Appendix B: Vegetation Communities

Exhibit B.1: Rhazya Stricta Community

Number of Releve	*19*	*20*	*21*
Area (m²)	100	100	100
Direction	N	S	E
Slope (%)	90	90	85
Elevation (m)	400	410	420
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 20 57 E 71 33 137		
Total coverage abundance value (%)	80	70	70
Total number of species	27	13	15

Number of Releve	*19*	*20*	*21*	*Presence*	*Frequency %*	*Constancy Class*
1st storey						
D Acacia nilotica	1	+		2	66	III
D Ehretia aspera	+		+	2	66	III
2nd storey						
D Rhazya stricta	2	2	2	3	100	V
D Astragalus leucocephalus	+		+	2	66	III
D Fagonia cretica	+		+	2	66	III
D Cocculus laeba	+	+		2	66	III
D Solanum xanthocarpum	+	+		2	66	III
D Withania coagulanse	+		+	2	66	III
O Otostegia limbata	+	+		2	66	III
P Segeretia theezans	+		+	2	66	III
D Aerua tomentosa	+	+		2	66	III
D Calotropis procera	+		+	2	66	III
3rd storey						
D Euphorbia prostrata	+		+	2	66	III
D Marrubium sp	+	+		2	66	III
P Trigonella sp	+		+	2	66	III
D Galium sp	+	+		2	66	III
P Amaranthus sp	+		+	2	66	III
O Tribulus territris	+		+	2	66	III
P Cymbopogon jwanrancusa	+	+		2	66	III
P Themeda anathera	+		+	2	66	III
P Achyranthes aspera	+	+		2	66	III
P Chrysopogon aucheri	+		+	2	66	III
P Tetrapogon villosus	+	+		2	66	III
P Cenchrus ciliaris	+	+		2	66	III
D Euphorbia prostrata	+		+	2	66	III
D Artimisia maritima	+		+	2	66	III
D Medicago minima	+	+		2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.2: Acacia Nilotica Community

Number of Releve	22	23	24
Area (m²)	100	100	100
Direction	N	S	W
Slope (%)	90	90	80
Elevation (m)	440	450	460
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 35 E 71 33 41		
Total coverage abundance value (%)	80	80	75
Total number of species	24	12	15

Number of Releve	*22*	*23*	*24*	*Presence*	*Frequency %*	*Constancy Class*
1st storey						
D Acacia nilotica	3	3	3	3	100	V
D Capparis aphylla	2		1	2	66	III
D Zizyphus mauritiana	1		1	2	66	III
2nd storey						
D Rhazya stricta	1		1	2	66	III
D Aerua pseudotomentosa	1		+	2	66	III
D Cleome brachycarpa	1	+		2	66	III
D Withana coagulanse	1	+		2	66	III
0 Otostegia limbata	1	+		2	66	III
P Saccharum spontaneum	1		+	2	66	III
D Fagonia cretica	1	+		2	66	III
P Cenchrus ciliaris	1		+	2	66	III
D Carissa opaca	1	+		2	66	III
D Solanum xanthocarpum	+	+		2	66	III
D Perioploca aphylla	+		+	2	66	III
D Leptadenia pyrotechnica	+	+		2	66	III
3rd storey						
D Convolvulus spinosa	+		+	2	66	III
D Geranium sp	+	+		2	66	III
D Polygonum sp	+		+	2	66	III
D Plantago major	+		+	2	66	III
O Carthamus sp	+		+	2	66	III
O Cousinia sp	+	+		2	66	III
D Stachys sp	+		+	2	66	III
D Amaranthus viridis	+	+		2	66	III
P Heteropogon contortus	+		+	2	66	III
O Tribulus terrestris		+	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.3: Zizyphus Nummalaria - Acacia Nilotica Community

Number of Releve	25	26	27
Area (m²)	100	100	100
Direction	W	S	N
Slope (%)	90	95	90
Elevation (m)	470	480	490
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 133 E 71 32 402		
Total coverage abundance value (%)	90	80	80
Total number of species	20	10	14

	Number of Releve	25	26	27	Presence	Frequency %	Constancy Class
1st storey							
D	*Acacia nilotica*	1	2	1	3	66	V
D	*Zizyphus mauritiana*	1		+	2	66	III
2nd storey							
D	*Zizyphus nummularia*	2	2	2	3	100	V
D	*Rhazya stricta*	1		1	2	66	III
O	*Otostegia limbata*	1	+		2	66	III
D	*Periplocta aphylla*	1	+		2	66	III
D	*Solanum xanthocarpum*	1		+	2	66	III
D	*Asparagus gracilis*	1	+		2	66	III
D	*Fagonia cretica*	1	+		2	66	III
D	*Gymnosporia royleana*	1		+	2	66	III
P	*Saccharum spontaneum*	1		+	2	66	III
3rd storey							
P	*Andropogon contortus*	1		+	2	66	III
P	*Eleusine flagellifera*	1	+		2	66	III
P	*Aristida depressa*	1		+	2	66	III
P	*Cymbopogon jwarancusa*	1	+		2	66	III
P	*Amaranthus sp*	+	+		2	66	III
O	*Cousinia sp*	+		+	2	66	III
D	*Plumbago sp*		+	+	2	66	III
P	*Medicago denticulata*	+		+	2	66	III
O	*Carthamus sp*	+		+	2	66	III
D	*Lactuca viminea*	+		+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.4: Adhatoda Vasica Community

Number of Releve	28	29	30
Area (m²)	100	100	100
Direction	N	S	W
Slope (%)	85	80	80
Elevation (m)	500	510	520
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 188 E 71 32 298		
Total coverage abundance value (%)	85	80	80
Total number of species	19	11	17

	Number of Releve	28	29	30	Presence	Frequency %	Constancy Class
2nd storey							
D	*Adhatoda vasica*	2	2	2	3	100	V
D	*Zizyphus numularia*	1	+		2	66	III
D	*Aerua pseudotomentosa*		1	+	2	66	III
O	*Otostegia limbata*	1		+	2	66	III
D	*Fagonia cretica*	1	+		2	66	III
P	*Segeretia theezans*		1	1	2	66	III
D	*Periploca aphylla*	1		+	2	66	III
D	*Leptadenia pyrotechnica*	1	+		2	66	III
3rd storey							
P	*Cymbopogon jwarancusa*	1		+	2	66	III
D	*Euphorbia prostrata*	1	+		2	66	III
D	*Achyranthes aspera*	1		+	2	66	III
O	*Echinops echinoides*	1	+		2	66	III
P	*Eulaliopsis binata*	1		+	2	66	III
D	*Dicleptera edelbergii*	1		+	2	66	III
D	*Marrubium sp*	1	+		2	66	III
D	*Geranium sp*	1		+	2	66	III
O	*Carthamus sp*	1		+	2	66	III
O	*Tribulus terrestris*		+	+	2	66	III
P	*Oxalis corniculata*		+	+	2	66	III
P	*Cenchrus ciliaris*	+		+	2	66	III
P	*Anaranthus sp*	+		+	2	66	III
P	*Cynodon dactylon*	+		+	2	66	III
P	*Trigonella sp*	+		+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.5: Chrysopogon - Adhatoda Community

Number of Releve	31	32	33
Area (m²)	100	100	100
Direction	N	S	E
Slope (%)	95	90	90
Elevation (m)	520	530	540
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 113 E 60 32 203		
Total coverage abundance values (%)	85	80	70
Total number of species	16	10	7

	Number of Releve	31	32	33	Presence	Frequency %	Constancy Class
1st storey							
B	*Acacia modesta*	1	–	+	2	66	III
D	*Capparis aphylla*	1	+	–	2	66	III
2nd storey							
D	*Periploca aphylla*	1	–	+	2	66	III
D	*Grewia oppositifolia*	1	+	–	2	66	III
O	*Otostegia limbata*	+	1	–	2	66	III
D	*Adhatoda vasoca*	2	1	1	3	100	V
D	*Dodonaea viscosa*	1	+	–	2	66	III
3rd storey							
D	*Verbascum thapsus*	1	+	–	2	66	III
P	*Chrysopogon aucheri*	2	1	1	3	100	V
P	*Themeda anathera*	1	+	–	2	66	III
D	*Geranium sp*	1	–	+	2	66	III
P	*Medicago minima*	+	–	–	2	66	III
P	*Cynodon dactylon*	+	+	–	2	66	III
O	*Cousinia sp*	+	–	+	2	66	III
P	*Aristida depressa*	+	–	+	2	66	III
P	*Eualioposis binata*	+	+	–	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.6: Aerua Pseudotomentosa Community

Area of the releve (m²)	100	100	100
Direction	N	S	W
Slope (%)	90	90	80
Elevation (m)	550	560	570
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 67 E 71 31 510		
Total coverage abundance values (%)	95	90	90
Total number of species	24	9	16

	Number of Releve	34	35	36	Presence	Frequency %	Constancy Class
1st storey							
B	*Acacia modesta*	+	+	–	2	66	III
2nd storey							
D	*Aerua pseudotomentosa*	2	2	2	3	100	V
D	*Rhazya stricta*	1	–	1	2	66	III
D	*Segeretia theezans*	1	+	–	2	66	III
D	*Zizyphys nummularia*	+	+		2	66	III
D	*Periploca aphylla*	+	–	+	2	66	III
D	*Withania coagulanse*	+	+	–	2	66	III
D	*Adhatoda vasica*	+	–	+	2	66	III
D	*Calotropis procera*	+	–	+	2	66	III
3rd storey							
P	*Cymbopogon aucheri*	+	–	+	2	66	III
D	*Verbascum thapsus*	+	+	–	2	66	III
P	*Aristida depressa*	+	–	+	2	66	III
O	*Onopordon sp*	+	–	+	2	66	III
D	*Polygonum sp*	+	–	+	2	66	III
D	*Plantago major*	+	+	–	2	66	III
D	*Convolvulus spinosus*	+	–	+	2	66	III
D	*Convolvulus arvensis*	+	–	+	2	66	III
D	*Cspinosa*	+	–	+	2	66	III
D	*Euphorbia prostrata*	+	+	–	2	66	III
P	*Trigonella sp*	+	+	–	2	66	III
P	*Medicago sp*	+	–	+	2	66	III
D	*Plantago major*	+	–	+	2	66	III
P	*Scandix sp*	+	–	+	2	66	III
O	*Tribulus terrestris*	+	–	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.7: Themeda Anathera Community

Number of Releve	37	38	39
Area (m²)	100	100	100
Direction	N	S	W
Slope (%)	90	90	85
Elevation (m)	580	590	600
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 21 345		
	E 71 31 417		
Total coverage abundance values (%)	95	90	90
Total number of species	24	11	15

	Number of Releve	37	38	39	Pre-sence	Fre-quency %	Constancy Class
1st storey							
B	*Acacia modesta*	1	+	–	2	66	III
D	*Ehretia aspera*	1	+	–	2	66	III
2nd storey							
D	*Adhatoda vasica*	1	–	+	2	66	III
D	*Rhazya stricta*	1	–	+	2	66	III
D	*Aerua pseudotomentosa*	–	+	1	2	66	III
D	*Zizyphus nummularia*	1	–	+	2	66	III
P	*Segeretia theezans*	1	+	–	2	66	III
D	*Fagonia cretica*	1	–	+	2	66	III
3rd storey							
D	*Verbascum thapus*	1	–	+	2	66	III
P	*Heteropogon contortus*	1	+	–	2	66	III
P	*Chrysopogon aucheri*	1	+	–	2	66	III
P	*Cympogon jwarancusa*	1	+	–	2	66	III
P	*Apluda mutica*	1	+	–	2	66	III
P	*Cenchrus ciliaris*	1	–	+	2	66	III
P	*Eleusine flagellifera*	1	+	–	2	66	III
P	*Tetrapogon villosus*	1	–	+	2	66	III
P	*Digitaria pinnata*	1	–	+	2	66	III
P	*Aristida depressa*	+	+	–	2	66	III
D	*Galium sp*	+	–	+	2	66	III
D	*Boerhaavia diffusa*	+	–	+	2	66	III
O	*Echinops echinoids*	+	–	+	2	66	III
P	*Rumex hastatus*	+	–	+	2	66	III
P	*Amaranthus viridis*	+	–	+	2	66	III
D	*Chenopodium botrys*	+	+	–	2	66	III
D	*Myosotis sp*	+	–	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.8: Saccharum - Plectranthes Community

Number of Releve	1	2	3
Area (m²)	100	100	100
Direction	N	E	S
Slope (%)	90	85	80
Elevation (m)	500	510	520
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 89 139		
	E 71 76 25		
Total coverage abundance value (%)	95	90	90
Total number of species	28	20	18

	Number of Releve	1	2	3	Pre-sence	Fre-quency %	Constancy Class
2nd Storey							
D	*Aerua pseudotomentosa*	1	–	+	2	66	III
D	*Rhazya stricta*	1	–	+	2	66	III
D	*Fagonia cretica*	–	1	+	2	66	III
O	*Nerium odorum*	+	+	–	2	66	III
P	*Saccharum spontaneum*	2	2	2	3	100	V
B	*Plectranthes rugosus*	2	1	1	3	100	V
P	*Zizyphus nummularia*	1	–	+	2	66	III
D	*Tecomella nudulata*	1	+	–	2	66	III
3rd Storey							
D	*Cannabis sativa*	1	+	–	2	66	III
D	*Verbascum thapsus*	1	+	–	2	66	III
P	*Eulaliopsis binata*	1	+	–	2	66	III
P	*Aristida depressa*	1	–	+	2	66	III
P	*Cymbopogon jwarancusa*	1	–	+	2	66	III
P	*Themeda anathera*	1	–	+	2	66	III
P	*Cenchrus ciliaris*	1	+	–	2	66	III
P	*Cynodon dactylon*	1	–	+	2	66	III
P	*Andropogon choenanthus*	1	+	–	2	66	III
P	*Heteropogon contortus*	1	+	–	2	66	III
D	*Datura alba*	1	–	+	2	66	III
D	*Solanum xanthocarpum*	1	+	–	2	66	III
P	*Plumbago sp*	1	–	+	2	66	III
P	*Digitaria bipinnata*	1	–	+	2	66	III
P	*Boerhaavia diffusa*	1	+	–	2	66	III
P	*Amaranthus viridis*	1	–	+	2	66	III
O	*Cousinia sp*	1	+	–	2	66	III
O	*Echinops ritro*	–	1	+	2	66	III
P	*Geranium sp*	+	1	–	2	66	III
P	*Medicago denticulata*	+	–	+	2	66	III
P	*Achyranthes aspera*	+	+	–	2	66	III
P	*Medicago minima*	+	+	–	2	66	III
P	*Chrysopogon aucheri*	–	+	+	2	66	III
P	*Cenchrus pennisetiformis*	–	+	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.9: Dodonaea Viscosa Community

Number of Releve	4	5	6
Area (m²)	100	100	100
Direction	N	E	S
Slope (%)	90	90	90
Elevation (m)	530	540	550
Mother rock	Cal	Cal	Cal
Co-ordinates	N 34 39 139 E 71 46 325		
Total coverage abundance value (%)	95	90	90
Total number of species	21	15	9

	Number of Releve	4	5	6	Presence	Frequency %	Constancy Class
2nd Storey							
D	*Dodonaea viscosa*	2	2	2	3	100	V
P	*Saccharum spontaneum*	1	–	1	2	66	III
D	*Adhatoda vesica*	1	–	+	2	66	III
B	*Plectranthes rugosus*	1	+	–	2	66	III
D	*Withania coagulanse*	+	1	–	2	66	III
D	*Rhazya stricta*	+	1	–	2	66	III
D	*Periploca aphylla*	+	–	+	2	66	III
P	*Zizyphus nummularia*	+	–	1	2	66	III
D	*Calotropis procera*	+	–	+	2	66	III
3rd Storey							
D	*Thymus squarrosus*	1	+	–	2	66	III
P	*Cymbopogon jwarancusa*	1	+	–	2	66	III
D	*Cannabis sativa*	+	1	–	2	66	III
D	*Verbascum thapsus*	+	1	–	2	66	III
D	*Minuartia sp*	+	1	–	2	66	III
D	*Marrubium sp*	+	+	–	2	66	III
P	*Dicleptera edelbergi*	1	+	–	2	66	III
P	*Heteropogon contortus*	1	+	–	2	66	III
P	*Achyranthes aspera*	–	1	+	2	66	III
D	*Tribulus terrestris*	1	+	–	2	66	III
P	*Cymbopogon jwarancusa*	+	–	+	2	66	III
P	*Boerhaavia diffusa*	+	–	+	2	66	III
P	*Rumex hastatus*	+	+	–	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.10: Olea – Dodonea – Adhatoda Community

Number of Releve	7	8	9
Area (m²)	100	100	100
Direction	N	E	W
Slope (%)	90	90	85
Elevation (m)	560	570	580
Mother rock	Mod Cal	Mod Cal	Mod Cal
Co-ordinates	N 44 49 197 E 71 45 336		
Total coverage abundance(%)	96	90	90
Total number of species	32	21	16

	Number of Releve	7	8	9	Presence	Frequency %	Constancy Class
1st Storey							
D	*Olea cuspidata*	2	2	2	3	100	V
D	*Acacia modesta*	1	+	–	2	66	III
P	*Monotheca buxifolia*	1	+	–	2	66	III
P	*Zizyphus mauritiana*	1	–	+	2	66	III
2nd Storey							
D	*Dodonaea viscosa*	2	2	2	3	100	V
D	*Adhatoda vasica*	2	1	1	3	100	V
D	*Rhazya stricta*	1	–	+	2	66	III
D	*Asparagus gracilis*	1	+	–	2	66	III
D	*Cocculus laeba*	1	+	–	2	66	III
D	*Gymnosporia royleana*	1	–	+	2	66	III
D	*Otostegia limbata*	+	1	–	2	66	III
D	*Astragalus leucocephalus*	+	1	–	2	66	III
P	*Cymbopogon jwarancusa*	1	+	–	2	66	III
D	*Aerua pseudotomentosa*	+	–	1	2	66	III
D	*Segeretia theezans*	1	+	–	2	66	III
D	*Fagonia cretica*	1	–	+	2	66	III
D	*Euphorbia prostrata*	1	+	–	2	66	III
P	*Ehretica aspera*	1	–	+	2	66	III
D	*Withania coagulense*	1	+	–	2	66	III
O	*Echinops ritro*	+	–	+	2	66	III
P	*Cynodon dactylon*	+	+	–	2	66	III
D	*Galium sp*	+	–	+	2	66	III
D	*Grewia oppositifolia*	–	+	+	2	66	III
3rd Storey							
P	*Aristida depressa*	+	+	–	2	66	III
P	*Cenchrus ciliaris*	+	+	–	2	66	III
P	*Heteropogon contortus*	+	–	+	2	66	III
P	*Cymbopogon jwarancusa*	+	+	–	2	66	III
D	*Cannabis sativa*	+	–	+	2	66	III
P	*Andropogon squarrosus*	+	+	–	2	66	III
P	*Minuartia species*	+	–	+	2	66	III
D	*Euphorbia prostrata*	+	+	–	2	66	III
P	*Amaranthus viridis*	+	–	+	2	66	III
P	*Chenopodium botrys*	+	+	–	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.11: Dodonaea - Cymbopogon Community

Number of Releve	10	11	12
Area (m²)	100	100	100
Direction	N	E	S
Slope (%)	90	90	80
Elevation (m)	600	610	620
Mother rock	Mod Cal	Mod Cal	Mod Cal
	N 44 49 197		
	E 71 45 336		
Total coverage abundance(%)	98	95	90
Total number of species	20	15	13

	Number of Releve	10	11	12	Pre-sence	Fre-quency %	Constancy Class
2nd Storey							
D	*Dodonaea viscosa*	2	2	2	3	100	V
D	*Adhatoda vasica*	1	1	–	2	66	III
P	*Ehretia aspera*	+	1	–	2	66	III
O	*Otostagia limbata*	+	+	–	2	66	III
D	*Vitex negundo*	1	+	–	2	66	III
D	*Periploca aphylla*	+	1	–	2	66	III
3rd Storey							
P	*Cymbopogon jwarancusa*	2	1	2	3	100	V
P	*Andropogon squarrosus*	1	–	1	2	66	III
D	*Verbascum thapsus*	1	+	–	2	66	III
D	*Cannabis sativa*	1	+	–	2	66	III
P	*Boerhaavia diffusa*	+	1	–	2	66	III
P	*Heteropogon contortus*	+	–	1	2	66	III
P	*Chrysopogon aucheri*	+	–	1	2	66	III
P	*Panicum antidotale*	–	1	+	2	66	III
P	*Eulaliopsis binata*	+	–	1	2	66	III
P	*Themeda anathera*	+	–	+	2	66	III
D	*Marrubium sp*	+	+	–	2	66	III
P	*Geranium sp*	+	+	–	2	66	III
P	*Medicago denticulata*	+	–	+	2	66	III
D	*Lactuca viminea*	+	–	+	2	66	III
D	*Plumbago sp*	+	–	+	2	66	III
D	*Plantago major*	–	+	+	2	66	III
P	*Dicleptera edelbergii*	–	+	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.12: Monotheca - Dodonaea Community

Number of Releve	13	14	15
Area (m²)	100	100	100
Direction	N	E	S
Slope (%)	90	90	80
Elevation (m)	630	640	650
Mother rock	Mod Cal	Mod Cal	Mod Cal
Co-ordinates	N 34 39 176		
	E 71 45 304		
Total coverage abundance(%)	98	95	90
Total number of species	30	16	16

	Number of Releve	13	14	15	Pre-sence	Fre-quency %	Constancy Class
1st Storey							
D	*Monothica buxifolia*	2	2	2	3	100	V
2nd Storey							
D	*Dodonaea viscosa*	2	2	2	3	100	V
D	*Adhatoda vasica*	1	1	–	2	66	III
O	*Nerium odorum*	+	–	1	2	66	III
O	*Nannorrhops ritchiaena*	+	1	–	2	66	III
D	*Segeretia theezans*	1	–	+	2	66	III
P	*Ehretia aspera*	1	+	–	2	66	III
P	*Zizyphus nummularia*	+	1	–	2	66	III
D	*Gymnosporia royleana*	1	+	–	2	66	III
3rd Storey							
P	*Andropogon squarrosus*	1	+	–	2	66	III
D	*Verbascum thapsus*	1	–	+	2	66	III
P	*Cymbopogon jwarancusa*	+	1	–	2	66	III
D	*Polygonum species*	+	–	1	2	66	III
P	*Rumex hastatus*	1	+	–	2	66	III
P	*Lannea coromandelica*	+	–	1	2	66	III
P	*Heteropogon contortus*	+	–	1	2	66	III
D	*Euphorbia prostrata*	+	1	–	2	66	III
O	*Echinops echinoides*	1	–	+	2	66	III
P	*Eulaliopsis binata*	+	–	1	2	66	III
D	*Marrubium sp*	+	1	–	2	66	III
D	*Amaranthus viridis*	+	–	+	2	66	III
D	*Oxalis corniculata*	+	–	+	2	66	III
P	*Aristida depressa*	+	+	–	2	66	III
D	*Galium sp*	+	–	+	2	66	III
D	*Chenopodium botrys*	+	+	–	2	66	III
P	*Boerhaavia diffusa*	+	+	–	2	66	III
D	*Achyranthes aspera*	+	–	+	2	66	III
P	*Cynodon dactylon*	+	–	+	2	66	III
P	*Bromus tectorum*	+	+	–	2	66	III
P	*Sonchus aspera*	+	–	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.13: Acacia Modesta - Cymbopogon Jwarancusa Community

Number of Releve	16	17	18
Area (m²)	100	100	100
Direction	N	S	W
Slope (%)	90	85	80
Elevation (m)	450	630	610
Mother rock	Mod Cal	Mod Cal	Mod Cal
Co-ordinates	N 34 24 526		
	E 71 36 211		
Total coverage abundance value (%)	80	85	80
Total number of species	23	18	13

	Number of Releve	16	17	18	Presence	Frequency %	Constancy Class
1st Storey							
D	*Acacia modesta*	2	2	2	3	100	V
D	*Butea frondosa*	1	1	–	2	66	III
2nd Storey							
D	*Dodonaea viscosa*	1	–	+	2	66	III
O	*Otostegia limbata*	+	1	–	2	66	III
D	*Withania coagulanse*	+	1	–	2	66	III
D	*Rhazya stricta*	+	–	+	2	66	III
D	*Calotropis procera*	+	+	–	2	66	III
P	*Periploca aphylla*	+	+	–	2	66	III
P	*Saccharum spontaneum*	+	+	–	2	66	III
3rd Storey							
P	*Cymbogon jwarancusa*	2	1	1	3	100	V
P	*Andropogon squarrosus*	1	+	–	2	66	III
P	*Themeda anathera*	+	1	–	2	66	III
P	*Eulaliopsis binata*	+	–	1	2	66	III
D	*Solonum xanthocarpum*	+	–	+	2	66	III
P	*Cynodon dactylon*	+	+	–	2	66	III
P	*Cenchrus ciliaris*	+	–	+	2	66	III
D	*Amaranthus viridis*	+	+	–	2	66	III
D	*Galium sp*	+	+	–	2	66	III
P	*Eleusine compressa*	+	–	+	2	66	III
D	*Achyranthes aspera*	–	+	+	2	66	III
D	*Tetrapogon villosus*	–	+	+	2	66	III
D	*Euphorbia pilifera*	+	+	–	2	66	III
P	*Aristida depressa*	+	+	–	2	66	III
D	*Verbascum thapsus*	+	–	+	2	66	III
O	*Echinops echinoides*	+	–	+	2	66	III
P	*Rumex hastatus*	–	+	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.14: Butea - Frondosa Community

Number of Releve	19	20	21
Area (m²)	100	100	100
Direction	N	S	E
Slope (%)	70	70	66
Elevation (m)	460	470	480
Mother rock	Mod Cal	Mod Cal	Mod Cal
Co-ordinates	N 34 25 104		
	E 71 36 376		
Total coverage abundance(%)	90	80	80
Total number of species	23	19	19

	Number of Releve	19	20	21	Presence	Frequency %	Constancy Class
1st Storey							
D	*Butea frondosa*	2	2	2	3	100	V
D	*Acacia modesta*	1	+	–	2	66	III
2nd Storey							
O	*Otostegia limbata*	+	1	–	2	66	III
D	*Gymnosporia royleana*	1	–	+	2	66	III
D	*Segeretia theezans*	–	+	+	2	66	III
D	*Dodonaea viscosa*	1	+	–	2	66	III
D	*Adhatoda vasica*	1	+	–	2	66	III
D	*Leptadenia pyrotechnica*	–	1	+	2	66	III
D	*Aerua pseudotomentosa*	+	–	1	2	66	III
O	*Nerium odorum*	1	+	–	2	66	III
D	*Astragalus leucocephalus*	–	1	+	2	66	III
D	*Fagonia arabica*	+	–	+	2	66	III
3rd Storey							
P	*Heteropogon contortus*	+	+	–	2	66	III
P	*Cenchrus ciliaris*	+	–	+	2	66	III
P	*Andropogon schoenanthus*	+	+	–	2	66	III
P	*Cynodon dactylon*	–	+	+	2	66	III
O	*Echinops echinoides*	+	+	–	2	66	III
D	*Datura alba*	–	+	+	2	66	III
D	*Canabis sativa*	+	–	+	2	66	III
P	*Themeda anathera*	+	+	–	2	66	III
D	*Medicago minima*	+	–	+	2	66	III
D	*Euphorbia prostrata*	+	–	+	2	66	III
P	*Sonchus aspera*	–	+	+	2	66	III
D	*Plectranthus rugosus*	+	–	+	2	66	III
P	*Eulaliopsis binata*	+	–	+	2	66	III
D	*Conyza sp*	–	+	+	2	66	III
P	*Achyranthes aspera*	+	+	–	2	66	III
D	*Dicleptera edelbergi*	+	–	+	2	66	III
D	*Convolvulus spinosa*	+	+	–	2	66	III
D	*Peganum harmala*	+	–	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Exhibit B.15: Plectranthus – Dodonaea - Olea Community

Number of Releve	22	23	24
Area (m²)	100	100	100
Direction	N	S	W
Slope (%)	90	80	80
Elevation (m)	500	510	540
Mother rock	Mod Cal	Mod Cal	Mod Cal
Co-ordinates	N 34 28 150 E 71 36 3014		
Total coverage abundance value (%)	95	90	90
Total number of species	18	15	16

	Number of Releve	*22*	*23*	*24*	*Presence*	*Frequency %*	*Constancy Class*
1st Storey							
D	*Olea cuspidata*	2	2	2	3	100	V
D	*Acacia modesta*	+	1	–	2	66	III
D	*Butea frondosa*	–	+	+	2	66	III
D	*Monotheca buxifolia*	1	+	–	2	66	III
2nd Storey							
D	*Plectranthus rugosus*	2	2	2	3	100	V
P	*Saccharum spontaneum*	1	–	+	2	66	III
O	*Olostegia limbata*	+	+	–	2	66	III
D	*Gymnosporia royleana*	+	+	–	2	66	III
D	*Carassa spinarum*	1	–	+	2	66	III
D	*Dodonaea vicosa*	2	2	2	3	100	V
D	*Adhatoda vasica*	1	+	–	2	66	III
D	*Ehretia aspera*	1	–	+	2	66	III
3rd Storey							
P	*Convolvulus spinosa*	–	+	1	2	66	III
D	*Chenopodium botrys*	+	–	+	2	66	III
P	*Rumex hastatus*	1	+	–	2	66	III
P	*Cymbopogon jwarancusa*	1	–	+	2	66	III
D	*Geranium sp*	–	1	+	2	66	III
P	*Themeda anathera*	+	+	–	2	66	III
D	*Cannabis sativa*	+	–	+	2	66	III
P	*Minuartia sp*	–	+	+	2	66	III
P	*Bromus tectorum*	+	–	+	2	66	III
D	*Euphorbia pilifera*	–	+	+	2	66	III
P	*Aristida depressa*	+	–	+	2	66	III

D: Drug plants; P: Palatable plants; O: Obnoxious plants; B: Bee flora

Appendix C: Monthly Rainfall Data at Major Gauging Stations

This appendix contains monthly rainfall data at major gauging stations present in the study area. Citation in Main Report: Section 3.1.

Exhibit C.1: Monthly Rainfall (mm) at Mardan Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1962	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1963	NA	NA	NA	NA	49	1	44	100	31	20	30	60	585
1964	62	44	45	33	18	3	176	73	101	2	2	26	728
1965	27	33	66	121	119	2	168	152	9	1	21	10	363
1966	–	84	72	72	21	–	23	50	27	16	–	–	852
1967	–	69	197	49	1	22	95	239	19	20	2	140	586
1968	71	35	47	41	6	2	67	245	8	24	18	24	389
1969	–	68	22	17	30	–	25	166	8	44	9	–	
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	811
1971	1	45	31	42	3	185	160	240	70	21	1	12	280
1972	41	50	49	27	15	13	4	8	14	8	17	34	627
1973	23	78	78	16	40	6	157	132	78	4	–	13	345
1974	13	38	21	19	15	3	124	31	38	–	–	43	743
1975	6	57	61	17	40	22	93	407	32	–	–	9	892
1976	30	96	70	52	9	31	243	300	45	16	–	–	
1977	73	8	–	54	36	74	295	155	NA	32	NA	12	892
1978	24	17	207	15	3	89	141	333	1	13	44	4	508
1979	70	147	71	19	13	3	69	22	51	–	40	3	726
1980	20	76	76	6	11	50	224	204	17	25	12	6	590
1981	49	34	121	33	29	4	126	117	34	31	13	–	501
1982	28	24	82	11	9	–	28	239	1	5	46	9	736
1983	22	39	100	147	3	44	73	228	41	33	1	4	690
1984	5	24	44	62	2	–	178	324	30	–	21	2	501
1985	24	5	13	47	6	–	160	108	14	20	8	98	519
1986	17	66	64	30	3	3	73	70	93	–	44	57	
1987	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1988	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	340
1989	53	4	56	14	17	–	47	88	18	12	2	29	764
1990	36	56	97	55	8	3	114	210	47	51	11	78	

Exhibit C.2: Monthly Rainfall (mm) at Utmanzai Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1962	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	48	30	51	37	4	–	124	33	6	–	4	16	352
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	–	87	67	59	22	–	14	19	20	24	–	–	313
1967	–	52	77	46	16	19	28	62	5	20	1	126	453
1968	55	38	32	37	22	–	33	140	2	16	22	17	411
1969	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1970	19	51	34	15	4	14	48	137	64	1	–	6	393
1971	1	64	20	26	1	70	144	112	77	1	–	4	519
1972	27	61	50	31	23	1	19	1	13	5	21	33	284
1973	11	61	99	9	69	30	40	66	13	2	–	11	411
1974	7	36	8	18	3	–	103	22	41	–	–	41	278
1975	3	52	85	42	34	1	66	248	26	–	–	6	563
1976	18	124	31	47	6	–	125	433	44	–	–	–	827
1977	65	7	–	75	4	–	187	126	–	14	34	11	524
1978	21	14	298	11	–	29	275	221	10	11	54	–	946
1979	85	133	85	29	9	–	22	68	22	–	–	–	433
1980	55	68	107	2	–	15	80	81	46	3	–	5	463
1981	48	46	116	40	21	–	48	111	–	18	20	–	468
1982	26	24	97	50	–	3	20	243	–	8	49	26	545
1983	24	52	100	162	–	–	143	202	77	–	2	–	761
1984	15	29	33	65	–	–	101	284	4	–	11	4	545
1985	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–
1986	19	52	79	19	–	–	–	67	15	–	29	33	313
1987	–	52	213	–	20	14	–	–	8	–	–	–	307
1988	32	14	140	4	–	–	137	–	–	–	–	–	327
1989	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1995	–	–	97	117	5	–	127	268	5	–	13	–	631
1996	26	NA	NA	41	5	38	15	48	10	74	NA	NA	
1997	5	13	31	205	36	10	169	33	40	75	0	25	642

Exhibit C.3: Monthly Rainfall (mm) at Abazai Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	58	37	23	79	2	7	172	71	81	5	39	–	575
1962	1	57	55	33	5	–	40	50	23	4	14	38	320
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	48	18	63	29	27	–	223	9	41	1	–	11	469
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	–	124	152	56	8	–	10	18	4	4	–	–	375
1967	–	73	196	72	–	19	39	52	4	28	–	188	671
1968	72	NA	114	42	47	–	53	36	–	15	15	24	
1969	NA	NA	NA	NA	NA	NA	74	86	1	34	11	–	
1970	12	57	33	10	–	4	35	145	71	–	5	–	373
1971	2	30	33	47	1	27	52	35	38	1	–	8	274
1972	42	66	53	52	62	10	12	10	17	4	15	37	381
1973	17	71	53	8	61	24	118	84	51	3	–	8	497
1974	8	47	1	22	–	–	123	7	15	–	–	36	259
1975	1	53	72	48	20	–	25	131	57	–	–	5	412
1976	8	86	77	56	0	–	131	199	38	15	–	–	611
1977	61	1	–	58	6	–	253	138	–	32	81	6	638
1978	10	14	297	119	–	–	281	154	13	3	30	5	926
1979	82	105	81	38	–	–	48	155	13	–	–	–	522
1980	48	68	149	3	–	10	201	183	30	NA	–	6	
1981	43	48	141	30	15	–	79	102	–	0	1	–	460
1982	27	23	100	17	–	–	–	35	–	–	13	–	216
1983	3	61	116	132	–	58	6	NA	73	–	–	–	
1984	–	8	40	56	–	–	84	451	18	–	25	–	681
1985	13	3	27	19	–	–	410	76	16	58	3	89	713
1986	18	36	94	20	10	18	–	89	1	–	41	66	392
1987	–	42	239	–	8	15	–	–	–	–	–	–	304
1988	24	6	169	3	–	15	165	42	67	77	115	100	782
1989	24	10	63	6	2	14	48	44	81	71	146	126	637
1990	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1991	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1993	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1994	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1995	–	–	89	79	3	–	77	247	48	13	8	5	569
1996	27	NA	NA	43	5	15	13	72	27	127	NA	NA	
1997	5	28	28	102	37	6	102	33	36	103	0	33	512

Exhibit C.4: Monthly Rainfall (mm) at Charbagh Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	58	37	23	79	2	7	172	71	81	5	39	–	575
1962	NA	NA	NA	NA	NA	NA	195	131	62	10	30	80	507
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	104	74	71	88	41	11	165	104	103	29	11	83	884
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	1	138	174	137	52	25	89	286	76	67	–	2	1047
1967	11	144	150	134	58	29	152	147	56	97	3	98	1079
1968	27	60	96	103	61	20	95	88	22	67	6	97	742
1969	NA	NA	NA	NA	NA	NA	26	125	54	94	22	–	
1970	50	61	46	33	24	25	94	84	84	49	27	27	576
1971	4	88	41	100	68	137	221	109	10	19	24	24	822
1972	109	85	82	121	48	46	169	157	77	51	83	83	1052
1773	60	86	119	70	26	15	228	221	49	35	28	28	943
1974	44	151	42	44	27	39	197	97	72	–	79	79	792
1975	30	128	135	114	80	70	110	310	27	30	32	32	1096
1976	109	103	149	77	32	71	77	170	14	37	11	11	853
1977	188	28	22	165	109	120	118	23	64	58	27	27	953
1978	47	52	61	52	25	41	121	135	8	23	–	–	599
1979	58	78	185	128	100	3	154	95	61	9	NA	NA	739
1980	103	109	–	47	14	74	217	104	41	9	–	–	682
1981	84	–	95	140	101	20	110	81	10	76	–	–	809
1982	32	75	107	79	61	30	56	112	39	6	95	95	857
1983	114	56	170	102	99	51	–	119	110	93	25	25	759
1984	107	107	70	103	–	39	–	122	88	–	32	32	481
1985	80	16	20	–	–	–	113	72	61	25	119	119	1591
1986	23	103	165	191	44	38	–	–	230	64	476	476	2412
1987	14	307	680	323	165	139	252	47	146	111	228	228	2533
1988	169	200	558	33	34	248	677	349	47	53	164	164	956
1989	201	90	117	25	33	23	144	175	37	50	39	39	1071
1990	77	156	142	94	77	38	93	110	28	99	133	133	1055
1991	78	138	157	192	100	28	183	58	96	13	9	9	1247
1992	214	62	115	87	101	29	218	134	121	115	37	37	906
1993	33	77	243	117	25	70	185	22	49	30	1	1	1089
1994	55	86	95	197	74	58	105	167	47	95	103	103	1143
1995	14	115	191	146	33	9	357	189	20	46	4	24	
1996	63	134	186	78	78	113	78	176	28	77	NA	NA	
1997	36	27	113	174		58	104	71	10	75	5	5	707

Exhibit C.5: Monthly Rainfall (mm) at Malakand Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	134	40	147	147	--	--	185	58	53	7	64	--	743
1962	3	81	68	43	10	6	121	186	67	10	25	94	714
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1964	88	52	72	32	22	4	148	123	56	8	1	38	644
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1966	--	73	149	257	19	9	21	112	61	14	--	--	738
1967	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1968	92	73	140	42	28	--	36	152	6	13	19	42	643
1969	10	124	73	38	20	--	90	185	24	107	8	--	680
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1971	--	100	17	69	9	91	65	22	26	--	--	--	397
1972	109	99	101	66	31	6	41	6	52	3	51	61	645
1973	50	202	126	38	31	107	158	269	47	9	--	11	1047
1974	25	99	8	31	31	28	202	175	43	--	--	79	723
1975	9	165	112	81	44	8	140	305	70	--	--	--	934
1976	51	210	139	109	4	--	151	479	21	24	--	5	1192
1977	178	19	3	115	17	9	207	246	25	10	52	29	911
1978	57	16	180	13	2	68	190	259	47	3	21	--	856
1979	65	199	112	39	35	158	237	122	31	--	17	--	1,015
1980	67	80	180	3	3	79	6	17	57	28	37	13	568
1981	61	139	186	82	15	--	234	171	13	8	--	--	909
1982	31	83	156	25	53	--	20	42	2	5	67	49	533
1983	45	67	106	--	37	4	48	359	102	18	--	10	804
1984	20	26	101	79	--	27	72	259	98	4	149	14	848
1985	69	--	0	2	0	--	9	150	16	24	11	--	282
1986	39	80	--	--	--	38	70	225	--	--	58	94	624
1987	--	95	57	49	66	12	NA	NA	NA	NA	NA	NA	481
1988	62	121	189	11	--	13	128	203	18	23	119	194	
1989	116	--	64	49	8	--	65	95	13	7	5	49	469
1990	38	144	--	121	8	3	--	321	62	23	38	185	943
1991	81	292	237	264	28	3	93	175	115	40	0	24	1553
1992	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	488
1993	--	--	229	109	--	25	--	25	61	33	6	--	
1994	37	97	50	80	82	--	--	--	29	45	--	109	528
1995	--	70	123	189	6	6	291	270	72	18	13	13	1071
1996	71	69	122	36	34	56	17	158	18	52	NA	8	637
1997	53	21	78	0	50	24	102	289	33	98	30	21	794

Exhibit C.6: Monthly Rainfall (mm) at Kalam Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1961	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1962	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	102	86	187
1963	--	70	314	206	170	5	38	31	21	19	60	49	982
1964	160	136	111	253	67	12	62	29	16	27	29	158	1060
1965	157	232	224	315	118	1	39	21	23	25	37	40	1231
1966	--	153	215	295	27	3	32	20	74	71	--	25	915
1967	51	193	125	211	123	17	12	22	41	64	5	105	968
1968	40	62	135	250	132	8	3	65	6	43	36	NA	
1969	80	176	211	213	80	28	16	31	43	90	21	8	998
1970	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	
1971	7	169	69	216	12	27	49	9	30	15	7	24	635
1972	132	151	106	231	144	31	22	76	82	44	33	122	1173
1973	125	180	192	157	57	1	35	38	57	33	8	22	906
1974	78	169	74	136	94	33	34	26	76	12	--	106	839
1975	57	155	217	254	195	2	49	113	28	50	36	60	1215
1976	86	205	191	137	62	27	29	68	43	30	24	31	934
1977	123	29	100	139	42	5	16	33	13	29	49	36	614
1978	73	46	149	123	62	21	130	19	34	13	112	10	792
1979	42	92	176	201	140	13	12	75	14	1	44	22	834
1980	115	36	5	105	89	31	44	25	32	88	84	27	681
1981	78	217	222	219	69	20	28	59	31	66	32	5	1047
1982	57	185	167	64	49	12	28	12	26	32	123	1	756
1983	49	32	279	63	59	11	15	44	16	10	16	25	621
1984	37	160	177	146	90	11	24	22	46	7	83	77	878
1985	78	26	53	137	85	7	37	54	11	72	28	145	734
1986	27	147	363	178	53	20	27	97	12	10	183	39	1156
1987	--	82	324	235	102	80	27	3	19	207	--	64	1142
1988	58	96	194	91	52	50	39	41	8	3	1	133	765
1989	NA	NA	NA	79	185	8	48	NA	26	36	92	1	
1990	NA	NA	NA	NA	14	30	NA	23	10	NA	NA	NA	
1991	173	263	337	202	172	30	31	11	117	3	6	71	1416
1992	236	171	337	229	167	39	7	48	121	72	18	72	1515
1993	--	--	--	10	77	57	85	38	10	61	59	34	430
1994	164	149	182	248	NA	25	23	25	61	78	31	105	
1995	9	101	NA	231	NA	104	54	12	29	110	28	59	
1996	67	148	323	208	128	46	29	28	9	76	20	22	1103
1997	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	

Exhibit C.7: Monthly Rainfall (mm) at Amandara Gauging Station

Year	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Annual Total (mm)
1960	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	760
1961	129	55	57	154	–	–	143	84	62	11	63	3	606
1962	3	87	65	61	6	2	100	129	28	11	25	90	
1963	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–
1964	76	61	65	38	27	--	120	72	55	20	6	30	570
1965	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–	600
1966	–	132	142	112	48	18	27	57	55	10	–	62	766
1967	–	133	222	88	38	–	52	115	30	23	3	42	371
1968	32	23	94	28	37	--	33	59	2	6	16	–	683
1969	18	93	84	48	23	6	42	83	104	177	5	39	588
1970	64	61	83	21	4	5	58	121	114	19	–	35	483
1971	4	109	18	65	11	49	115	72	–	1	4	90	769
1972	95	106	111	72	41	40	74	30	35	14	61	14	1041
1973	62	237	118	42	33	75	164	265	25	5	–	58	611
1974	33	119	17	32	38	17	99	140	57	–	–	25	921
1975	15	136	110	101	61	2	84	352	35	–	1	--	789
1976	52	164	113	79	14	34	42	235	35	21	–	12	895
1977	179	26	3	168	2	5	127	162	65	105	41	4	773
1978	65	21	324	10	3	42	120	126	15	11	31	8	534
1979	51	155	99	37	65	5	38	44	24	–	10	14	562
1980	97	77	165	8	3	46	31	13	18	40	50	–	666
1981	39	103	160	55	13	–	243	32	22	–	–	NA	–
1982	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–
1983	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–
1984	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	–	461
1985	50	–	0	1	1	–	3	341	18	27	20	–	461
1996	7	74	--	48	20	2	--	–	–	--	94	54	299
1987	6	59	–	25	–	15	41	69	16	–	--	–	231
1988	45	8	155	9	--	62	62	97	24	13	–	–	474
1989	53	1	48	41	20	–	53	217	5	10	6	42	495
1990	42	131	–	46	8	–	–	149	16	31	18	104	545
1991	74	120	124	148	32	4	60	16	26	–	–	11	616
1992	90	34	140	–	1192	4	65	168	19	159	10	15	1895
1993	0	0	149	57	1	26	4	2	12	27	–	–	279
1994	20	58	21	42	35	10	–	2	17	41	–	62	308
1995	–	51	84	101	6	6	140	62	12	13	12	15	503
1996	45	39	72	19	15	11	3	57	22	51	NA	6	
1997	48	27	108	0	76	37	67	206	34	18	39	15	674

Appendix D: Mean Monthly Water Discharge Data

This appendix provides the mean monthly discharge data of important gauging stations nearby the study area including average discharge of Swat River at Chakdara water level station and Swat river at Kalam water level station. Citation in Main Report: Section 3.2.

Exhibit D.1: Monthly Average Water Discharge of Swat River at Kalam Water Level Station

Year	Monthly Average Discharge (m^3/s)												Annual Average (m^3/s)
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1961	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1962	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1963	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1964	14	13	16	40	118	234	292	188	92	34	19	16	90
1965	13	11	14	37	130	335	318	184	89	38	23	16	101
1966	14	14	19	41	101	282	226	186	93	36	22	16	87
1967	14	12	13	32	95	252	338	190	94	32	21	17	92
1968	14	13	15	N.A	102	246	280	179	76	34	21	17	
1969	14	13	93	52	105	271	367	252	76	38	26	19	105
1970	16	14	15	47	124	231	197	182	108	40	24	18	85
1971	15	13	18	54	142	241	175	154	62	28	19	15	78
1972	13	11	15	45	125	317	282	181	95	35	21	16	96
1973	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1974	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1975	13	12	13	43	182	269	250	223	88	37	26	19	98
1976	15	13	14	27	145	248	305	172	81	38	23	16	91
1977	14	13	18	48	107	214	219	146	64	31	20	16	76
1978	14	13	13	42	136	260	257	137	52	31	22	18	83
1979	14	13	13	55	94	249	294	145	63	28	21	15	84
1980	17	13	13	44	134	257	215	129	63	32	23	18	80
1981	17	16	18	62	186	233	259	141	58	30	21	17	88
1982	15	13	14	36	95	139	151	143	45	27	22	19	60
1983	16	15	15	30	105	194	210	168	80	34	25	20	76
1984	16	13	17	41	125	321	207	180	80	30	20	16	89
1985	14	13	14	35	86	186	214	157	64	34	22	17	72
1986	15	13	16	47	114	218	295	173	62	35	22	16	85
1987	16	15	18	53	128	234	271	197	96	39	26	19	93
1988	19	17	N.A	N.A	184	258	266	152	67	32	21	17	
1989	15	13	15	27	99	263	227	157	77	33	23	18	81
1990	15	14	20	38	213	253	249	162	96	36	22	16	95
1991	15	16	20	47	114	300	369	234	116	42	26	21	110
1992	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1993	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1994	17	16	19	42	139	288	336	201	92	36	25	19	103
1995	15	14	15	42	119	262	337	199	72	38	23	18	96

Exhibit D.2: Monthly Average Water Discharge of Swat River at Chakdara Water Level Station

Year	Monthly Average Discharge (m^3/s)												Annual Average (m^3/s)
	Jan.	Feb.	Mar.	Apr.	May	Jun.	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	
1961	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1962	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1963	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1964	40	46	85	174	234	350	450	319	154	65	37	41	166
1965	39	63	81	263	370	568	526	294	125	66	50	39	207
1966	33	47	107	234	299	509	405	301	168	79	47	36	189
1967	32	51	85	175	234	525	523	282	143	72	44	47	185
1968	40	41	80	170	261	551	545	349	103	62	48	55	192
1969	41	56	139	198	282	479	568	396	137	91	59	41	207
1970	37	35	65	147	254	388	292	265	214	78	42	34	154
1971	28	29	52	163	288	387	321	267	103	N.A	N.A	N.A	
1972	30	43	99	169	308	528	453	299	150	67	54	45	187
1973	44	58	109	211	341	514	460	402	174	71	39	37	205
1974	34	41	79	156	197	329	335	219	88	54	34	34	133
1975	29	36	81	210	354	466	439	416	168	69	48	47	197
1976	47	59	88	234	318	398	450	332	149	70	44	37	185
1977	44	41	60	168	228	388	418	226	111	79	52	42	155
1978	38	37	123	194	320	452	452	312	111	64	56	40	183
1979	35	41	76	210	233	380	426	258	135	58	45	37	161
1980	38	50	132	217	309	445	359	233	415	70	55	44	172
1981	39	50	121	300	402	339	408	241	105	63	43	31	178
1982	32	35	68	144	208	231	224	251	74	60	72	54	121
1983	44	48	114	172	269	318	301	316	162	67	49	47	159
1984	44	45	68	132	250	502	312	283	152	57	51	46	162
1985	43	40	54	117	185	273	330	225	93	61	31	38	124
1986	38	48	107	197	238	301	431	320	91	59	42	46	160
1987	24	36	133	200	249	368	422	262	133	138	66	48	173
1988	36	46	127	229	334	390	477	269	106	56	36	35	179
1989	44	37	59	108	282	396	348	256	110	67	55	65	152
1990	46	73	181	276	459	397	366	283	168	98	70	64	207
1991	75	131	222	370	374	604	523	336	196	84	52	45	251
1992	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1993	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	N.A	
1994	46	58	107	214	352	509	589	421	163	96	68	63	223
1995	49	55	181	268	263	427	605	404	116	76	50	45	211

Exhibit D.3: Water Discharge Data of Swat River at Munda Headworks (Cusecs)

Year	Jan	Feb	Mar	Apr.	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual Average
1961	1,010	1,091	1,974	7,554	14,343	23,235	23,817	14,265	9,813	2,753	1,392	1,015	8,522
1962	755	802	1,498	5,055	7,900	14,446	18,547	12,276	4,968	1,444	1,018	981	5,808
1963	534	360	3,980	9,288	17,318	23,505	20,757	13,007	4,866	1,410	1,528	760	8,109
1964	1,112	1,448	3,453	8,540	12,014	18,985	25,007	17,274	7,195	1,988	610	1,049	8,223
1965	1,010	2,434	3,215	13,895	20,208	32,075	29,597	15,744	8,478	2,073	389	896	10,585
1966	670	1,482	4,830	12,144	15,788	28,505	22,287	16,084	8,062	2,821	1,205	726	9,550
1967	602	1,737	3,487	8,625	12,014	29,525	29,427	15,030	6,549	2,379	1,069	1,406	9,321
1968	1,095	1,108	3,198	8,285	13,595	31,055	30,787	18,974	4,135	1,784	1,307	1,882	9,767
1969	1,112	2,026	6,751	9,968	14,887	26,635	32,147	21,864	6,192	3,552	1,936	1,032	10,675
1970	891	802	2,280	6,942	13,204	21,195	15,487	13,976	10,289	2,787	916	607	7,448
1971	362	411	14,181	7,860	15,278	21,195	17,187	14,112	4,135	951	440	301	6,976
1972	483	1,227	4,286	8,234	16,468	29,695	25,177	16,084	6,991	2,090	1,630	1,304	9,472
1973	1,299	2,145	4,949	10,767	18,338	28,846	25,517	22,204	8,402	2,328	746	811	10,529
1974	721	1,210	3,096	7,469	9,787	17,625	18,037	11,205	3,268	1,342	457	641	6,238
1975	398	816	3,265	10,673	19,149	25,896	24,318	23,119	8,069	2,233	1,299	1,420	10,055
1976	1488	2,205	3,630	12,133	17,083	21,818	25,032	18,018	6,899	2,302	1,027	788	9,369
1977	1338	1,166	1,969	2,812	11,622	21,190	23,061	11,674	4,667	2,823	1,528	1,130	7,531
1978	970	899	5,729	9,725	17,166	25,042	25,131	16,810	4,627	1,907	1,780	1,006	9,233
1979	774	1,160	2,959	10,680	11,935	20,717	23,584	13,589	6,055	1,559	1,120	824	7,913
1980	942	1,686	6,292	11,141	16,468	24,595	19,567	12,038	4,849	2,277	1,698	1,253	8,567
1981	1,020	1,654	5,607	16,089	22,096	18,254	22,449	12,544	4,281	1,852	976	440	8,939
1982	624	752	2,526	6,746	10,454	11,785	11,467	13,109	2,399	1,805	2,742	1,814	5,510
1983	1,314	1,582	5,234	8381	14,114	10,967	15,886	17,042	7,708	2,099	1,354	1,397	7,756
1984	398	810	2,121	6,032	12,935	28,035	16,705	15,055	7,060	1,534	1,489	1,323	7,792
1985	1,170	1,064	1,592	5,086	9,032	13,315	17,311	11,195	3,540	1,755	243	862	5,514
1986	652	1,586	4,115	10,933	15,491	16,023	23,857	17,286	3,431	1,633	902	1,800	8,197
1987	404	855	6,343	10,066	12,863	19,973	23,303	13,762	5,944	6,997	2,377	1,472	8,696
1988	840	1,363	6,020	11,855	17,998	19,835	26,707	14,197	4,322	1,444	559	709	8,821
1989	1,207	872	2,016	4,647	14,607	21,640	18,998	13,492	4,480	2,236	1,659	1,566	7,285
1990	1,469	3,077	9,222	14,649	25,531	21,747	19,936	15,039	8,030	3,961	2,587	2,786	10,670
AVG	889	1,328	3,926	9,389	14,990	22,445	22,370	15,336	5,890	2,267	1,266	1,133	8,436

Note: These are net discharge values after deducting direct diversion 200 cfs and historic discharge values of Upper Swat Canal at Amandara Headworks.

Appendix E: Water Availability Data

Exhibit E.1: Estimated Water Availability at Munda with Future Diversion Pattern at Amandara and other Locations

					Run off (Acre-ft)								
Year	Jan.	Feb.	Mar.	Apr.	May	Jun	Jul.	Aug.	Sep.	Oct.	Nov.	Dec.	Cumulative
1962	51,702	46,560	76,557	210,011	399,491	778,087	1,051,761	6,662,305	211,513	82,026	61,653	58,208	3,689,873
1963	46,107	36,452	221,419	461,895	978,589	1,317,161	1,187,650	707,253	205,444	81,165	74,149	52,613	5,369,898
1964	60,741	61,333	189,015	417,385	652,454	1,048,181	1,448,977	969,625	344,031	95,799	51,656	59,930	5,399,127
1965	58,158	97,966	174,381	736,035	1,156,291	1,827,101	1,731,209	875,547	241,861	97,951	46,241	56,056	7,098,797
1966	49,550	62,110	273,685	731,841	884,512	1,614,668	1,281,728	896,453	395,622	116,890	66,235	51,752	6,325,046
1967	47,828	67,942	191,106	422,443	652,454	1,675,363	1,720,756	831,644	305,591	105,699	62,903	68,969	6,152,698
1968	60,310	53,558	173,335	402,212	749,668	1,766,406	1,804,380	1,074,155	161,946	90,634	68,734	81,021	6,486,358
1969	60,741	75,306	391,804	502,359	829,111	1,503,394	1,888,004	1,251,857	284,347	135,398	91,021	59,500	7,072,841
1970	55,145	46,560	116,889	322,296	725,626	1,179,587	863,606	766,836	528,139	116,029	59,154	48,739	4,828,706
1971	41,759	37,618	76,126	376,922	853,153	1,179,687	968,136	775,198	161,946	69,543	47,491	40,992	4,628,571
1972	44,815	56,279	240,235	399,177	926,324	1,685,479	1,459,430	896,453	331,892	98,382	76,648	66,386	6,281,500
1973	65,475	81,915	281,002	549,903	1,041,308	1,633,490	1,480,336	1,272,763	415,853	104,407	54,988	53,904	7,036,755
1974	50,841	55,890	167,064	353,656	515,520	967,254	1,020,402	596,451	120,717	79,443	47,907	49,600	4,024,744
1975	42,666	46,872	177,479	544,290	1,091,170	1,459,436	1,406,600	1,329,022	196,033	102,003	68,528	69,325	6,733,424
1976	70,256	85,239	199,888	631,191	964,117	1,216,761	1,450,538	1,015,379	326,410	103,749	61,874	53,331	6,178,734
1977	66,456	54,884	97,746	397,851	628,326	1,179,371	1,329,320	625,289	193,591	116,928	74,147	61,975	4,825,888
1978	57,155	48,789	328,978	487,908	969,237	1,140,859	1,456,611	941,076	191,212	93,751	81,764	58,847	6,123,920
1979	52,193	54,747	158,679	544,718	647,616	1,151,270	1,361,470	743,054	276,172	84,945	64,159	54,233	5,193,208
1980	56,437	66,776	363,581	572,158	926,324	1,382,004	1,114,479	647,671	204,432	103,116	78,314	65,095	5,580,387
1981	58,410	66,038	321,452	866,578	1,272,402	1,004,688	1,291,692	678,754	170,648	92,364	60,634	44,506	5,928,167
1982	48,374	45,426	132,004	310,605	556,524	619,719	616,418	713,500	99,415	88,623	138,968	79,293	3,448,868
1983	65,858	64,391	298,530	407,949	781,575	928,123	888,147	955,365	374,552	98,596	69,876	68,737	5,001,699
1984	42,666	46,748	107,141	268,131	709,059	1,586,727	938,516	833,194	335,995	84,313	73,191	66,874	5,092,555
1985	62,220	52,550	78,937	211,856	469,123	710,811	975,787	595,759	127,387	89,888	42,674	55,189	3472181
1986	49,090	64,499	270,274	559,781	866,238	871,920	1,378,260	970,368	124,705	96,818	58,805	78,940	5,379,698
1987	42,814	47,774	366,689	508,162	704,653	1,106,974	1,344,204	753,652	269,564	343,544	117,261	70,629	5,675,919
1988	53,854	59,389	346,856	614,645	1,020,402	1,098,760	1,553,507	780,425	173,073	82,026	50,406	51,322	5,884,664
1989	63,141	48,156	100,680	185,722	811,924	1,206,153	1,079,482	737,092	182,461	102,072	77,363	73,019	4,667,266
1990	69,787	133,681	543,761	780,915	1,483,613	1,212,523	1,137,191	832,191	339,700	156,887	129,731	135,264	7,009,248
Avg.	55,090	60,621	218,777	467,910	835,416	1,254,076	1,286,814	850,431	268,269	107,272	70,910	63,111	5,538,696

Exhibit E.2: Estimated Additional Diversions from Panjkora River

Month	Irrigaiton Requirement (Cusecs)			
	Darora Jaghabanj	Balam Bat	Gopalam	Total
Jan.	0	13	0	13
Feb.	0	37	0	37
Mar.	0	43	0	43
Apr.	32	59	59	150
May	35	65	65	165
Jun	35	65	65	165
Jul.	35	65	65	165
Aug.	32	59	59	150
Sep.	33	61	61	155
Oct.	0	52	0	52
Nov.	0	42	0	42
Dec.	0	40	0	40

Exhibit E.3: Estimated Additional Diversions from Swat River Upstream of Chakdara

Month	Additional Irrigaiton Requirements (Cusecs)		
	Nipki Khel	Fateh Pur	Total
Jan	36	19	55
Feb	37	20	56
Mar	43	23	66
Apr	59	32	91
May	65	35	100
Jun	65	35	100
Jul	65	35	100
Aug	59	32	91
Sep	61	33	94
Oct	52	28	80
Nov	42	23	64
Dec	40	22	62

Exhibit E.4: Swat River Upstream Munda Headworks Suspended Sediment Concentration-1971

Date	Discharge (Cusecs)	Sedidment (ppm)			Total Sediment (ppm)	Load (tons/day)	Soluble Contrants (ppm)
		Sand	Silt	Clay			
6.1.71	856	39	750	500	1,289	2,659	250
7.1.71	698	52	700	400	1,152	1,937	100
8.1.71	596	33	500	400	933	1,340	250
14.1.71	590	48	550	300	898	1,277	100
15.1.71	625	58	650	350	1,058	1,593	200
21.1.71	544	33	800	500	1,333	1,748	200
22.1.71	544	32	700	400	1,132	1,487	200
27.1.71	562	25	500	350	875	1,183	150
28.1.71	562	30	700	450	1,180	1,598	200
29.1.71	562	33	700	450	1,183	1,602	200
10.2.71	1,390	25	500	400	925	3,098	100
12.2.71	1,038	22	150	400	872	2,181	100
17.2.71	1,320	23	550	350	923	2,939	100
18.2.71	1,508	23	580	400	923	3,345	100
24.2.71	1,038	33	750	450	1,233	3,084	50
25.2.71	1,038	33	550	350	933	2,334	150
26.2.71	1,012	30	600	450	1,080	2,461	100
5.3.71	1,011	35	750	400	1,185	288	200
10.3.71	1,410	39	500	350	889	303	150
11.3.71	1,410	28	750	350	1,128	383	150
12.3.71	1,407	23	450	400	873	320	150
17.3.71	1,461	22	300	250	572	199	100
19.3.71	1,817	33	350	300	683	299	100
24.3.71	1,402	28	300	250	578	195	50
25.3.71	1,425	24	300	200	524	180	50
26.3.71	1,461	22	350	200	572	199	100
7.4.71	4,354	899	1,000	650	2,549	26,737	250
8.4.71	4,354	728	750	550	2,028	21,200	200
14.4.71	4,606	737	1,050	800	2,587	28,717	150
15.4.71	4,606	745	600	350	1,695	21,717	150
16.4.71	4,383	808	600	500	1,308	17,144	150
17.4.71	7,282	982	800	500	2,282	40,095	200
21.4.71	5,362	780	700	500	1,980	25,585	200
22.4.71	5,362	788	550	450	1,788	23,105	100
23.4.71	5,813	833	500	400	1,733	24,760	100
28.4.71	17,266	1,178	1,000	700	2,878	122,166	300
29.4.71	16,574	1,060	1,150	860	3,060	122,226	250
5.5.71	5,812	6,262	600	300	962	13,475	100
6.5.71	5,200	552	500	350	902	11,304	100
7.5.71	5,362	40	400	300	740	9,553	150
12.5.71	6,004	65	500	400	965	13,853	100
14.5.71	7,269	55	500	400	955	16,530	100
20.5.71	11,977	52	500	350	902	26,036	100
21.5.71	11,605	56	750	400	1,206	33,789	150
26.5.71	11,109	58	550	350	958	23,648	150
27.5.71	10,551	61	600	450	1,111	28,250	100
28.5.71	10,613	45	500	400	945	24,195	100
9.6.71	14,707	415	2,900	2,175	5,496	194,597	175
10.6.71	14,287	421	3,250	2,100	5,771	198,805	150
12.6.71	13,480	82	675	425	1,182	38,393	125
16.6.71	9,673	848	450	325	8,593	20,003	175
17.6.71	8,109	148	875	650	1,683	32,880	175
28.6.71	8,900	395	775	550	1,720	36,792	175
5.7.71	9,661	126	1,500	800	2,426	56,726	200
6.7.71	8,838	143	2,000	1,250	3,393	72,269	250
7.7.71	7,269	190	500	300	9,904	173,437	150
8.7.71	5,362	274	1,000	500	1,774	229,247	200
14.7.71	21,717	670	3,000	2,300	5,970	312,467	200
15.7.71	9,661	105	1,500	800	2,405	55,890	200
16.7.71	7,793	231	1,900	650	2,781	52,230	150
21.7.71	8,041	1,051	900	450	11,401	223,348	150
22.7.71	8,041	1,051	8,000	4,250	22,301	432,167	250
24.7.71	5,362	8,282	1,500	800	2,382	30,721	200
27.7.71	5,812	106	1,200	850	2,156	31,199	200

Exhibit E.4: Swat River Upstream Munda Headworks Suspended Sediment Concentration-1971 (*Contd.*)

Date	Discharge (Cusecs)	Sedidment (ppm)			Total Sediment (ppm)	Load (tons/day)	Soluble Contrants (ppm)
		Sand	Silt	Clay			
4.8.71	8,433	55	650	350	1,055	11,801	150
5.8.71	8,433	111	1,750	1,000	2,861	58,126	250
11.8.71	5,806	119	1,000	550	1,669	24,353	200
12.8.71	5,806	96	1,700	1,050	2,846	39,919	250
13.8.71	5,060	55	850	550	1,455	17,743	100
18.8.71	6,060	74	1,100	750	1,924	28,099	150
19.8.71	5,806	107	1,050	800	1,957	27,393	150
25.8.71	5,222	81	1,000	550	1,631	20,526	200
26.8.71	6,766	84	1,050	600	1,734	21,503	200
2.9.71	5,806	22	400	250	672	9,403	100
3.9.71	6,766	26	400	200	626	10,208	100
9.9.71	4,514	20	350	250	620	6,840	50
10.9.71	2,257	19	350	300	669	3,639	100
13.9.71	2,169	50	500	300	850	4,202	50
16.9.71	2,017	48	550	300	898	4,360	100
17.9.71	1,919	40	500	250	790	3,654	100
21.9.71	1,835	50	450	300	800	3,538	150
24.9.71	1,606	47	450	250	745	2,883	50
30.9.71	16.6	49	450	300	799	3,093	50
1.10.71	1,710	16	350	250	616	2,539	50
5.10.71	1,483	13	350	250	613	2,191	50
6.10.71	1,347	11	250	200	461	1,496	50
7.10.71	1,047	12	300	200	512	1,292	100
8.10.71	1,026	11	250	150	411	1,012	100
14.10.71	1,026	14	250	150	414	1,224	100
18.10.71	1,026	13	300	200	513	1,273	50
20.10.71	1,047	11	250	150	411	1,037	100
22.10.71	1,254	17	300	250	567	1,707	100
25.10.71	1,483	13	400	200	613	2,200	50
2.11.71	1,102	14	300	100	514	1,365	100
4.11.71	1,047	12	250	200	462	1,165	50
5.11.71	1,017	16	300	150	466	1,144	100
8.11.71	987	15	350	200	565	1,341	100
11.11.71	931	12	350	200	562	1,259	100
12.11.71	931	12	300	250	562	1,259	50
15.11.71	907	13	250	200	463	1,011	100
16.11.71	907	13	300	200	513	1,122	100
18.11.71	883	12	250	200	462	986	50
24.11.71	865	13	250	150	413	861	50
2.12.71	852	18	400	250	668	1,372	100
3.12.71	833	26	450	300	776	1,557	100
6.12.71	806	19	300	200	519	1,011	100
7.12.71	812	17	350	250	617	1,267	50
10.12.71	833	18	400	200	618	1,233	50
11.12.71	784	13	300	200	513	929	100
23.12.71	984	20	300	250	570	1,351	50
18.12.71	916	16	300	200	510	1,129	100

Exhibit E.5: Swat River at Chakdara Suspended Sediment Concentration-1995

Date	Discharge (m^3/s)	Water Temperature (°C)	Total Sediments (ppm by weight)	Sand (%)	Silt (%)	Clay (%)
4.1.95	53.933	9	50			
14.1.95	49.090	9	62			
19.1.95	47.096	8	40			
25.1.95	44.515	9	77			
3.2.95	41.408	9	64			
12.2.95	129.741	9	212			
19.2.95	55.222	10	113			
24.2.95	49.090	10	74			
7.3.95	53.224	14	76			
13.3.95	49.765	12	113			
19.3.95	57.559	14	77			
25.3.95	832.140	14	4,370	7	73	20
26.3.95	734.806	12	148			
3.4.95	142.042	13	114			
9.4.95	384.368	13	569			
10.4.95	489.937	14	268			
18.4.95	303.441	13	204			
26.4.95	329.853	15	219			
2.5.95	202.664	13	581			
13.5.95	331.940	15	261			
21.5.95	263.505	15	91			
31.5.95	205.798	19	93			
6.6.95	424.293	18	488			
10.6.95	561.253	15	551			
13.6.95	538.697	15	495			
18.6.95	541.486	15	360			
26.6.95	351.067	16	229			
4.7.95	549.906	18	273			
7.7.95	569.854	19	332			
10.7.95	587.288	19	324			
13.7.95	549.906	18	286			
17.7.95	555.563	19	195			
19.7.95	650.781	19	1,930	3	73	24
24.7.95	647.670	21	5,860	3	81	16
25.7.95	1725.623	21	5,390	27	51	22
26.7.95	835.750	18	371			
2.8.95	386.652	20	433			
4.8.95	1129.080	21	9,970	14	62	24
8.8.95	544.284	21	3,690	7	73	20
12.8.95	368.605	26	139			
18.8.95	375.312	21	93			
24.8.95	309.420	21	85			
27.8.95	258.071	21	248			
31.8.95	263.505	19	154			
3.9.95	159.031	18	43			
6.9.95	135.809	23	53			
10.9.95	127.360	20	54			
14.9.95	120.373	18	68			
18.9.95	97.733	19	51			
21.9.95	85.098	19	44			
24.9.95	107.094	21	65			
27.9.95	87.922	21	56			
6.10.95	70.950	18	47			
13.10.95	65.235	19	43			
20.10.95	86.034	17	64			
25.10.95	69.288	17	123			
4.11.95	54.647	15	59			
13.11.95	47.096	13	50			
20.11.95	45.152	12	61			
28.11.95	70.116	8	105			
5.12.95	44.515	8	31			
10.12.95	45.795	7	496			
17.12.95	45.795	10	50			
24.12.95	38.434	12	22			

Note: Sand is all sizes above 0,0055 mm; Silt is all sizes between 0.0625 mm and 0.0055 mm; Clay is all sizes smaller than 0.0055.

Exhibit E.6: Annual Water Yield and Suspended Sediment

Station	Year	Water Yield			Suspended Sediment			Sediment / Discharge Ratio		Observed Concentration	
		Total Runoff (10^6 m^3)	Maximum Discharge (m^3/s)	Minimum Discharge m^3/s	10^6 Tons	10^6 m^3	M^3km^2	By wt Kg m^3	By Vol. mm percent	Max ppm	Min ppm
Kabul River at Warsak CA=26000sq.mile CA = 673401 km^2	1961	22,386	2,377	87	9.8	10,332	153.43	0.44	0.4615	2,900	19
	1962	15,498	1,916	103	3.5	3,727	55.34	0.23	0.2405	0.743	10
	1963	20,787	3,028	91	16.1	16,974	252.06	0.77	0.8166	2.240	9
	1964	19,926	2,567	122	13.2	14,022	208.23	0.66	0.7037	19.200	13
	1965	29,274	4,273	125	39.8	42,066	624.68	1.36	1.4370	3.070	19
	1966	23,616	3,283	172	18.2	19,188	284.94	0.77	0.8125	2.350	24
	1967	22,386	3,679	152	16.7	17,589	261.20	0.75	0.7857	2.090	7
	1968	24,969	3,028	186	21.8	23,001	341.57	0.87	0.9212	6.910	8
	1969	21,033	2,270	171	12.7	13,407	199.09	0.60	0.6374	13.000	33
		16,482	1,562	139	5.9	6,273	93.15	0.36	0.3806	10.600	33
	Mean	21,648			15.8	16,605	246.58	0.73	0.7670		
Swat River near Kalam CA=780 sq.mile CA-20202 km^2	1961	2,903	314	10	0.3	344	170.48	0.11	0.1186	210	12
	1962	2,202	405	14	0.2	209	103.50	0.09	0.0950	607	6
	1963	2,681	473	11	0.3	283	140.04	0.09	0.1055	2.020	10
	1964	2,841	521	12	0.3	344	170.48	0.11	0.1212	299	19
	1965	3,186	464	10	0.4	431	213.10	0.12	0.1351	320	10
	1966	2,780	425	12	0.2	246	121.77	0.08	0.0885	198	10
	1967	2,923	422	8	0.3	308	152.21	0.09	0.1050	134	10
	1968	2,755	439	12	0.2	246	121.77	0.08	0.0893	204	7
	1969	3,321	456	12	0.3	258	127.86	0.10	0.0778	245	10
	1970	2,669	371	12	0.2	221	109.52	0.07	0.0829	315	
	1971	2,472	351	12	0.2	197	97.42	0.07	0.0796	188	9
	1972	3,050	473	10	0.2	209	103.50	0.06	0.0685	112	10
	1973	3,235	388	10	0.2	246	121.77	0.07	0.0760	137	21
	1974	2,312	337	12	0.1	135	66.97	0.05	0.0585	1,180	10
	1975	3,100	464	11	0.3	283	140.04	0.08	0.0913	92	3
	1976	2,903	393	13	0.2	241	119.33	0.07	0.0831	363	6
	1977	2,399	342	12	0.2	171	84.63	0.06	0.0713	322	3
	1978	2,632	597	18	0.5	606	300.16	0.21	0.2304	3,430	3
	1979	2,645	470	10	0.2	256	126.64	0.09	0.0967	204	14
	1980	2,522	393	11	0.3	346	171.09	0.12	0.1371	470	6
	1981	2,792	408	14	0.4	448	221.62	0.14	0.1604	176	5
	1982	1,894	233	12	0.1	164	80.98	0.08	0.0864	211	7

Exhibit E.6: Annual Water Yield and Suspended Sediment (*Contd.*)

Station	Year	Water Yield			Suspended Sediment			Sediment / Discharge Ratio		Observed Concentration	
		Total Runoff (10^6 m^3)	Maximum Discharge (m^3/s)	Minimum Discharge m^3/s	10^6 Tons	10^6 m^3	M^3km^2	By wt Kg m^3	By Vol. mm percent	Max ppm	Min ppm
	1983	2,411	368	12	0.3	280	138.82	0.11	0.1163	191	7
	1984	2,804	413	12	0.4	412	203.96	0.14	0.1469	2,580	6
	1985	2,312	308	12	0.2	237	117.51	0.10	0.1027	265	8
	1986	2,706	430	11	0.4	411	203.36	0.15	0.1518	297	15
	1987	2,940	342	14	0.4	416	205.79	0.14	0.1414	345	17
	1988	2,964	376	14	0.4	426	210.66	0.14	0.1436	4.310	14
	1989	2,546	328	12	0.4	410	202.75	0.16	0.1609	590	18
	1990	3,001	422	13	0.4	413	204.57	0.13	0.1377	332	16
	Mean	2,743			0.3	308	152.21	0.10	0.1121		13
Swat River at Chakdara CA=2230 sq.mile CA=5775.7 km^2	1961	5,412	744	32	1.4	1,624	281.11	0.25	0.3000	872	5
	1962	3,998	942	29	0.9	1,082	187.41	0.23	0.2708	647	6
	1963	5,240	608	20	1.3	1,562	270.46	0.25	0.2981	1.210	14
	1964	5,264	945	31	1.4	1,636	283.24	0.26	0.3107	1.280	5
	1965	6,531	809	29	1.0	1,242	215.09	0.16	0.1902	1.430	2
	1966	5,953	1.002	29	1.0	1,193	206.57	0.17	0.2004	1.560	5
	1967	5,843	900	26	1.1	1,267	219.35	0.18	0.2168	355	6
	1968	6,076	925	30	0.8	984	170.37	0.14	0.1619	1.700	4
	1969	6,556	985	34	1.0	1,169	202.31	0.15	0.1782	994	11
	1970	4,846	674	29	0.6	750	129.91	0.13	0.1548	7.130	13
	1971	4,600	572	23	C.6	738	127.78	0.13	0.1604	173	10
	1972	5,904	818	26	0.5	603	104.35	0.09	0.1021	135	32
	1973	6,470	611	34	1.3	1,501	259.81	0.19	0.2319	3.750	10
	1974	4,219	583	30	0.3	320	55.37	0.06	0.0758	216	7
	1975	6,224	906	26	1.4	1,624	281.11	0.22	0.2609	2.400	7
	1976	5,855	685	31	0.8	922	166.54	0.14	0.1643	959	3
	1977	4,895	1208	31	1.3	1,513	261.94	0.26	0.3090	8.400	5
	1978	9,793	942	33	2.0	2,349	406.76	0.34	0.4055	1.380	19
	1979	5,092	611	29	0.8	945	163.55	0.15	0.1855	157	3
	1980	5,437	1,282	31	1.6	1,857	321.57	0.29	0.3416	5.990	26
	1981	5,646	897	29	0.8	999	172.92	0.15	0.1769	472	7
	1982	3,838	642	28	0.4	435	75.39	0.09	0.1135	242	8
	1983	5,031	883	36	0.2	48	8.31	0.05	0.0095	91	6
	1984	5,105	951	32	0.9	1,097	189.96	0.18	0.2149	1.800	31
	1985	5,781	1.330	24	0.8	909	157.38	0.13	0.1572	1.080	23
	1986	5,055	659	27	1.1	1,216	210.62	0.22	0.2406	1.190	31

Exhibit E.6: Annual Water Yield and Suspended Sediment (*Contd.*)

Station	Year	Water Yield			Suspended Sediment			Sediment / Discharge Ratio		Observed Concentration	
		Total Runoff (10^6 m^3)	Maximum Discharge (m^3/s)	Minimum Discharge m^3/s	10^6 Tons	10^6 m^3	M^3km^2	By wt Kg m^3	By Vol. mm percent	Max ppm	Min ppm
	1987	5,486	679	20	1.0	1,156	200.18	0.19	0.2108	1,226	10
	1988	5,646	1,602	28	5.5	6,113	1058.42	0.97	1.0828	1,270	14
	1989	4,809	744	32	1.6	1,747	302.40	0.32	0.3632	1,920	11
	1990	6,519	718	39	2.9	3,223	537.96	0.44	0.4943	605	19
	Mean	5,375				1,402	242.78	0.00	0.2609		
Kabul River at Nowshera CA=3422 sq.mile CA=88578 km^2	1961	28,659	3,141	136	29.0	30,627	345.76	1.01	1.0687	1,770	72
	1962	20,664	3,255	142	17.2	18,204	205.51	0.83	0.8810	2,110	31
	1963	27,306	4,075	140	26.7	28,167	317.99	0.98	1.0315	2,540	9
	1964	27,429	3,849	170	26.8	28,290	319.38	0.98	1.0314	9,100	42
	1965	39,360	6,311	179	51.9	54,735	617.93	1.32	1.3906	5,230	42
	1966	33,210	4,585	179	34.8	36,777	415.19	1.05	1.1074	3,880	34
	1967	31,980	5,037	163	32.7	34,563	390.20	1.02	1.0808	3,740	26
	1968	34,932	4,047	187	53.2	56,088	633.20	1.52	1.6056	3,820	28
	1969	30,258	3,028	181	35.5	37,392	422.14	1.17	1.2358	6,030	44
	1970	20,787	1,981	126	15.2	15,990	180.52	0.73	0.7692	2,210	55
	1971	19,065	2,323	145	14.3	15,129	170.80	0.75	0.7935	6,220	36
	1972	29,274	3,934	132	40.6	42,804	483.24	1.39	1.4622	6,600	20
	1973	35,178	3,622	190	56.7	59,778	674.86	1.61	1.6993	4,380	81
	1974	19,311	2,541	112	25.6	26,937	304.10	1.32	1.3949	4,570	6
	1975	27,675	4,839	118	39.2	41,328	466.57	1.42	1.4933	3,150	33
	1976	25,953	577	199	36.7	38,745	437.41	1.42	1.4929	3,790	19
	1977	22,878	2,972	197	27.1	28,659	323.55	1.19	1.2527	3,790	81
	1978	29,520	4,754	156	47.5	50,184	566.55	1.61	1.7000	7,520	25
	1979	27,306	2,972	136	23.5	24,846	280.50	0.86	0.9099	6,200	26
	1980	24,969	2,972	134	56.0	59,040	666.53	2.24	2.3644	15,000	38
	1981	26,445	3,339	173	64.6	68,142	769.29	2.44	2.5767	5,980	33
	1982	17,466	2,216	98	29.1	30,750	347.15	1.67	1.7606	6,220	7
	1983	27,675	2,915	198	50.1	50,307	567.94	1.81	1.8178	3,880	21
	1984	26,076	3,226	159	60.5	60,885	687.36	2.32	2.3349	6,950	86
	1985	17,466	2,858	99	19.8	19,926	224.95	1.13	1.1408	3,830	62
	1986	25,707	3,056	154	33.7	33,825	381.87	1.31	1.3158	4,620	82
	1987	24,969	2,649	169	26.0	26,199	295.77	1.04	1.0493	3,850	78
	1988	26,691	3,453	174	66.2	66,543	751.24	2.48	2.4931	9,050	76
	1989	21,279	2,473	121	21.6	21,771	245.78	1.01	1.0231	5,610	80
	1990	27,183	3,311	190	35.2	35,424	399.92	1.29	1.3032	4,910	47
	Mean	26,691			36.6	38,130	430.47	1.37	1.4286		

Exhibit E.7: Estimated Sediment Yield of Kabul and Swat Rivers

Station	Catchment Area (km^2)	Annual Sediment (Million Ton)	Sediment Yield (ton/km^2)
Kalam	2,020	0.254	125
Chakdara	5,776	0.998	173
Warsak	67,340	15.776	235
Nowshera	88,578	35.635	403

Exhibit E.8: Water Availability at Swat River and Demands at Munda

Month	Adjusted River Inflow	Demand				Total	Deficient Supply
		Lower Swat Canal + Doaba Canal	Additional Area at Munda Dam		Down Stream Munda		
			Left	Right			
January	896	190	18	18	300	526	0
February	1092	440	34	34	300	808	0
March	3558	930	93	93	300	1416	0
April	7683	1710	140	140	300	2290	0
May	13587	2290	222	222	300	3034	0
June	21075	2290	270	270	300	3130	0
July	20928	1300	205	205	300	2010	0
August	13831	1680	182	182	300	2344	0
September	4508	1820	158	158	300	2436	0
October	1745	1490	90	90	300	1970	225
November	1192	1130	13	13	300	1456	264
December	1026	570	2	2	300	874	0

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