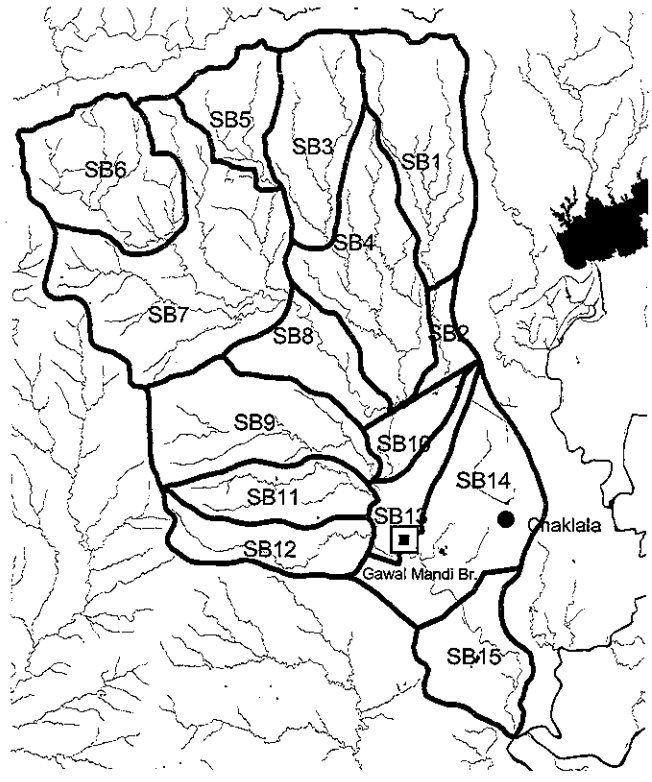
(a) 4 Rain Gauges



(b) 3 Rain Gauges

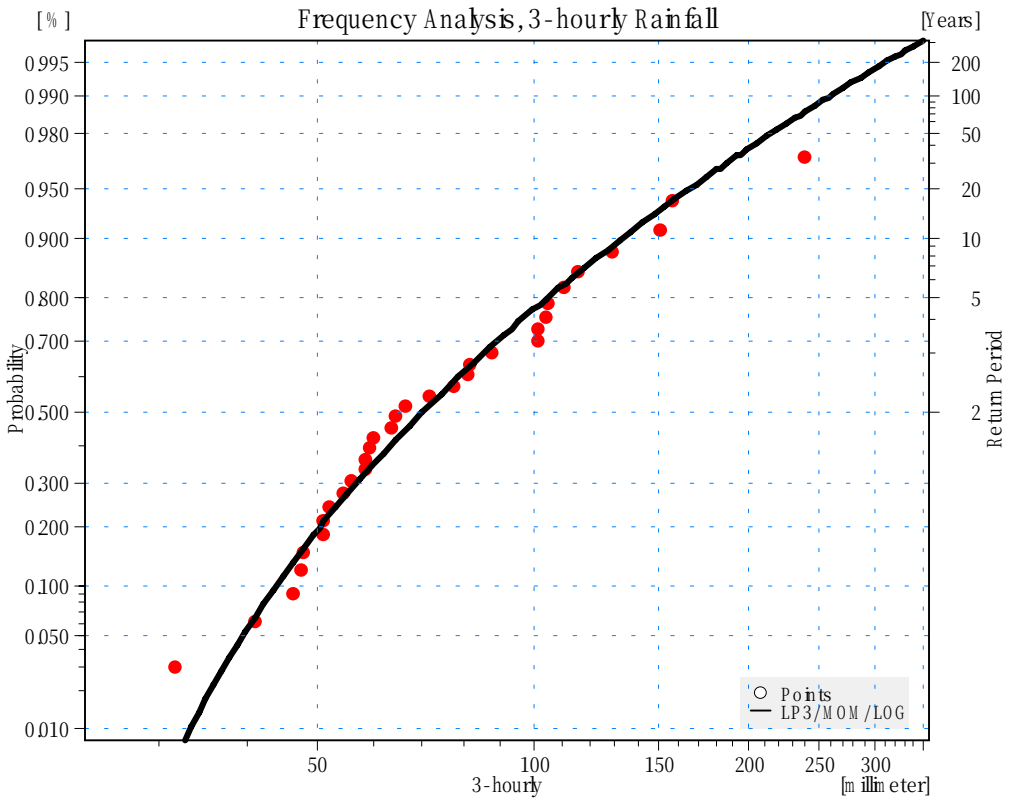


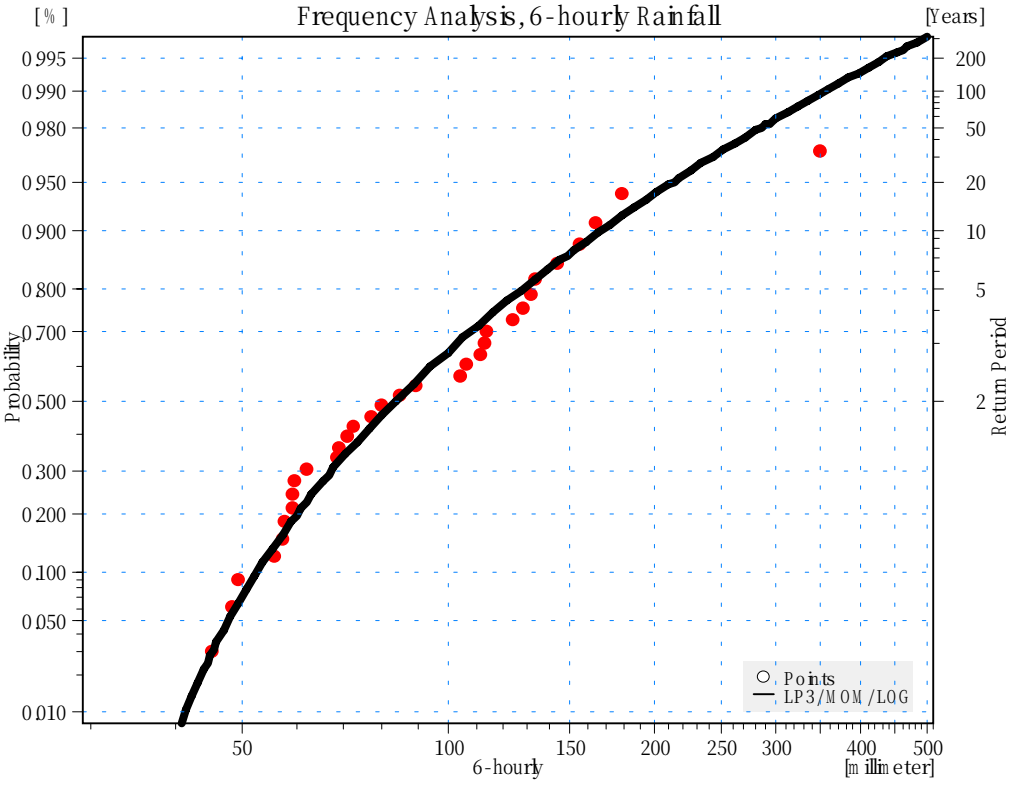
(c) 2 Rain Gauges



(d) 1 Rain Gauge

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 5.1.5 Tiessen Polygon Division of Lai Nullah Basin
JAPAN INTERNATIONAL COOPERATION AGENCY	

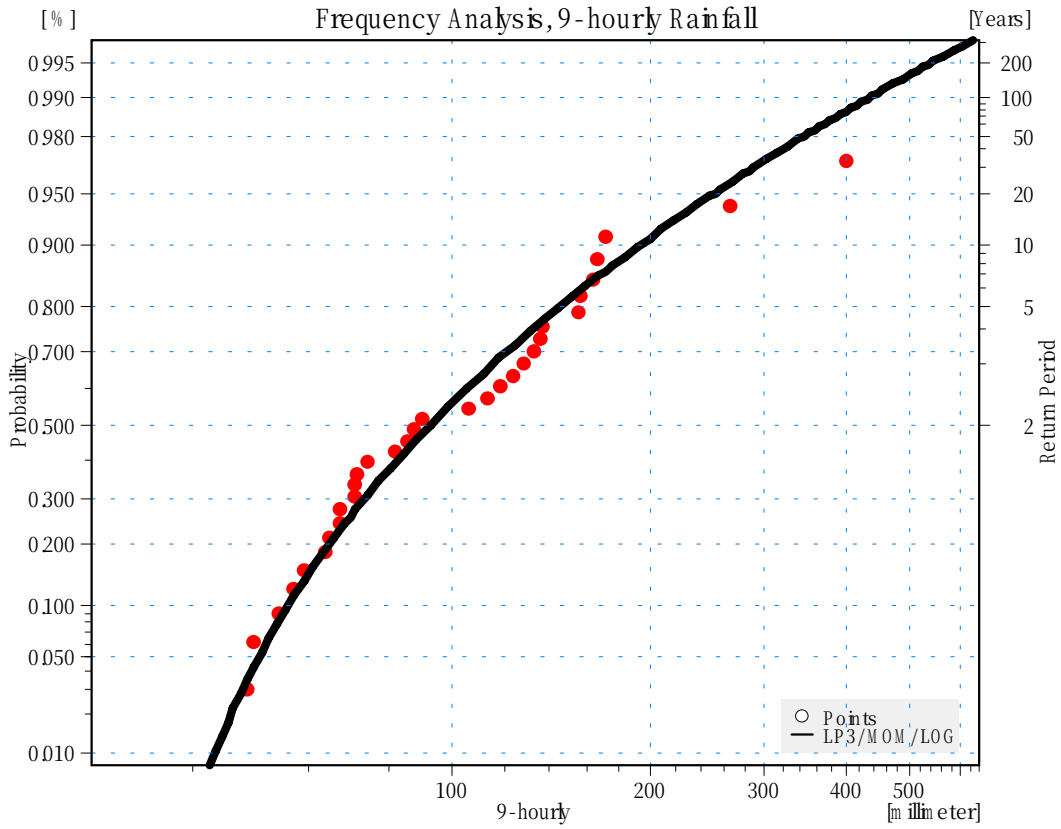


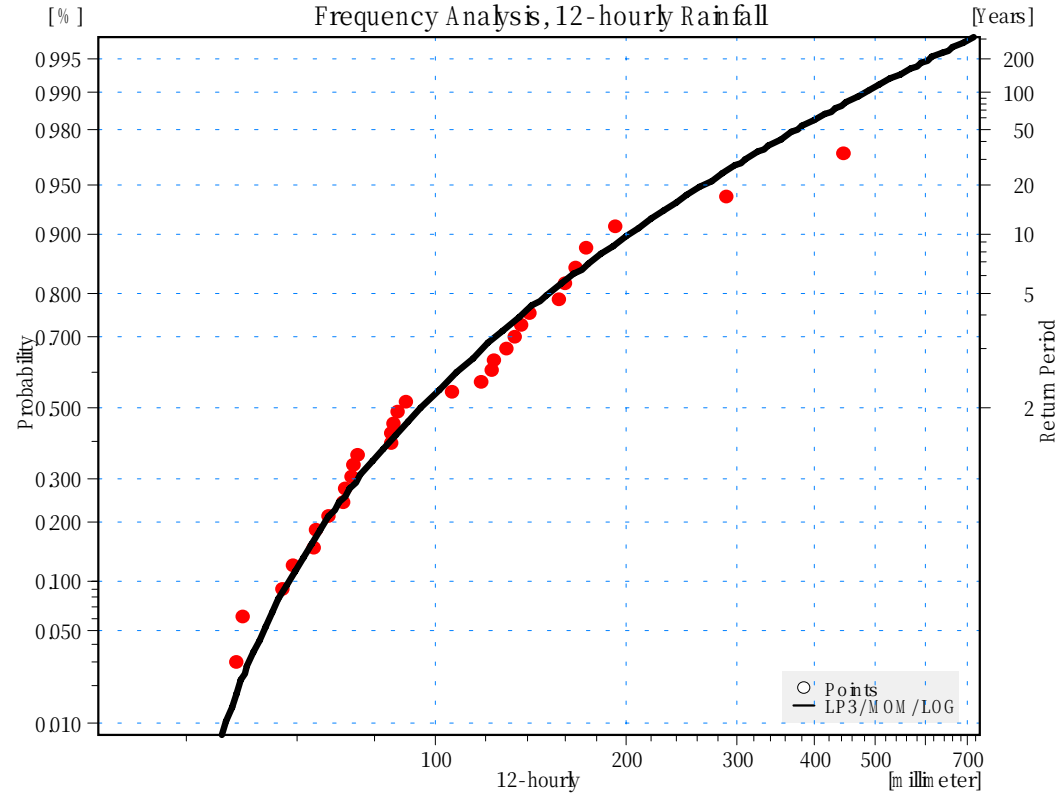


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.1.6 (1/2)
Probability Plotting of Rainfall
(3-hourly and 6-hourly Rainfalls)

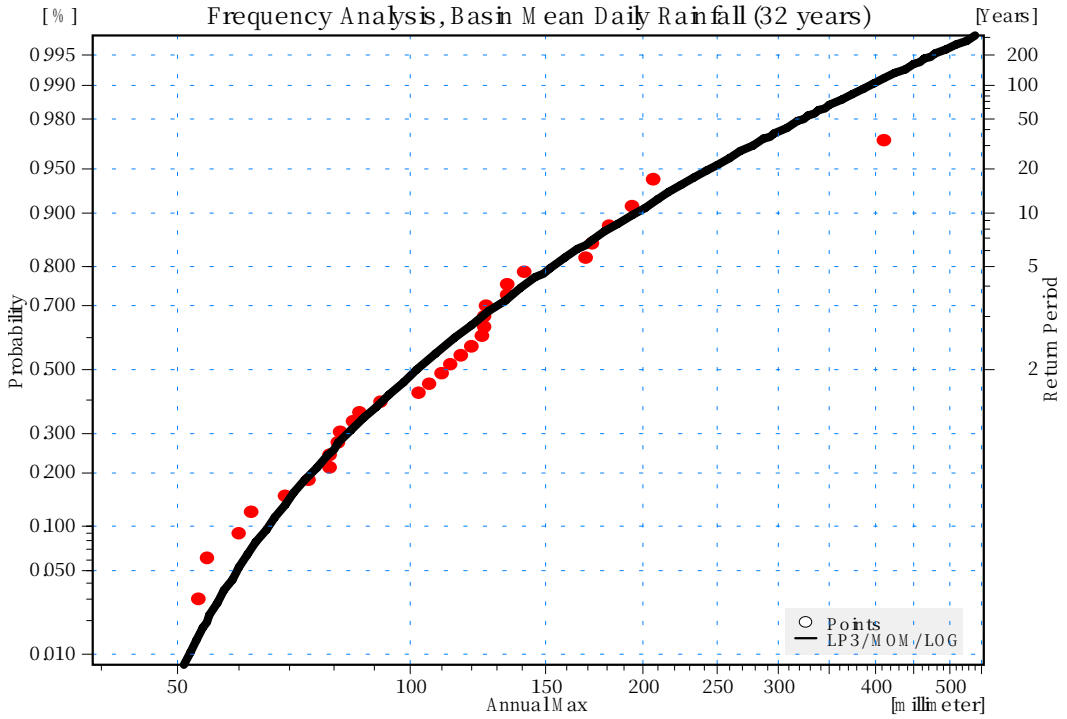


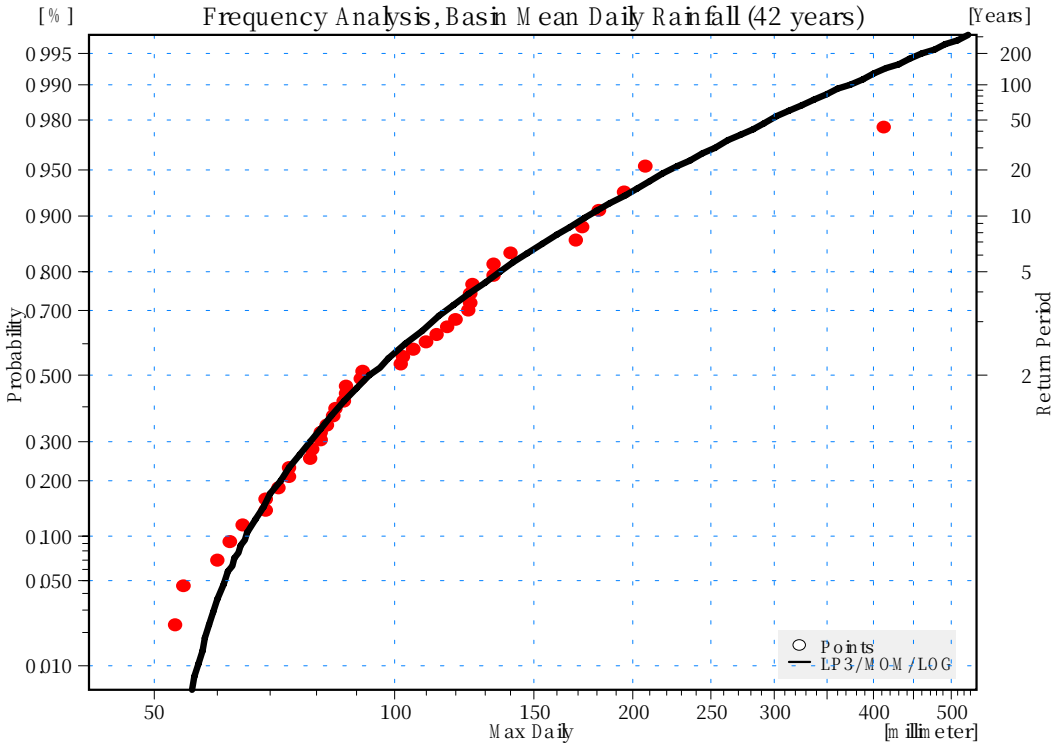


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.1.6 (2/2)
Probability Plotting of Rainfall
(9-hourly and 12-hourly Rainfalls)

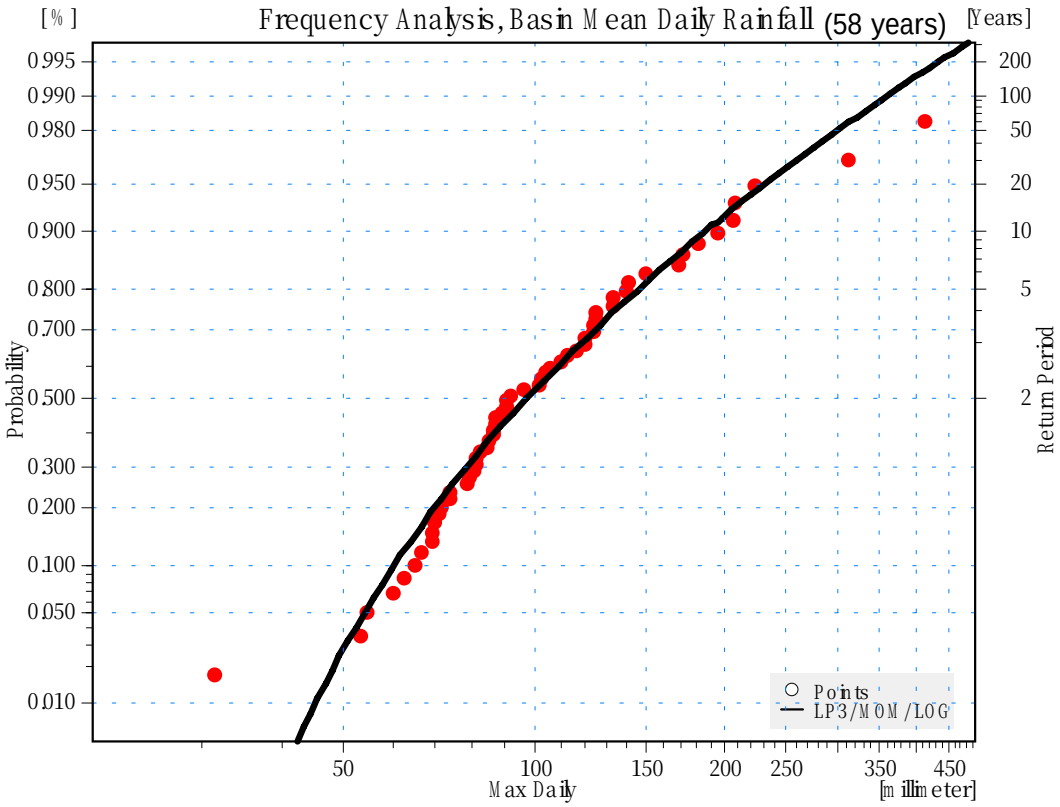




THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

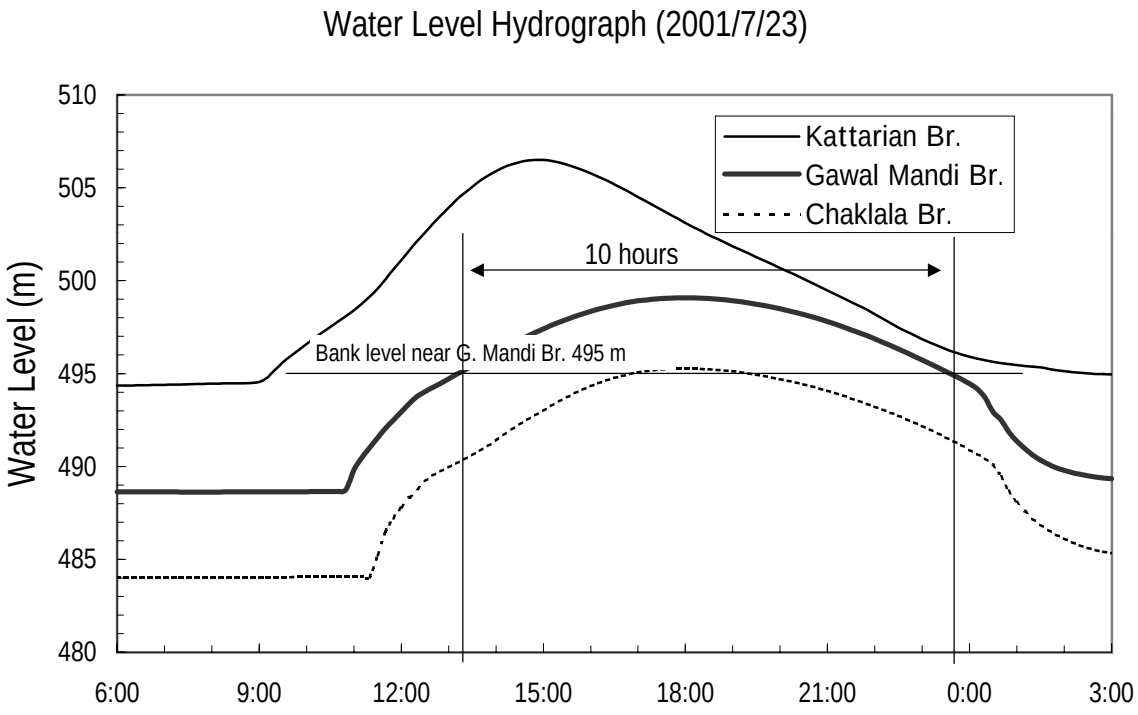
Fig. 5.1.7 (1/2)
Probability Plotting of Basin Mean Daily Rainfall (32 years (1970 to 2001) and 42 years (1960 to 2001))

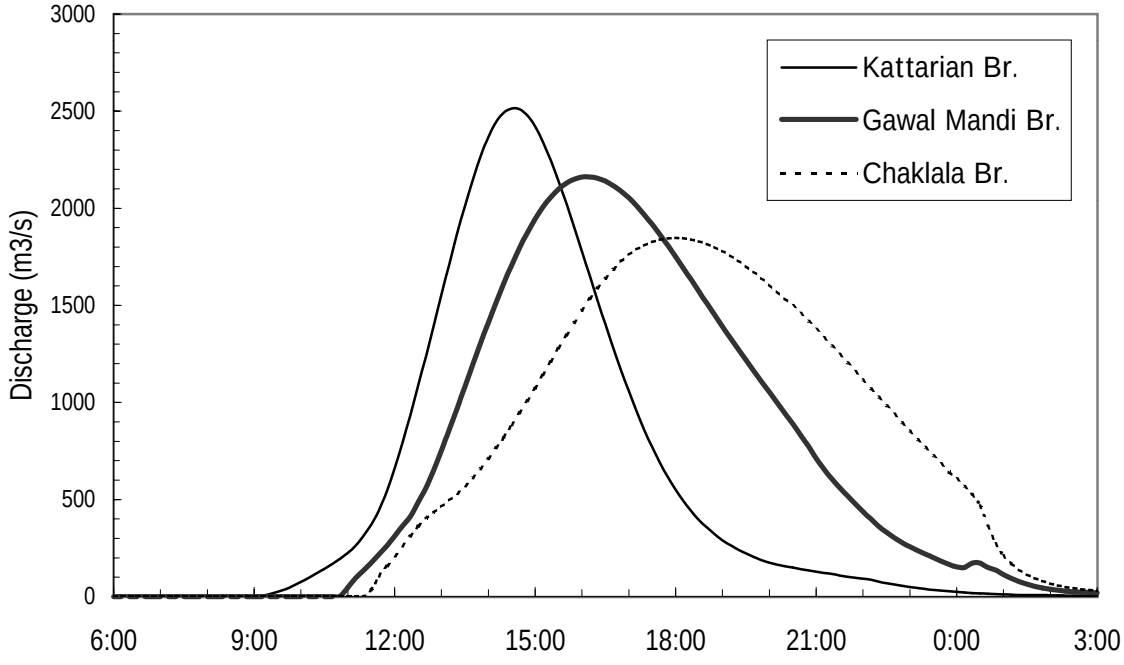


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.1.7 (2/2)
Probability Plotting of Basin Mean Daily Rainfall (53 years (1944 to 2001))

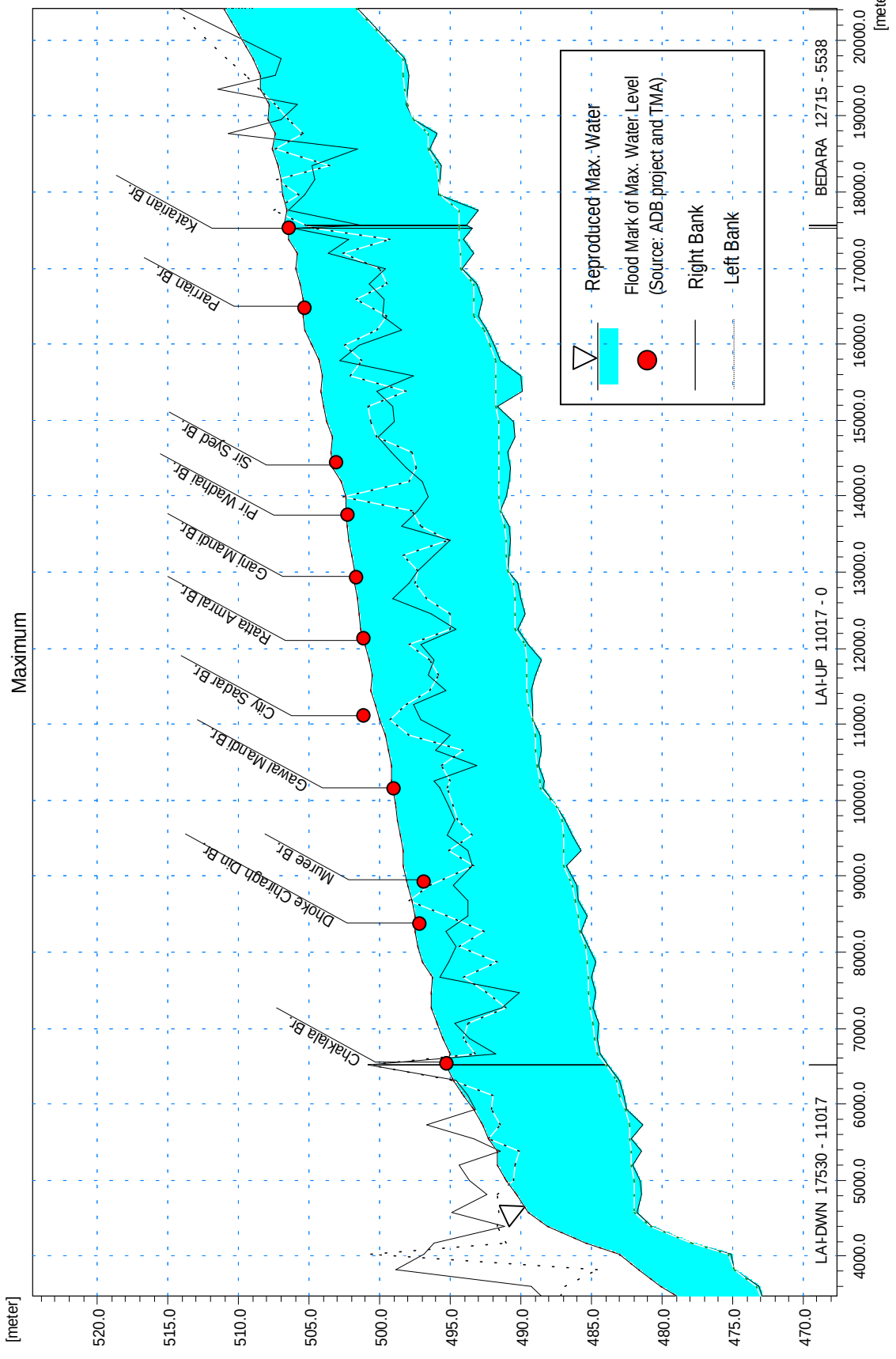




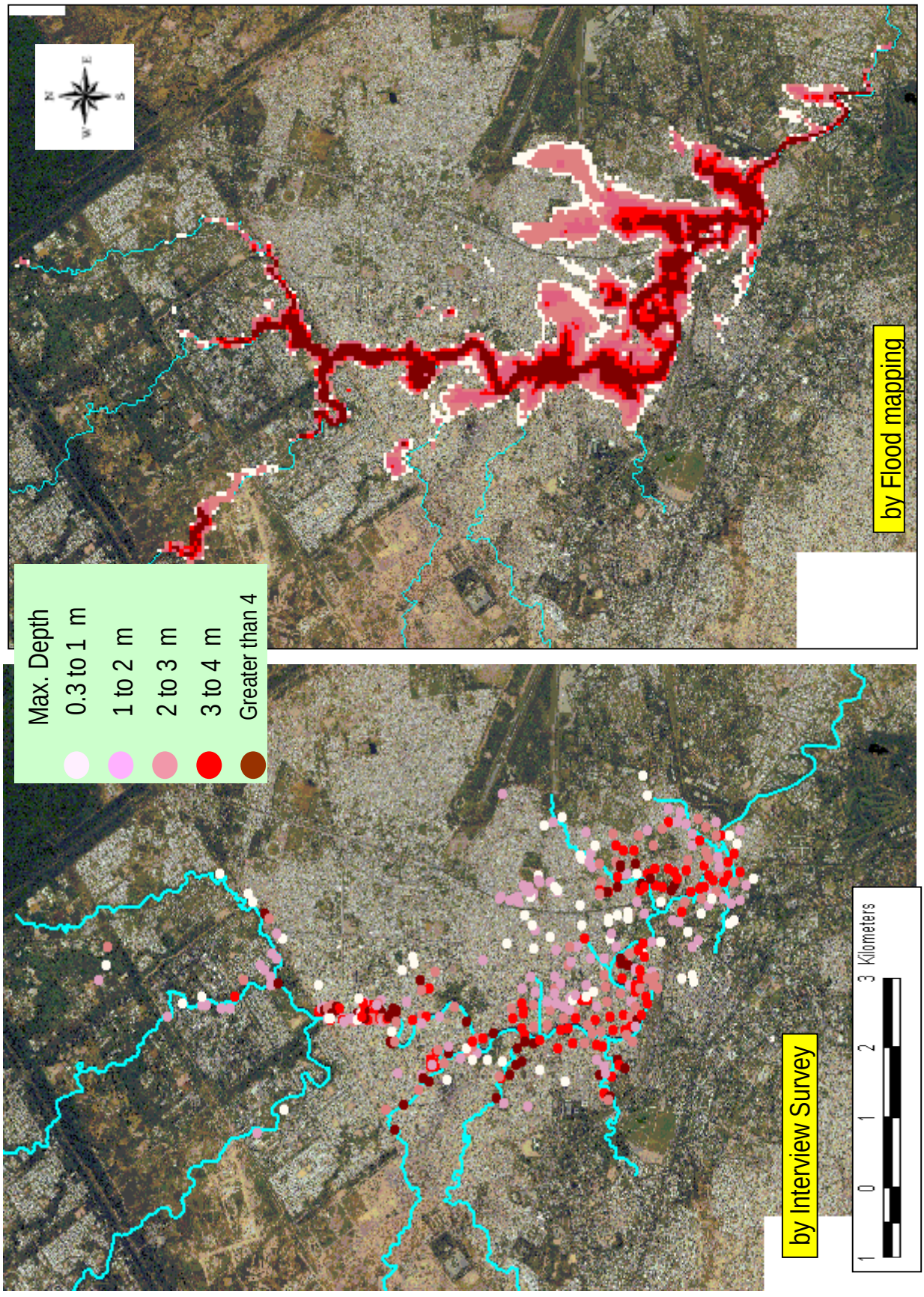
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.2.1
Reproduced Water Level and Discharge Hydrographs during 2001 Flood



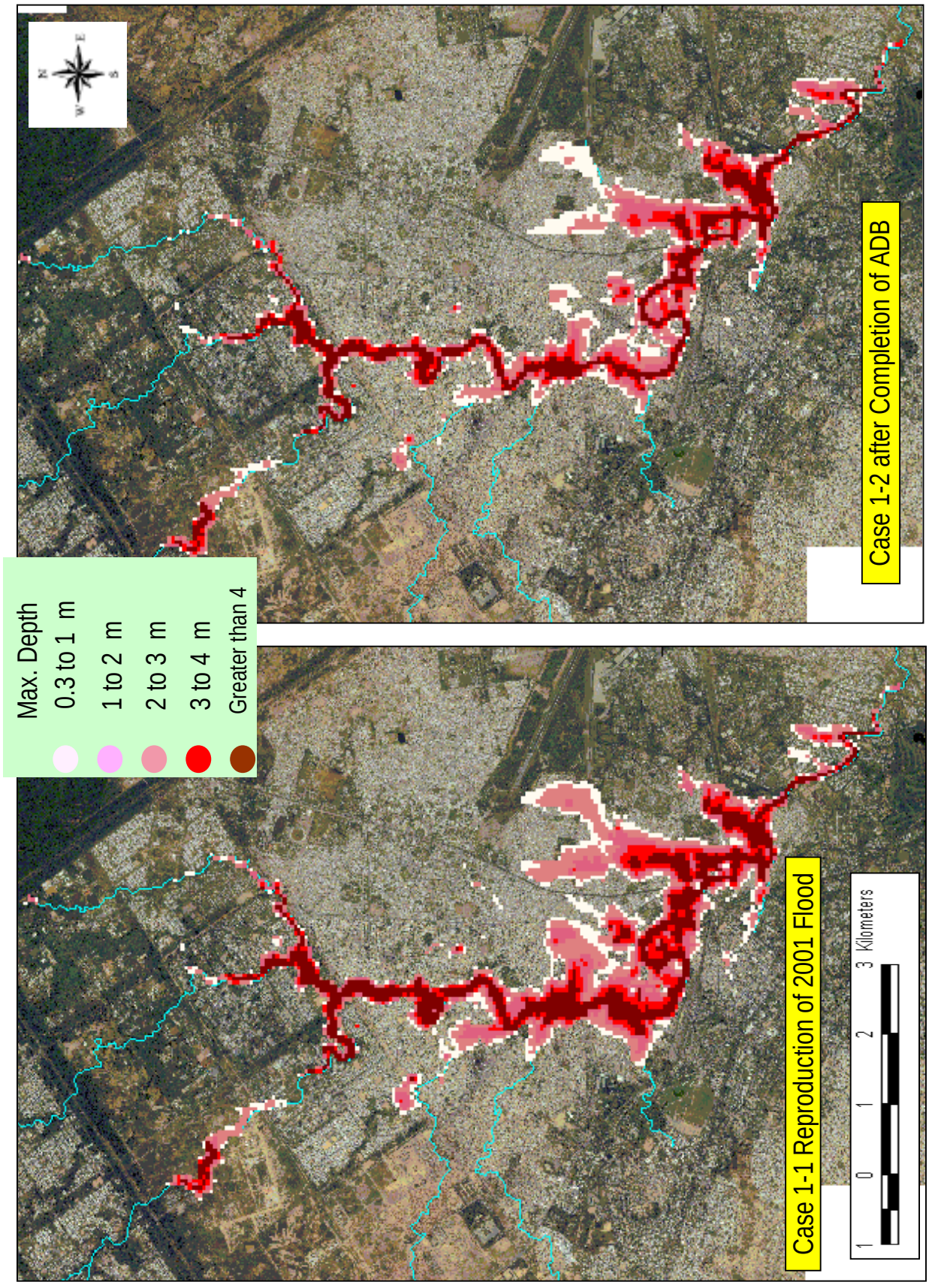
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig.5.2.2 Comparison of Reproduced and Observed Maximum Water Levels during 2001
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

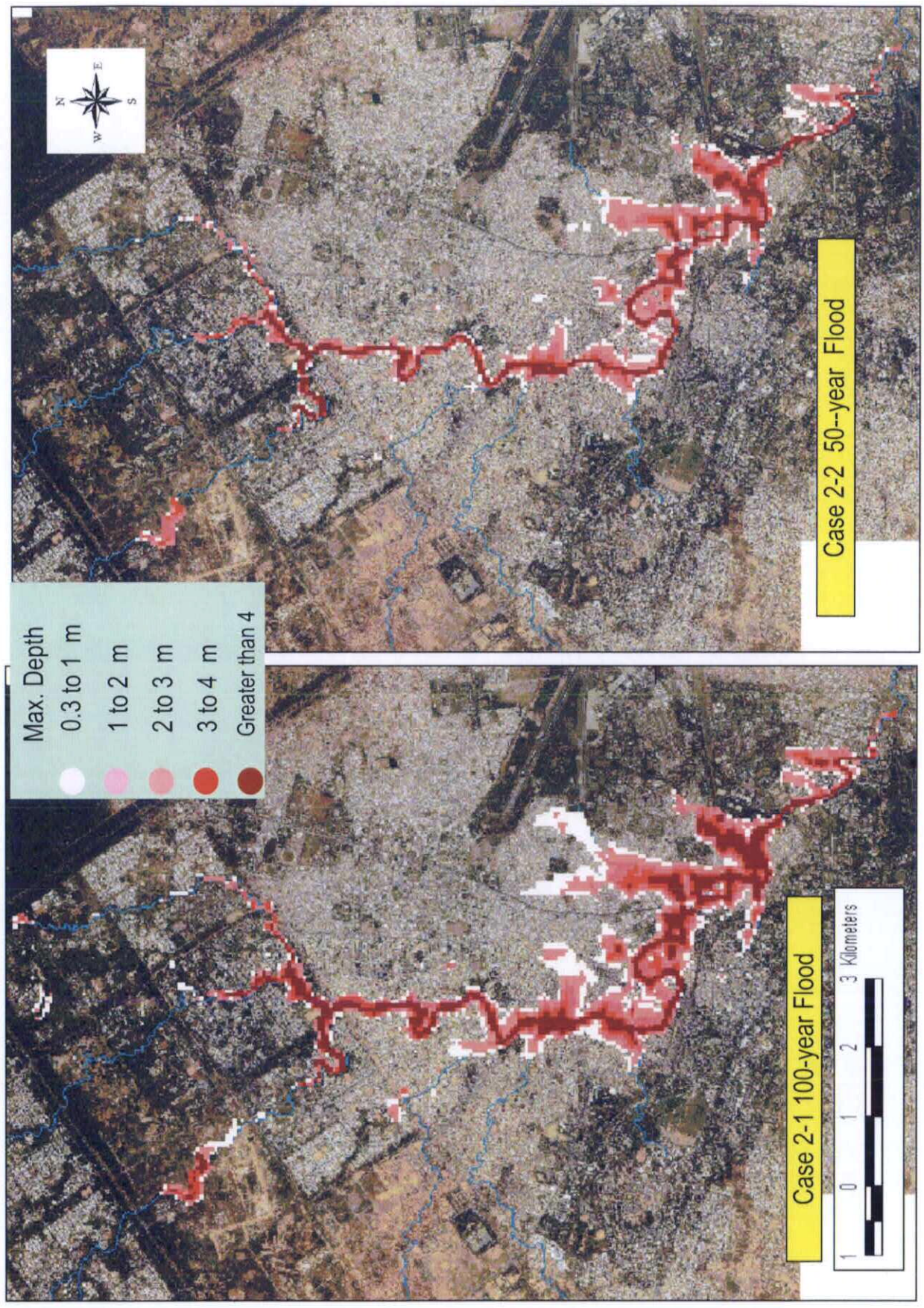
Fig. 5. 2. 3
Comparison of Generated Flood Map and Interview Survey Results



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

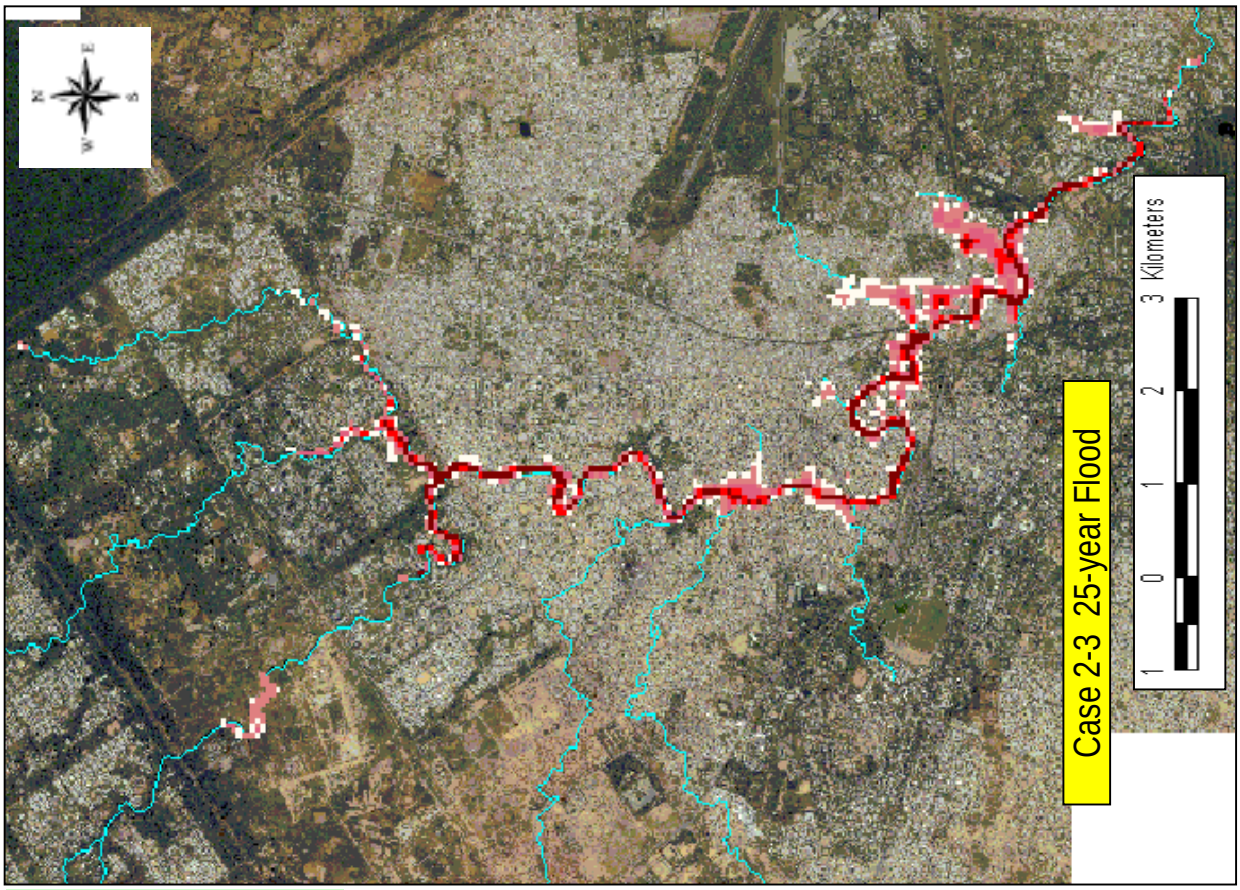
Fig. 5.2.4 (1/3)
Flood Mapping (Cases 1-1 and 1-2)

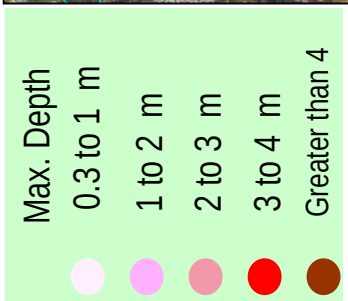


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.2.4 (2/3)
Flood Mapping (Cases 2-1 and 2-2)

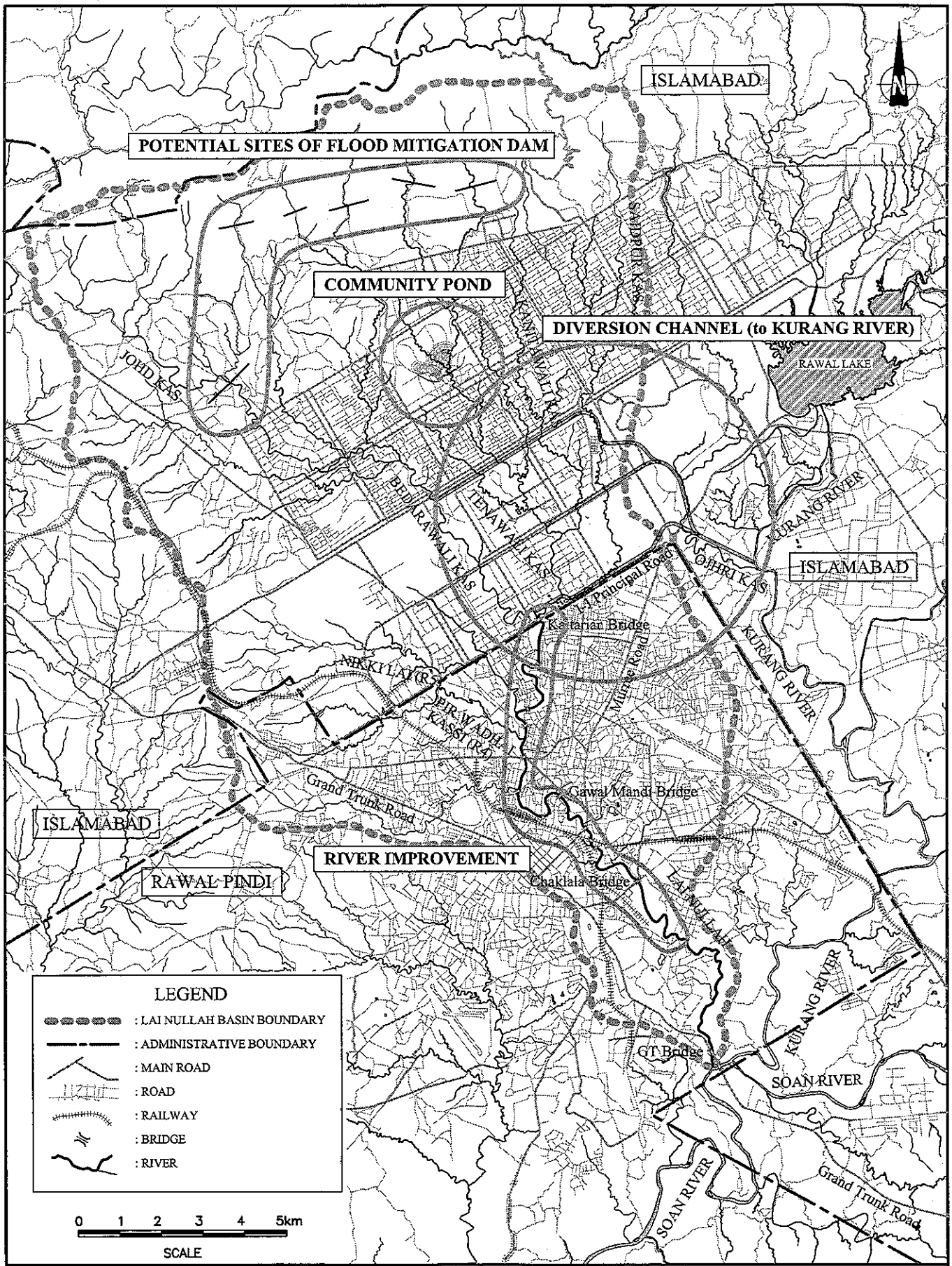




THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENT IMPROVEMENT PLAN OF LAI NULLAH BASIN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 5.2.4 (3/3)
Flood Mapping (Cases 2-3)

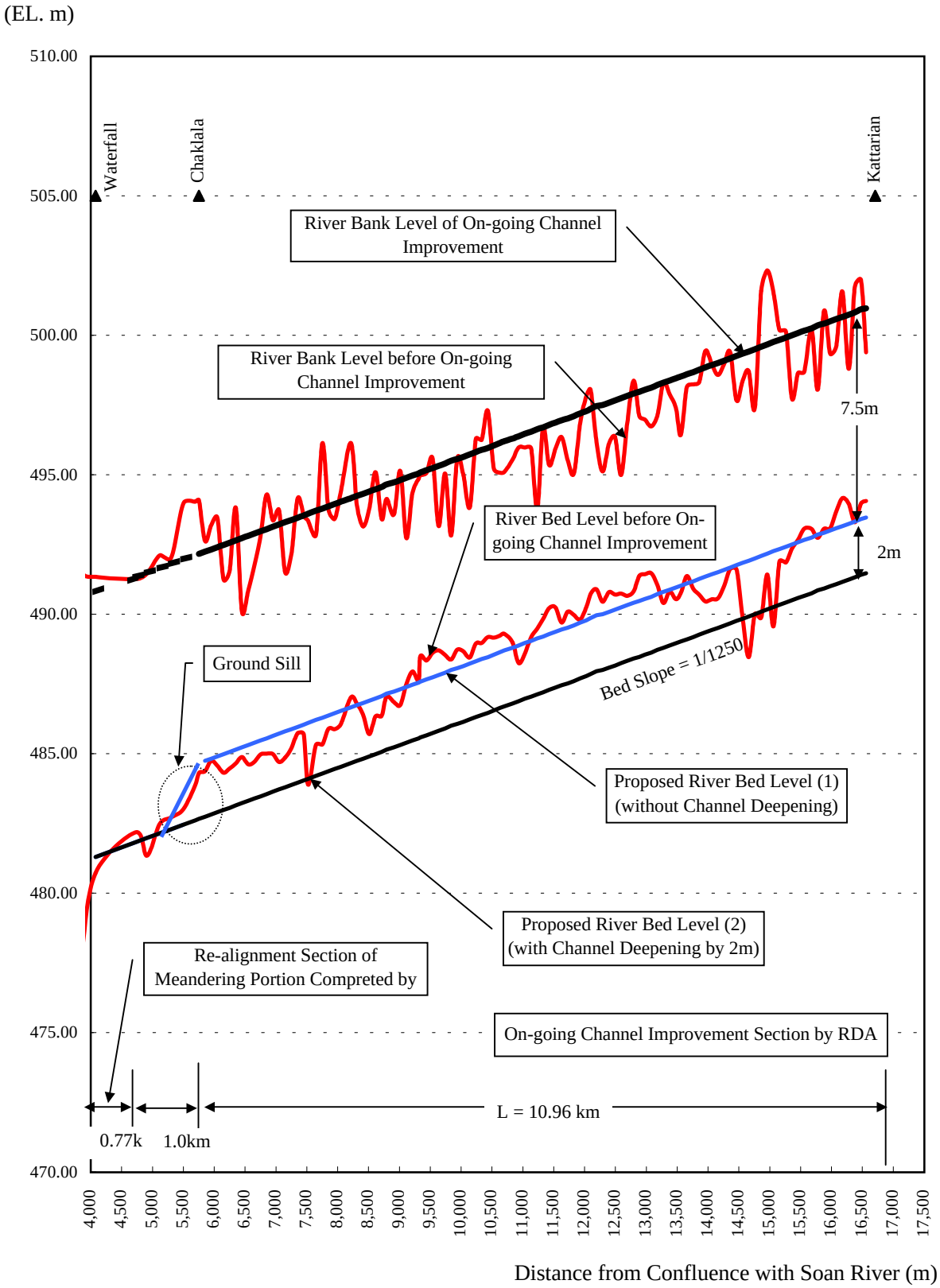


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

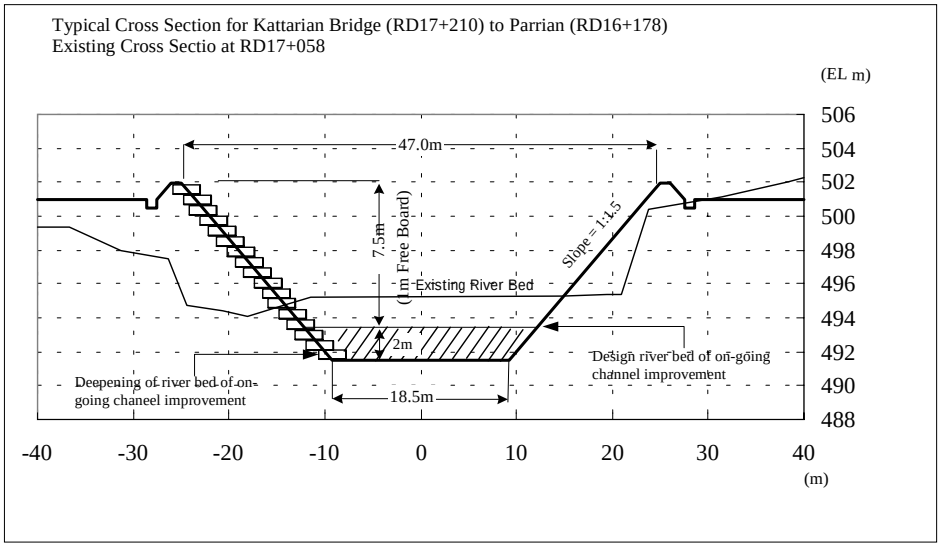
JAPAN INTERNATIONAL COOPERATION AGENCY

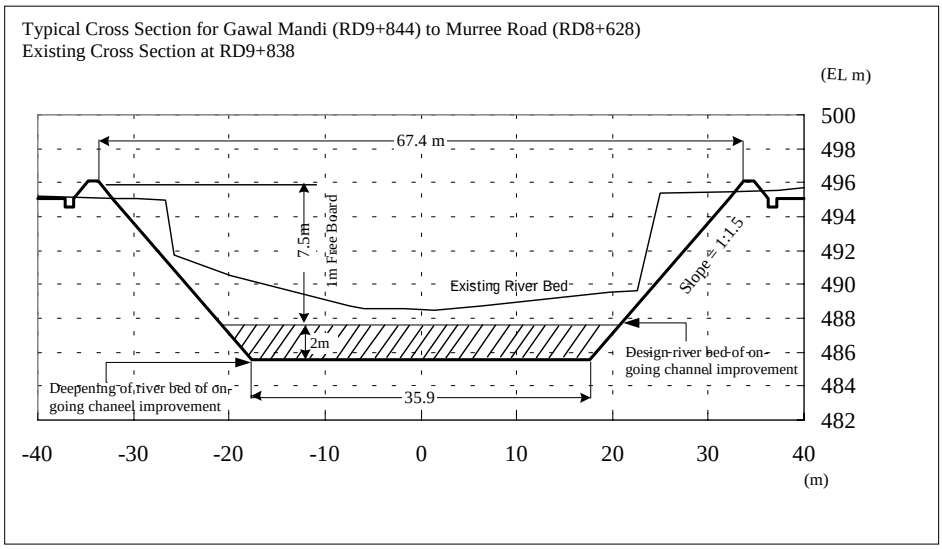
Fig. 6.2.1

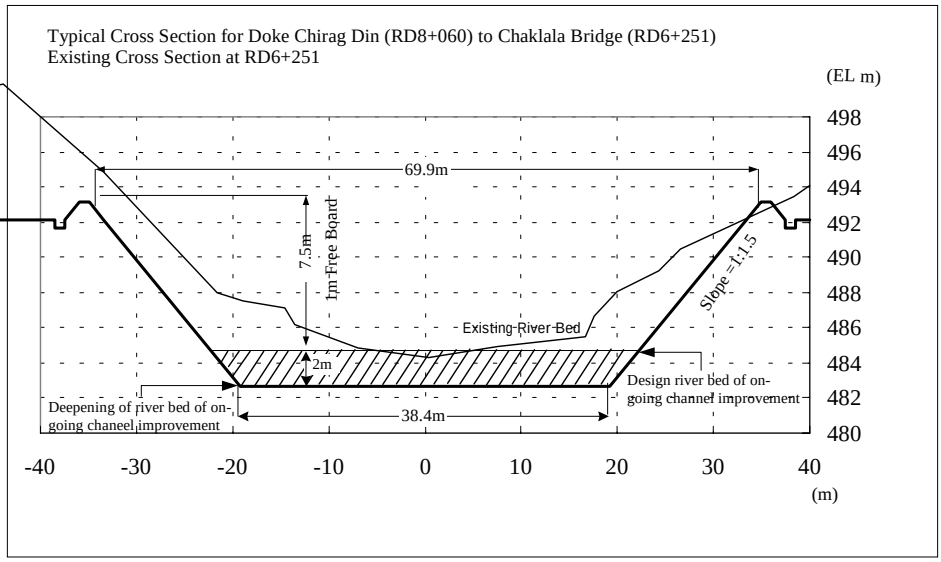
Overview of Possible Flood Mitigation Measures



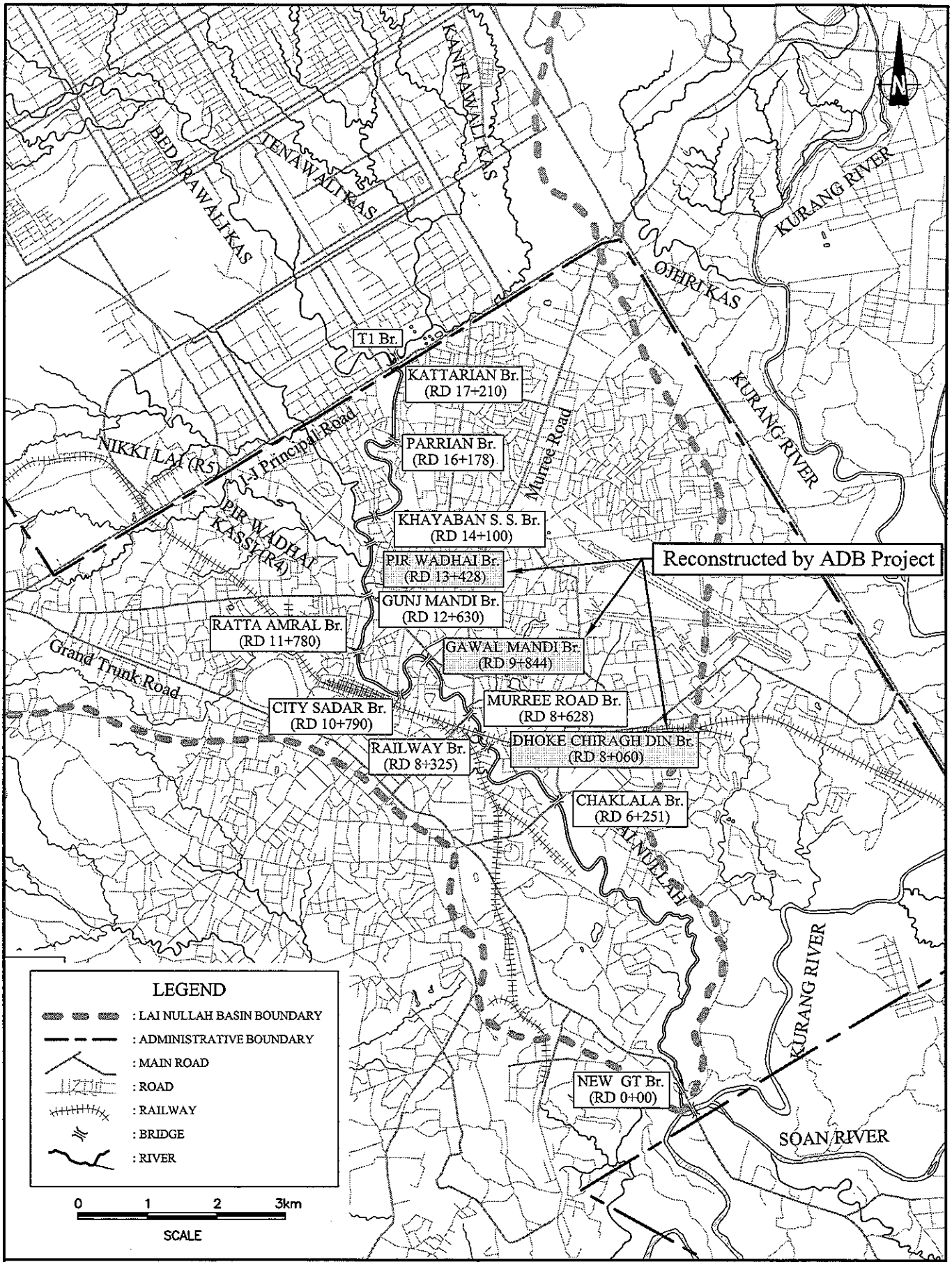
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 6.2.2 Longitudinal Profile for Proposed Channel Improvement







THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.3 Typical Cross-section for Proposed Channel Deepening from Chaklala Bridge to Kattarian Bridge
JAPAN INTERNATIONAL COOPERATION AGENCY	

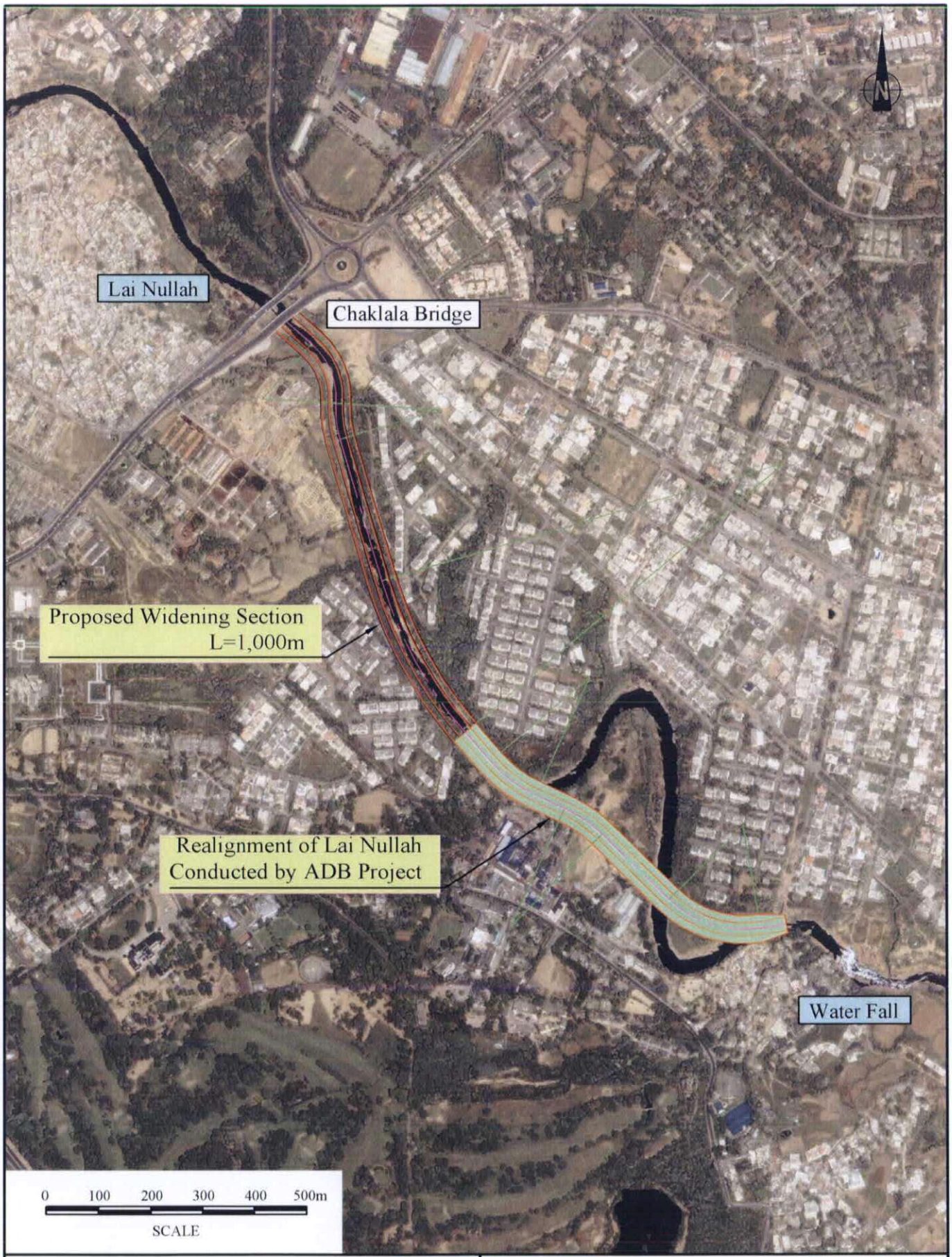


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.4

Location of Bridges to be Reconstructed and Reinforced through Proposed River Improvement

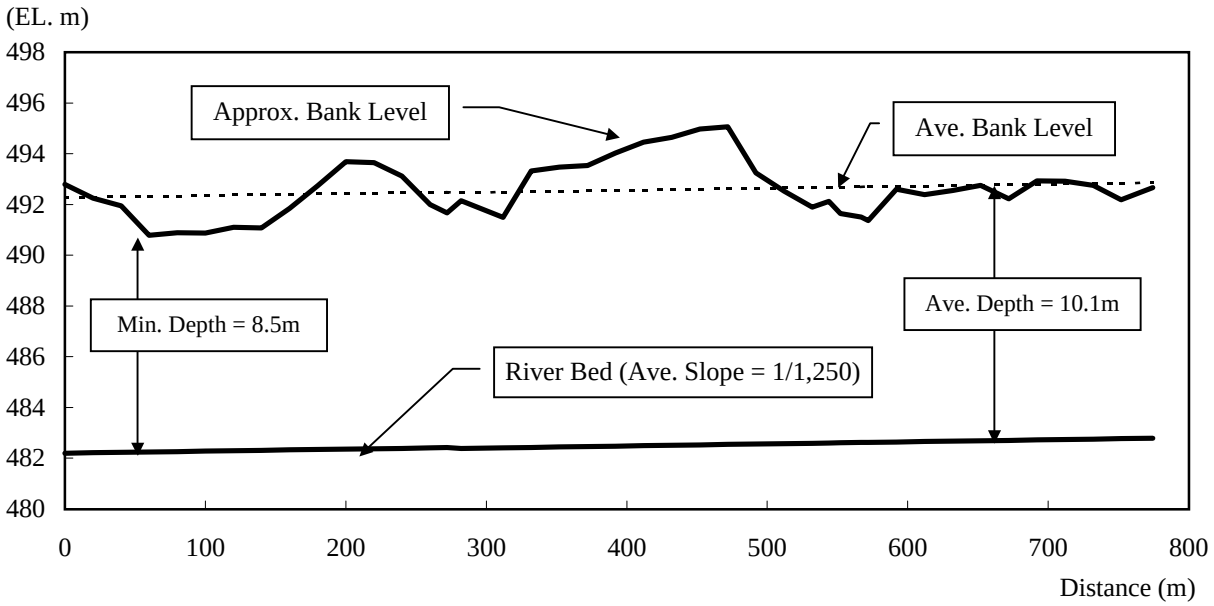


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

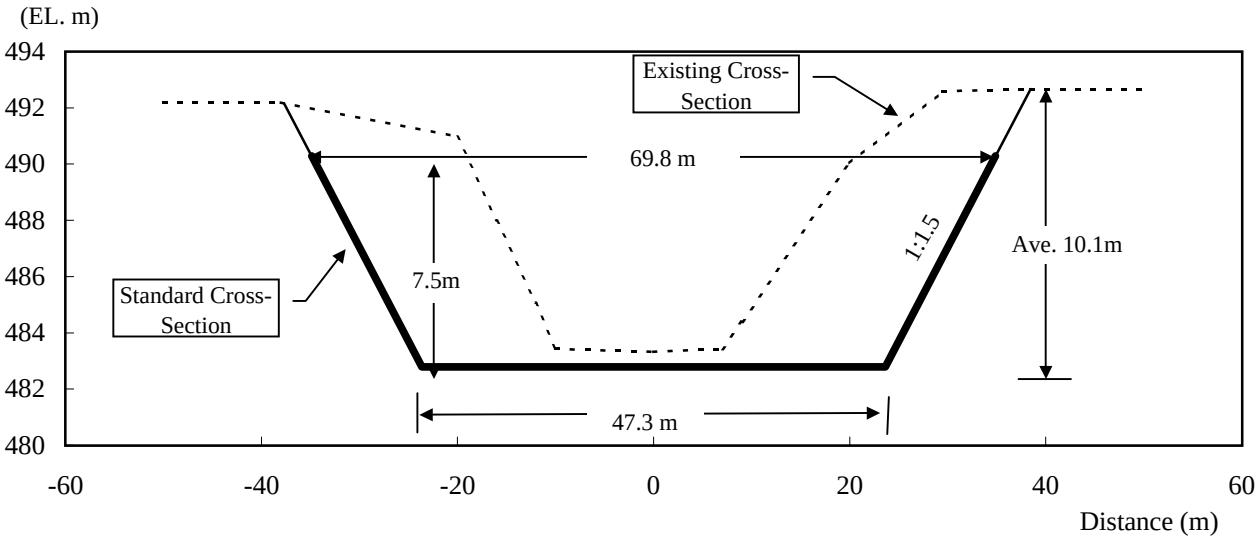
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.5

Proposed Widening Section of Lai Nullah below Chaklala Bridge

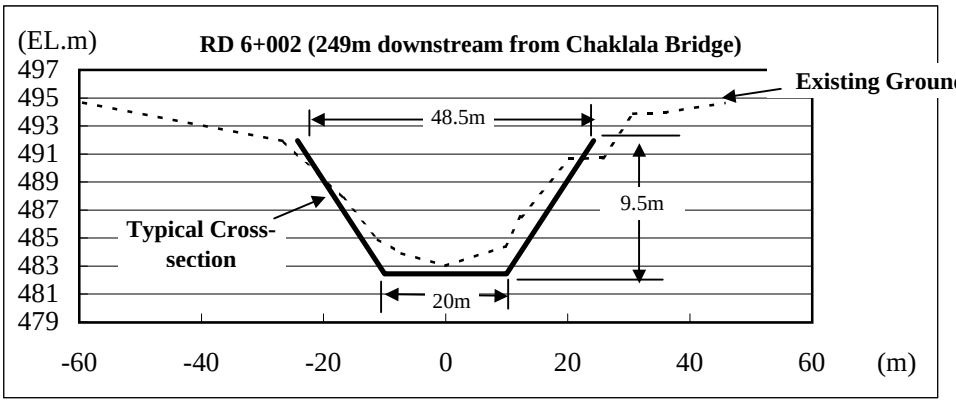


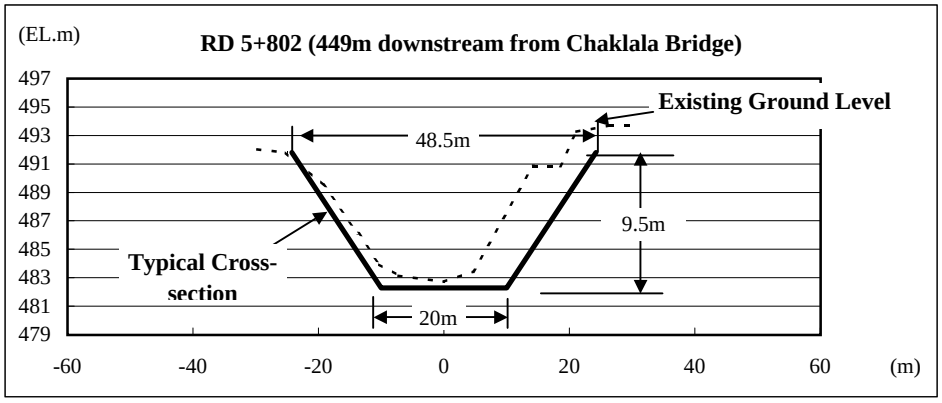
Longitudinal Profile

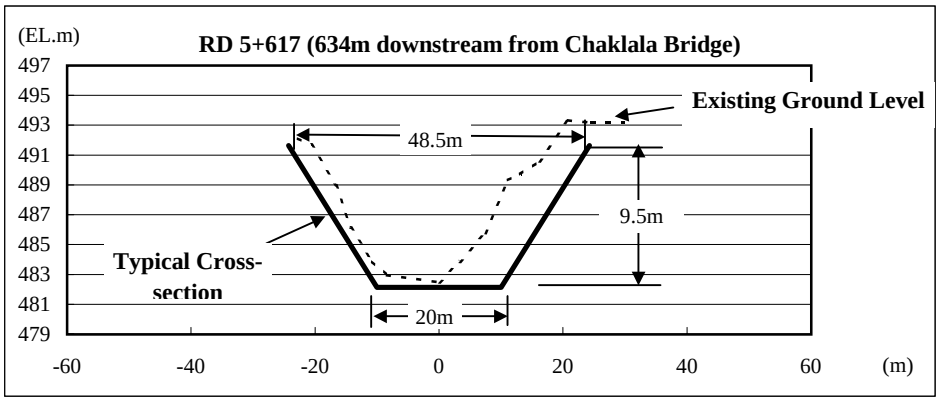


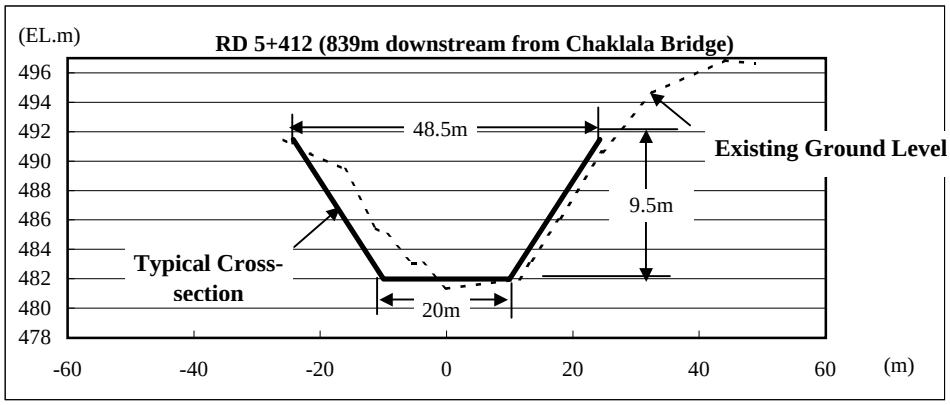
Standard Cross-section

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN JAPAN INTERNATIONAL COOPERATION AGENCY	Fig. 6.2.6 Designed Longitudinal Profile and Typical Cross-section for Realignment and Widening of Meandering Section along Murree Blue Area



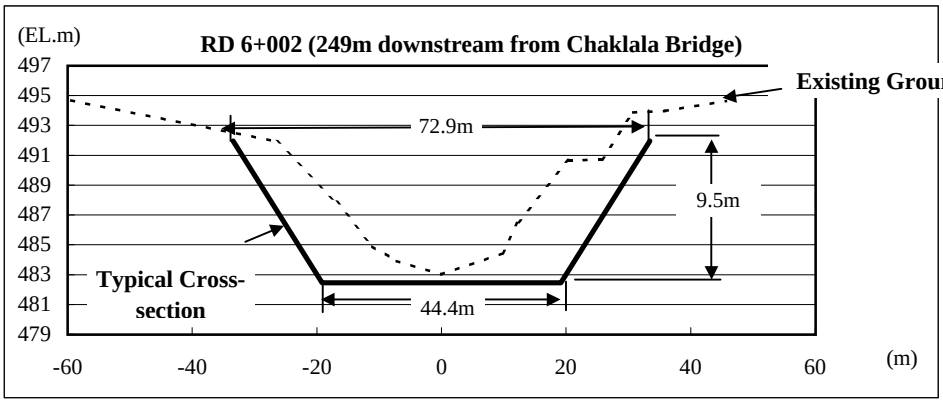


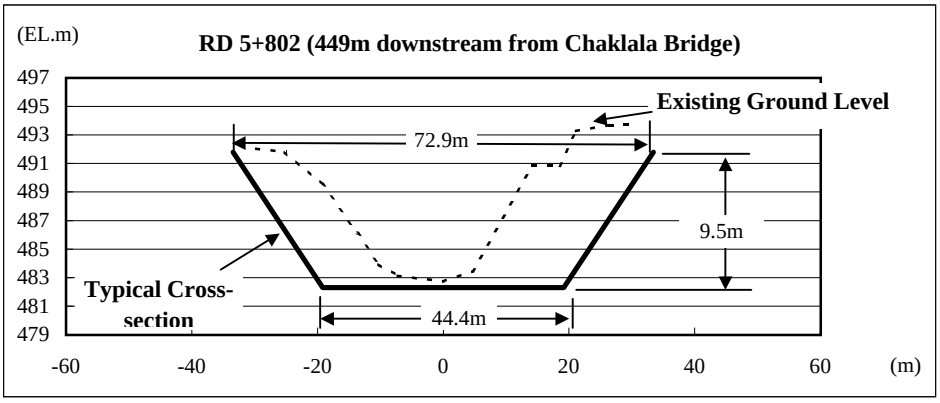


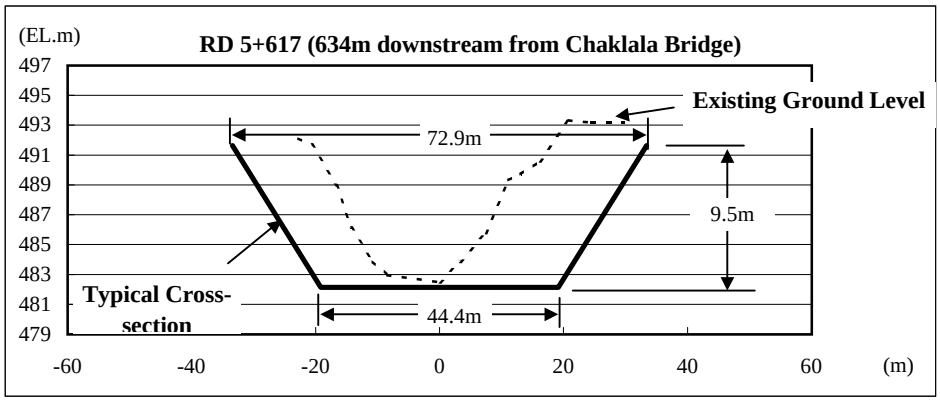


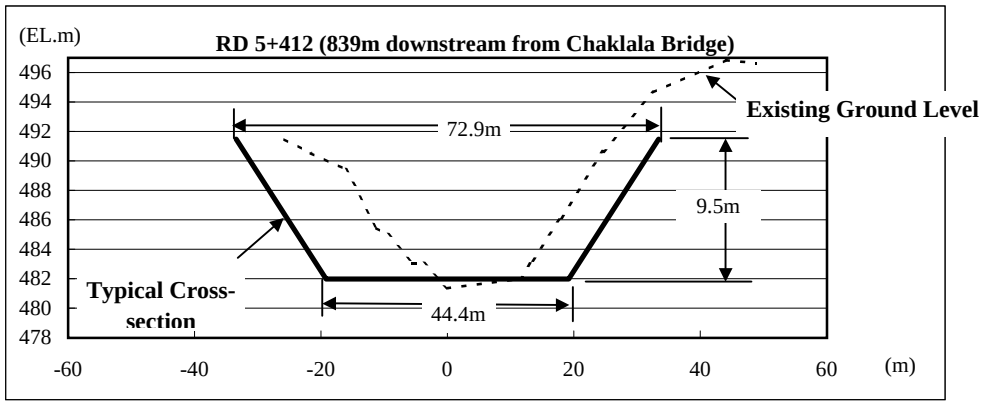
Note: Proposed section is subject to no channel deepening for the on-going improvement section above Chaklala Bridge

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.7 Proposed Typical Cross-section below Chaklala Bridge (In Case of Non-Channel Deepening above Chaklala Bridge)
Japan International Cooperation Agency	



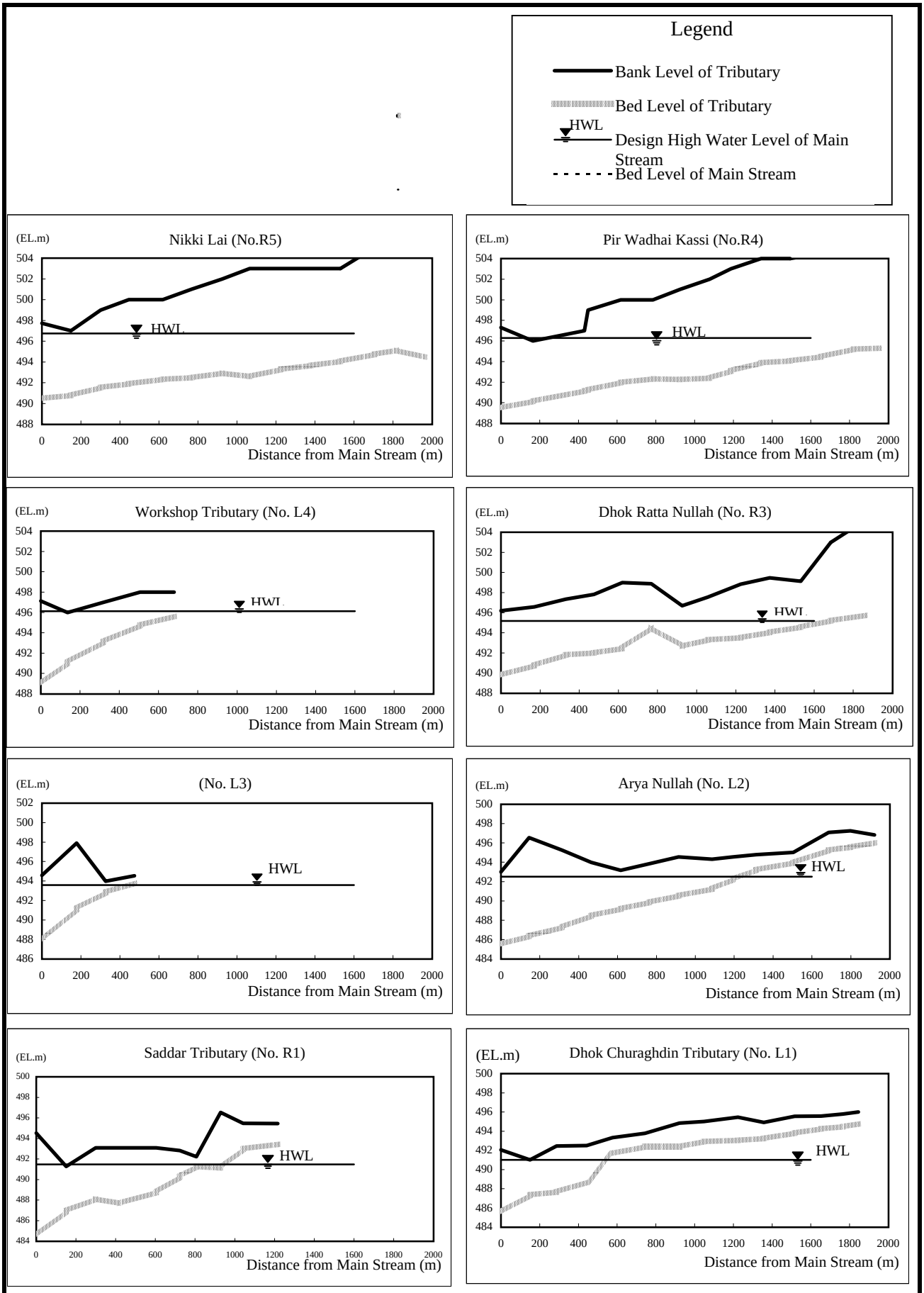






Note: Proposed section is subject to channel deepening for the on-going improvement section above Chaklala Bridge

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.8 Proposed Typical Cross-section below Chaklala Bridge (In Case of Channel Deepening above Chaklala Bridge)
Japan International Cooperation Agency	

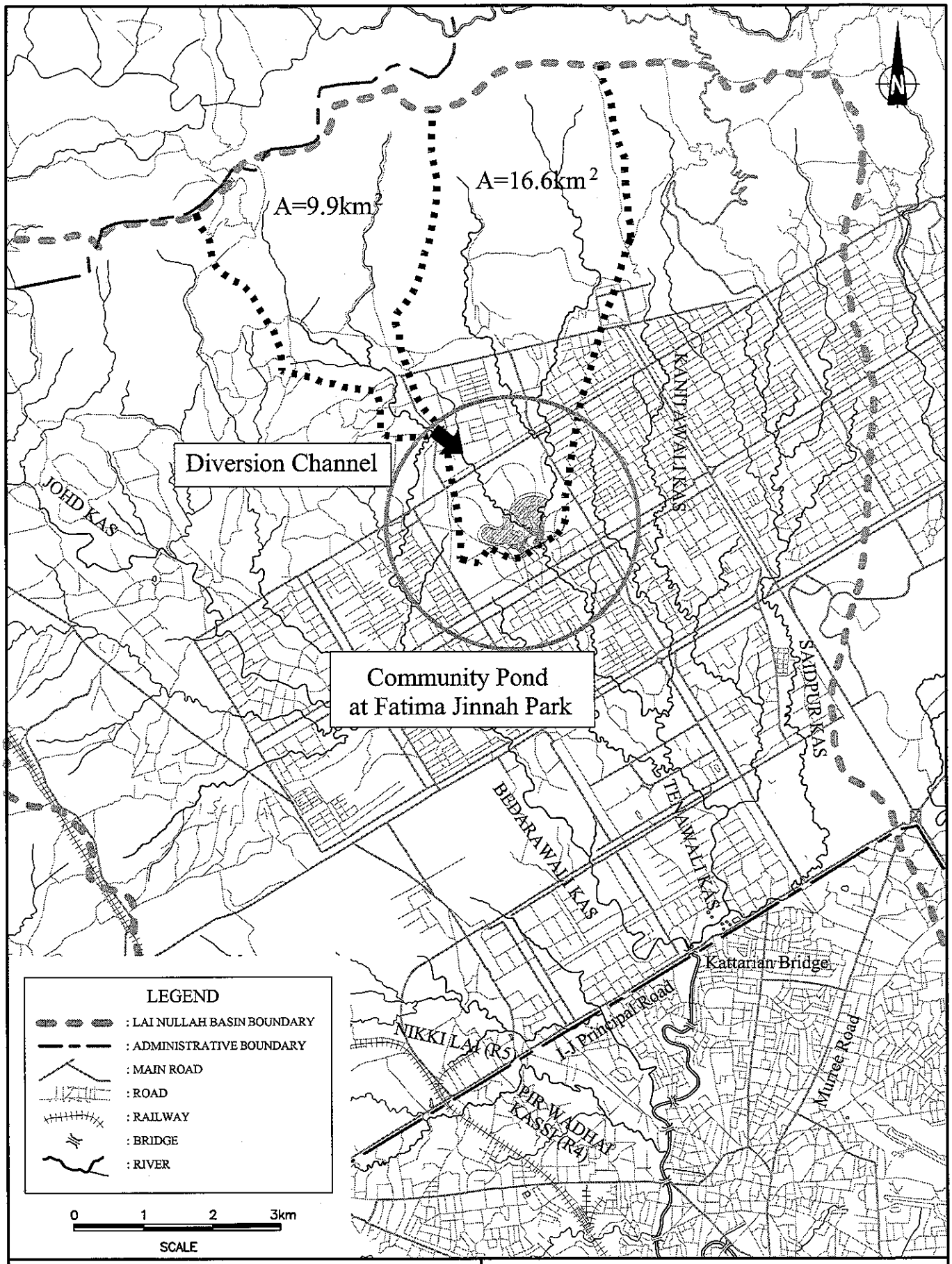


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.9

Comparison between High Water Level of Lai Nullah and Bank Level of Tributaries



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.10

Location of Community Pond proposed at Fatima Jinnah Park

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

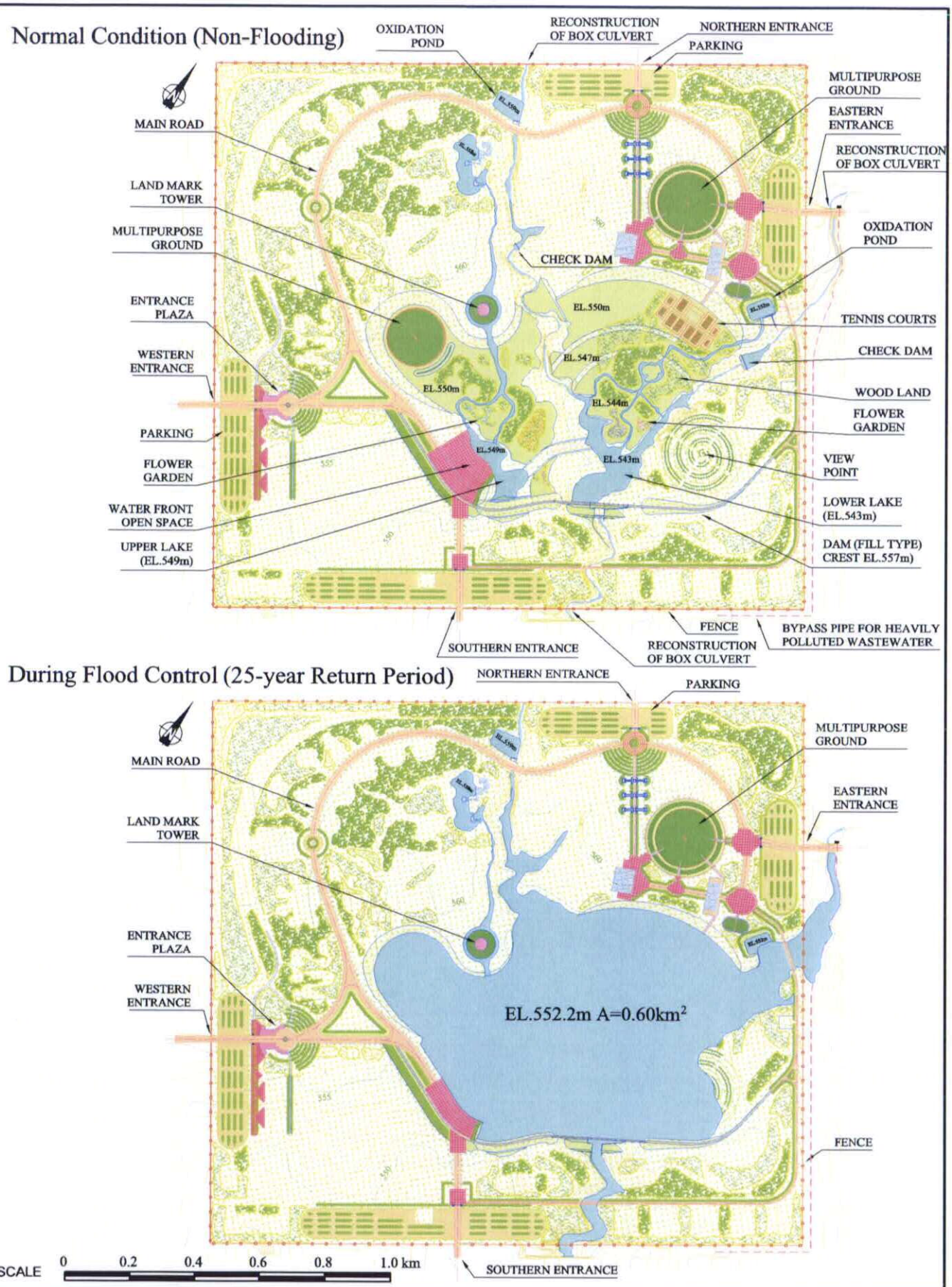
Fig. 6.2.11

Existing Conditions of Fatima Jinnah Park

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.12
Layout Plan of Flood Diversion from Tributary of Bedarawali Kas

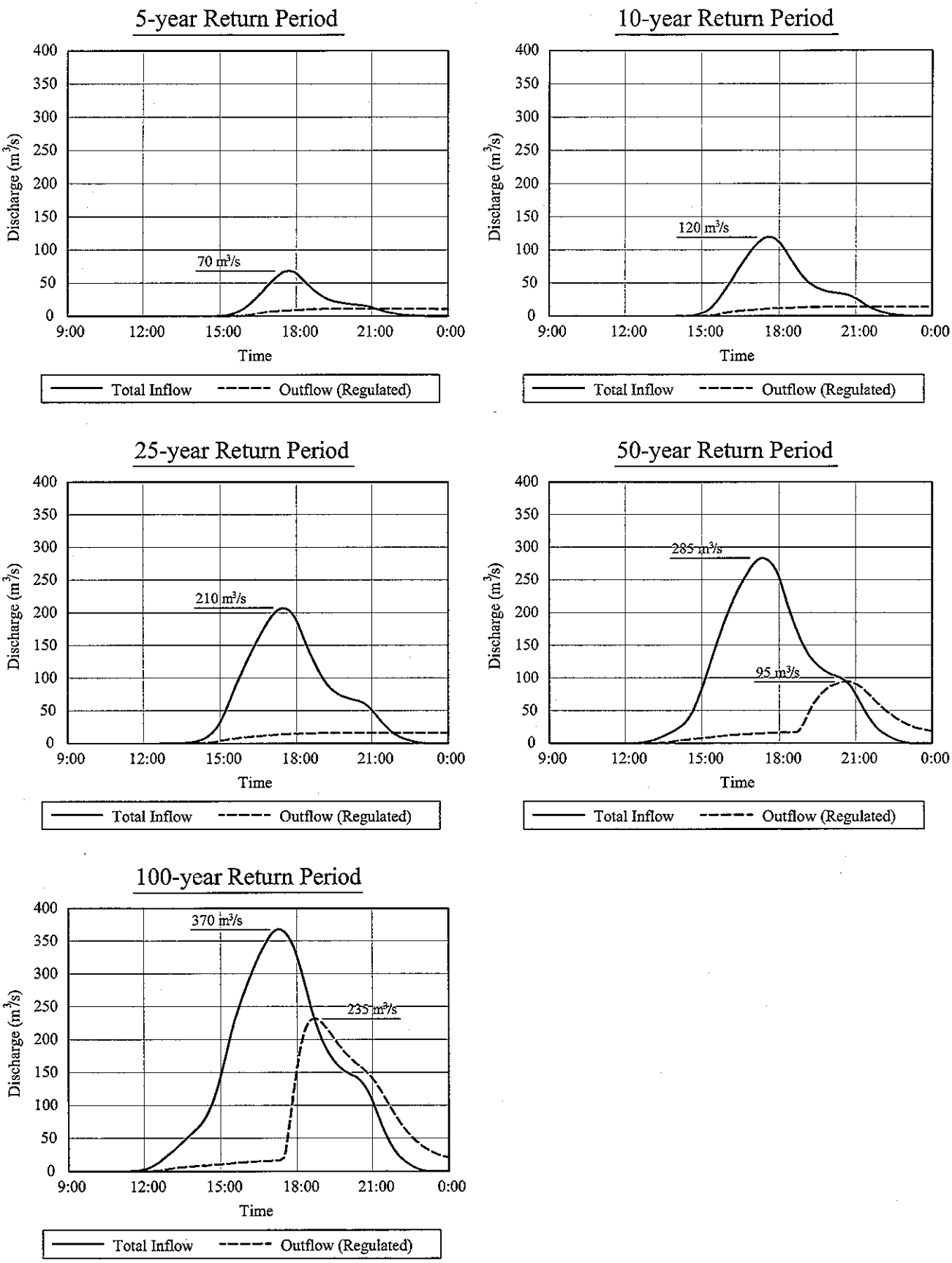


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.13

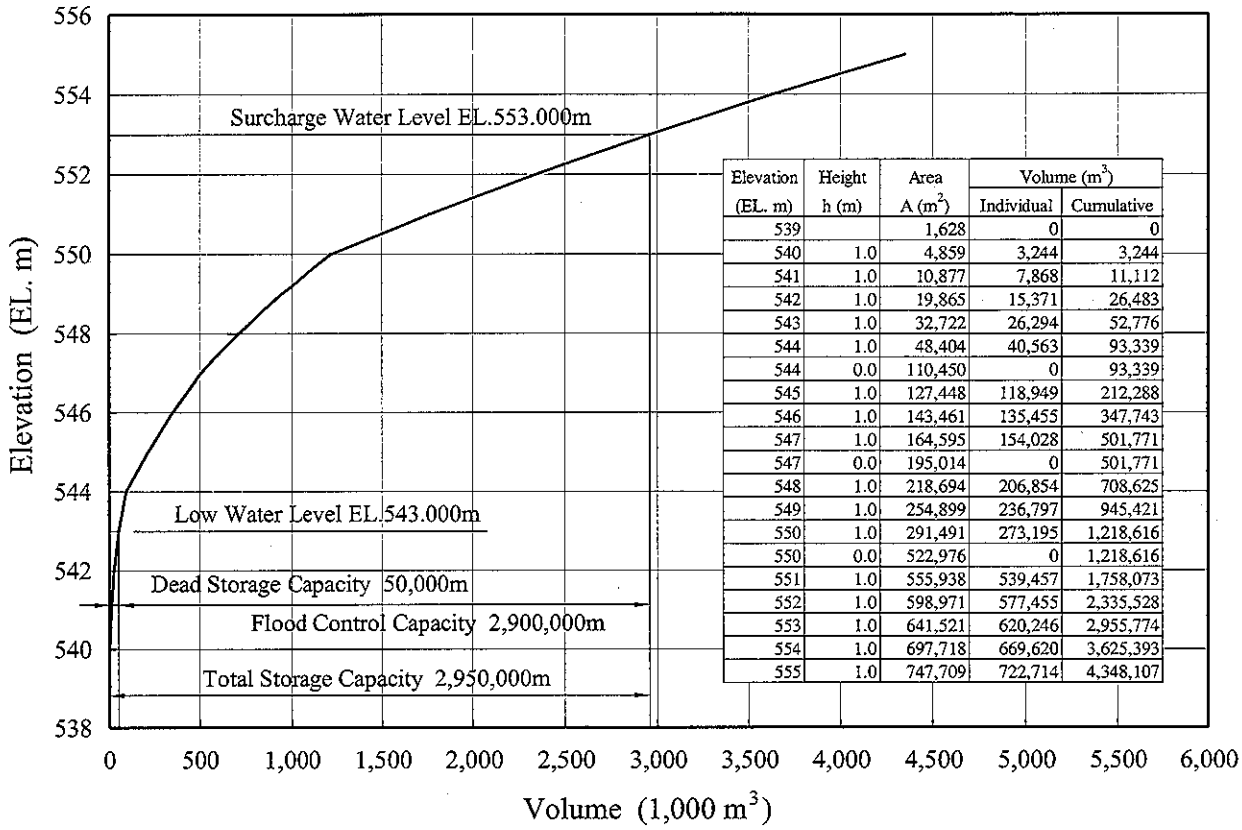
Plan of Community Pond



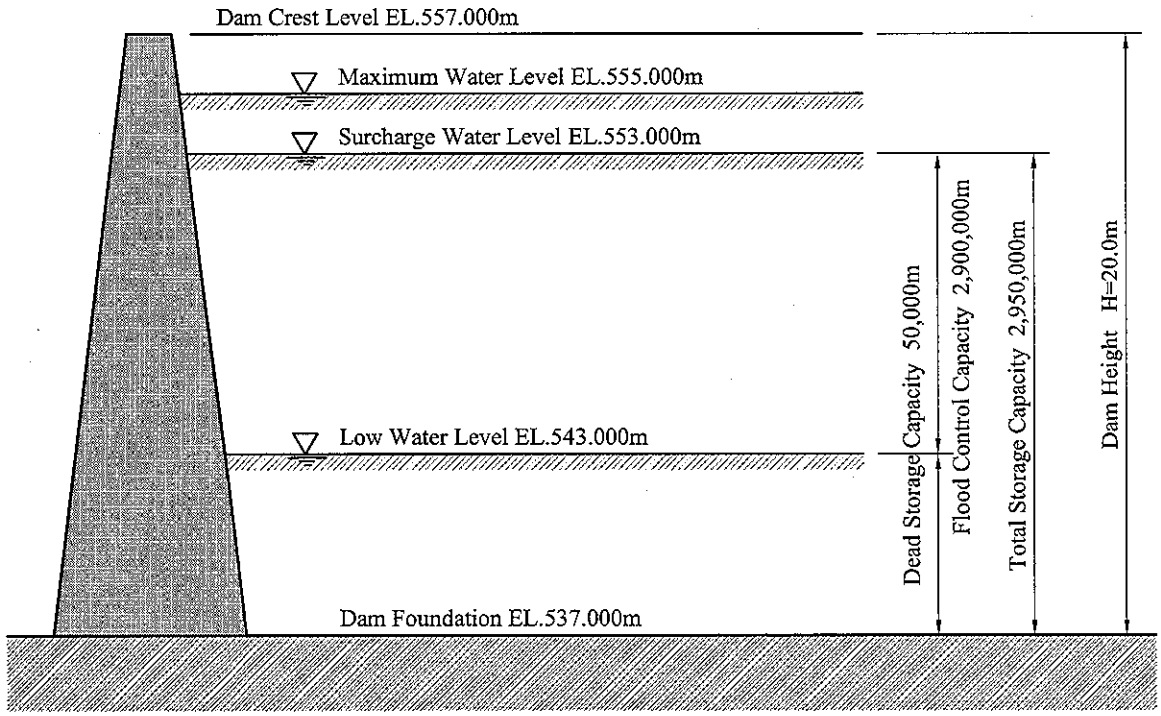
THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.14
Effect of Community Pond in Fatima Jinnah Park



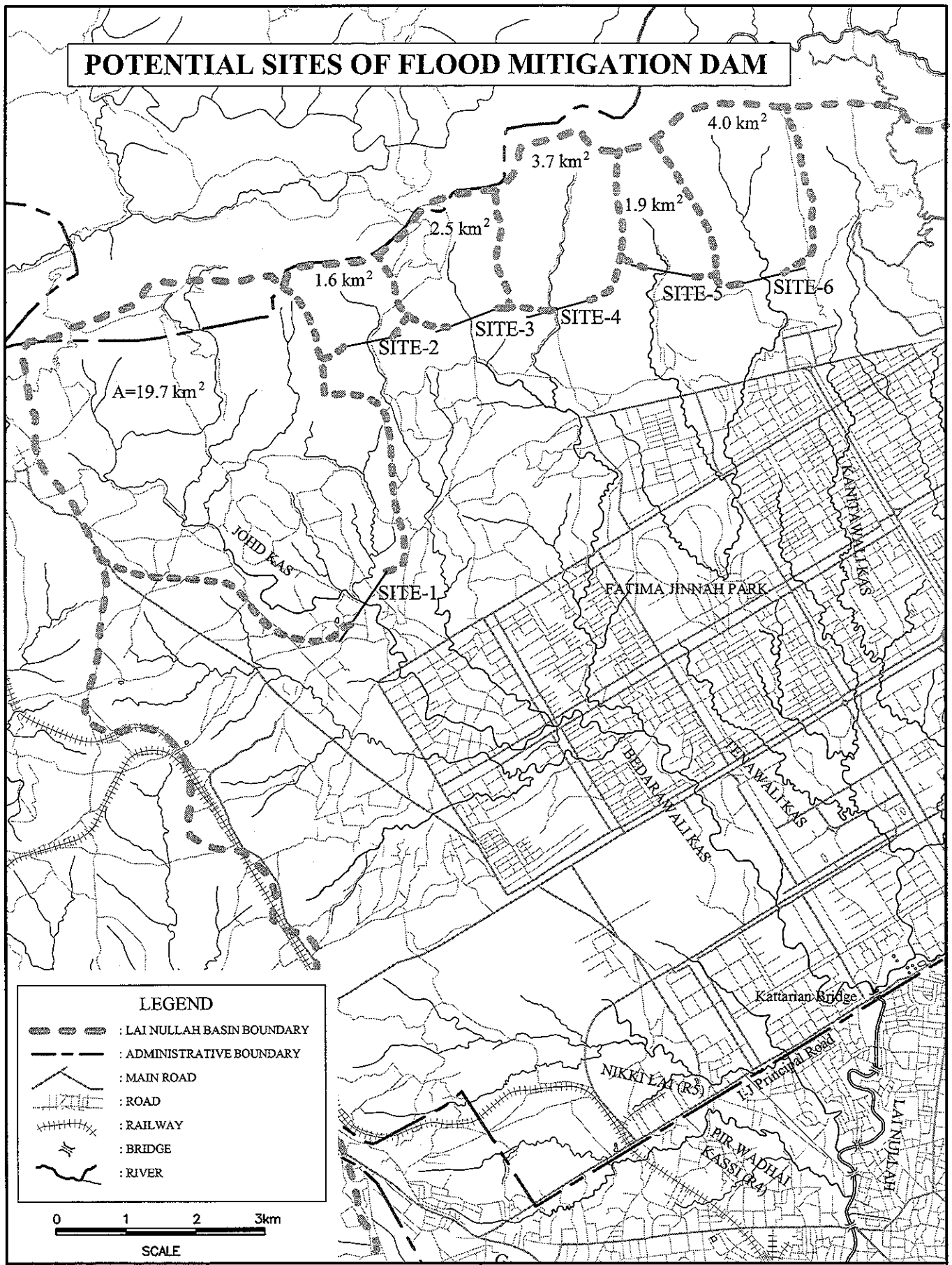
Elevation (EL. m)	Height h (m)	Area A (m^2)	Volume (m^3) Individual	Cumulative
539		1,628	0	0
540	1.0	4,859	3,244	3,244
541	1.0	10,877	7,868	11,112
542	1.0	19,865	15,371	26,483
543	1.0	32,722	26,294	52,776
544	1.0	48,404	40,563	93,339
544	0.0	110,450	0	93,339
545	1.0	127,448	118,949	212,288
546	1.0	143,461	135,455	347,743
547	1.0	164,595	154,028	501,771
547	0.0	195,014	0	501,771
548	1.0	218,694	206,854	708,625
549	1.0	254,899	236,797	945,421
550	1.0	291,491	273,195	1,218,616
550	0.0	522,976	0	1,218,616
551	1.0	555,938	539,457	1,758,073
552	1.0	598,971	577,455	2,335,528
553	1.0	641,521	620,246	2,955,774
554	1.0	697,718	669,620	3,625,393
555	1.0	747,709	722,714	4,348,107



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.15
Pond Storage Curve of
Community Pond in Fatima Jinnah Park

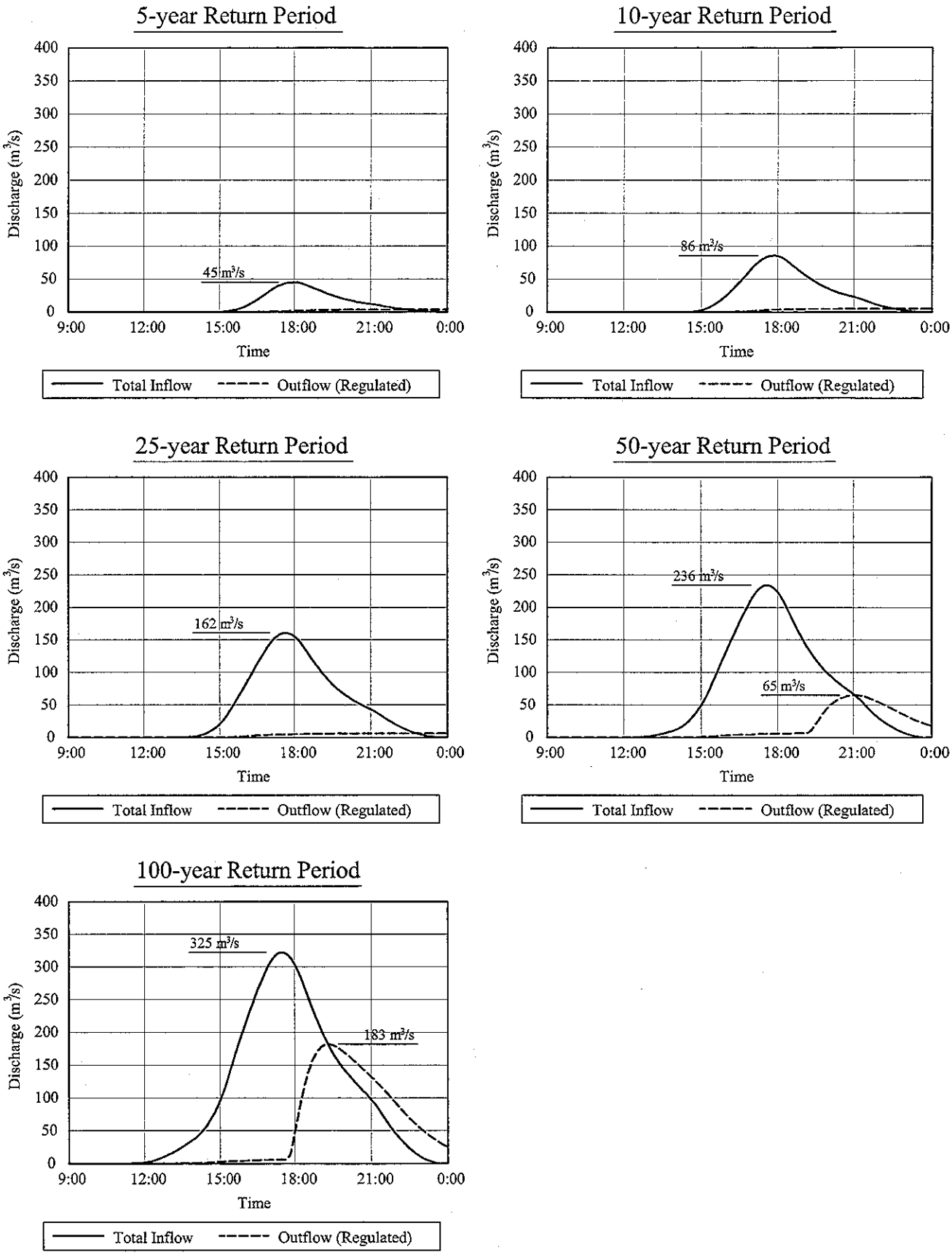


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

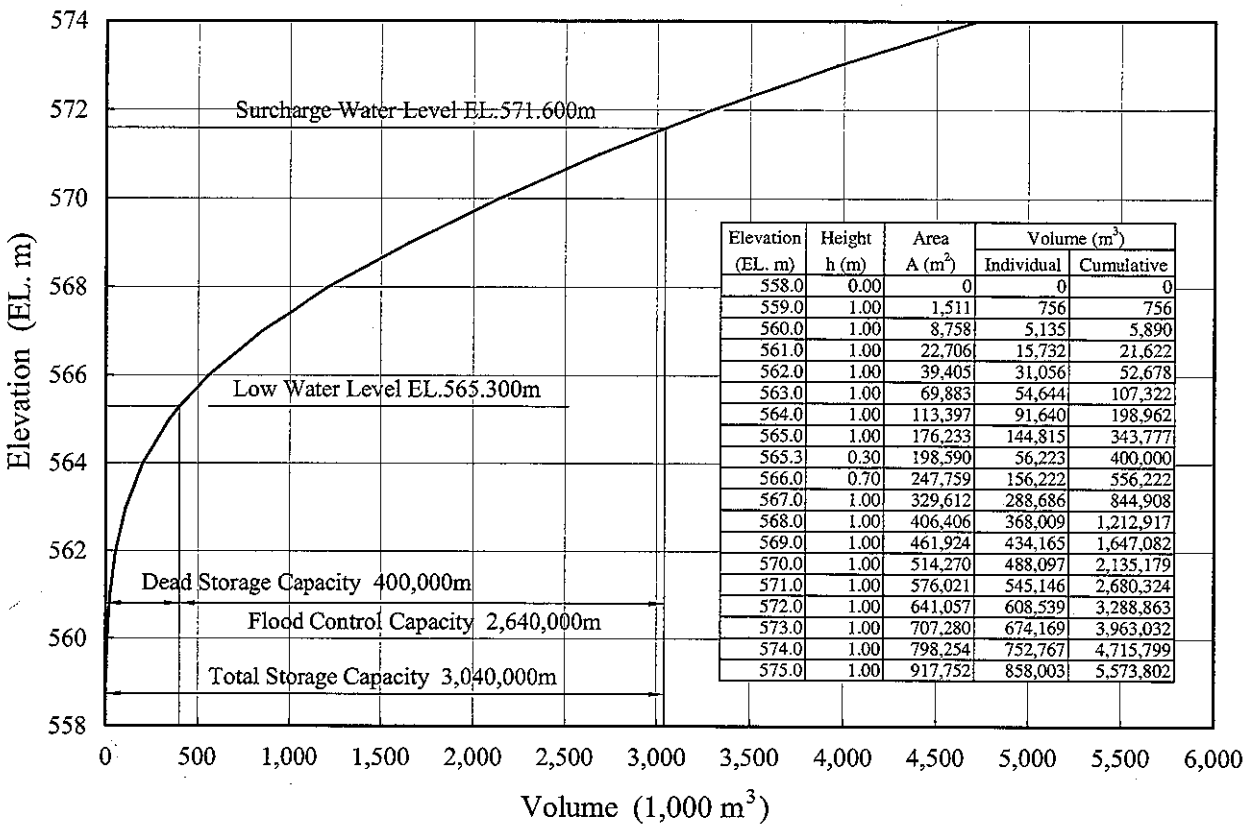
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.16

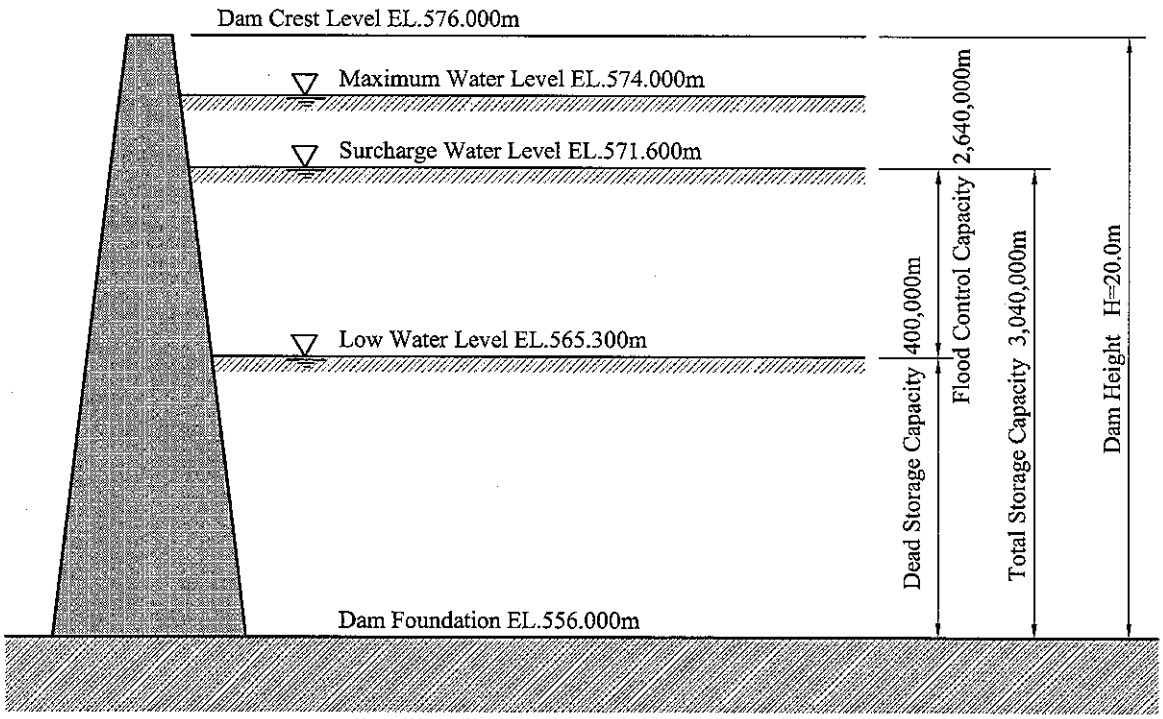
Location of Potential Dam Site



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.17 Effect of Flood Mitigation Dam
JAPAN INTERNATIONAL COOPERATION AGENCY	



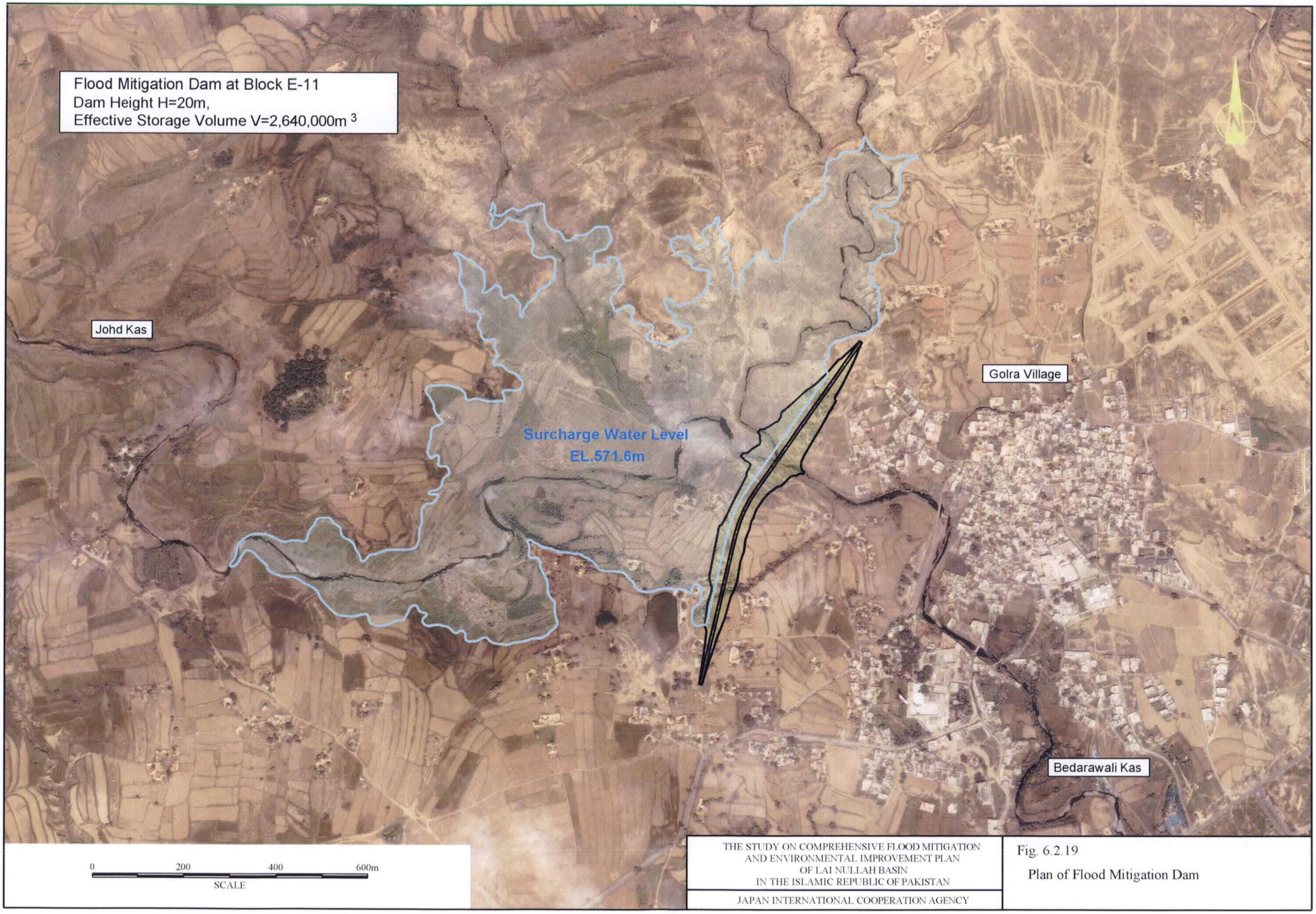
Elevation (EL. m)	Height h (m)	Area A (m^2)	Volume (m^3) Individual	Volume (m^3) Cumulative
558.0	0.00	0	0	0
559.0	1.00	1,511	756	756
560.0	1.00	8,758	5,135	5,890
561.0	1.00	22,706	15,732	21,622
562.0	1.00	39,405	31,056	52,678
563.0	1.00	69,883	54,644	107,322
564.0	1.00	113,397	91,640	198,962
565.0	1.00	176,233	144,815	343,777
565.3	0.30	198,590	56,223	400,000
566.0	0.70	247,759	156,222	556,222
567.0	1.00	329,612	288,686	844,908
568.0	1.00	406,406	368,009	1,212,917
569.0	1.00	461,924	434,165	1,647,082
570.0	1.00	514,270	488,097	2,135,179
571.0	1.00	576,021	545,146	2,680,324
572.0	1.00	641,057	608,539	3,288,863
573.0	1.00	707,280	674,169	3,963,032
574.0	1.00	798,254	752,767	4,715,799
575.0	1.00	917,752	858,003	5,573,802



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.18
Reservoir Storage Curve of Flood Mitigation Dam

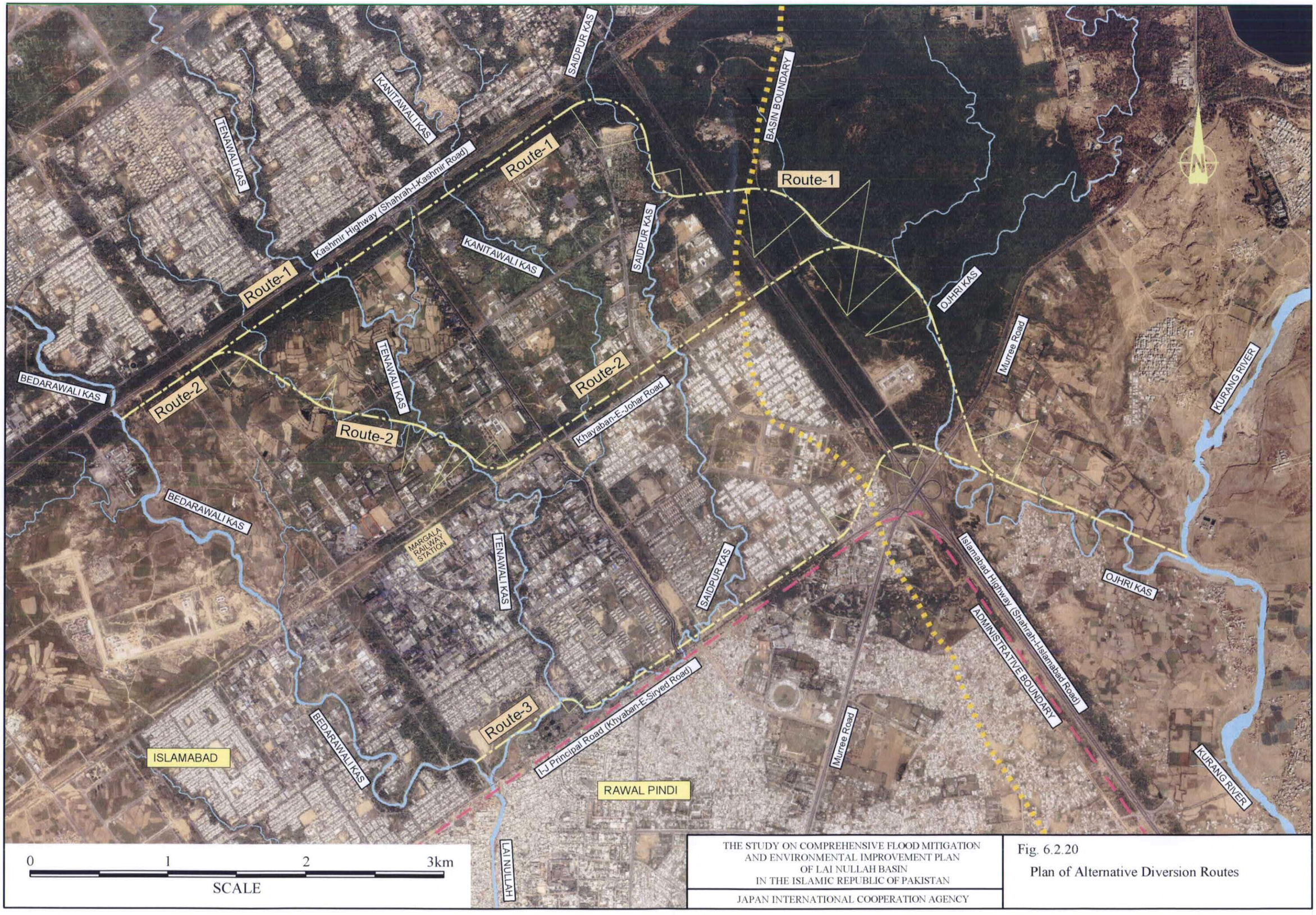


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.19

Plan of Flood Mitigation Dam

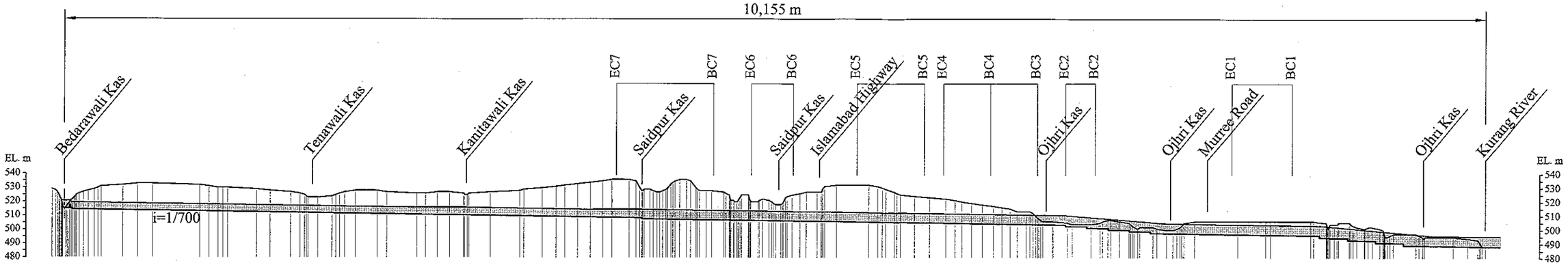


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

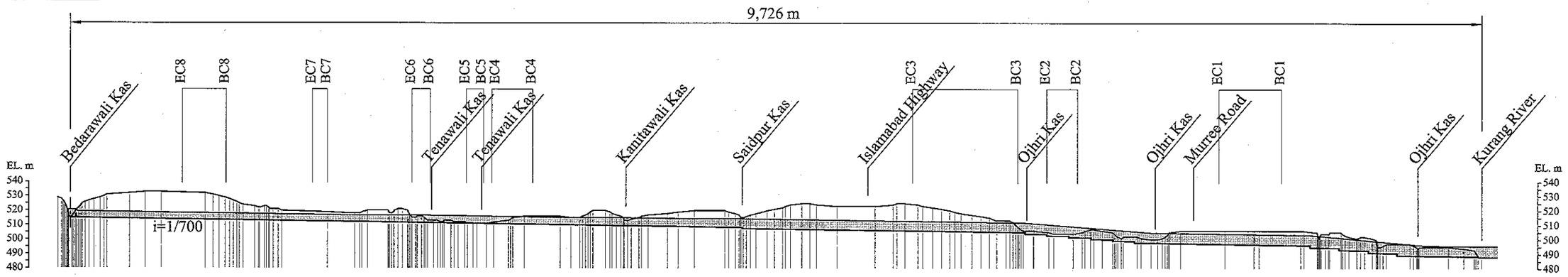
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.20
Plan of Alternative Diversion Routes

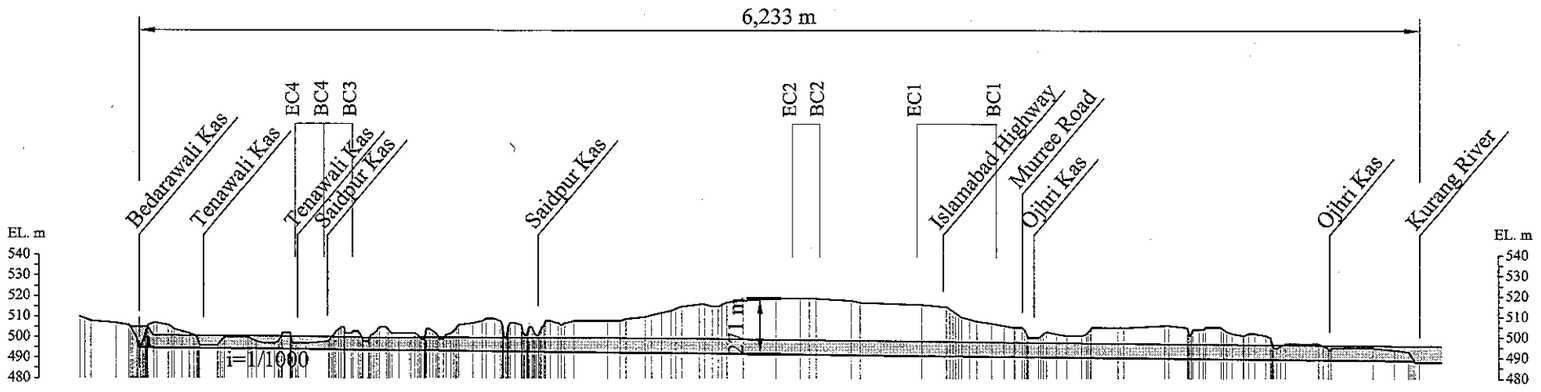
Route 1



Route 2



Route 3



0 1 2 3km

SCALE (HOROIZONTAL)

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

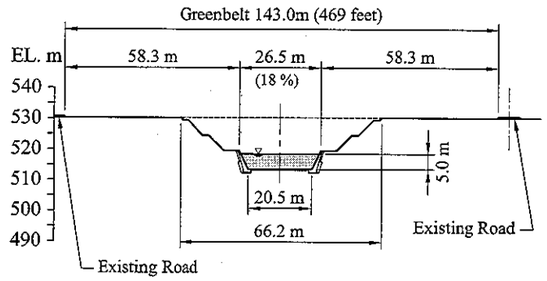
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.21
Longitudinal Profile of Alternative Diversion Routes

Diversion Channel - Route 1

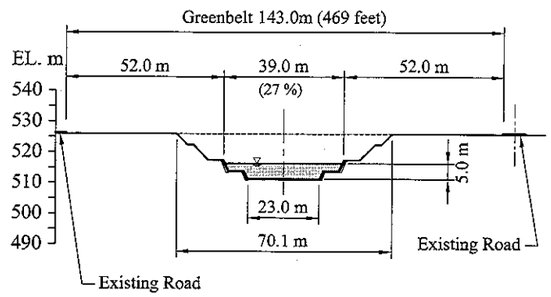
Bedarawali Kas - Tenawali Kas

Q = 720 m³/s



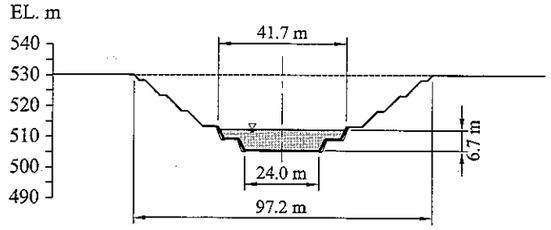
Tenawali Kas - Saidpur Kas

Q = 1,000 m³/s



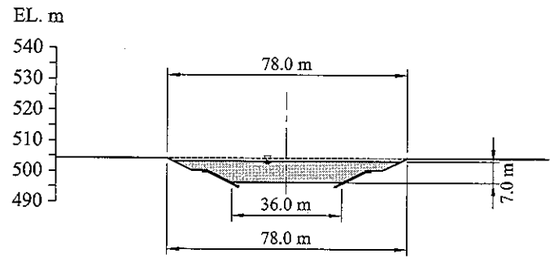
Saidpur Kas - Ojhri Kas

Q = 1,480 m³/s



Ojhri Kas - Kurang River

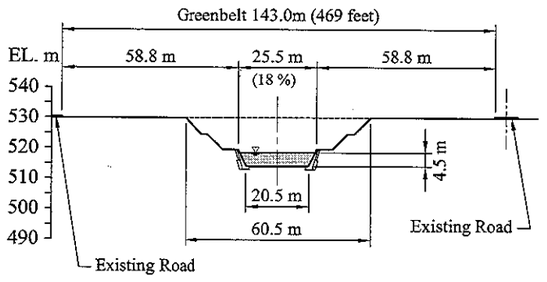
Q = 1,790 m³/s



Diversion Channel - Route 2

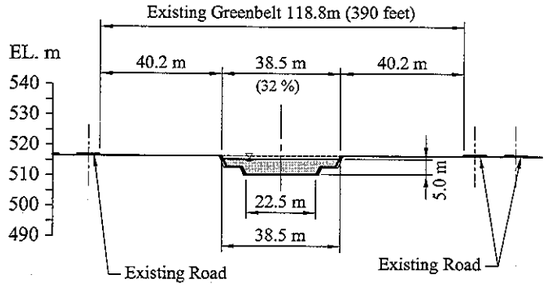
Bedarawali Kas - Tenawali Kas

Q = 600 m³/s



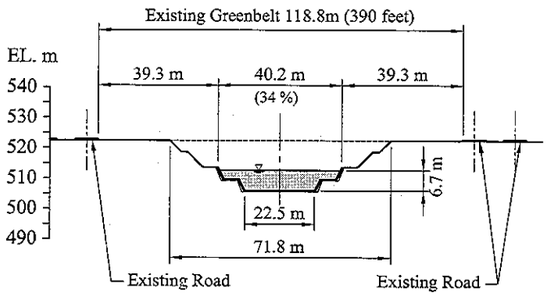
Tenawali Kas - Saidpur Kas

Q = 980 m³/s



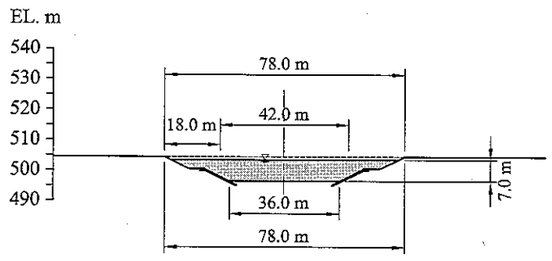
Saidpur Kas - Ojhri Kas

Q = 1,480 m³/s



Ojhri Kas - Kurang River

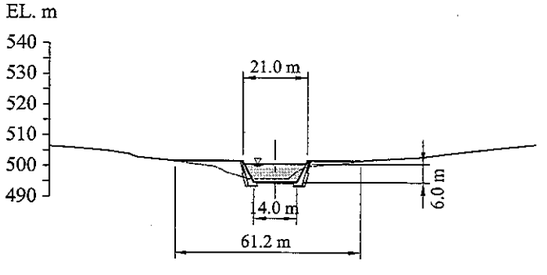
Q = 1,790 m³/s



Diversion Channel - Route 3

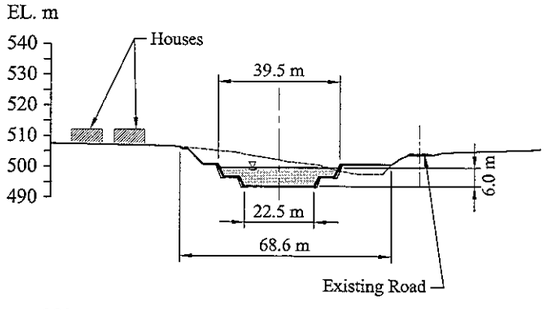
Bedarawali Kas - Tenawali Kas

Q = 550 m³/s



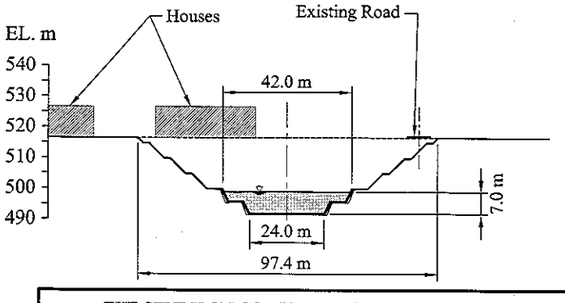
Tenawali Kas - Saidpur Kas

Q = 1,100 m³/s



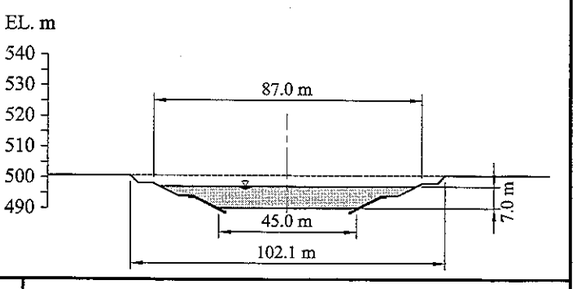
Saidpur Kas - Ojhri Kas

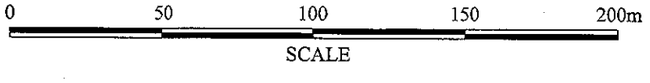
Q = 1,480 m³/s



Ojhri Kas - Kurang River

Q = 1,790 m³/s





THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.22

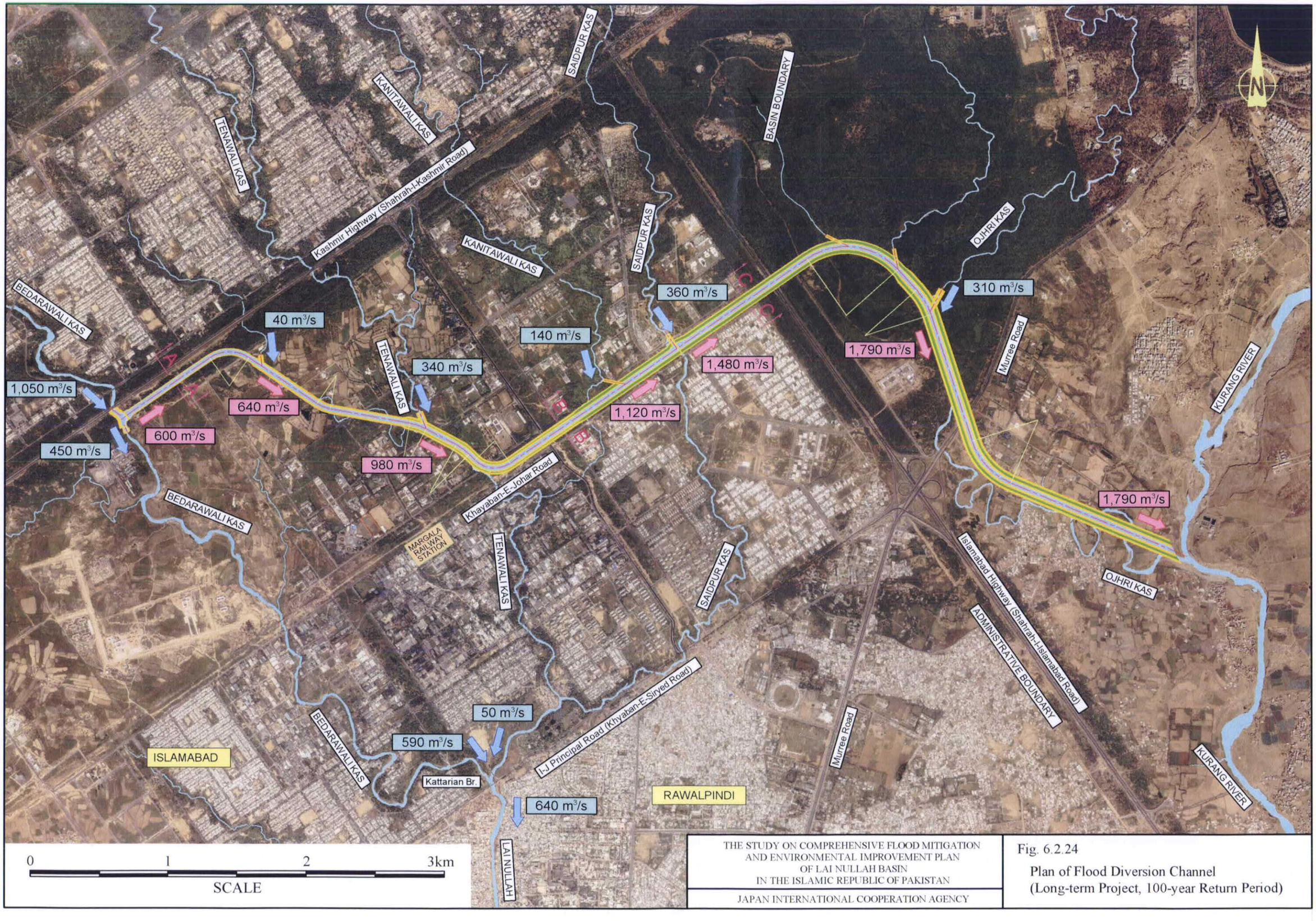
Cross Section of Alternative Diversion Routes

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.23

Plan of Flood Diversion Channel
(Short-term Project, 25-year Return Period)



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

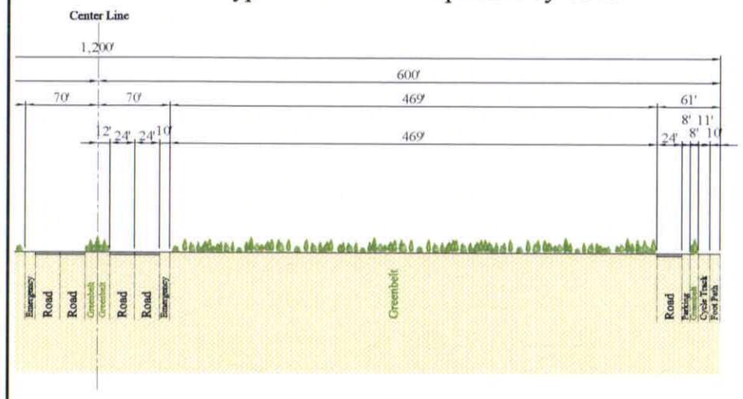
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.24

Plan of Flood Diversion Channel
(Long-term Project, 100-year Return Period)

Section of Kasihimir Highway

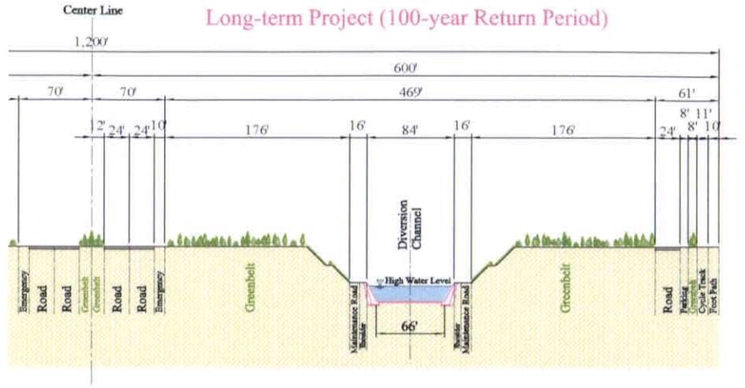
Typical Cross Section planned by CDA



Section A - A

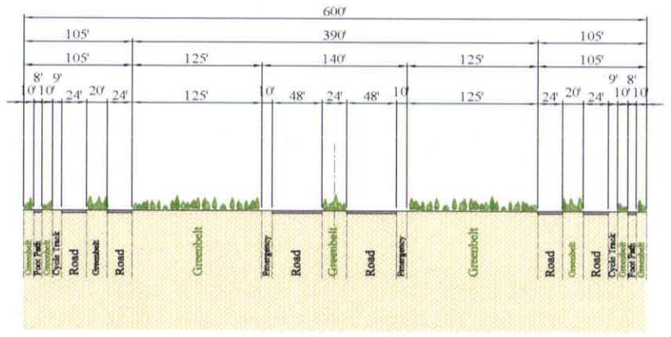
Flood Diversion Channel with Maintenance Road

Long-term Project (100-year Return Period)

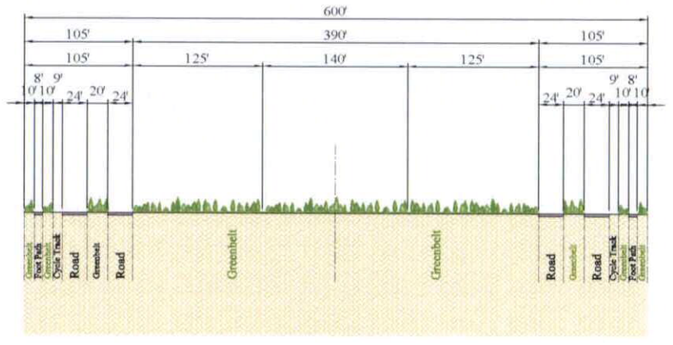


Section of Khayaban-E-Johar Road

Typical Cross Section planned by CDA



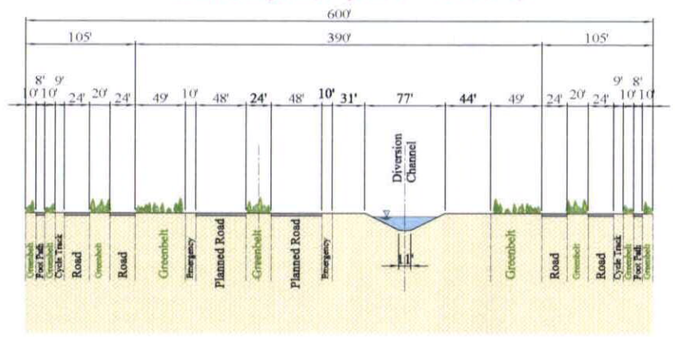
Existing Condition



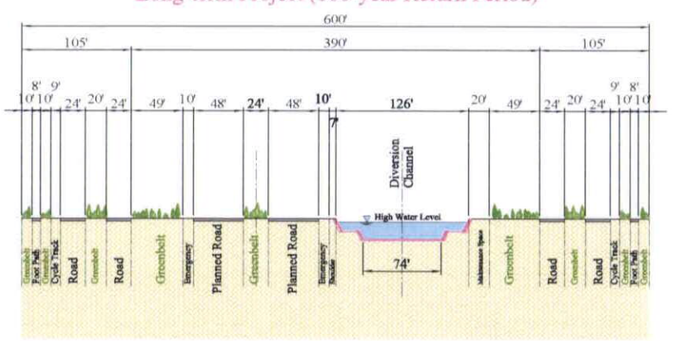
Section B - B

Flood Diversion Channel with Road planned by CDA

Short-term Project (25-year Return Period)



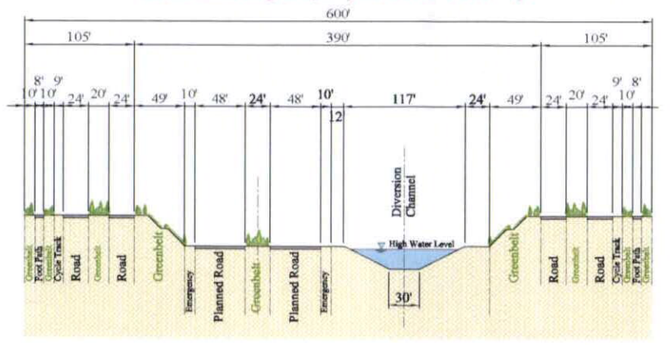
Long-term Project (100-year Return Period)



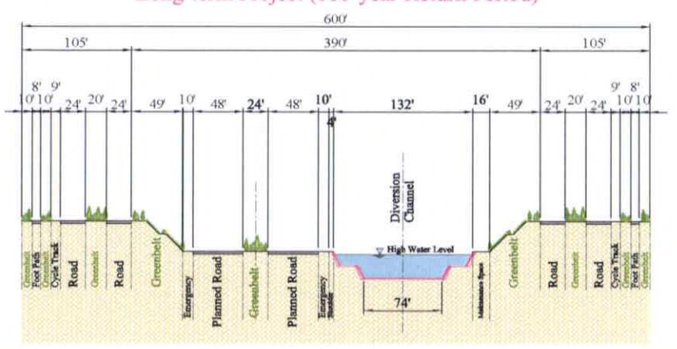
Section C - C

Flood Diversion Channel with Road planned by CDA

Short-term Project (25-year Return Period)



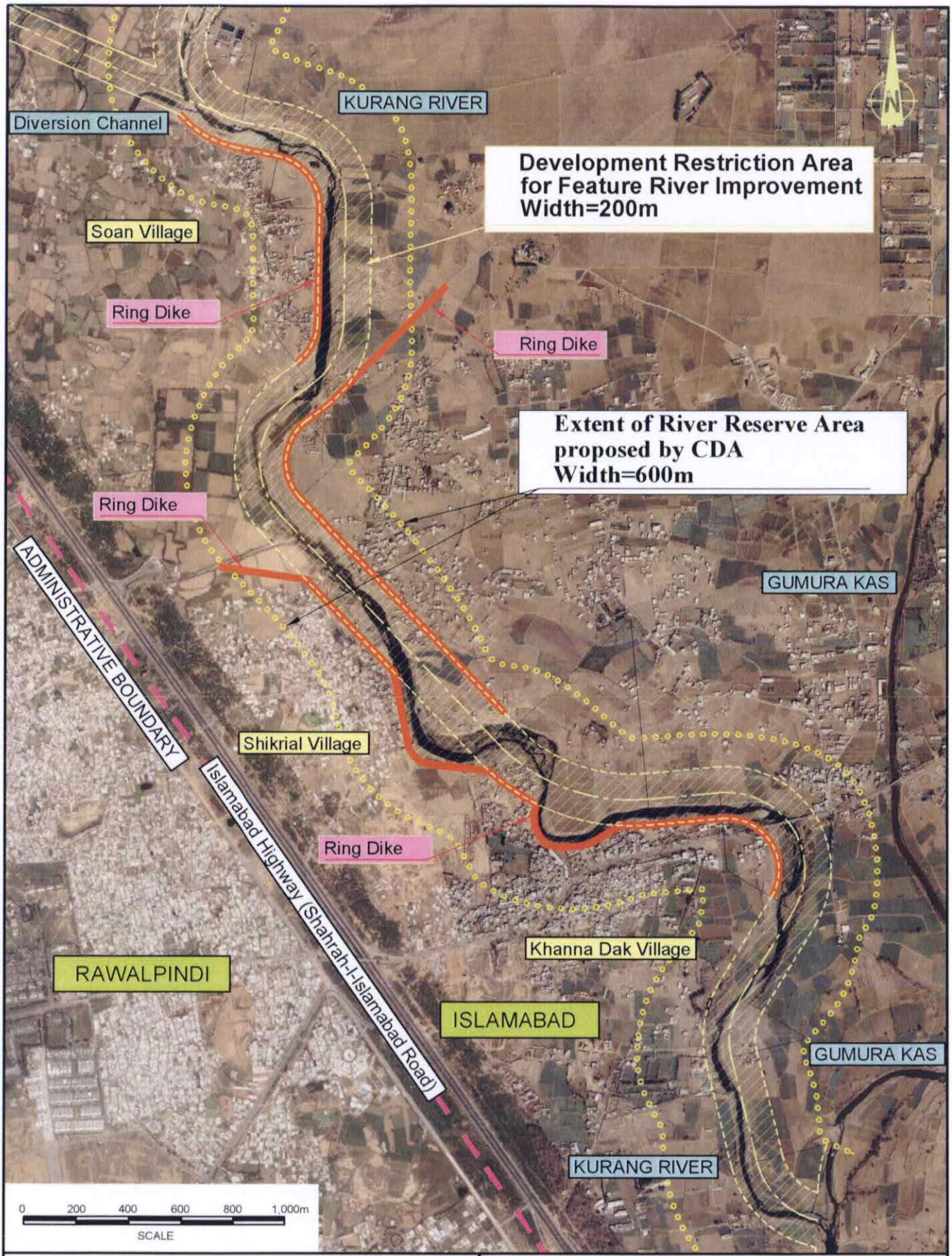
Long-term Project (100-year Return Period)



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.25
Cross Sectional Layout of Flood Diversion Channel

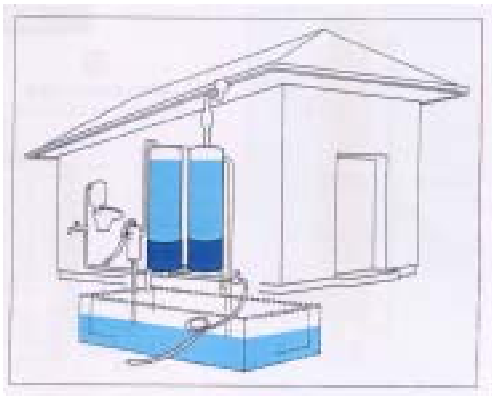


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

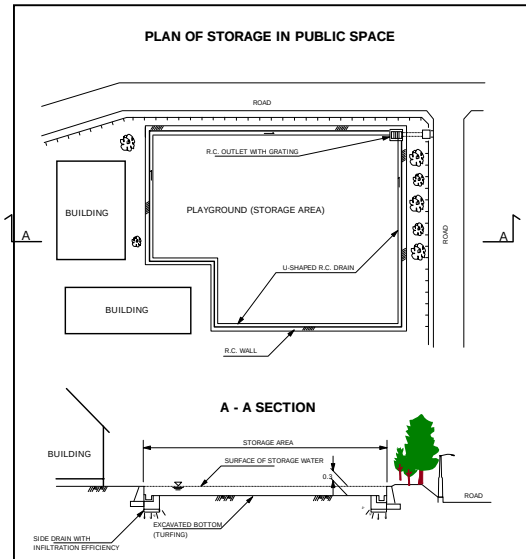
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.2.26

Ring Dike and River Reserve Area along Kurang River



Storage Tank in House Lot



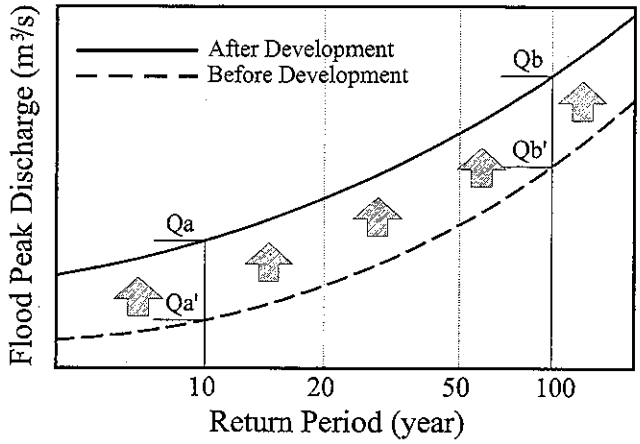
Flood Detention Wall at Public Open Space

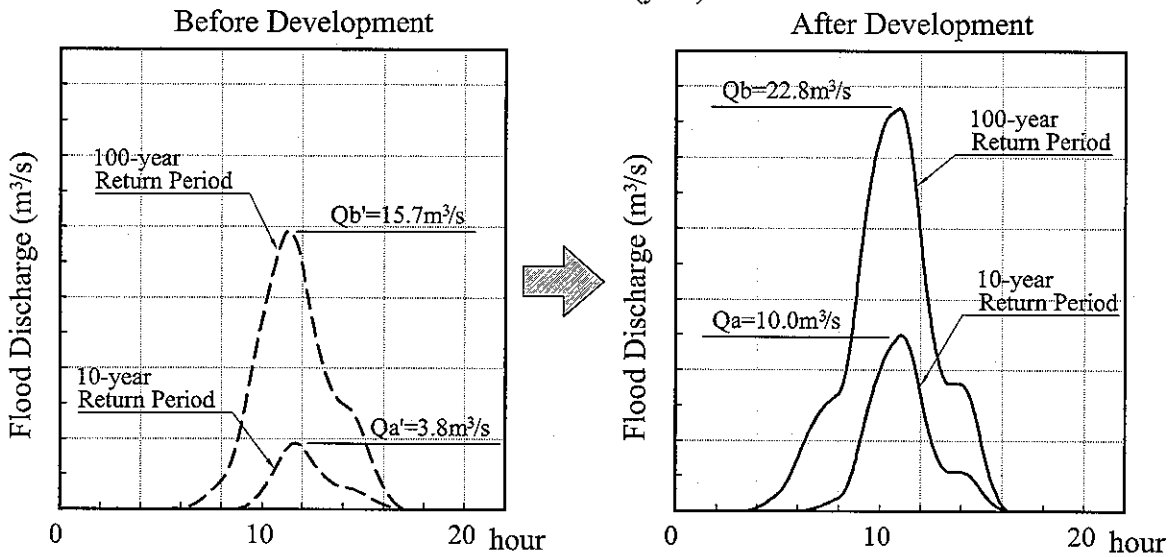
Dry Pond

Wet Pond

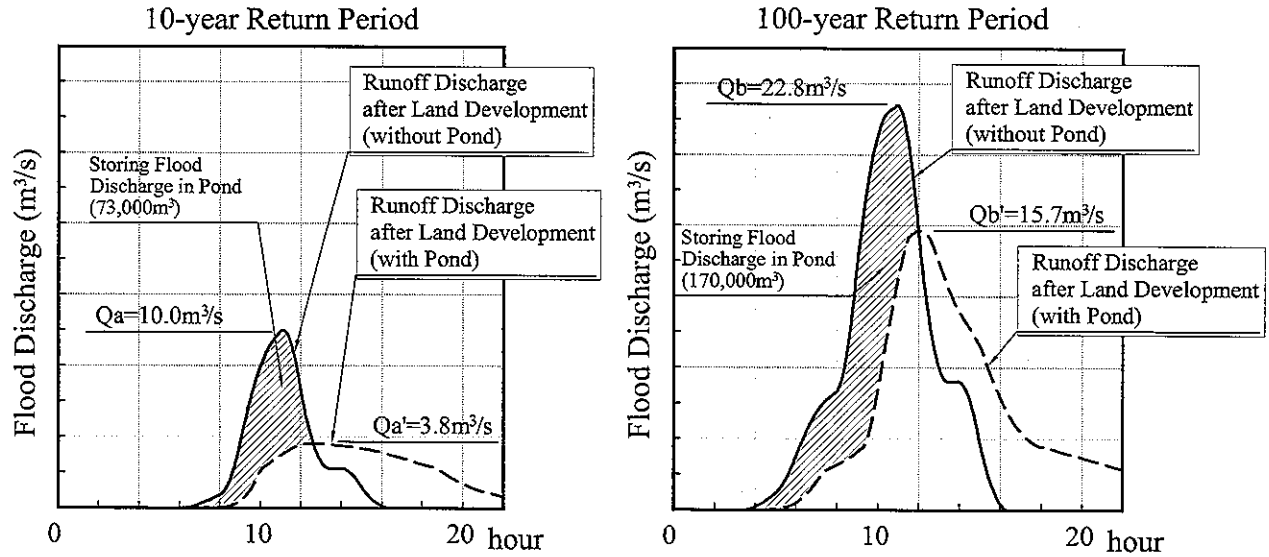
On-site Flood Detention Pond

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.27 Typical Structure of On-site Flood Detention Facilities
JAPAN INTERNATIONAL COOPERATION AGENCY	



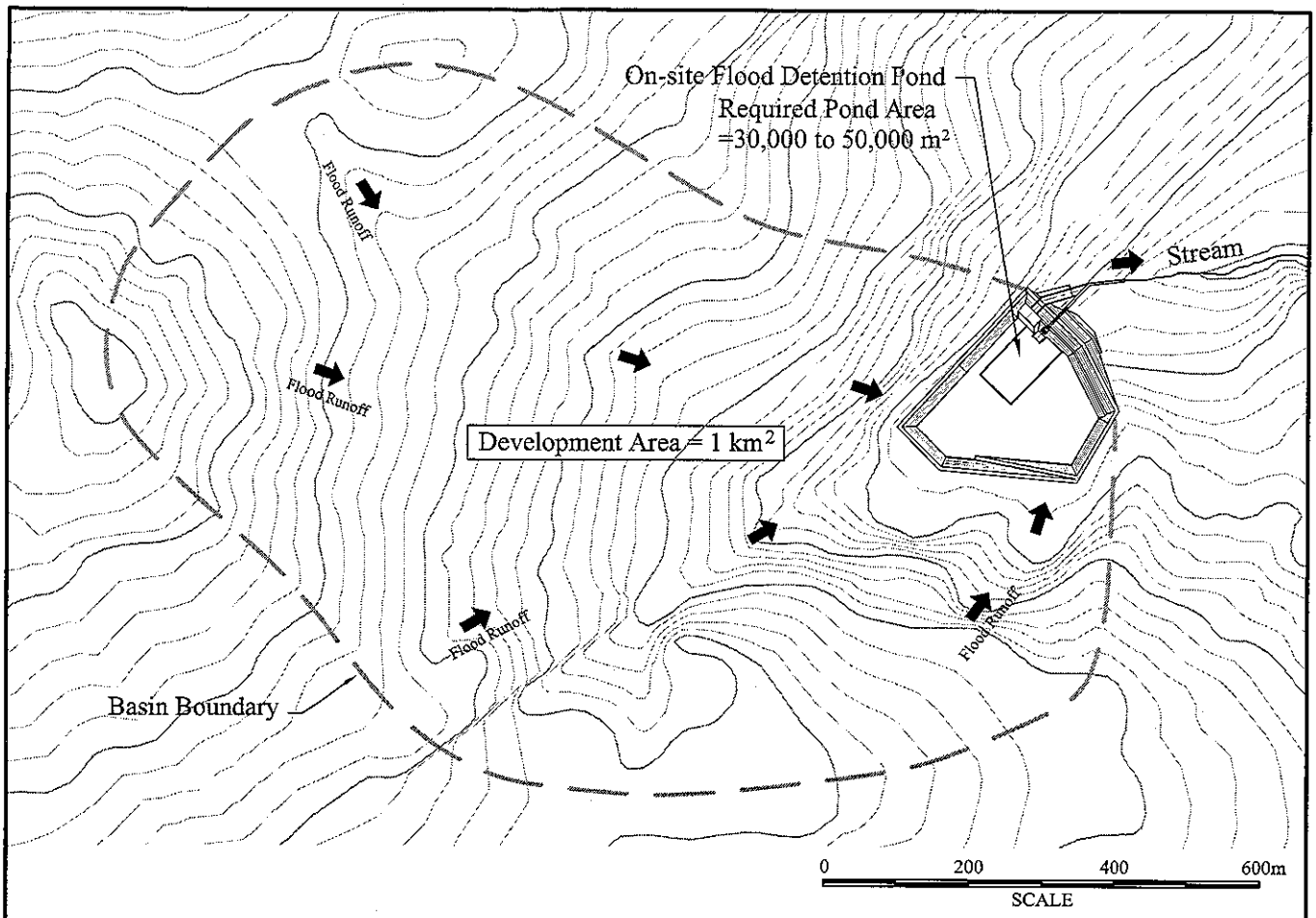


Flood Runoff Discharge from Land Development Area of 1 km²

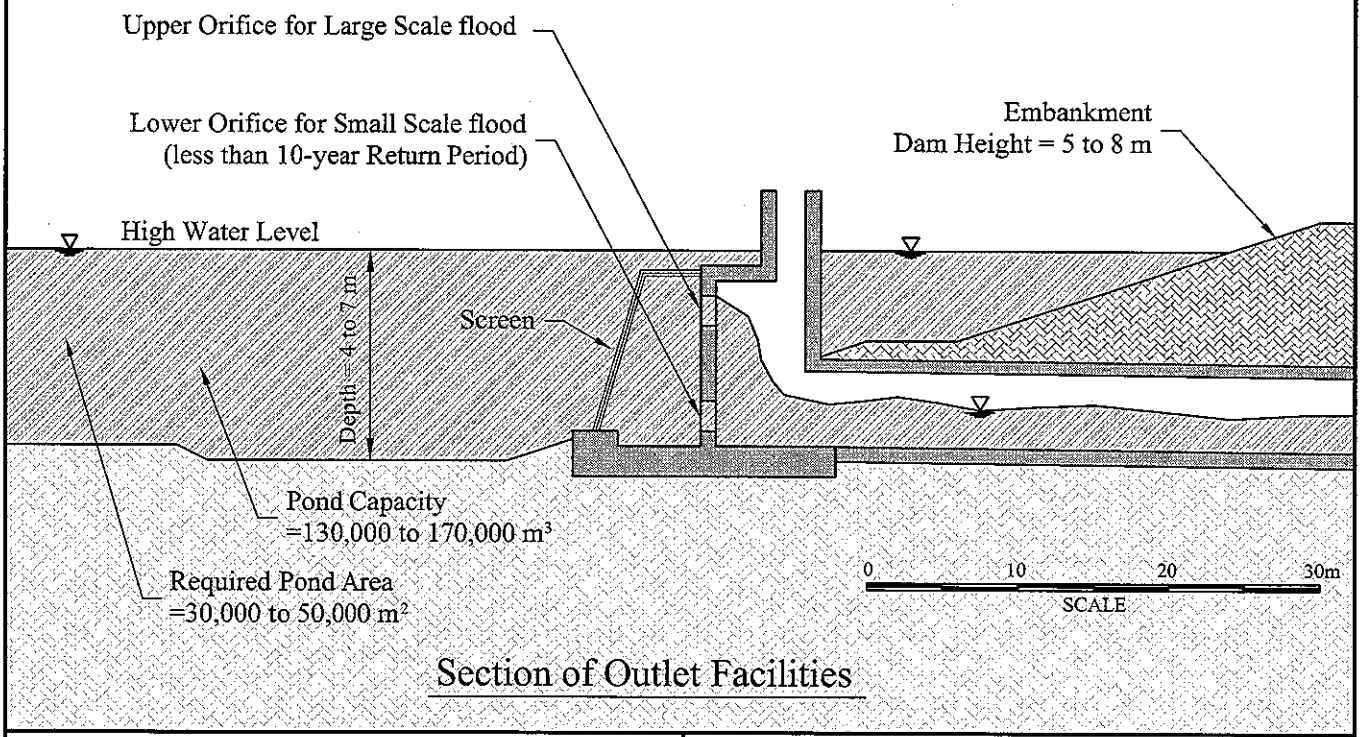


Effect of On-site Flood Detention Pond

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.28 Conceptual Effect of On-site Flood Detention Pond
JAPAN INTERNATIONAL COOPERATION AGENCY	

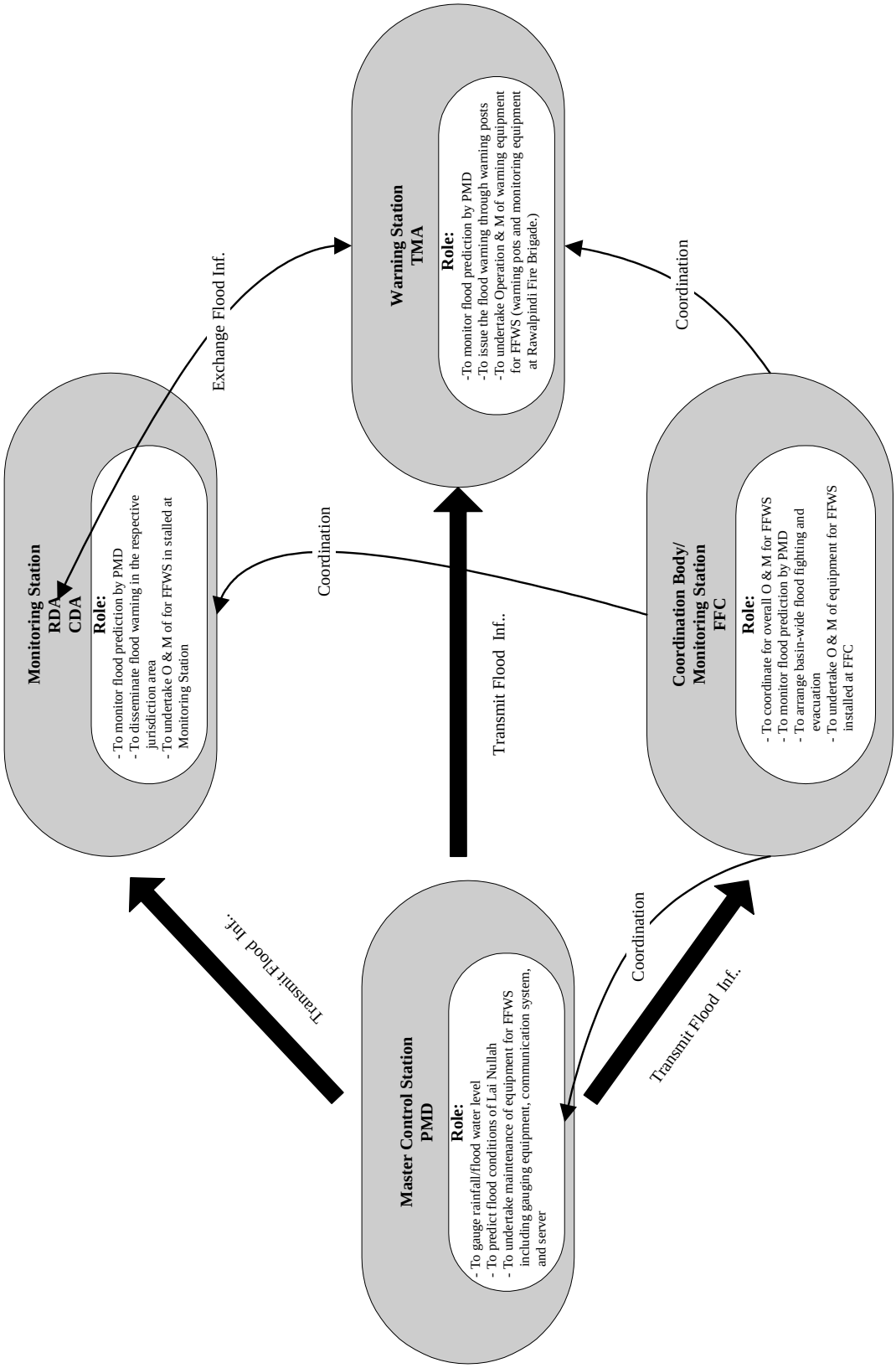


Layout of On-site Flood Detention Pond



Section of Outlet Facilities

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.2.29 Standard Design of On-site Flood Detention Pond
JAPAN INTERNATIONAL COOPERATION AGENCY	

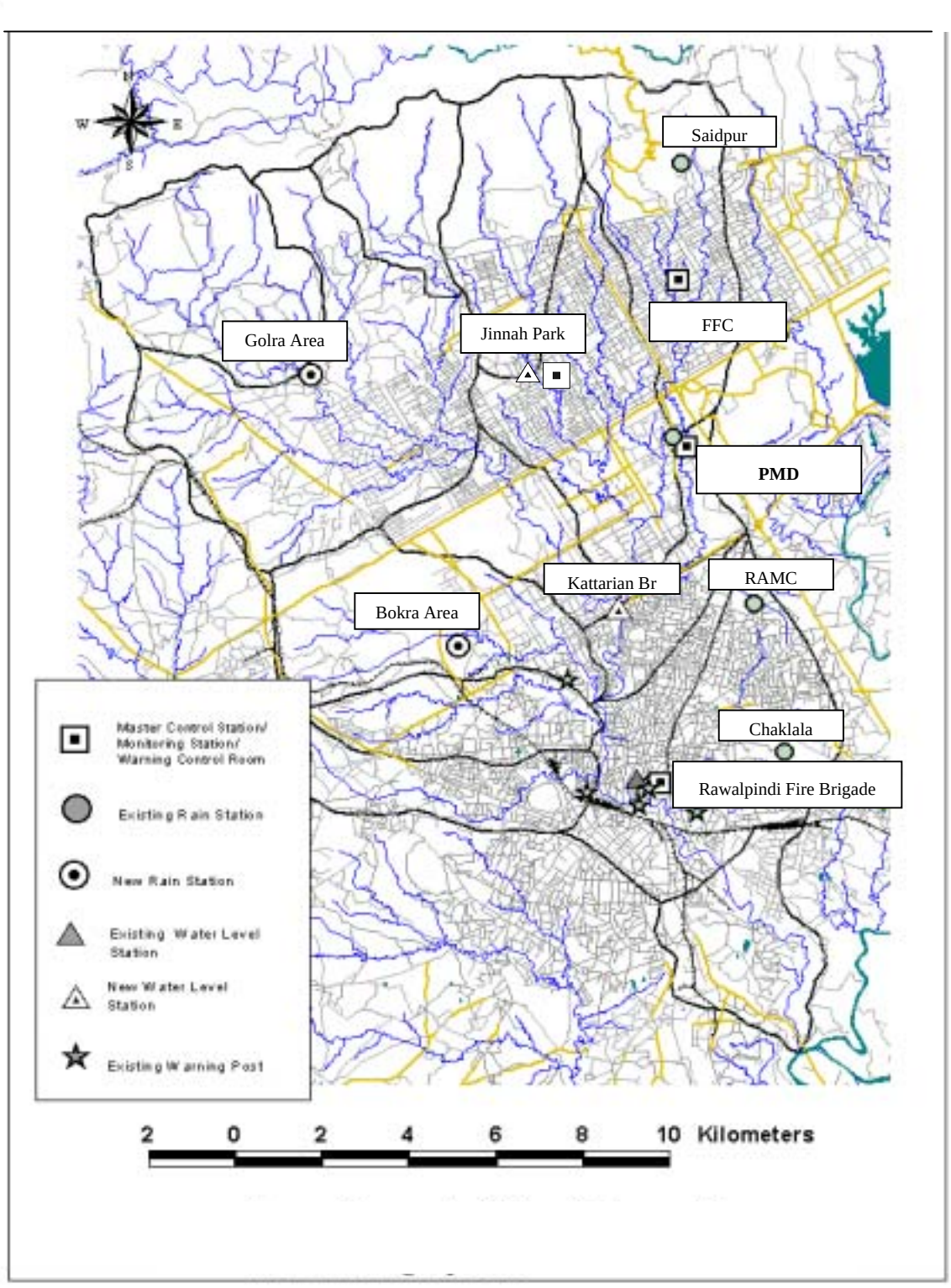


THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

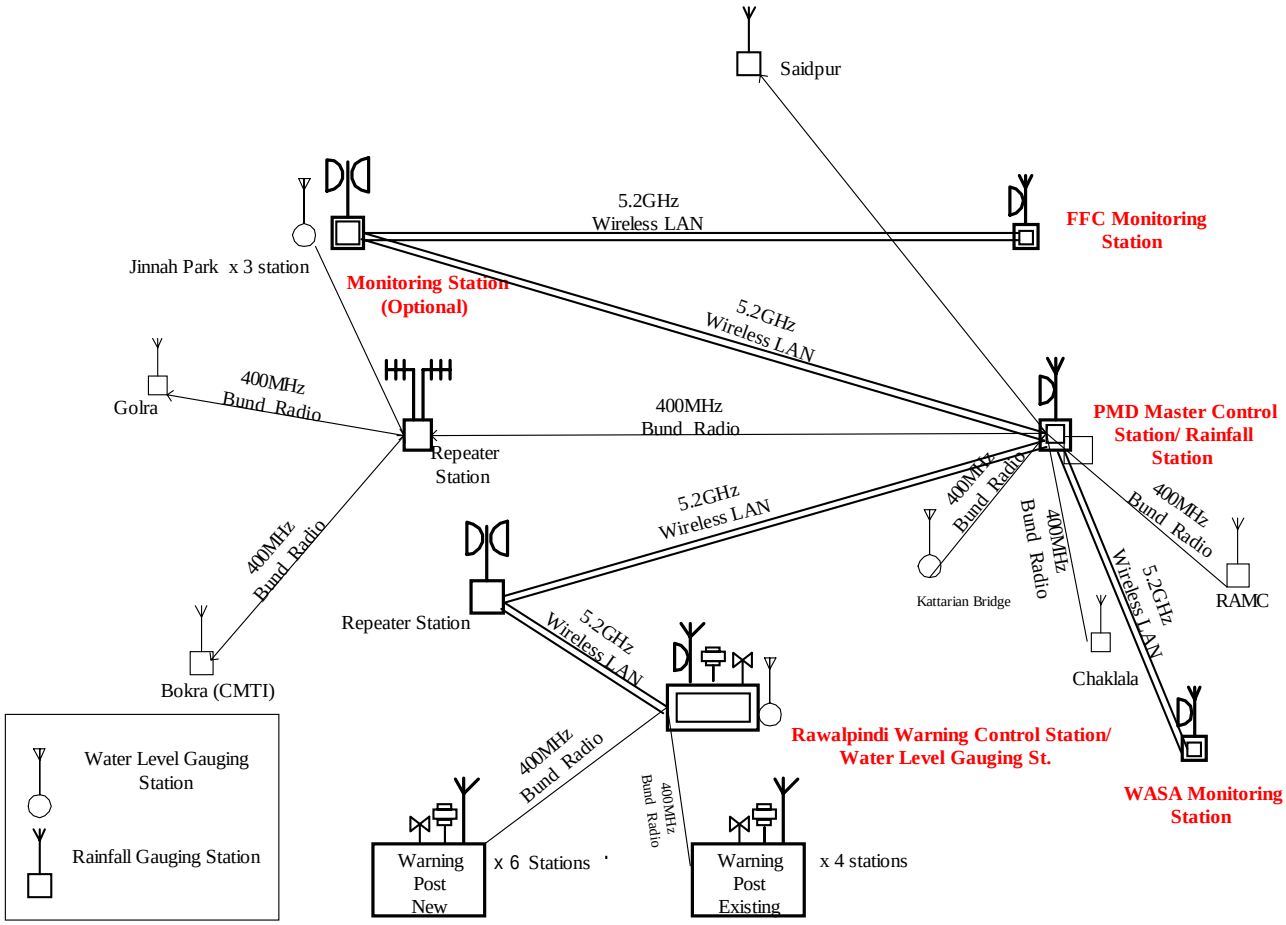
JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.4.1

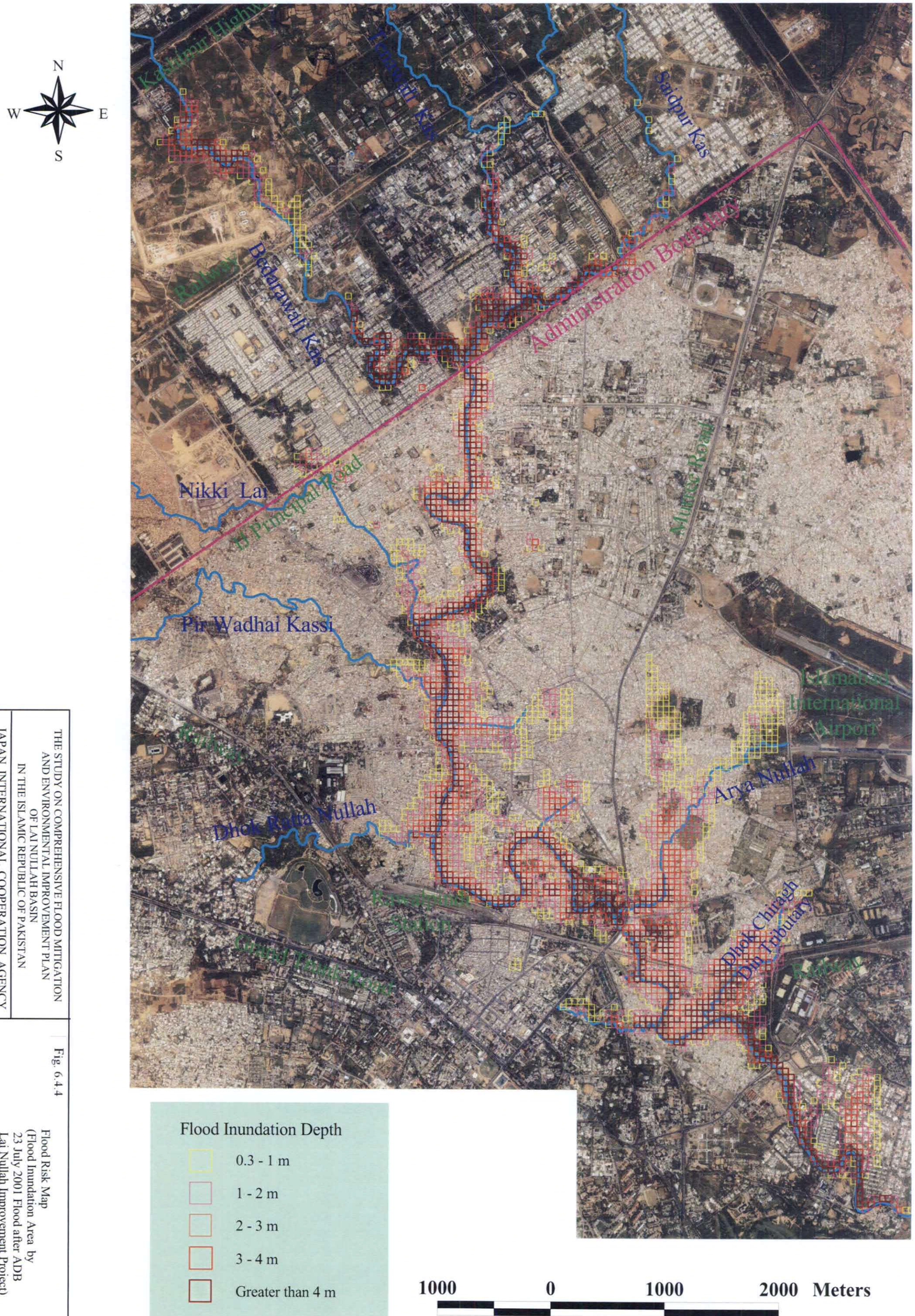
Flow Diagram of Duties for Implementation of FFWS of Lai Nullah



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.4.2 General Layout of Flood Forecasting and Warning System
JAPAN INTERNATIONAL COOPERATION AGENCY	



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 6.4.3
JAPAN INTERNATIONAL COOPERATION AGENCY	Telecommunication Network for FFWS



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.4.4

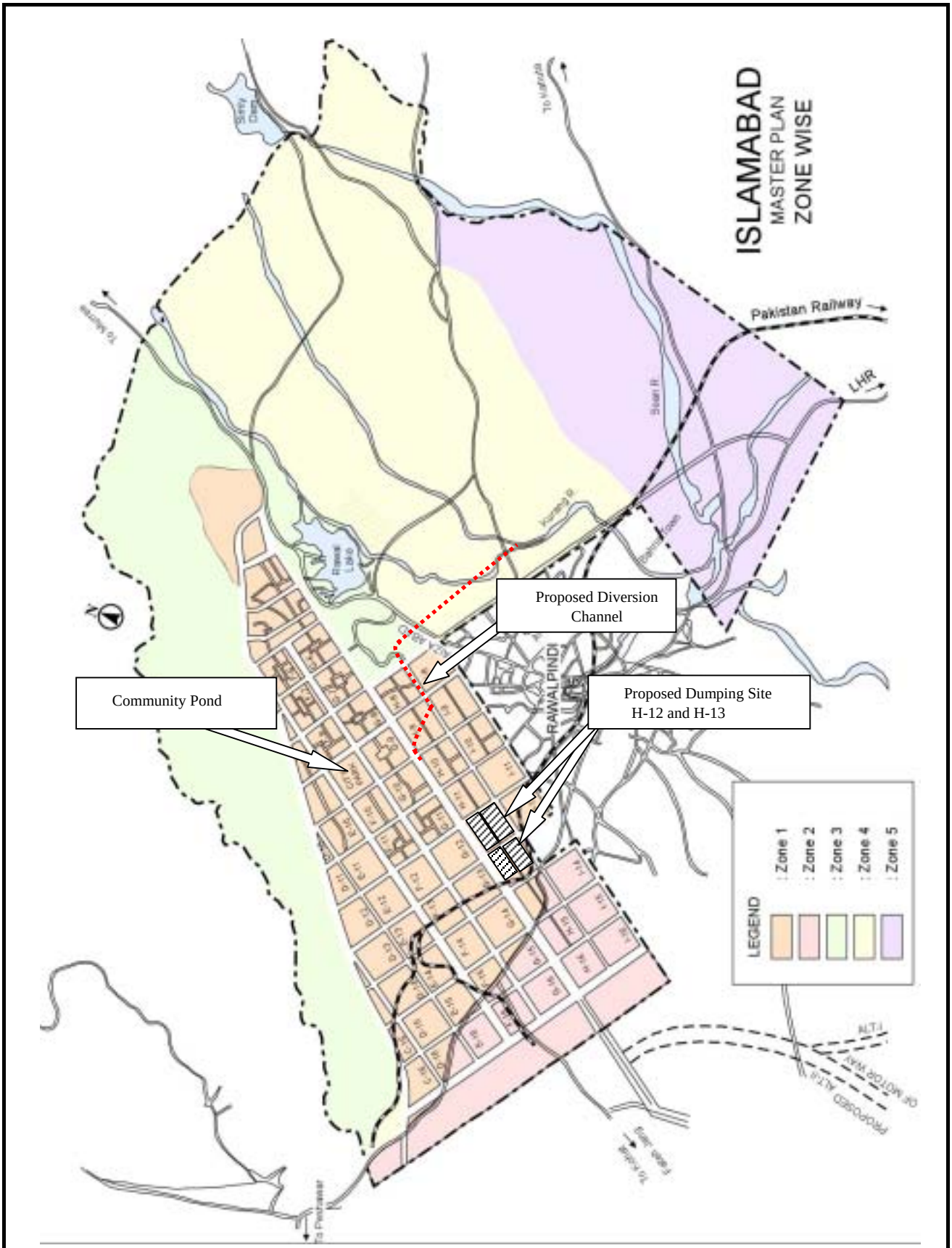
Flood Risk Map
(Flood Inundation Area by 23 July 2001 Flood after ADB Lai Nullah Improvement Project)

THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN

JAPAN INTERNATIONAL COOPERATION AGENCY

Fig. 6.5.1

Flow Diagram of Duties of Task Force and other Relevant Organizations for Implementation of Flood Mitigation Project of Lai Nullah



THE STUDY ON COMPREHENSIVE FLOOD MITIGATION AND ENVIRONMENTAL IMPROVEMENT PLAN OF LAI NULLAH BASIN IN THE ISLAMIC REPUBLIC OF PAKISTAN	Fig. 7.2.1
JAPAN INTERNATIONAL COOPERATION AGENCY	Proposed Dumping Area for Excavated Soil from Community Pond and Diversion Channel