

## C. RUNOFF CALCULATION DATA BY RATIONAL METHOD

### I. MASTER PLAN STAGE

#### QUED IN GREATER TUNIS AREA

1. ENNKHILET AND ARIANA
2. GREB
3. GARIANA
4. MAYZETTE
5. BOU KHAMSA
6. AIN ZERGA

#### QUED IN GREATER SOUSSE AREA

7. HAMMAM
8. BLIBENE
9. HALLOUF
10. HAMDOUN

### II. FEASIBILITY STUDY STAGE

#### QUED IN GREATER TUNIS AREA

1. ENNKHILET

#### QUED IN GREATER SOUSSE AREA

2. HAMMAM



# **RUNOFF CALCULATION DATA BY RATIONAL METHOD**

## **I. Master Plan Stage**



Runoff Calculation by Rational Method

Qued Ennkhet Basin

(Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cum/m)	Calc. Q(2) (cum/m)	Calc. Q(5) (cum/m)	Calc. Q(10) (cum/m)	Calc. Q(25) (cum/m)	Calc. Q(50) (cum/m)	Calc. Q(100) (cum/m)
1	1	0.32	0.28	20	0.8	1.0	1.4	1.7	2.3	2.8	3.5
2	2	0.35	0.33	11	1.8	2.2	2.9	3.6	4.8	5.9	7.4
3	1-2	0.67	0.31	20	2.0	2.4	3.2	4.0	5.3	6.5	8.1
4	1-3	0.89	0.35	26	2.2	2.7	3.6	4.5	6.0	7.4	9.2
5	5	1.56	0.24	30	2.5	3.1	4.1	5.1	6.8	8.4	10.4
6	4	0.60	0.32	13	2.6	3.2	4.2	5.2	6.9	8.6	10.7
7	4-5	1.22	0.32	34	2.4	2.9	3.9	4.8	6.4	7.9	9.8
8	1-6	3.67	0.29	34	6.5	7.9	10.5	13.0	17.9	21.5	26.7
9	1-7	4.72	0.31	67	5.1	6.2	8.2	10.2	13.6	16.8	20.9
10	9	1.14	0.20	10	3.8	4.7	6.2	7.7	10.3	12.7	15.8
11	Dam No. 1	1.14	0.20	10	3.8	4.7	6.2	7.7	10.3	12.7	15.8
12	3-10	1.67	0.25	18	4.8	5.9	7.8	9.7	12.9	16.0	19.8
13	9-11	2.18	0.28	23	4.7	5.8	7.7	9.5	12.7	15.7	19.5
14	8	0.25	0.20	8	1.0	1.2	1.6	2.0	2.7	3.4	4.2
15	8-18	0.28	0.20	11	0.9	1.1	1.5	1.8	2.4	3.0	3.7
16	8-11,18	2.45	0.26	23	5.4	6.6	8.7	10.8	14.4	17.8	22.1
17	8-12,18	2.74	0.28	41	4.0	4.9	6.5	8.1	10.7	13.3	16.4
18	1-12,18	7.46	0.30	67	7.8	9.5	12.6	15.6	20.8	25.7	31.9
19	1-13,18	7.52	0.30	73	7.4	9.0	12.0	14.9	19.8	24.5	30.4
20	14	0.96	0.24	12	3.3	4.1	5.4	6.7	8.9	11.0	13.7
21	Dam No. 2	0.96	0.24	12	3.3	4.1	5.4	6.7	8.9	11.0	13.7
22	14-15	1.70	0.29	27	3.6	4.4	5.9	7.3	9.7	12.1	14.9
23	14-16	2.36	0.36	47	4.0	4.8	6.4	8.0	10.6	13.1	16.3
24	1-16,18	9.98	0.31	73	10.0	12.2	16.2	20.1	26.7	33.1	41.1
25	1-16,17-18	12.13	0.30	93	10.6	12.9	17.2	21.3	28.3	35.0	43.4
26	20	1.41	0.28	25	3.1	3.8	5.0	6.2	8.3	10.3	12.8
27	19-20	2.39	0.28	38	3.7	4.5	6.0	7.5	9.9	12.3	15.3
28	1-20	14.52	0.30	83	12.7	15.4	20.5	25.5	33.8	41.9	52.0
29	1-20,23	15.12	0.30	101	11.2	13.7	18.2	22.5	29.9	37.1	46.0
30	21	0.51	0.28	68	0.5	0.6	0.8	1.0	1.3	1.6	2.0
31	22	0.57	0.24	59	0.5	0.6	0.8	0.9	1.2	1.5	1.9
32	21-22	1.08	0.28	59	1.0	1.2	1.5	1.9	2.5	3.2	3.9
33	21-22,25	1.46	0.28	83	1.1	1.3	1.8	2.2	2.9	3.7	4.5
34	1-23,25	16.58	0.30	101	12.3	15.0	19.9	24.7	32.6	40.7	50.5
35	1-25	17.12	0.29	118	10.8	13.1	17.5	21.7	28.8	35.7	44.3
36	26	73.58	0.32	118	51.1	62.4	82.9	102.8	136.6	169.2	208.9
37	27	93.73	1.00	118	73.9	89.3	118.8	147.2	195.6	242.5	300.7
38	1-27	124.43	0.50	118	135.1	164.6	219.2	271.6	350.9	447.2	554.6

Runoff Calculation by Rational Method

Quied Enkhkhel Basin

(Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo	to (min)	ol. vo (m/s)	L1 (v=1.5) (km)	L2 (v=1.0) (km)	L3 (v=0.5) (km)	L3 (min)	Calc. to (min)	Design to (min)	Calc. Q(100) (l/100) (mm/h)	Calc. Q(100) (sum/s)	Spillover Discharge (cum/secs.km)
1	1	0.32	0.28	0.250	36	0.14000	17	2.91	1.43	1.000	16.67		19.58	20	140.03	3.5	10.8
2	2	0.35	0.33	1.000	70	0.07200	114	11.07	1.51				11.07	11	230.00	7.4	21.1
3	1-2	0.67	0.31	0.250	36	0.14000	17	2.91	1.43	1.000	16.67		19.58	20	140.03	8.1	12.1
4	1-3	0.69	0.35	0.250	36	0.14000	17	2.91	1.43	1.500	25.00		27.91	28	105.91	9.2	10.3
5	6	1.56	0.24	3.500	225	0.06433	116	30.01	1.94				30.01	30	100.02	10.4	6.7
6	4	0.80	0.32	1.500	160	0.10667	119	12.86	1.94				12.86	13	200.22	10.7	17.8
7	4-5	1.22	0.32	1.500	160	0.10667	119	12.86	1.94	1.250	20.83		33.69	34	90.15	9.8	9.0
8	1-6	3.67	0.23	1.500	160	0.10667	119	12.86	1.94	1.250	20.83		33.69	34	90.15	26.7	7.3
9	1-7	4.72	0.31	1.500	160	0.10667	119	12.86	1.94	3.250	54.17		67.03	67	51.34	20.9	4.4
10	9	1.14	0.20	1.300	195	0.15000	17	10.10	2.15				10.10	10	240.93	15.8	13.8
11	Dam No.1	1.14	0.20	1.300	195	0.15000	17	10.10	2.15				10.10	10	240.93	15.8	13.8
12	9-10	1.87	0.25	2.250	215	0.09556	110	18.33	2.05				18.33	18	152.83	19.8	10.6
13	9-11	2.16	0.26	2.750	215	0.07818	113	23.11	1.98				23.11	23	124.70	19.5	9.0
14	9	0.25	0.20	0.800	90	0.11250	119	7.76	1.72				7.76	8	293.58	4.2	16.6
15	8-15	0.29	0.20	0.800	90	0.11250	119	7.76	1.72	0.850	2.78		10.54	11	230.00	3.7	12.8
16	8-11-15	2.45	0.26	2.750	215	0.07818	113	23.11	1.98				23.11	23	124.70	22.1	9.0
17	8-12-15	2.74	0.28	2.750	215	0.07818	113	23.11	1.98	1.100	16.33		41.45	41	77.17	18.4	6.0
18	1-12-15	7.46	0.30	1.500	160	0.10667	119	12.86	1.94	3.250	54.17		67.03	67	51.34	31.9	4.3
19	1-13-15	7.62	0.30	1.500	160	0.10667	119	12.86	1.94	3.500	60.00		72.86	73	47.81	30.4	4.0
20	14	0.96	0.24	1.250	100	0.09000	113	12.48	1.67				12.48	12	213.98	13.7	14.3
21	Dam No.2	0.96	0.24	1.250	100	0.09000	113	12.48	1.67				12.48	12	213.98	13.7	14.3
22	14-15	1.70	0.23	1.250	100	0.09000	113	12.48	1.67	0.850	14.17		26.55	27	103.16	14.9	8.8
23	14-16	2.36	0.36	1.250	100	0.09000	113	12.48	1.67	2.100	35.00		47.48	47	68.90	18.3	6.9
24	1-16-15	9.99	0.31	1.500	160	0.10667	119	12.86	1.94	3.600	60.00		72.86	73	47.81	41.1	4.1
25	1-16-17-15	12.13	0.30	1.500	160	0.10667	119	12.86	1.94	4.000	70.00		82.86	83	42.98	43.4	3.6
26	20	1.41	0.28	2.800	187	0.06679	115	24.90	1.87				24.90	25	116.35	12.8	9.1
27	19-20	2.39	0.28	2.800	187	0.06679	115	24.90	1.87	0.800	13.33		38.23	38	82.20	15.3	6.4
28	1-20	14.52	0.30	1.500	160	0.10667	119	12.86	1.94	4.200	70.00		82.86	83	42.98	52.0	3.8
29	1-20-23	15.12	0.30	1.500	160	0.10667	119	12.86	1.94	5.000	80.00		101.19	101	38.52	48.0	3.0
30	21	0.51	0.28	1.700	3	0.00176	1267	68.69	0.41				68.69	68	50.10	2.0	3.9
31	22	0.57	0.24	1.500	2	0.00133	1750	69.49	0.36				69.49	69	50.10	1.9	3.3
32	21-22	1.08	0.26	1.500	2	0.00133	1750	69.49	0.36				69.49	69	50.10	3.9	3.8
33	21-22-25	1.46	0.26	1.500	2	0.00133	1750	69.49	0.36			0.400	82.82	83	42.98	4.5	3.1
34	1-23-25	16.59	0.30	1.500	160	0.10667	119	12.86	1.94	5.000	80.00		101.19	101	38.52	50.5	3.0
35	1-25	17.12	0.29	1.500	160	0.10667	119	12.86	1.94	6.000	105.00		117.86	118	38.09	44.3	2.6
36	26	73.58	0.32	1.800	160	0.10667	119	12.86	1.94	6.000	105.00		117.86	118	38.09	209.9	2.9
37	27	33.73	1.00	1.500	160	0.10667	119	12.86	1.94	6.000	105.00		117.86	118	38.09	300.7	6.9
38	1-27	124.43	0.50	1.500	160	0.10667	119	12.86	1.94	6.000	105.00		117.86	118	38.09	554.8	4.5

Note:  $(\text{mm/h}) = 403.7 \times T(\text{year})^{0.31} / (\text{min})^{0.63}$

Runoff Calculation by Rational Method

Qued Ernkhiilet Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. f	Design to (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	0.36	0.39	20	1.2	1.4	1.9	2.4	3.2	3.9	4.9
2	2	0.35	0.44	11	2.4	2.9	3.9	4.9	6.4	7.9	9.8
3	1-2	0.67	0.42	20	2.7	3.3	4.3	5.4	7.1	8.8	10.9
4	1-3	0.69	0.50	26	3.2	3.9	5.2	6.4	8.5	10.8	13.1
5	6	1.56	0.28	30	2.7	3.3	4.5	5.5	7.3	9.1	11.3
6	4	0.80	0.50	13	4.1	5.0	6.6	8.2	10.9	13.5	16.7
7	4-5	1.22	0.53	34	3.9	4.8	6.4	7.8	10.5	13.1	16.2
8	1-6	3.67	0.41	34	3.2	11.2	14.9	18.4	24.5	30.4	37.7
9	1-7	4.72	0.50	67	8.2	10.0	13.3	16.5	21.8	27.1	33.7
10	9	1.14	0.20	10	3.8	4.7	6.2	7.7	10.3	12.7	15.9
11	Dam No. 1	1.14	0.20	10	3.9	4.7	6.2	7.7	10.3	12.7	15.9
12	9-10	1.97	0.27	18	6.2	6.4	8.5	10.5	13.9	17.3	21.4
13	8-11	2.16	0.34	23	6.2	7.6	10.1	12.5	16.6	20.5	25.4
14	8	0.25	0.27	8	1.4	1.7	2.2	2.8	3.7	4.5	5.8
15	8-18	0.29	0.34	11	1.5	1.9	2.5	3.1	4.1	5.1	6.3
16	8-11-18	2.45	0.34	23	7.0	8.6	11.4	14.1	18.9	23.3	28.9
17	8-12-18	2.74	0.39	41	5.8	6.8	9.1	11.2	14.9	18.5	22.9
18	1-12-18	7.46	0.46	67	11.9	14.5	19.3	24.0	31.8	39.5	48.9
19	1-13-18	7.82	0.46	73	11.3	13.9	18.4	22.8	30.3	37.5	46.8
20	14	0.96	0.28	12	3.6	4.4	5.9	7.3	9.7	12.0	14.8
21	Dam No. 2	0.96	0.28	12	3.6	4.4	5.9	7.3	9.7	12.0	14.8
22	14-15	1.70	0.36	27	4.5	5.5	7.3	9.1	12.1	15.0	18.6
23	14-16	2.36	0.47	47	5.2	6.3	8.4	10.4	13.8	17.1	21.2
24	1-16-18	9.99	0.47	73	15.2	18.5	24.6	30.5	40.5	50.2	62.3
25	1-16-17-18	12.13	0.47	93	16.6	20.2	26.9	33.3	44.3	54.9	68.1
26	20	1.41	0.32	25	3.6	4.3	5.8	7.1	9.5	11.8	14.8
27	19-20	2.39	0.39	38	5.2	6.3	8.4	10.4	13.8	17.2	21.3
28	1-20	14.52	0.46	83	19.4	23.7	31.5	39.0	51.9	64.3	79.7
29	1-20-23	15.12	0.47	101	17.6	21.4	28.5	35.3	46.9	58.1	72.1
30	21	0.51	0.80	69	1.4	1.7	2.2	2.8	3.7	4.8	5.7
31	22	0.57	0.80	69	1.5	1.9	2.5	3.1	4.1	5.1	6.3
32	21-22	1.08	0.80	69	2.9	3.6	4.8	5.9	7.8	9.7	12.0
33	21-22-25	1.48	0.80	93	3.4	4.1	5.5	6.8	8.1	11.2	13.9
34	1-23-25	16.59	0.50	101	20.5	25.0	33.2	41.2	54.7	67.8	84.1
35	1-25	17.12	0.51	118	18.0	23.1	30.8	38.1	50.6	62.8	77.8
36	26	79.58	0.50	119	79.9	97.4	129.9	160.6	213.4	264.5	328.0
37	27	38.73	1.00	118	73.3	86.3	118.8	147.2	195.6	242.5	300.7
38	1-27	124.43	0.84	118	173.0	210.9	280.5	347.6	461.9	572.4	709.9

Runoff Calculation by Rational Method

Qued Errikhlet Basin

(Future Land Use Condition)

Calc. Point	Sub-Basin Combination	Total Area (sq.km)	Runoff Coeff. $\frac{1}{T}$	Lo (km)	Mo	Average slope for Lo	to (min)	of. vo (m/s)	L1 (v=1.5) (km)	L2 (v=1.0) (km)	L3 (v=0.5) (km)	Calc. to (min)	Design to (min)	Calc. to (min)	Calc. Q(100) (cumec/s)	Specific Discharge (cumec/s/km)
1	1	0.32	0.39	0.250	35	0.14000	1.7	2.91		1.000	16.67	19.59	20	140.03	4.9	15.2
2	2	0.35	0.44	1.000	70	0.07000	1/4	1.51		1.000	16.67	11.07	11	230.00	9.8	28.1
3	1-2	0.67	0.42	0.250	35	0.14000	1.7	2.91		1.000	16.67	19.59	20	140.03	10.9	16.3
4	1-3	0.89	0.50	0.250	35	0.14000	1.7	2.91		1.500	25.00	27.81	28	105.91	13.1	14.7
5	5	1.56	0.26	3.500	225	0.06400	1/16	30.01				30.01	30	100.02	11.3	7.2
6	4	0.60	0.50	1.500	160	0.10667	1/9	12.86				12.86	13	200.22	16.7	27.9
7	4-5	2.16	0.53	1.500	160	0.10667	1/9	12.86		1.250	20.83	33.59	34	90.15	16.2	13.3
8	1-6	3.67	0.41	1.500	160	0.10667	1/9	12.86		1.250	20.83	33.59	34	90.15	37.7	10.3
9	1-7	4.72	0.50	1.500	160	0.10667	1/9	12.86		3.250	54.17	67.03	67	51.34	33.7	7.1
10	9	1.14	0.20	1.300	195	0.15000	1/7	10.10				10.10	10	248.93	15.8	13.9
11	9-10	1.87	0.27	2.250	215	0.09556	1/10	18.33				18.33	18	162.83	21.4	11.5
12	11	2.16	0.34	2.750	215	0.07816	1/13	23.11				23.11	23	124.70	25.4	11.8
13	8	0.25	0.27	0.800	90	0.11250	1/9	7.76				7.76	8	288.59	3.8	22.5
14	8-18	0.29	0.34	0.800	90	0.11250	1/9	7.76	0.250			10.54	11	230.00	6.3	21.7
15	8-11-18	2.45	0.34	2.750	215	0.07816	1/13	23.11				23.11	23	124.70	28.9	11.8
16	8-12-19	2.74	0.33	2.750	215	0.07816	1/13	23.11		1.100	18.33	41.45	41	77.17	22.9	8.4
17	1-12-19	7.46	0.46	1.500	160	0.10667	1/9	12.86		3.250	54.17	67.03	67	51.34	48.9	6.8
18	1-13-19	7.62	0.46	1.500	160	0.10667	1/9	12.86		3.600	60.00	72.86	73	47.81	46.8	6.1
19	14	0.96	0.26	1.250	100	0.08000	1/13	12.48				12.48	12	213.99	14.8	15.5
20	20	0.96	0.26	1.250	100	0.08000	1/13	12.48				12.48	12	213.99	14.8	15.5
21	Dam No. 2	0.96	0.26	1.250	100	0.08000	1/13	12.48		0.850	14.17	12.48	12	213.99	14.8	15.5
22	14-15	1.70	0.36	1.250	100	0.09000	1/13	12.48		2.100	35.00	26.65	27	109.16	19.8	10.8
23	14-16	2.36	0.47	1.250	100	0.08000	1/13	12.48		3.000	60.00	47.49	47	68.90	21.2	9.0
24	1-15-19	8.98	0.47	1.500	160	0.10667	1/9	12.86		4.200	70.00	72.86	73	47.81	62.3	8.2
25	1-16-17-18	12.13	0.47	1.500	160	0.10667	1/9	12.86				82.86	83	42.99	68.1	5.6
26	20	1.41	0.32	2.800	187	0.06879	1/15	24.30				24.30	25	116.36	14.8	10.3
27	19-20	2.39	0.39	2.800	187	0.06879	1/15	24.30		0.800	13.33	38.23	38	82.20	21.3	8.9
28	1-20	14.52	0.46	1.500	160	0.10667	1/9	12.86		4.200	70.00	82.86	83	42.99	79.7	5.5
29	1-20-23	15.12	0.47	1.500	160	0.10667	1/9	12.86		5.300	88.33	101.19	101	36.52	72.1	4.8
30	21	0.51	0.60	1.700	3	0.00176	1/567	68.69				68.69	69	60.10	6.3	11.1
31	22	0.57	0.60	1.500	2	0.00133	1/750	69.49				69.49	69	60.10	6.3	11.1
32	21-22	1.08	0.60	1.500	2	0.00133	1/750	69.49				69.49	69	60.10	6.3	11.1
33	21-22-25	1.46	0.60	1.500	2	0.00133	1/750	69.49				69.49	69	60.10	6.3	11.1
34	1-23-25	15.58	0.50	1.500	160	0.10667	1/9	12.86		5.300	88.33	82.86	83	42.99	13.9	3.8
35	1-25	17.12	0.51	1.500	160	0.10667	1/9	12.86		6.300	105.00	101.19	101	36.52	64.1	5.1
36	26	73.58	0.50	1.500	160	0.10667	1/9	12.86		6.300	105.00	117.86	118	32.09	77.8	4.5
37	27	33.73	1.00	1.500	160	0.10667	1/9	12.86		6.300	105.00	117.86	118	32.09	308.0	4.5
38	1-27	124.43	0.64	1.500	160	0.10667	1/9	12.86		6.300	105.00	117.86	118	32.09	709.9	5.7

Note:  $l(m/h) = 493.7 \times T(\text{year})^{0.31} / (l(\text{min}))^{0.63}$



Runoff Calculation by Rational Method												Qued Greb Basin												(Present Land Use)											
Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)																								
1	1	1.10	0.20	15	2.6	3.2	4.3	5.3	7.1	8.8	10.9																								
2	Dam 1 (B.greb)	1.10	0.20	15	2.6	3.2	4.3	5.3	7.1	8.8	10.9																								
3	1,2	1.99	0.25	22	4.4	5.3	7.1	8.8	11.6	14.4	17.9																								
4	Dam 2 (R.B. A)	1.99	0.25	22	4.4	5.3	7.1	8.8	11.6	14.4	17.9																								
5	1,2,3	2.50	0.28	30	4.7	5.8	7.7	9.5	12.7	15.7	19.4																								
6	4	0.63	0.36	15	3.6	4.4	5.8	7.2	9.6	11.9	14.8																								
7	Dam 3 (Ennasr)	0.63	0.36	15	3.6	4.4	5.8	7.2	9.6	11.9	14.8																								
8	4,5	1.03	0.37	20	3.6	4.4	5.9	7.3	9.6	12.0	14.8																								
9	1,2,3,4,5	3.53	0.30	30	7.2	8.7	11.6	14.4	19.1	23.7	29.4																								
10	Dam 4 (EGU-4)	3.53	0.30	30	7.2	8.7	11.6	14.4	19.1	23.7	29.4																								
11	1,2,3,4,5,6	5.05	0.38	42	8.8	12.0	15.9	19.7	26.2	32.5	40.3																								
12	1,2,3,4,5,6,7	6.02	0.41	59	9.5	11.8	15.5	19.2	25.4	31.5	39.1																								
13	1,2,3,4,5,6,7,8	7.06	0.43	74	9.7	11.8	15.8	19.5	25.9	32.1	39.9																								
14	Dam 5 (EGU-7)	7.06	0.43	74	9.7	11.8	15.8	19.5	25.9	32.1	39.8																								
15	1,2,3,4,5,6,7,8,9	8.23	0.43	87	9.0	11.0	14.7	18.2	24.2	29.9	37.1																								
16	11	1.14	0.20	19	2.3	2.7	3.7	4.5	6.0	7.5	9.3																								
17	Dam 6 (B.Rotiche)	1.14	0.20	19	2.3	2.7	3.7	4.5	6.0	7.5	9.3																								
18	11,12	3.29	0.28	32	5.9	7.2	9.6	11.9	15.8	19.6	24.3																								
19	Dam 7 (ERO-3)	3.29	0.28	32	5.9	7.2	9.6	11.9	15.8	19.6	24.3																								
20	11,12,13	3.60	0.28	34	6.1	7.5	10.0	12.4	16.4	20.4	25.2																								
21	Dam 8 (ERO-3b)	3.60	0.28	34	6.1	7.5	10.0	12.4	16.4	20.4	25.2																								
22	11,12,13,14	6.20	0.35	68	7.4	9.1	12.1	15.0	19.9	24.6	30.6																								
23	11,12,13,14,15	7.43	0.38	76	8.8	10.8	14.3	17.8	23.6	29.2	36.3																								
24	11,12,13,14,15,16	8.44	0.41	101	9.6	11.7	15.5	19.2	25.5	31.7	39.3																								
25	Dam 9 (ERO-5)	8.44	0.41	101	9.6	11.7	15.5	19.2	25.5	31.7	39.3																								
26	11,12,13,14,15,16,17	9.78	0.41	112	9.1	11.1	14.7	18.3	24.3	30.1	37.3																								
27	1-9,11-17	18.01	0.42	112	17.2	20.9	27.8	34.5	45.8	56.8	70.4																								
28	1-17	18.87	0.42	130	15.9	19.4	25.8	31.9	42.4	52.6	65.2																								

Calc. Point	Sub-Basin Combination	Total Area (sq km)	Runoff Coeff. $C_p$	$L_o$ (km)	$H_o$ (m)	Average slope for $L_o$		$t_o$ (min)	$C_f$ $v_o$ (m/s)	$L_1$ (km) $(v=2.0)$	$t_1$ (min)	$L_2$ (km) $(v=1.0)$	$t_2$ (min)	Calc. to (min)	Design to (min)	Calc. $Q(100)$ (mm/h)	Calc. $Q(100)$ (cu m/s)	Specific Discharge (cu m/s/sq km)
1	1	1.10	0.20	1.750	160	0.09143	1/11	15.36	1.90					15.36	15	177.50	10.9	9.9
2	Dam 1 (B.greb)	1.10	0.20	1.750	160	0.09143	1/11	15.36	1.90					15.36	15	177.50	10.9	9.9
3	1,2	1.89	0.25	1.750	160	0.09143	1/11	15.36	1.90	0.800	5.67			22.03	22	129.38	17.9	9.0
4	Dam 2 (R.B. A)	1.98	0.25	1.750	160	0.09143	1/11	15.36	1.90	0.800	5.67			22.03	22	129.38	17.9	9.0
5	1,2,3	2.50	0.28	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			30.36	30	100.02	19.4	7.8
6	4	0.83	0.36	1.500	105	0.07000	1/14	15.12	1.65					15.12	15	177.50	14.8	17.8
7	Dam 3 (Ennaur)	0.83	0.36	1.500	105	0.07000	1/14	15.12	1.65					15.12	15	177.50	14.8	17.8
8	4,5	1.03	0.37	1.500	105	0.07000	1/14	15.12	1.65			0.900	5.00	20.12	20	140.03	14.8	14.4
9	1,2,3,4,5	3.59	0.30	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			30.36	30	100.02	29.4	8.3
10	Dam 4 (EGU-4)	3.59	0.30	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			30.36	30	100.02	29.4	8.3
11	1,2,3,4,5,6	5.05	0.38	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			42.03	42	75.55	40.3	8.0
12	1,2,3,4,5,6,7	6.02	0.41	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			59.70	59	57.05	39.1	5.5
13	1,2,3,4,5,6,7,8	7.06	0.43	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			73.70	74	47.27	36.9	5.8
14	Dam 5 (EGU-7)	7.06	0.43	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			73.70	74	47.27	36.9	5.5
15	1,2,3,4,5,6,7,8,9	8.23	0.43	1.750	160	0.09143	1/11	15.36	1.90	1.800	15.00			87.03	87	37.76	37.1	4.5
16	11	1.14	0.20	2.000	140	0.07000	1/14	18.87	1.77					18.87	19	146.12	9.3	8.1
17	Dam 6 (B.Rolche)	1.14	0.20	2.000	140	0.07000	1/14	18.87	1.77					18.87	19	146.12	9.3	8.1
18	11,12	3.29	0.28	2.000	140	0.07000	1/14	18.87	1.77	1.800	13.33			32.21	32	94.80	24.3	7.4
19	Dam 7 (ERO-9)	3.29	0.28	2.000	140	0.07000	1/14	18.87	1.77	1.800	13.33			32.21	32	94.80	24.3	7.4
20	11,12,13	3.60	0.28	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			34.29	34	90.15	25.2	7.0
21	Dam 8 (ERO-3b)	3.60	0.28	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			34.29	34	90.15	25.2	7.0
22	11,12,13,14	6.20	0.35	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			67.62	68	50.71	30.6	4.9
23	11,12,13,14,15	7.43	0.38	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			75.96	76	46.24	36.3	4.5
24	11,12,13,14,15,16	9.44	0.41	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			100.96	101	36.52	39.3	4.2
25	Dam 9 (ERO-5)	9.44	0.41	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			100.96	101	36.52	39.3	4.2
26	11,12,13,14,15,16,17	9.76	0.41	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			111.79	112	33.51	37.3	3.8
27	1-9,11-17	18.01	0.42	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			111.79	112	33.51	70.4	3.9
28	1-17	18.87	0.42	2.000	140	0.07000	1/14	18.87	1.77	1.850	15.42			130.12	130	29.81	65.2	3.5

Note:  $t_1(\text{mm/h}) = 408.7 \times T(\text{year})^{-0.31} / t(\text{min})^{-0.83}$

Runoff Calculation by Rational Method

Oued Greb Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design to (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	1.10	0.20	15	2.6	3.2	4.3	5.3	7.1	8.8	10.9
2	Dam 1 (B.greb)	1.10	0.20	15	2.6	3.2	4.3	5.3	7.1	8.8	10.9
3	1,2	1.99	0.39	22	8.8	8.3	11.0	13.7	18.1	22.5	27.9
4	Dam 2 (R.B. A)	1.99	0.39	22	8.8	8.3	11.0	13.7	18.1	22.5	27.9
5	1,2,3	2.50	0.44	30	7.4	9.1	12.1	15.0	19.9	24.8	30.6
6	4	0.83	0.62	15	6.2	7.6	10.0	12.4	16.5	20.5	25.4
7	Dam 3 (Ennasr)	0.83	0.62	15	6.2	7.6	10.0	12.4	16.5	20.5	25.4
8	4,5	1.03	0.65	20	6.3	7.7	10.3	12.8	16.9	21.0	26.0
9	1,2,3,4,5	3.53	0.50	30	11.8	14.6	19.4	24.0	31.9	39.5	49.0
10	Dam 4 (EGU-4)	3.53	0.50	30	11.9	14.8	19.4	24.0	31.9	39.5	49.0
11	1,2,3,4,5,6	5.05	0.59	42	15.3	18.6	24.7	30.7	40.7	50.5	62.6
12	1,2,3,4,5,6,7	6.02	0.62	59	14.4	17.6	23.4	29.0	38.5	47.7	59.2
13	1,2,3,4,5,6,7,8	7.06	0.64	74	14.5	17.6	23.4	29.1	38.6	47.8	59.3
14	Dam 5 (EGU-7)	7.06	0.64	74	14.5	17.6	23.4	29.1	38.6	47.8	59.3
15	1,2,3,4,5,6,7,8,9	8.23	0.65	87	13.7	16.7	22.2	27.5	36.5	45.2	56.1
16	11	1.14	0.20	19	2.3	2.7	3.7	4.5	6.0	7.5	9.3
17	Dam 6 (B.Roriche)	1.14	0.20	19	2.3	2.7	3.7	4.5	6.0	7.5	9.3
18	11,12	3.29	0.47	32	9.9	12.1	16.1	19.9	26.5	32.8	40.7
19	Dam 7 (ERO-3)	3.29	0.47	32	9.9	12.1	16.1	19.9	26.5	32.8	40.7
20	11,12,13	3.60	0.50	34	11.0	13.4	17.8	22.1	29.3	36.3	45.1
21	Dam 8 (ERO-3b)	3.60	0.50	34	11.0	13.4	17.8	22.1	29.3	36.3	45.1
22	11,12,13,14	6.20	0.63	68	13.4	16.3	21.7	26.9	35.8	44.4	55.0
23	11,12,13,14,15	7.43	0.66	76	15.3	18.7	24.9	30.8	41.0	50.8	63.0
24	11,12,13,14,15,16	9.44	0.67	101	15.6	19.1	25.4	31.4	41.7	51.7	64.2
25	Dam 8 (ERO-5)	9.44	0.67	101	15.6	19.1	25.4	31.4	41.7	51.7	64.2
26	11,12,13,14,15,16,17	9.78	0.68	112	15.1	18.4	24.5	30.3	40.3	49.8	61.9
27	1-9,11-17	18.01	0.67	112	27.4	33.4	44.4	55.0	73.1	90.6	112.3
28	1-17	18.87	0.67	130	25.3	30.9	41.1	50.9	67.7	83.9	104.0

Runoff Calculation by Rational Method

Qued Grab Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. $f$	$L_o$ (km)	$H_o$ (m)	Average slope for $L_o$		$t_o$ (min)	$d_f$ (m/s)	$L_1$ (km)	$t_1$ (min)	$L_2$ (km)	$t_2$ (min)	Calc. to (min)	Design to (min)	Calc. $I(100)$ (mm/h)	Calc. $Q(100)$ (cu m/s)	Specific Discharge (cu m/s/sq km)
1	1	1.10	0.20	1.750	160	S	I	15.36	1.90	0.800	15.00	0.300	5.00	15.36	15	177.90	10.9	9.9
2	Dam 1 (B grab)	1.10	0.20	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	15.36	15	177.90	10.9	9.9
3	1.2	1.99	0.39	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	22.03	22	129.38	27.9	14.0
4	Dam 2 (A,B,A)	1.99	0.39	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	22.03	22	129.38	27.9	14.0
5	1.2,3	2.60	0.44	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	30.96	30	100.02	50.6	12.2
6	4	0.63	0.62	1.500	105	0.07000	1/4	15.12	1.65	1.000	15.00	0.300	5.00	15.12	15	177.90	25.4	30.8
7	Dam 3 (Ennaar)	0.63	0.62	1.500	105	0.07000	1/4	15.12	1.65	1.000	15.00	0.300	5.00	15.12	15	177.90	25.4	30.8
8	4.5	1.03	0.65	1.500	105	0.07000	1/4	15.12	1.65	1.000	15.00	0.300	5.00	20.12	20	140.03	26.0	25.3
9	1.2,3,4,5	3.53	0.50	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	30.96	30	100.02	49.0	13.9
10	Dam 4 (EGU-4)	3.53	0.50	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	30.96	30	100.02	49.0	13.9
11	1.2,3,4,5,6	5.05	0.59	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	42.09	42	75.55	82.6	12.4
12	1.2,3,4,5,6,7	6.02	0.62	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	58.70	59	57.05	59.2	9.8
13	1.2,3,4,5,6,7,8	7.06	0.64	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	73.70	74	47.27	59.3	8.4
14	Dam 5 (EGU-7)	7.06	0.64	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	73.70	74	47.27	59.3	8.4
15	1.2,3,4,5,6,7,8,9	8.23	0.65	1.750	160	0.09143	1/1	15.36	1.90	0.800	15.00	0.300	5.00	97.03	97	37.75	56.1	6.6
16	11	1.14	0.20	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	18.87	19	146.12	9.3	6.1
17	Dam 6 (B Riche)	1.14	0.20	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	18.87	19	146.12	9.3	6.1
18	11,12	3.29	0.47	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	32.21	32	94.80	40.7	12.4
19	Dam 7 (ERO-3)	3.29	0.47	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	32.21	32	94.80	40.7	12.4
20	11,12,13	3.60	0.50	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	34.29	34	90.15	45.1	12.5
21	Dam 8 (ERO-3b)	3.60	0.50	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	34.29	34	90.15	45.1	12.5
22	11,12,13,14	6.20	0.53	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	57.62	58	50.71	55.0	8.9
23	11,12,13,14,15	7.49	0.66	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	75.96	76	46.24	63.0	6.5
24	11,12,13,14,15,16	9.44	0.67	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	100.96	101	36.52	64.2	6.8
25	Dam 9 (ERO-5)	9.44	0.67	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	100.96	101	36.52	64.2	6.8
26	11,12,13,14,15,16,17	9.78	0.68	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	111.79	112	33.51	61.9	5.3
27	1-9,11-17	18.01	0.67	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	111.79	112	33.51	112.9	6.2
28	1-17	18.87	0.67	2.000	140	0.07000	1/4	18.87	1.77	1.000	15.00	0.300	5.00	130.12	130	29.61	104.0	5.6

Note:  $t = (L_o/H_o) \times T(\text{year})^{0.31} / (f(\text{min}))^{0.63}$



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Amount Calculated by Reflected Method

Omic Point	Sub-beam Combination	Total Area (acres)	Runoff Coeff	Lo (mi)	Ho (ft)	Average slope		to (min)	c (m/s)	L1 (v=3.0) (mi)	t1 (min)	L2 (v=2.0) (mi)	t2 (min)	Omic to (min)	Design (c)	Omic (1100) (mm/hr)	Calc. (1100) (mm/hr)	Specific Discharge (cu. in./sq. mi./hr)
						s	f											
1	1	2.36	6.20	3.500	230	0.04371	1/15	23.75	1.98		23.75	30	100.02	15.1				5.5
2	2	2.36	0.20	3.500	230	0.04371	1/15	23.75	1.98		23.75	30	100.02	15.1				5.5
3	3	8.99	0.20	3.500	530	0.04371	1/15	29.75	1.98	0.500	2.75	33	92.41	20.9				5.1
4	4	4.47	0.24	4.500	270	0.03000	1/17	37.59	2.01			37	84.04	25.0				9.5
5	5	4.47	0.24	4.500	270	0.03000	1/17	37.59	2.01			37	84.04	25.0				9.5
6	6	6.00	0.23	4.500	285	0.04353	1/18	36.62	2.05	1.500	0.33	45	71.44	28.5				4.8
7	7	9.79	0.22	4.500	285	0.04353	1/18	36.62	2.05	1.500	0.33	45	71.44	28.5				4.4
8	8	18.28	0.22	4.500	285	0.04353	1/18	36.62	2.05	2.500	13.89	51	64.09	32.2				3.9
9	9	13.82	0.22	4.500	285	0.04353	1/18	36.62	2.05	2.500	13.89	51	64.09	32.2				3.9
10	10	13.82	0.22	4.500	285	0.04353	1/18	36.62	2.05	2.500	17.78	54	61.46	31.1				3.8
11	11	9.94	0.24	5.500	165	0.03000	1/23	55.99	1.51			57	38.71	36.9				5.9
12	12	9.94	0.24	5.500	165	0.03000	1/23	55.99	1.51			57	38.71	36.9				5.9
13	13	10.58	0.27	8.500	87	0.03000	1/23	55.99	1.51	0.500	2.78	60	36.48	38.9				3.6
14	14	25.83	0.23	9.500	165	0.03000	1/23	55.99	1.51	0.500	2.78	60	36.48	38.9				5.5
15	15	27.26	0.23	9.500	165	0.03000	1/23	55.99	1.51	1.500	6.59	65	32.65	37.7				0.4
16	16	1.99	0.32	2.000	43	0.02190	1/47	23.75	1.12			23	100.02	23.0				14.4
17	17	1.99	0.32	2.000	43	0.02190	1/47	23.75	1.12			23	100.02	23.0				14.4
18	18	28.63	0.23	3.500	165	0.03000	1/23	55.99	1.51	1.500	5.33	65	32.65	37.7				3.7
19	19	33.72	0.26	5.500	165	0.03000	1/23	55.99	1.51	5.000	18.97	74	47.27	115.1				5.4
20	20	41.80	0.28	3.500	165	0.03000	1/23	55.99	1.51	4.000	22.22	79	44.79	144.9				3.9
21	21	45.83	0.20	3.500	165	0.03000	1/23	55.99	1.51	5.500	30.35	86	40.94	140.7				0.3
22	22	42.63	0.20	5.500	165	0.03000	1/23	55.99	1.51	5.500	30.35	86	40.94	140.7				0.3
23	23	2.47	0.20	3.500	210	0.03000	1/17	35.61	1.98			31	97.33	19.8				5.4
24	24	2.47	0.20	3.500	210	0.03000	1/17	35.61	1.98			31	97.33	19.8				5.4
25	25	3.47	0.20	3.500	210	0.03000	1/17	35.61	1.98			3	97.33	19.8				5.4
26	26	3.32	0.24	2.500	85	0.04600	1/28	29.59	1.41			29	99.59	30.6				6.7
27	27	6.70	0.22	3.500	210	0.04000	1/17	50.61	1.89	1.000	5.35	36	85.07	35.2				5.3
28	28	10.84	0.25	3.500	210	0.03000	1/17	50.61	1.89	1.000	6.95	36	85.07	35.2				8.3
29	29	15.84	0.25	3.500	210	0.03000	1/17	50.61	1.89	3.000	10.87	47	80.93	73.8				4.3
30	30	19.11	0.31	3.500	210	0.04000	1/17	50.61	1.89	5.000	18.97	47	80.93	73.8				4.3
31	31	15.19	0.31	3.500	210	0.04000	1/17	50.61	1.89	5.000	18.97	47	80.93	73.8				5.1
32	32	3.11	0.32	3.500	85	0.02714	1/27	41.82	1.39	4.300	25.00	56	69.61	86.0				0.7
33	33	20						41.82	1.39	4.300	25.00	56	69.61	86.0				0.7
34	34	8.43	0.39	3.500	85	0.02714	1/27	41.82	1.39	1.000	5.56	47	68.93	40.9				7.5
35	35	9.43	0.39	3.500	85	0.02714	1/27	41.82	1.39	1.000	5.56	47	68.93	40.9				7.5
36	36	24.34	0.32	3.500	210	0.03000	1/17	50.61	1.89	4.900	22.00	56	69.61	86.0				5.3
37	37	24.96	0.33	3.500	210	0.03000	1/17	50.61	1.90	5.900	30.36	61	55.59	126.7				5.1
38	38	2.15	0.44	2.000	40	0.05900	1/46	28.05	1.19			28	105.91	14.9				12.9
39	39	1.15	0.44	2.000	40	0.05900	1/46	28.05	1.19			28	105.91	14.9				12.9
40	40	1.15	0.44	2.000	40	0.05900	1/46	28.05	1.19			28	105.91	14.9				12.9
41	41	8.39	0.40	2.000	80	0.02500	1/46	28.05	1.19	0.900	2.76	31	97.53	44.9				15.2
42	42	4.20	0.46	2.000	80	0.02500	1/46	28.05	1.19	0.900	2.76	31	97.53	44.9				15.2
43	43	4.20	0.46	2.000	80	0.02500	1/46	28.05	1.19	0.900	2.76	31	97.53	44.9				15.2
44	44	28.10	0.35	3.500	210	0.03000	1/17	50.61	1.89	5.500	30.56	61	55.59	197.0				5.4
45	45	20.80	0.35	3.500	210	0.03000	1/17	50.61	1.89	5.500	30.56	61	55.59	197.0				5.4
46	46	18.20						50.61	1.89	7.000	38.89	66	60.09	311.2				2.6
47	47	72.63	0.31	5.500	165	0.03000	1/23	55.99	1.51	6.500	30.36	81	55.59	197.0				5.4
48	48	72.63	0.31	5.500	165	0.03000	1/23	55.99	1.51	6.500	30.36	81	55.59	197.0				5.4
49	49	120.78	0.24	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				2.6
50	50	25.84	1.00	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
51	51	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
52	52	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
53	53	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
54	54	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
55	55	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
56	56	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
57	57	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
58	58	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
59	59	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
60	60	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
61	61	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
62	62	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
63	63	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
64	64	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
65	65	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
66	66	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
67	67	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
68	68	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
69	69	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
70	70	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
71	71	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
72	72	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
73	73	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
74	74	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
75	75	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
76	76	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.000	38.89	86	58.09	327.0				16.9
77	77	24.14	0.36	5.500	165	0.03000	1/23	55.99	1.51	7.								

Note:  $|\eta(\text{m})| = 499.7 \times T(\text{year}) \sim 0.51 / t(\text{min}) \sim 0.69$

Outc. Point	Sub-area Combination	Total Area (ac.)	Runoff Coeff. f	Design Ic (in)	Q (1.05) (cfs)	Q (2) (cfs)	Q (5) (cfs)	Q (10) (cfs)	Q (25) (cfs)	Q (50) (cfs)	Q (100) (cfs)
1	1	2.36	0.80	30	10.0	13.2	17.8	21.8	28.0	35.0	44.8
2	Dem 1 (EQA-2)	2.36	0.80	30	10.0	13.2	17.8	21.8	28.0	35.0	44.8
3	1-2	3.00	0.80	30	17.0	20.7	27.5	34.1	43.3	55.2	69.6
4	1-3	4.47	0.82	37	19.8	19.2	28.5	31.7	42.1	52.2	64.7
5	Dem 2 (EQA-4)	4.47	0.82	37	19.8	19.2	28.5	31.7	42.1	52.2	64.7
6	3-15	8.80	0.85	44	10.2	22.2	29.3	36.8	48.7	60.3	74.6
7	1-3-15	9.79	0.85	43	31.2	28.1	50.7	52.8	69.4	103.4	128.2
8	1-4-15	13.26	0.80	51	39.5	47.8	63.7	78.0	104.9	130.0	161.3
9	Dem 3 (EQA-3)	13.26	0.80	51	39.5	47.8	63.7	78.0	104.9	130.0	161.3
10	1-4-15	15.63	0.80	54	50.5	47.0	62.3	77.4	102.9	127.5	158.1
11	6	3.64	0.82	37	12.0	15.4	20.3	23.4	33.7	41.8	51.9
12	Dem 4 (EQA-2)	3.64	0.82	37	12.0	15.4	20.3	23.4	33.7	41.8	51.9
13	6-7	10.28	0.85	60	13.0	19.7	26.0	33.9	54.4	42.7	50.0
14	1-7-15	23.09	0.85	60	48.2	26.8	78.2	86.0	126.7	139.6	197.9
15	1-8-15	27.26	0.85	65	81.9	62.9	83.9	103.4	137.3	170.4	211.3
16	8	1.59	0.80	30	8.0	10.5	14.0	17.3	22.0	28.3	35.3
17	Dem 5 (D-Highway)	1.59	0.80	30	8.0	10.5	14.0	17.3	22.0	28.3	35.3
18	1-4-15	28.65	0.84	65	95.5	67.7	50.6	111.3	140.2	183.7	227.8
19	1-10-15	39.72	0.85	74	59.3	72.4	96.2	119.2	156.3	198.4	243.9
20	Dem 6 (EQA-3)	39.72	0.85	74	59.3	72.4	96.2	119.2	156.3	198.4	243.9
21	1-11-15	41.60	0.85	79	65.3	84.3	112.4	138.5	189.2	229.3	284.5
22	1-12-15	42.89	0.85	80	66.2	80.7	107.3	133.0	178.7	219.0	271.8
23	Dem 7 (EQA-1)	42.89	0.85	80	66.2	80.7	107.3	133.0	178.7	219.0	271.8
24	18	3.47	0.80	31	8.7	10.6	14.1	17.5	23.2	28.7	35.7
25	Dem 8 (EQA-3)	3.47	0.80	31	8.7	10.6	14.1	17.5	23.2	28.7	35.7
26	17	3.23	0.80	30	10.9	13.3	17.7	22.0	29.2	36.2	44.9
27	10-17	6.70	0.44	36	17.2	23.0	27.0	34.3	45.6	55.0	70.4
28	Dem 9 (EQA-2)	6.70	0.44	36	17.2	23.0	27.0	34.3	45.6	55.0	70.4
29	18-19	19.84	0.98	47	42.8	32.2	68.9	86.1	114.4	141.8	178.0
30	Dem 10 (EQA-4)	19.84	0.98	47	42.8	32.2	68.9	86.1	114.4	141.8	178.0
31	18-19	19.11	0.92	38	47.8	35.5	77.5	96.0	127.8	158.1	198.1
32	20	9.11	0.80	43	12.7	15.9	20.7	23.6	34.0	42.2	52.9
33	20-21	5.43	0.80	47	30.3	24.7	32.0	40.7	54.1	67.0	83.1
34	Dem 11 (EQA-2)	5.43	0.80	47	30.3	24.7	32.0	40.7	54.1	67.0	83.1
35	10-21	24.54	0.80	56	65.3	79.8	103.0	131.2	174.4	216.1	263.0
36	10-22	24.00	0.86	51	61.7	73.5	100.1	124.0	164.8	204.5	250.0
37	23	1.15	0.80	28	6.6	8.0	10.7	13.3	17.6	21.8	27.1
38	Dem 12 (EQA-4)	1.15	0.80	28	6.6	8.0	10.7	13.3	17.6	21.8	27.1
39	23-24	9.39	0.80	31	17.0	21.6	29.0	35.9	47.7	58.1	73.3
40	23-25	4.20	0.74	39	16.9	20.6	27.4	34.0	45.2	55.8	69.2
41	Dem 13 (EQA-2)	4.20	0.74	39	16.9	20.6	27.4	34.0	45.2	55.8	69.2
42	18-25	28.12	0.87	61	73.2	89.5	118.8	147.2	193.5	242.6	300.6
43	18-26	29.03	0.87	70	67.3	82.1	109.1	135.8	179.7	222.7	278.2
44	1-12-19-25	72.83	0.80	88	120.7	147.2	192.6	242.6	322.4	392.6	489.6
45	1-13-19-26	72.80	0.80	89	118.8	144.8	189.7	238.7	317.2	383.1	487.0
46	27	5.05	0.80	61	11.5	14.0	18.7	23.1	30.7	38.1	47.2
47	1-13-19-27	76.63	0.81	90	127.1	155.0	206.2	255.5	336.9	420.7	521.6
48	1-27	86.92	0.82	98	138.0	168.8	224.3	277.8	363.3	457.6	567.6
49	28	128.76	0.44	98	146.0	178.1	236.9	293.8	380.1	483.4	599.5
50	29	24.84	1.00	68	85.8	81.2	108.0	133.9	177.9	220.4	273.4
51	1-29	241.14	0.97	98	594.5	432.0	574.6	712.0	940.2	1172.6	1484.9

Runoff Calculation by Rational Method

Oved Gulluolu Basin

Urban Land Use

Calc Point	Sub-basin Combination	Total Area (ac.km)	Runoff Coeff. f	L <sub>0</sub> (km)	H <sub>0</sub> (m)	Average slope		to (min)	cf (m <sup>3</sup> /s)	L <sub>1</sub> (u=3.5) (km)	t <sub>1</sub> (min)	L <sub>2</sub> (u=2.5) (km)	t <sub>2</sub> (min)	Calc. tc (min)	Design TC (min)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/m <sup>2</sup> /s)
						s	for L <sub>0</sub>										
1	1	2.86	0.68	3,500	200	0.0571	1115	23.75	1.08				23.75	30	100.02	44.6	16.9
2	Den 1 (E0E-5)	2.86	0.68	3,500	200	0.0571	1115	23.75	1.08				23.75	30	100.02	44.6	16.9
3	1-2	2.92	0.68	3,500	200	0.0571	1115	23.75	1.08	0.502	2.78		32.03	33	82.41	89.5	17.5
4	1-3	4.47	0.62	4,500	270	0.0400	1117	37.39	2.01				37.39	37	84.04	84.7	14.5
5	Den 2 (E0E-4)	4.47	0.62	4,500	270	0.0400	1117	37.39	2.01				37.39	37	84.04	84.7	14.5
6	1-1,15	5.80	0.62	4,500	200	0.0333	1116	36.82	2.05	1.500	6.35		44.03	45	71.44	74.6	12.9
7	1-2,15	9.73	0.58	4,500	200	0.0333	1116	36.82	2.05	1.500	6.35		44.03	45	71.44	74.6	12.9
8	1-4,15	13.26	0.68	4,500	280	0.0333	1116	36.82	2.05	2.500	13.89		50.51	51	64.89	161.3	12.2
9	Den 3 (E0E-3)	13.26	0.68	4,500	280	0.0333	1116	36.82	2.05	2.500	13.89		50.51	51	64.89	161.3	12.2
10	1-5,15	13.03	0.68	4,500	265	0.0333	1118	36.82	2.05	2.200	17.78		54.40	54	61.40	155.1	11.6
11	6	9.94	0.52	3,500	185	0.03000	1123	39.95	1.81				50.59	57	58.71	51.9	5.2
12	Den 4 (E0E-2)	9.94	0.52	3,500	185	0.03000	1123	39.95	1.81				50.59	57	58.71	51.9	5.2
13	6-7	10.23	0.33	3,500	185	0.03000	1123	39.95	1.81	0.900	2.78		50.59	60	55.26	32.8	5.2
14	1-2,15	20.82	0.55	3,500	185	0.03000	1123	39.95	1.81	0.500	2.78		50.59	60	55.26	107.9	5.3
15	1-3,15	27.23	0.55	3,500	185	0.03000	1123	39.95	1.81	1.900	6.35		65.52	85	92.85	211.3	7.5
16	9	1.99	0.80	2,000	43	0.01500	1147	26.75	1.12				26.75	30	100.02	35.3	22.2
17	Den 5 (E0E-1)	1.99	0.80	2,000	43	0.01500	1147	26.75	1.12				26.75	30	100.02	35.3	22.2
18	1-4,15	28.85	0.54	3,500	185	0.03000	1123	39.95	1.81	1.500	6.35		65.52	83	92.85	227.6	7.9
19	1-10,15	33.72	0.55	3,500	185	0.03000	1123	39.95	1.81	0.000	16.87		73.60	74	47.27	243.9	7.2
20	Den 6 (E0E-4)	33.72	0.55	3,500	185	0.03000	1123	39.95	1.81	0.000	16.87		73.60	74	47.27	243.9	7.2
21	1-11,15	47.60	0.55	3,500	185	0.03000	1123	39.95	1.81	4.000	22.82		78.81	78	44.78	284.6	6.8
22	1-12,15	42.85	0.56	3,500	185	0.03000	1123	39.95	1.81	5.000	30.55		87.55	86	40.94	271.8	6.4
23	Den 7 (E0E-1)	42.85	0.56	3,500	185	0.03000	1123	39.95	1.81	5.000	30.55		87.55	86	40.94	271.8	6.4
24	15	3.47	0.38	3,500	210	0.02000	1117	30.81	1.89				30.81	31	27.33	35.7	10.3
25	Den 8 (E0E-5)	3.47	0.38	3,500	210	0.02000	1117	30.81	1.89				30.81	31	27.33	35.7	10.3
26	17	3.20	0.50	2,500	65	0.04000	1129	20.59	1.41				20.59	30	100.02	44.9	13.9
27	18-17	6.70	0.44	3,500	210	0.03000	1117	30.81	1.89	1.300	9.59		20.59	36	85.07	70.4	10.5
28	Den 9 (E0E-4)	6.70	0.44	3,500	210	0.03000	1117	30.81	1.89	1.300	9.59		20.59	36	85.07	70.4	10.5
29	18-19	11.84	0.58	3,500	210	0.03000	1117	30.81	1.89	3.000	16.87		27.48	47	68.20	179.6	11.1
30	Den 10 (E0E-6)	11.84	0.58	3,500	210	0.03000	1117	30.81	1.89	3.000	16.87		27.48	47	68.20	179.6	11.1
31	18-19	16.11	0.62	3,500	210	0.03000	1117	30.81	1.90	4.000	23.00		27.48	47	68.20	179.6	11.1
32	20	3.11	0.90	3,500	65	0.02714	1127	41.82	1.39				41.82	42	75.65	32.3	16.8
33	20-21	9.43	0.80	3,500	95	0.02714	1127	41.82	1.39	1.900	9.55		47.38	47	68.20	85.1	16.3
34	Den 11 (E0E-3)	9.43	0.80	3,500	95	0.02714	1127	41.82	1.39	1.900	9.55		47.38	47	68.20	85.1	16.3
35	19-21	24.58	0.58	3,500	210	0.03000	1117	30.81	1.89	4.500	25.06		27.48	47	68.20	179.6	11.1
36	18-22	24.58	0.58	3,500	210	0.03000	1117	30.81	1.89	4.500	25.06		27.48	47	68.20	179.6	11.1
37	25	1.18	0.80	2,000	50	0.02900	1140	28.05	1.19				28.05	28	105.81	27.1	23.5
38	Den 12 (E0E-1)	1.18	0.80	2,000	50	0.02900	1140	28.05	1.19				28.05	28	105.81	27.1	23.5
39	23-24	5.26	0.80	2,000	50	0.02900	1140	28.05	1.19	0.500	2.78		28.05	31	97.33	73.3	21.9
40	23-25	4.20	0.74	2,000	50	0.02900	1140	28.05	1.19	0.500	2.78	1.000	28.05	31	97.33	73.3	21.9
41	Den 13 (E0E-2)	4.20	0.74	2,000	50	0.02900	1140	28.05	1.19	0.500	2.78	1.000	28.05	31	97.33	73.3	21.9
42	18-23	20.10	0.87	3,500	210	0.03000	1117	30.81	1.89	5.500	30.56		31.17	39	60.45	65.6	16.9
43	18-24	28.84	0.87	3,500	210	0.03000	1117	30.81	1.89	7.000	38.89		31.17	39	60.45	65.6	16.9
44	1-12,15-26	72.63	0.50	3,500	185	0.03000	1123	39.95	1.81	5.000	30.56		87.55	86	40.94	494.6	6.6
45	1-13,15-26	72.89	0.50	3,500	185	0.03000	1123	39.95	1.81	5.000	30.56		87.55	86	40.94	494.6	6.6
46	27	5.93	0.90	3,500	55	0.01000	1100	61.42	0.95				61.42	61	25.10	47.2	12.3
47	1-13,15-27	78.63	0.51	3,500	185	0.03000	1123	39.95	1.81	6.000	35.33		87.55	86	40.94	494.6	6.6
48	1-13,15-27	78.63	0.51	3,500	185	0.03000	1123	39.95	1.81	6.000	35.33		87.55	86	40.94	494.6	6.6
49	1-27	88.52	0.52	3,500	185	0.03000	1123	39.95	1.81	7.000	38.89		87.55	86	40.94	507.0	6.5
50	28	128.78	0.44	3,500	185	0.03000	1123	39.95	1.81	7.000	38.89		87.55	86	40.94	507.0	6.5
51	29	23.84	1.00	3,500	185	0.03000	1123	39.95	1.81	7.000	38.89		87.55	86	40.94	507.0	6.5
52	1-29	241.14	0.37	3,500	185	0.03000	1123	39.95	1.81	7.000	38.89		87.55	86	40.94	1454.3	5.9

Note: (ft/min) = 405.7 x (ft/min) \* 0.91 / (ft/min) \* 0.63



Runoff Calculation by Rational Method

Oued Mayzette Basin

(Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	0.50	0.40	40	1.1	1.3	1.7	2.1	2.8	3.5	4.4
2	1,2	0.81	0.37	46	1.4	1.7	2.3	2.8	3.8	4.7	5.8
3	3	0.47	0.32	46	0.7	0.8	1.2	1.4	1.8	2.4	2.9
4	1,2,3	1.28	0.35	48	2.1	2.6	3.4	4.3	5.7	7.0	8.7
5	1,2,3,4	1.86	0.34	70	2.1	2.6	3.4	4.3	5.7	7.0	8.7
6	5	0.79	0.24	30	1.1	1.4	1.8	2.3	3.0	3.7	4.6
7	1,2,3,4,5	2.65	0.31	70	2.8	3.4	4.5	5.5	7.4	9.1	11.3
8	1,2,3,4,5,6	3.97	0.29	87	3.2	3.9	5.2	6.5	8.8	10.7	13.2
9	1,2,3,4,5,6,7	5.08	0.28	104	3.4	4.2	5.6	6.9	9.2	11.4	14.1
10	9	1.24	0.32	74	2.1	2.5	3.3	4.1	5.5	6.8	8.5
11	1,2,3,4,5,6,7,9	6.32	0.32	104	4.9	5.9	7.8	9.8	13.0	16.1	20.0
12	1,2,3,4,5,6,7,8,9	6.98	0.34	114	5.3	6.5	8.6	10.7	14.2	17.6	21.8

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	0.50	0.80	36	2.3	2.8	3.8	4.7	6.2	7.7	9.6
2	1,2	0.81	0.80	46	3.1	3.8	5.0	6.2	8.2	10.2	12.6
3	3	0.47	0.80	46	1.8	2.2	2.8	3.6	4.6	5.8	7.3
4	1,2,3	1.28	0.80	46	4.9	5.9	7.8	9.8	13.0	16.1	20.0
5	1,2,3,4	1.86	0.71	63	4.8	5.8	7.8	9.7	12.9	16.0	19.9
6	5	0.79	0.28	35	1.2	1.5	2.0	2.5	3.3	4.0	5.0
7	1,2,3,4,5	2.65	0.57	63	5.5	6.7	9.0	11.1	14.7	18.3	22.7
8	1,2,3,4,5,6	3.97	0.47	79	5.7	6.9	9.2	11.4	15.1	18.7	23.2
9	1,2,3,4,5,6,7	5.08	0.42	96	5.5	6.7	8.9	11.1	14.7	18.2	22.6
10	8	1.24	0.80	74	3.2	3.8	5.1	6.4	8.5	10.5	13.0
11	1,2,3,4,5,6,7,9	6.32	0.50	98	8.1	9.9	13.2	16.4	21.8	27.0	33.4
12	1,2,3,4,5,6,7,8,9	6.98	0.50	107	8.2	10.0	13.3	16.5	22.0	27.2	33.7

Runoff Calculation by Rational Method

Dued Mayzeite Basin

(Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. $f$	Lo (km)	Ho (m)	Average slope for Lo			to (min)	of. vo (m/s)	L1 (km) (v=1.5)	t1 (min)	L2 (km) (v=1.0)	t2 (min)	Calc. to (min)	Design to (min)	Calc. I(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq. km)
						S	I	I											
1	1	0.50	0.40	1.250	5	0.00400	1/250	36.56	36.56	0.53					36.56	40	79.77	4.4	8.9
2	1,2	0.81	0.37	2.150	17	0.00751	1/125	48.20	48.20	0.78					48.20	46	70.14	5.9	7.2
3	3	0.47	0.32	1.500	6	0.00400	1/250	45.52	45.52	0.55					45.52	46	70.14	2.9	6.2
4	1,2,3	1.28	0.35	2.150	17	0.00751	1/125	48.20	48.20	0.78					48.20	46	70.14	8.7	8.9
5	1,2,3,4	1.86	0.34	3.150	18	0.00571	1/175	70.26	70.26	0.75					70.26	70	49.51	9.7	4.7
6	5	0.79	0.24	1.250	7	0.00550	1/175	34.75	34.75	0.60					34.75	35	86.01	4.6	5.9
7	1,2,3,4,5	2.65	0.31	3.150	18	0.00571	1/175	70.26	70.26	0.75					70.26	70	49.51	11.3	4.3
8	1,2,3,4,5,6	3.57	0.29	3.150	18	0.00571	1/175	70.26	70.26	0.75			1.000	16.67	86.92	87	41.33	13.2	3.3
9	1,2,3,4,5,6,7	5.08	0.28	3.150	18	0.00571	1/175	70.26	70.26	0.75			2.000	33.33	103.53	104	36.64	14.1	2.8
10	9	1.24	0.52	2.000	4	0.00200	1/500	74.18	74.18	0.45					74.18	74	47.27	8.5	8.8
11	1,2,3,4,5,6,7,8	6.32	0.32	3.150	18	0.00571	1/175	70.26	70.26	0.75			2.000	33.33	103.53	104	36.64	20.0	3.2
12	1,2,3,4,5,6,7,8,9	6.98	0.34	3.150	18	0.00571	1/175	70.26	70.26	0.75			2.650	44.17	114.42	114	33.03	21.8	3.1

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. $f$	Lo (km)	Ho (m)	Average slope for Lo			to (min)	of. vo (m/s)	L1 (km) (v=1.5)	t1 (min)	L2 (km) (v=1.0)	t2 (min)	Calc. to (min)	Design to (min)	Calc. I(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq. km)
						S	I	I											
1	1	0.50	0.80	1.000	4	0.00400	1/250	33.31	33.31	0.50	0.250	2.78			36.09	36	66.97	9.6	19.1
2	1,2	0.81	0.80	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			45.09	46	70.14	12.6	15.6
3	3	0.47	0.80	1.500	6	0.00400	1/250	45.52	45.52	0.55					45.52	46	70.14	7.3	15.8
4	1,2,3	1.28	0.80	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			45.09	46	70.14	20.0	15.8
5	1,2,3,4	1.86	0.71	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			62.76	63	54.03	19.8	10.7
6	5	0.78	0.28	1.250	7	0.00550	1/175	34.75	34.75	0.80					34.75	35	86.01	5.0	6.4
7	1,2,3,4,5	2.65	0.57	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			62.76	63	54.03	22.7	8.6
8	1,2,3,4,5,6	3.57	0.47	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			79.42	79	44.78	23.2	5.8
9	1,2,3,4,5,6,7	5.08	0.42	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			96.09	96	36.09	22.6	4.4
10	9	1.24	0.80	2.000	4	0.00200	1/500	74.18	74.18	0.45					74.18	74	47.27	13.0	10.6
11	1,2,3,4,5,6,7,8	6.32	0.50	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			96.09	96	36.09	33.4	5.3
12	1,2,3,4,5,6,7,8,9	6.98	0.50	1.000	4	0.00400	1/250	33.31	33.31	0.50	1.150	12.78			106.92	107	34.81	33.7	4.9

Note:  $I(\text{mm/h}) = 408.7 \times T(\text{year})^{-0.31} / t(\text{min})^{-0.83}$

Runoff Calculation by Rational Method      Qued Bou Khamsa Basin      (Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design to (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	0.82	0.24	16	2.2	2.7	3.6	4.5	6.0	7.4	9.2
2	1,2	1.36	0.24	29	2.3	2.8	3.7	4.6	6.1	7.5	9.3
3	3	0.29	0.24	10	1.2	1.4	1.9	2.4	3.1	3.9	4.8
4	1,2,3	1.65	0.24	29	2.8	3.4	4.5	5.5	7.4	9.1	11.3
5	1,2,3,4	2.17	0.24	37	3.0	3.6	4.8	6.0	7.9	9.8	12.2
6	5	0.79	0.28	44	1.1	1.3	1.8	2.2	2.9	3.6	4.5
7	1,2,3,4,5	2.96	0.25	44	3.6	4.4	5.9	7.3	9.7	12.1	15.0
8	1,2,3,4,5,6	3.05	0.26	47	3.7	4.5	6.0	7.4	9.9	12.2	15.2
9	7	0.50	0.52	83	0.8	0.9	1.2	1.5	2.0	2.5	3.1
10	1,2,3,4,5,6,7	3.55	0.29	83	3.0	3.7	4.9	6.0	8.0	9.9	12.3
11	1,2,3,4,5,6,7,8	3.67	0.30	91	3.0	3.6	4.8	6.0	7.9	9.8	12.2
12	14	0.61	0.20	9	2.2	2.7	3.6	4.5	6.0	7.4	9.2
13	Dam No.1	0.61	0.20	9	2.2	2.7	3.6	4.5	6.0	7.4	9.2
14	13,14	1.22	0.24	14	3.7	4.5	6.1	7.5	10.0	12.3	15.3
15	12,13,14	1.42	0.27	15	4.6	5.6	7.5	9.3	12.3	15.3	18.9
16	11,12,13,14	1.52	0.28	29	3.0	3.6	4.8	6.0	7.9	9.8	12.2
17	9	0.78	0.60	56	1.9	2.3	3.1	3.8	5.0	6.2	7.7
18	1-9,11-14	5.97	0.33	91	5.3	6.5	8.6	10.7	14.2	17.6	21.8
19	1-14	6.20	0.34	100	5.3	6.4	8.5	10.6	14.0	17.4	21.6

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo	S	I	to (min)	cf. vo (m/s)	L1 (km) (N=1.5)	H (min)	L2 (km) (N=1.0)	I2 (min)	Calc. tc (min)	Design tc (min)	Calc. I(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq km)
1	1	0.82	0.24	2.000	208	0.10400	1/10	16.20	2.06	2.06					16.20	16	168.52	9.2	11.2
2	1,2	1.96	0.24	2.000	208	0.10400	1/10	16.20	2.06	2.06			0.750	12.50	26.70	29	102.87	9.9	5.9
3	3	0.28	0.24	1.250	168	0.15040	1/7	9.79	2.19	2.19					9.79	10	248.92	4.8	16.6
4	1,2,3	1.85	0.24	2.000	208	0.10400	1/10	16.20	2.06	2.06			0.750	12.50	26.70	29	102.87	11.3	5.9
5	1,2,3,4	2.17	0.24	2.000	208	0.10400	1/10	16.20	2.06	2.06			1.250	20.83	37.04	37	84.03	12.2	5.6
6	5	0.79	0.28	1.125	15	0.01333	1/75	22.95	0.82	0.82			1.250	20.83	43.78	44	72.78	4.5	5.7
7	1,2,3,4,5	2.96	0.25	1.125	15	0.01333	1/75	22.95	0.82	0.82			1.250	20.83	43.78	44	72.78	15.0	5.1
8	1,2,3,4,5,6	3.05	0.28	1.125	15	0.01333	1/75	22.95	0.82	0.82			1.450	24.17	47.11	47	88.90	15.2	5.0
9	7	0.50	0.52	1.750	2	0.00114	1/875	83.03	0.95	0.95					83.03	83	42.99	3.1	6.2
10	1,2,3,4,5,6,7	3.55	0.29	1.750	2	0.00114	1/875	83.03	0.95	0.95					83.03	83	42.99	12.3	3.5
11	1,2,3,4,5,6,7,8	3.87	0.30	1.750	2	0.00114	1/875	83.03	0.95	0.95			0.500	8.33	91.96	91	80.92	12.2	3.3
12	14	0.61	0.20	1.250	260	0.20800	1/5	8.64	2.41	2.41					8.64	8	271.67	9.2	15.1
13	Dam No.1	0.61	0.20	1.250	260	0.20800	1/5	8.64	2.41	2.41					8.64	9	271.67	3.2	15.1
14	13,14	1.22	0.24	1.250	260	0.20800	1/5	8.64	2.41	2.41		5.56			14.20	14	168.27	15.3	12.6
15	12,13,14	1.42	0.27	1.250	260	0.20800	1/5	8.64	2.41	2.41			0.400	5.67	15.91	16	177.79	18.9	13.3
16	11,12,13,14	1.52	0.29	1.250	260	0.20800	1/5	8.64	2.41	2.41			1.200	20.00	26.64	29	102.87	12.2	6.0
17	9	0.78	0.50	0.750	2	0.00267	1/375	91.20	0.40	0.40			1.500	25.00	58.20	56	58.57	7.7	8.9
18	1-9,11-14	5.97	0.33	1.750	2	0.00114	1/875	83.03	0.95	0.95			0.500	8.33	91.96	91	80.92	21.8	3.6
19	1-14	6.20	0.34	1.750	2	0.00114	1/875	83.03	0.95	0.95			1.000	15.67	99.89	100	96.82	21.6	3.5

Note:  $I((mm/h)) = 408.7 \times T(year)^{-0.31} / N(min)^{0.68}$

Runoff Calculation by Rational Method      Oued Bou Khamssa Basin      (Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design to (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	0.82	0.44	16	4.1	5.0	6.7	8.3	11.0	13.6	16.9
2	1,2	1.36	0.54	29	5.1	6.2	8.3	10.3	13.7	16.9	21.0
3	3	0.29	0.55	10	2.7	3.3	4.4	5.4	7.2	8.9	11.0
4	1,2,3	1.65	0.54	29	6.2	7.6	10.1	12.5	16.6	20.5	25.5
5	1,2,3,4	2.17	0.54	37	6.7	8.1	10.8	13.4	17.8	22.1	27.4
6	5	0.79	0.80	44	3.1	3.8	5.0	6.3	8.3	10.3	12.8
7	1,2,3,4,5	2.96	0.61	44	8.9	10.8	14.4	17.9	23.8	29.4	36.5
8	1,2,3,4,5,6	3.05	0.62	47	8.8	10.8	14.3	17.7	23.5	29.2	36.2
9	7	0.50	0.74	83	1.1	1.3	1.7	2.2	2.9	3.6	4.4
10	1,2,3,4,5,6,7	3.55	0.63	83	6.5	7.9	10.6	13.1	17.4	21.5	26.7
11	1,2,3,4,5,6,7,8	3.67	0.64	91	6.3	7.7	10.3	12.7	16.9	20.9	26.0
12	14	0.61	0.20	9	2.2	2.7	3.6	4.5	6.0	7.4	9.2
13	Dam No.1	0.61	0.20	9	2.2	2.7	3.6	4.5	6.0	7.4	9.2
14	13,14	1.22	0.29	14	4.5	5.5	7.3	9.1	12.0	14.9	18.5
15	12,13,14	1.42	0.34	15	5.8	7.1	9.4	11.7	15.5	19.2	23.6
16	11,12,13,14	1.52	0.35	29	3.7	4.5	6.0	7.4	9.9	12.3	15.2
17	9	0.78	0.80	56	2.5	3.1	4.1	5.1	6.7	8.3	10.3
18	1-9,11-14	5.97	0.59	91	9.5	11.6	15.4	19.1	25.3	31.4	39.0
19	1-14	6.20	0.59	100	9.1	11.1	14.8	18.3	24.3	30.2	37.4

Runoff Calculation by Rational Method

Qued Bou Khamea Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	$L_o$ (km)	$H_o$ (m)	Average slope for $L_o$		$t_o$ (min)	$d_f$ (m/s)	$L_1$ (km) $(V=1.5)$	$t_1$ (min)	$L_2$ (km) $(V=1.0)$	$t_2$ (min)	Calc. $t_o$ (min)	Design $t_o$ (min)	Calc. $I(100)$ (mm/h)	Calc. $Q(100)$ (cu m/s)	Specific Discharge (cu m/s/km)
1	1	0.82	0.44	2.000	208	0.10400	1/10	15.20	2.06			0.750	12.50	16.20	16	168.52	15.9	20.5
2	1,2	1.36	0.54	2.000	208	0.10400	1/10	15.20	2.06			0.750	12.50	28.70	29	102.87	21.0	15.4
3	3	0.29	0.55	1.250	188	0.15040	1/7	9.79	2.13			0.750	12.50	9.79	10	248.92	11.0	38.0
4	1,2,3	1.65	0.54	2.000	208	0.10400	1/10	15.20	2.06			0.750	12.50	28.70	29	102.87	25.5	15.4
5	1,2,3,4	2.17	0.54	2.000	208	0.10400	1/10	15.20	2.06			1.250	20.83	37.04	37	84.03	27.4	12.5
6	5	0.79	0.80	1.125	15	0.01333	1/75	22.95	0.82			1.250	20.83	43.78	44	72.78	12.8	16.2
7	1,2,3,4,5	2.96	0.51	1.125	15	0.01333	1/75	22.95	0.82			1.250	20.83	43.78	44	72.78	38.5	12.3
8	1,2,3,4,5,6	3.05	0.62	1.125	15	0.01333	1/75	22.95	0.82			1.450	24.17	47.11	47	68.90	35.2	11.9
9	7	0.50	0.74	1.750	2	0.00114	1/875	83.03	0.35					83.03	83	42.98	4.4	8.8
10	1,2,3,4,5,6,7	3.55	0.59	1.750	2	0.00114	1/875	83.03	0.35					83.03	83	42.98	26.7	7.5
11	1,2,3,4,5,6,7,8	3.67	0.54	1.750	2	0.00114	1/875	83.03	0.35			0.500	8.33	81.36	81	39.82	26.0	7.1
12	14	0.61	0.20	1.250	260	0.20800	1/5	8.64	2.41					8.64	9	271.67	9.2	15.1
13	Dam No.1	0.61	0.20	1.250	260	0.20800	1/5	8.64	2.41					8.64	9	271.67	9.2	15.1
14	13,14	1.22	0.29	1.250	260	0.20800	1/5	8.64	2.41	0.500	5.56	0.400	6.67	14.20	14	188.27	18.5	15.2
15	12,13,14	1.42	0.34	1.250	260	0.20800	1/5	8.64	2.41			1.200	20.00	28.64	29	177.79	23.8	16.8
16	11,12,13,14	1.52	0.35	1.250	260	0.20800	1/5	8.64	2.41			1.200	20.00	28.64	29	102.87	15.2	10.0
17	9	0.78	0.80	0.750	2	0.00287	1/375	31.20	0.40			1.500	25.00	56.20	56	59.57	10.9	13.2
18	1-9,11-14	5.97	0.59	1.750	2	0.00114	1/875	83.03	0.35			0.500	8.33	81.36	81	39.82	33.0	8.5
19	1-14	6.20	0.59	1.750	2	0.00114	1/875	83.03	0.35			1.000	16.67	99.69	100	36.82	37.4	6.0

Note:  $I(mm/h) = 408.7 \times T(year)^{-0.31} / t(min)^{-0.83}$

Runoff Calculation by Rational Method

Qued Ain Zerga Basin

(Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design $t_c$ (min)	Calc. $Q(1.05)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)
1	1	2.52	0.20	15	6.1	7.4	9.8	12.2	16.2	20.1	24.9
2	Dem No.1	2.52	0.20	15	6.1	7.4	9.8	12.2	16.2	20.1	24.9
3	1,2	2.64	0.20	18	5.5	6.7	8.9	11.0	14.8	18.1	22.4
4	3	0.27	0.20	14	0.7	0.8	1.1	1.4	1.8	2.3	2.8
5	1,2,3	2.81	0.20	18	6.0	7.3	9.8	12.1	16.1	19.9	24.7
6	Dem No.2	2.81	0.20	18	6.0	7.3	9.8	12.1	16.1	19.9	24.7
7	1,2,3,4	3.05	0.21	23	5.4	6.6	8.8	10.9	14.4	17.9	22.2
8	1,2,3,4,5	3.17	0.21	35	4.0	4.8	6.4	8.0	10.8	13.1	16.3
9	8	0.73	0.20	15	1.8	2.1	2.8	3.5	4.7	5.8	7.2
10	8,7	1.00	0.21	21	1.9	2.3	3.1	3.8	5.1	6.3	7.9
11	1,2,3,4,5,7,8	4.17	0.21	35	5.2	6.4	8.5	10.5	13.9	17.3	21.4
12	1,2,3,4,5,6,7,8	4.20	0.21	39	4.8	5.9	7.8	9.6	12.8	15.9	19.7

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design $t_c$ (min)	Calc. $Q(1.05)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)
1	1	2.52	0.20	15	6.1	7.4	9.8	12.2	16.2	20.1	24.9
2	Dem No.1	2.52	0.20	15	6.1	7.4	9.8	12.2	16.2	20.1	24.9
3	1,2	2.64	0.21	18	5.7	7.0	8.3	11.5	15.3	19.0	23.5
4	3	0.27	0.31	14	1.1	1.3	1.7	2.1	2.8	3.5	4.4
5	1,2,3	2.81	0.22	18	6.6	8.1	10.7	13.3	17.7	21.8	27.2
6	Dem No.2	2.81	0.22	18	6.6	8.1	10.7	13.3	17.7	21.8	27.2
7	1,2,3,4	3.05	0.25	23	6.4	7.8	10.4	12.9	17.2	21.3	26.4
8	1,2,3,4,5	3.17	0.27	35	5.1	6.2	8.3	10.2	13.6	16.8	20.9
9	8	0.73	0.50	15	4.4	5.4	7.1	8.8	11.7	14.5	18.0
10	8,7	1.00	0.58	21	5.3	6.4	8.8	10.8	14.1	17.5	21.7
11	1,2,3,4,5,7,8	4.17	0.34	35	8.4	10.3	13.7	17.0	22.8	27.9	34.7
12	1,2,3,4,5,6,7,8	4.20	0.35	39	8.0	9.8	13.0	16.1	21.4	26.5	32.8

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. $f$	Lo (km)	Ho (m)	Average slope for Lo		to (min)	cf. vo (m/s)	L1 (km) ( $v=3.0$ )	t1 (min)	L2 (km) ( $N=1.0$ )	L2 (min)	Calc. tc (min)	Design tc (min)	Calc. Q(100) (cu.m/s)	Specific Discharge (cu.m/s/sq.km)
						S	i										
1	1	2.52	0.20	1.000	235	0.23500	1/4	6.94	2.40	1.500	8.33			15.28	15	177.80	24.9
2	Dam No.1	2.52	0.20	1.000	235	0.23500	1/4	6.94	2.40	1.500	8.33			15.28	15	177.80	24.9
3	1,2	2.64	0.20	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
4	3	0.27	0.20	0.400	70	0.17500	1/8	3.84	1.74			0.600	10.00	13.84	14	198.28	28
5	1,2,3	2.91	0.20	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
6	Dam No.2	2.91	0.20	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
7	1,2,3,4	3.05	0.21	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	0.300	5.00	23.05	23	124.70	22.2
8	1,2,3,4,5	3.17	0.21	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.000	16.67	34.72	35	86.01	16.3
9	8	0.73	0.20	1.000	314	0.31400	1/3	6.21	2.88			0.500	8.33	14.54	15	177.80	24.9
10	8,7	1.00	0.21	1.000	314	0.31400	1/3	6.21	2.88			0.900	15.00	21.21	21	134.48	21.7
11	1,2,3,4,5,7,8	4.17	0.21	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.000	16.67	34.72	35	86.01	16.3
12	1,2,3,4,5,6,7,8	4.20	0.21	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.250	20.83	38.89	39	80.45	19.7

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. $f$	Lo (km)	Ho (m)	Average slope for Lo		to (min)	cf. vo (m/s)	L1 (km) ( $v=3.0$ )	t1 (min)	L2 (km) ( $N=1.0$ )	L2 (min)	Calc. tc (min)	Design tc (min)	Calc. Q(100) (cu.m/s)	Specific Discharge (cu.m/s/sq.km)
						S	i										
1	1	2.52	0.20	1.000	235	0.23500	1/4	6.94	2.40	1.500	8.33			15.28	15	177.80	24.9
2	Dam No.1	2.52	0.20	1.000	235	0.23500	1/4	6.94	2.40	1.500	8.33			15.28	15	177.80	24.9
3	1,2	2.64	0.21	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
4	3	0.27	0.21	0.400	70	0.17500	1/8	3.84	1.74			0.500	10.00	13.84	14	198.28	28
5	1,2,3	2.91	0.22	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
6	Dam No.2	2.91	0.22	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11			18.05	18	152.83	23.5
7	1,2,3,4	3.05	0.25	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	0.300	5.00	23.05	23	124.70	22.2
8	1,2,3,4,5	3.17	0.27	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.000	16.67	34.72	35	86.01	16.3
9	8	0.73	0.20	1.000	314	0.31400	1/3	6.21	2.88			0.500	8.33	14.54	15	177.80	24.9
10	8,7	1.00	0.28	1.000	314	0.31400	1/3	6.21	2.88			0.900	15.00	21.21	21	134.48	21.7
11	1,2,3,4,5,7,8	4.17	0.34	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.000	16.67	34.72	35	86.01	16.3
12	1,2,3,4,5,6,7,8	4.20	0.35	1.000	235	0.23500	1/4	6.94	2.40	2.000	11.11	1.250	20.83	38.89	39	80.45	19.7

Note:  $t_1(\text{min}) = 403.7 \times T(\text{year})^{0.31} / V(\text{min})^{0.83}$



Runoff Calculation by Rational Method												Oued Hammam Basin												(Present Land Use)											
Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design $t_c$ (min)	Calc. $Q(1.05)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)																								
1	1	48.00	0.20	280	12.2	15.2	20.7	26.2	35.8	45.4	57.4																								
2	2	13.00	0.20	100	7.0	8.7	11.9	15.0	20.5	26.0	32.9																								
3	1-2	59.00	0.20	280	15.6	19.5	26.6	33.7	46.0	59.2	73.6																								
4	1-3	99.00	0.20	344	21.3	26.8	36.3	45.9	62.7	79.3	100.4																								
5	4	14.80	0.20	84	8.9	11.1	15.2	19.2	26.2	33.2	42.0																								
6	1-4	113.80	0.20	344	24.5	30.5	41.8	52.7	72.0	91.1	115.3																								
7	Dam 3 (Late)	113.80	0.20	344	24.5	30.5	41.8	52.7	72.0	91.1	115.3																								
8	1-5	135.40	0.20	438	24.5	30.5	41.8	52.7	72.0	91.1	115.3																								
9	6	12.80	0.20	138	5.4	6.7	9.2	11.6	15.9	20.1	25.4																								
10	1-6	148.00	0.20	438	26.7	33.3	45.5	57.8	78.7	99.5	126.0																								
11	Dam 4 (R.B.-A)	148.00	0.20	438	26.7	33.3	45.5	57.8	78.7	99.5	126.0																								
12	1-7	163.00	0.20	508	26.4	32.9	44.9	56.8	77.6	98.2	124.3																								
13	Dam 5 (R.B.-B)	163.00	0.20	508	26.4	32.9	44.9	56.8	77.6	98.2	124.3																								
14	1-8	163.40	0.20	518	26.1	32.5	44.4	56.1	76.7	97.0	122.8																								
15	12	8.50	0.20	78	5.5	6.8	9.3	11.8	16.1	20.4	25.9																								
16	Dam 2 (M'derne)	8.50	0.20	78	5.5	6.8	9.3	11.8	16.1	20.4	25.9																								
17	12-13	9.70	0.22	102	5.8	7.0	9.6	12.2	16.8	21.0	26.8																								
18	10	12.80	0.20	76	8.3	10.3	14.1	17.9	24.4	30.9	38.1																								
19	Dam 1 (Guemgame)	12.80	0.20	76	8.3	10.3	14.1	17.9	24.4	30.9	38.1																								
20	10-11	13.10	0.20	84	8.0	10.0	13.6	17.2	23.9	29.8	37.7																								
21	10-13	22.80	0.21	102	12.7	15.8	21.8	27.3	37.3	47.2	59.7																								
22	10-14	23.90	0.22	128	11.8	14.7	20.0	25.3	34.8	43.8	55.4																								
23	15	4.10	0.28	52	5.0	6.2	8.5	10.8	14.7	18.6	23.6																								
24	10-15	28.00	0.22	128	13.8	17.2	23.5	29.7	40.5	51.3	64.9																								
25	10-16	28.30	0.22	138	13.2	16.4	22.4	28.4	38.8	49.0	62.1																								
26	17	10.80	0.20	90	6.3	7.8	10.7	13.5	18.5	23.3	29.8																								
27	10-17	39.10	0.22	138	18.2	22.7	31.0	39.2	53.8	67.8	85.8																								
28	10-18	44.90	0.22	168	18.1	22.5	30.8	38.8	53.2	67.3	85.2																								
29	1-8,10-18	208.30	0.21	516	34.9	43.5	58.4	75.1	102.6	129.9	164.4																								
30	1-18	222.30	0.21	576	34.3	42.8	58.4	73.9	101.0	127.8	161.7																								

Runoff Calculation by Rational Method																			Oued Hammam Basin																			(Present Land Use)																		
Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo			to (min)	cf. vo (m/s)	L1 (km) (v=1.5)	t1 (min)	L2 (km) (v=1.0)	t2 (min)	Calc. to (min)	Design to (min)	Calc. I(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq km)																																					
						S	I	Lo																																																
1	1	45.00	0.20	10.000	55	0.00550	1/182	260.29	0.64						260.29	260	22.47	57.4	1.2																																					
2	2	13.00	0.20	7.500	95	0.01267	1/79	100.86	1.24						100.86	100	45.58	32.9	2.5																																					
3	1-2	59.00	0.20	10.000	55	0.00550	1/182	260.29	0.64						260.29	260	22.47	73.6	1.2																																					
4	1-3	99.00	0.20	10.000	55	0.00550	1/182	260.29	0.64				5.000	83.33	343.63	344	18.26	100.4	1.0																																					
5	4	14.60	0.20	6.500	100	0.01536	1/65	83.82	1.29						83.82	84	51.84	42.0	2.9																																					
6	1-4	113.60	0.20	10.000	55	0.00550	1/182	260.29	0.64				5.000	83.33	343.63	344	18.26	115.3	1.0																																					
7	Dam 3 (Lase)	113.60	0.20	10.000	55	0.00550	1/182	260.29	0.64				5.000	83.33	343.63	344	18.26	115.3	1.0																																					
8	1-6	135.40	0.20	10.000	55	0.00550	1/182	260.29	0.64				10.500	175.00	435.29	436	15.32	115.3	0.9																																					
9	6	12.60	0.20	10.500	120	0.01143	1/99	135.96	1.29						135.96	136	36.29	25.4	2.0																																					
10	1-6	148.00	0.20	10.000	55	0.00550	1/182	260.29	0.64				10.500	175.00	435.29	436	15.32	126.0	0.9																																					
11	Dam 4 (R.B.-A)	148.00	0.20	10.000	55	0.00550	1/182	260.29	0.64				10.500	175.00	435.29	436	15.32	126.0	0.9																																					
12	1-7	163.00	0.20	10.000	55	0.00550	1/182	260.29	0.64				14.700	245.00	505.29	506	13.73	124.3	0.8																																					
13	Dam 5 (R.B.-B)	163.00	0.20	10.000	55	0.00550	1/182	260.29	0.64				14.700	245.00	505.29	506	13.73	124.3	0.8																																					
14	1-8	163.40	0.20	10.000	55	0.00550	1/182	260.29	0.64				15.400	256.67	516.96	516	13.53	122.8	0.8																																					
15	12	8.50	0.20	6.000	95	0.01583	1/63	77.94	1.28						77.94	78	64.76	25.9	3.0																																					
16	Dam 2 (M'darrei)	9.50	0.20	6.000	95	0.01583	1/63	77.94	1.28						77.94	78	64.76	25.9	3.0																																					
17	12-13	9.70	0.22	6.000	95	0.01583	1/63	77.94	1.28				1.500	25.00	102.94	102	44.90	26.6	2.7																																					
18	10	12.60	0.20	5.500	60	0.01455	1/69	75.31	1.22						75.31	76	55.92	33.1	3.1																																					
19	Dam 1 (Guergame)	12.60	0.20	5.500	60	0.01455	1/69	75.31	1.22						75.31	76	55.92	33.1	3.1																																					
20	10-11	13.10	0.20	5.500	60	0.01455	1/69	75.31	1.22				0.500	9.33	63.64	64	51.84	37.7	2.8																																					
21	10-13	22.80	0.21	6.000	95	0.01583	1/63	77.94	1.28				1.500	25.00	102.94	102	44.90	59.7	2.6																																					
22	10-14	23.90	0.22	6.000	95	0.01583	1/63	77.94	1.28				3.000	50.00	127.94	128	37.98	55.4	2.3																																					
23	15	4.10	0.26	4.000	80	0.02000	1/50	52.13	1.28						52.13	52	73.92	23.6	5.7																																					
24	10-15	29.00	0.22	6.000	95	0.01583	1/63	77.94	1.28				3.000	50.00	127.94	128	37.98	64.9	2.3																																					
25	10-16	28.30	0.22	6.000	95	0.01583	1/63	77.94	1.28				3.600	60.00	137.94	138	36.90	62.1	2.2																																					
26	17	10.80	0.20	6.500	82	0.01262	1/79	90.47	1.20						90.47	90	48.28	29.6	2.7																																					
27	10-17	39.10	0.22	6.000	95	0.01583	1/63	77.94	1.28				3.600	60.00	137.94	138	36.90	65.9	2.2																																					
28	10-18	44.90	0.22	6.000	95	0.01583	1/63	77.94	1.28				5.400	80.00	167.94	168	31.04	85.2	1.9																																					
29	1-8-10-18	206.30	0.21	10.000	55	0.00550	1/182	260.29	0.64				15.400	256.67	516.96	516	13.53	164.4	0.8																																					
30	1-18	222.90	0.21	10.000	55	0.00550	1/182	260.29	0.64				16.900	315.00	576.29	576	12.47	161.7	0.7																																					

Note:  $I(\text{mm/h}) = 287.4 \times T(\text{year})^{0.34} / t(\text{min})^{0.74}$

Runoff Calculation by Rational Method

Qued Hammam Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design to (min)	Calc. $Q(1.05)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)
1	1	48.00	0.20	260	12.2	15.2	20.7	26.2	35.8	45.4	57.4
2	2	13.00	0.20	100	7.0	8.7	11.9	15.0	20.5	26.0	32.9
3	1-2	59.00	0.20	260	15.6	18.9	26.8	33.7	46.0	58.2	73.8
4	1-3	99.00	0.20	344	21.3	26.8	36.3	45.9	62.7	79.3	100.4
5	4	14.80	0.20	84	8.8	11.1	15.2	19.2	26.2	33.2	42.0
6	1-4	113.80	0.20	344	24.5	30.5	41.6	52.7	72.0	91.1	115.3
7	Dam 3 (Lala)	113.80	0.20	344	24.5	30.5	41.6	52.7	72.0	91.1	115.3
8	1-5	135.40	0.21	436	25.7	32.0	43.7	55.3	75.6	95.8	121.0
9	6	12.80	0.23	136	8.2	7.7	10.6	13.4	18.2	23.1	29.2
10	1-6	148.00	0.21	436	28.1	35.0	47.8	60.5	82.6	104.5	132.3
11	Dam 4 (R.B.-A)	148.00	0.21	436	28.1	35.0	47.8	60.5	82.6	104.5	132.3
12	1-7	163.00	0.22	506	28.0	36.2	49.4	62.5	85.4	108.0	138.7
13	Dam 5 (R.B.-B)	163.00	0.22	506	28.0	36.2	49.4	62.5	85.4	108.0	138.7
14	1-8	163.40	0.22	516	28.7	35.7	48.8	61.8	84.3	106.7	135.1
15	12	8.50	0.20	78	5.5	6.8	9.3	11.9	16.1	20.4	25.9
16	Dam 2 (M'derre)	8.50	0.20	78	5.5	6.8	9.3	11.9	16.1	20.4	25.9
17	12-13	8.70	0.27	102	6.9	6.6	11.8	14.8	20.4	25.8	32.7
18	10	12.80	0.23	78	9.5	11.9	16.2	20.5	28.1	35.5	44.9
19	Dam 1 (Guemigame)	12.80	0.23	78	9.5	11.9	16.2	20.5	28.1	35.5	44.9
20	10-11	13.10	0.25	84	10.0	12.5	17.0	21.6	29.4	37.3	47.2
21	10-13	22.80	0.26	102	15.7	19.8	26.7	33.8	46.2	58.4	73.9
22	10-14	23.90	0.29	128	15.5	19.3	28.4	33.4	45.8	57.7	73.1
23	15	4.10	0.44	52	7.9	9.8	13.4	16.9	23.1	29.3	37.0
24	10-15	28.00	0.31	128	19.4	24.2	33.1	41.9	57.1	72.3	91.5
25	10-16	28.30	0.31	138	18.6	23.1	31.6	40.0	54.6	69.1	87.5
26	17	10.80	0.23	80	7.2	9.0	12.3	15.5	21.2	26.8	34.0
27	10-17	38.10	0.29	138	24.0	29.9	40.8	51.7	70.8	89.3	113.1
28	10-18	44.90	0.32	188	26.3	32.8	44.7	56.8	77.3	97.9	123.9
29	1-8,10-16	208.30	0.24	516	38.9	49.7	67.9	88.9	117.3	149.4	187.9
30	1-18	222.30	0.26	576	42.5	53.0	72.3	91.5	125.0	158.2	200.2

Runoff Calculation by Rational Method

Qued Hammam Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo		to (min)	cf. vo (m/s)	L1 (km) (v=1.5)	t1 (min)	L2 (km) (v=1.0)	t2 (min)	Calc. to (min)	Design to (min)	Calc. (100) (mm/h)	Calc. Q(100) (cu.m/s)	Specific Discharge (cu.m/s/sq.km)
1	1	46.00	0.20	10.000	56	0.00550	1/182	260.29	0.84					260.29	260	22.47	57.4	1.2
2	2	13.00	0.20	7.500	96	0.01267	1/79	100.85	1.24					100.85	100	45.59	82.9	2.5
3	1-2	59.00	0.20	10.000	56	0.00550	1/182	260.29	0.84					260.29	260	22.47	73.6	1.2
4	1-3	99.00	0.20	10.000	56	0.00550	1/182	260.29	0.84			5.000	63.33	343.63	344	16.28	100.4	1.0
5	4	14.80	0.20	6.500	100	0.01538	1/65	83.82	1.29					83.82	84	51.84	42.0	2.9
6	1-4	113.60	0.20	10.000	56	0.00550	1/182	260.29	0.84			5.000	63.33	343.63	344	16.28	115.3	1.0
7	Dam 3 (Lala)	113.60	0.20	10.000	56	0.00550	1/182	260.29	0.84			5.000	63.33	343.63	344	16.28	115.3	1.0
8	1-5	135.40	0.21	10.000	55	0.00550	1/182	260.29	0.84			10.500	175.00	435.29	436	15.32	121.0	0.9
9	6	12.60	0.23	10.500	120	0.01143	1/88	135.96	1.29					135.96	136	36.28	29.2	2.3
10	1-6	148.00	0.21	10.000	55	0.00550	1/182	260.29	0.84			10.500	175.00	435.29	436	15.32	132.3	0.9
11	Dam 4 (R.B.-A)	148.00	0.21	10.000	55	0.00550	1/182	260.29	0.84			10.500	175.00	435.29	436	15.32	132.3	0.9
12	1-7	163.00	0.22	10.000	55	0.00550	1/182	260.29	0.84			14.700	245.00	505.29	506	13.73	136.7	0.8
13	Dam 5 (R.B.-B)	163.00	0.22	10.000	55	0.00550	1/182	260.29	0.84			14.700	245.00	505.29	506	13.73	136.7	0.8
14	1-8	163.40	0.22	10.000	55	0.00550	1/182	260.29	0.84			15.400	256.67	516.96	516	13.53	135.1	0.8
15	12	8.50	0.20	5.000	95	0.01583	1/63	77.94	1.25					77.94	78	54.76	25.9	3.0
16	Dam 2 (M'darrel)	8.50	0.20	5.000	95	0.01583	1/63	77.94	1.25					77.94	78	54.76	25.9	3.0
17	12-13	9.70	0.27	5.000	95	0.01583	1/63	77.94	1.25			1.500	25.00	102.94	102	44.90	32.7	3.4
18	10	12.60	0.23	5.600	80	0.01455	1/69	75.31	1.22					75.31	76	55.82	44.9	3.6
19	Dam 1 (Guergame)	12.60	0.23	5.500	80	0.01455	1/69	75.31	1.22					75.31	76	55.82	44.9	3.6
20	10-11	13.10	0.25	5.500	80	0.01455	1/69	75.31	1.22			0.500	8.33	83.64	84	61.84	47.2	3.8
21	10-13	22.60	0.26	5.000	96	0.01583	1/63	77.94	1.28			1.500	25.00	102.94	102	44.90	73.9	3.2
22	10-14	23.90	0.29	5.000	96	0.01583	1/63	77.94	1.28			3.000	50.00	127.94	128	37.88	73.1	3.1
23	15	4.10	0.44	4.000	90	0.02000	1/50	52.13	1.28					52.13	52	73.92	37.0	9.0
24	10-15	28.00	0.31	6.000	96	0.01583	1/63	77.94	1.28			3.000	50.00	127.94	128	37.88	91.5	3.9
25	10-16	28.30	0.31	6.000	96	0.01583	1/63	77.94	1.28			3.600	60.00	137.94	138	35.90	87.5	3.1
26	17	10.80	0.23	5.500	82	0.01262	1/79	90.47	1.20					90.47	90	49.28	34.0	3.1
27	10-17	39.10	0.29	6.000	96	0.01583	1/63	77.94	1.28			3.500	60.00	137.94	138	35.90	113.1	2.8
28	10-18	44.50	0.32	6.000	95	0.01583	1/63	77.94	1.28			5.400	90.00	167.94	168	31.04	123.9	2.5
29	1-8-10-18	206.30	0.24	10.000	55	0.00550	1/182	260.29	0.84			15.400	256.67	516.96	516	13.53	187.9	0.9
30	1-18	222.30	0.26	10.000	55	0.00550	1/182	260.29	0.84			16.900	315.00	575.29	576	12.47	200.2	0.9

Note :  $t = (L^3 / (K \cdot H))^{0.74}$

Runoff Calculation by Rational Method				Oued Bilibene Basin				(Present Land Use)			
Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	3.98	0.24	51	4.2	5.3	7.2	9.1	12.4	15.7	19.9
2	1-2	4.48	0.24	60	4.2	5.3	7.2	9.1	12.4	15.7	19.9
3	3	2.18	0.24	33	3.2	4.0	5.4	6.9	9.4	11.9	15.0
4	1-3	6.66	0.24	60	6.3	7.8	10.7	13.5	18.4	23.3	29.5
5	1-4	7.03	0.24	68	6.0	7.5	10.3	13.0	17.7	22.4	28.4
6	5	0.85	0.24	24	1.6	2.0	2.7	3.4	4.6	5.9	7.4
7	1-5	7.88	0.24	68	6.8	8.4	11.5	14.6	19.9	25.2	31.8
8	1-6	9.14	0.24	88	6.5	8.1	11.0	14.0	19.1	24.1	30.5
9	11	0.37	0.40	16	1.5	1.9	2.6	3.3	4.5	5.7	7.3
10	10-11	0.94	0.47	25	3.3	4.1	5.6	7.1	9.7	12.3	15.6
11	8,10-11	1.29	0.49	35	3.7	4.6	6.3	8.0	10.9	13.7	17.4
12	9	0.16	0.36	11	0.8	1.0	1.3	1.7	2.3	2.9	3.7
13	8-11	1.45	0.47	35	4.0	5.0	6.8	8.6	11.7	14.8	18.8
14	7-11	1.50	0.47	37	4.0	4.9	6.7	8.5	11.6	14.7	18.8
15	12	0.34	0.60	24	1.6	2.0	2.7	3.4	4.6	5.9	7.4
16	1-12	10.98	0.28	88	9.1	11.3	15.4	19.6	26.7	33.8	42.8
17	1-13	11.51	0.29	101	8.9	11.1	15.1	19.2	26.2	33.1	41.9
18	18	2.36	0.24	36	3.2	4.0	5.5	7.0	9.5	12.1	15.3
19	17-18	2.91	0.27	57	3.2	4.0	5.4	6.9	9.4	11.9	15.1
20	1-13,17-18	14.42	0.29	101	11.1	13.9	19.0	24.0	32.8	41.5	52.5
21	1-14,17-18	14.50	0.29	106	10.8	13.5	18.4	23.3	31.8	40.3	51.0
22	16	0.45	0.56	17	2.5	3.1	4.3	5.4	7.4	9.3	11.8
23	1-14,16-18	14.95	0.30	106	11.5	14.4	19.6	24.9	33.9	42.9	54.4
24	1-18	15.13	0.30	116	10.9	13.6	18.6	23.5	32.1	40.7	51.5

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo		to (min)	cl. vo (m/s)	L1 (N=1.5) (km)	t1 (min)	L2 (N=1.0) (km)	t2 (min)	Calc. to (min)	Design to (min)	Calc. (100) (mm/h)	Calc. Q(100) (cu.m/s)	Specific Discharge (cu.m/s/sq.km)
						S	I											
1	1	3.98	0.24	3.000	36	0.0167	1/96	51.41	0.97					51.41	51	74.99	13.9	5.0
2	1-2	4.48	0.24	3.300	42	0.01273	1/79	53.50	1.03			0.400	6.67	60.17	60	86.49	19.9	4.4
3	3	2.18	0.24	2.900	49	0.02130	1/47	33.29	1.15					33.29	33	103.49	15.0	5.9
4	1-3	6.66	0.24	3.300	42	0.01273	1/79	53.50	1.03			0.400	8.67	60.17	60	86.49	29.5	4.4
5	1-4	7.03	0.24	3.300	42	0.01273	1/79	53.50	1.03			0.650	14.17	67.67	69	60.61	28.4	4.0
6	5	0.65	0.24	1.800	40	0.02600	1/40	23.69	1.13					23.69	24	131.00	7.4	8.7
7	1-5	7.68	0.24	3.300	42	0.01273	1/79	53.50	1.03			0.650	14.17	67.67	69	60.61	31.8	4.0
8	1-6	9.14	0.24	3.300	42	0.01273	1/79	53.50	1.03			2.050	34.17	87.67	88	50.09	30.5	3.3
9	11	0.37	0.40	1.000	25	0.02500	1/40	16.45	1.01					16.45	16	176.64	7.3	19.8
10	10-11	0.34	0.47	1.450	25	0.01724	1/58	25.27	0.96					25.27	25	127.10	15.6	16.6
11	8-10-11	1.29	0.49	1.450	25	0.01724	1/58	25.27	0.96	0.650	9.44			34.71	35	89.09	17.4	13.5
12	9	0.16	0.36	0.700	25	0.03571	1/28	10.80	1.07					10.80	11	233.34	3.7	23.3
13	8-11	1.45	0.47	1.450	25	0.01724	1/58	25.27	0.96	0.650	9.44			34.71	35	89.09	19.8	12.9
14	7-11	1.50	0.47	1.450	25	0.01724	1/58	25.27	0.96	1.100	12.22			37.43	37	95.09	18.6	12.4
15	12	0.34	0.60	1.400	26	0.01657	1/54	23.90	0.98					23.90	24	131.00	7.4	21.9
16	1-12	10.96	0.28	3.300	42	0.01273	1/79	53.50	1.03			2.050	34.17	87.67	88	50.09	42.8	3.9
17	1-13	11.51	0.29	3.300	42	0.01273	1/79	53.50	1.03			2.850	47.50	101.00	101	45.23	41.9	3.6
18	18	2.36	0.24	2.000	27	0.01950	1/74	36.57	0.94					36.57	36	97.04	15.9	6.5
19	17-18	2.91	0.27	2.000	27	0.01950	1/74	36.57	0.94			1.300	21.67	57.23	57	69.07	15.1	5.2
20	1-13,17-18	14.42	0.29	3.300	42	0.01273	1/79	53.50	1.03			2.850	47.50	101.00	101	45.23	52.5	3.6
21	1-14,17-18	14.50	0.29	3.300	42	0.01273	1/79	53.50	1.03			3.150	52.50	108.00	108	43.64	51.0	3.5
22	18	0.45	0.56	0.600	12	0.01600	1/67	18.67	0.79					18.67	17	169.06	11.8	26.3
23	1-14,16-18	14.95	0.30	3.300	42	0.01273	1/79	53.50	1.03			3.150	52.50	106.00	106	43.64	54.4	3.6
24	1-16	15.13	0.30	3.300	42	0.01273	1/79	53.50	1.03			3.750	52.50	116.00	116	40.92	51.5	3.4

Note:  $I(\text{mm/h}) = 257.4 \times T(\text{year})^{-0.34} / t(\text{min})^{-0.74}$

Runoff Calculation by Rational Method				Qued Bilibene Basin				(Future Land Use Condition)			
Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	3.98	0.32	51	5.6	7.0	9.6	12.1	16.6	21.0	26.5
2	1-2	4.48	0.31	60	5.4	6.8	9.3	11.7	16.0	20.3	25.7
3	3	2.18	0.38	33	5.1	6.3	8.6	10.9	14.9	18.8	23.8
4	1-3	6.66	0.34	60	8.9	11.1	15.1	19.1	26.1	33.0	41.8
5	1-4	7.03	0.33	68	8.3	10.3	14.1	17.9	24.4	30.9	39.1
6	5	0.85	0.50	24	3.3	4.1	5.6	7.1	9.7	12.2	15.5
7	1-5	7.88	0.35	68	9.9	12.3	16.8	21.2	29.0	36.7	46.4
8	1-6	9.14	0.36	88	9.7	12.1	16.5	20.9	28.6	36.2	45.8
9	11	0.37	0.80	16	3.1	3.8	5.3	6.8	9.1	11.5	14.5
10	10-11	0.94	0.80	25	5.6	7.0	9.6	12.1	16.6	21.0	26.5
11	8,10-11	1.29	0.80	35	6.0	7.5	10.3	13.0	17.7	22.4	28.4
12	9	0.16	0.80	11	1.8	2.2	3.0	3.8	5.2	6.6	8.3
13	8-11	1.45	0.80	35	6.8	8.4	11.5	14.6	19.9	25.2	31.9
14	7-11	1.50	0.80	37	6.7	8.4	11.4	14.5	19.8	25.0	31.7
15	12	0.34	0.80	24	2.1	2.8	3.6	4.5	6.2	7.8	9.9
16	1-12	10.98	0.44	88	14.3	17.8	24.3	30.7	42.0	53.1	67.2
17	1-13	11.51	0.45	101	13.8	17.2	23.5	29.7	40.6	51.4	65.1
18	18	2.36	0.32	36	4.3	5.4	7.4	9.3	12.7	16.1	20.4
19	17-18	2.91	0.41	57	4.9	6.1	8.3	10.5	14.3	18.1	22.9
20	1-13,17-18	14.42	0.44	101	16.9	21.1	28.6	36.4	49.8	63.0	79.7
21	1-14,17-18	14.50	0.44	106	16.4	20.5	27.9	35.4	48.3	61.1	77.3
22	18	0.45	0.80	17	3.6	4.5	6.1	7.7	10.6	13.4	16.9
23	1-14,16-18	14.95	0.46	106	17.7	22.1	30.1	38.1	52.0	65.9	83.4
24	1-18	15.13	0.46	116	16.7	20.9	28.5	36.1	49.3	62.3	78.9

Runoff Calculation by Rational Method

Quec Bilibene Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope		to (min)	cl. vo (m/s)	L1 (km) (v=1.5)	t1 (min)	L2 (km) (v=1.0)	t2 (min)	Calc. tc (min)	Design tc (min)	Calc. (100) (mm/h)	Calc. Q(100) (cu m/s/km)	Specific Discharge (cu m/s/eq km)
						S	i											
1	1	3.98	0.32	3.000	35	0.01167	1/96	51.41	0.97					51.41	51	74.99	26.5	5.7
2	1-2	4.48	0.31	3.300	42	0.01273	1/79	53.50	1.03			0.400	5.67	60.17	60	66.49	25.7	5.7
3	3	2.16	0.38	2.900	49	0.02130	1/47	33.23	1.15					33.23	33	103.49	23.8	10.9
4	1-3	6.66	0.34	3.300	42	0.01273	1/79	53.50	1.03			0.400	5.67	60.17	60	66.49	41.9	9.3
5	1-4	7.03	0.33	3.300	42	0.01273	1/79	53.50	1.03			0.850	14.17	67.67	68	80.61	38.1	5.6
6	5	0.86	0.50	1.800	40	0.02500	1/40	23.63	1.13					23.63	24	131.00	15.5	18.2
7	1-5	7.89	0.35	3.300	42	0.01273	1/79	53.50	1.03			0.850	14.17	67.67	68	80.61	46.4	5.9
8	1-6	9.14	0.36	3.300	42	0.01273	1/79	53.50	1.03			2.050	34.17	87.67	88	90.08	45.8	5.0
9	11	0.37	0.80	1.000	25	0.02500	1/40	16.45	1.01					16.45	15	176.94	14.5	39.3
10	10-11	0.94	0.80	1.450	25	0.01724	1/68	25.27	0.96					25.27	25	127.10	26.5	28.2
11	8-10-11	1.23	0.80	1.450	25	0.01724	1/68	25.27	0.96	0.850	9.44			34.71	35	98.09	26.4	22.0
12	9	0.16	0.80	0.700	25	0.03571	1/28	10.90	1.07					10.90	11	293.34	8.9	51.9
13	8-11	1.45	0.80	1.450	25	0.01724	1/68	25.27	0.96	0.850	9.44			34.71	35	98.09	31.9	22.0
14	7-11	1.50	0.80	1.450	25	0.01724	1/68	25.27	0.96	1.100	12.22			37.49	37	95.09	31.7	21.1
15	12	0.34	0.80	1.400	26	0.01957	1/54	23.90	0.98					23.90	24	131.00	3.9	29.1
16	1-12	10.98	0.44	3.300	42	0.01273	1/79	53.50	1.03			2.050	34.17	87.67	88	90.08	67.2	6.1
17	1-13	11.51	0.45	3.300	42	0.01273	1/79	53.50	1.03			2.850	47.50	101.00	101	45.23	65.1	5.7
18	18	2.95	0.32	2.000	27	0.01950	1/74	35.57	0.94					35.57	36	97.04	20.4	8.5
19	17-18	2.91	0.41	2.000	27	0.01950	1/74	35.57	0.94			1.300	21.67	57.23	57	89.07	22.9	7.9
20	1-13,17-18	14.42	0.44	3.300	42	0.01273	1/79	53.50	1.03			2.850	47.50	101.00	101	45.23	79.7	5.5
21	1-14,17-18	14.50	0.44	3.300	42	0.01273	1/79	53.50	1.03			3.150	52.50	108.00	106	43.84	77.3	6.3
22	16	0.45	0.80	0.800	12	0.01500	1/67	16.87	0.79					16.87	17	163.08	16.9	37.6
23	1-14,16-18	14.95	0.48	3.300	42	0.01273	1/79	53.50	1.03			3.150	52.50	108.00	106	43.84	83.4	5.6
24	1-18	15.13	0.45	3.300	42	0.01273	1/79	53.50	1.03			3.750	62.50	116.00	115	40.92	78.9	5.2

Note:  $t = (mm/h) = 287.4 \times T(\text{year})^{0.34} / i(\text{min})^{0.74}$



(Present Land Use)

Oued Hallouf Basin

Runoff Calculation by Rational Method

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	1.48	0.52	33	4.7	5.9	8.0	10.1	13.8	17.5	22.1
2	2	1.34	0.28	23	3.0	3.7	5.1	6.4	8.8	11.1	14.1
3	1-2	2.82	0.41	33	7.1	8.8	12.0	15.2	20.8	26.3	33.2
4	1-3	3.37	0.40	47	6.3	7.9	10.8	13.6	18.8	23.6	28.8
5	1-4	3.70	0.38	57	5.7	7.1	9.7	12.3	16.8	21.3	27.0
6	6	1.51	0.24	32	2.3	2.8	3.8	4.9	6.7	8.4	10.7
7	6-7	3.09	0.26	53	3.5	4.3	5.9	7.4	10.2	12.8	16.3
8	1-4, 6-7	6.79	0.33	57	9.1	11.4	15.5	19.7	26.8	34.0	43.0
9	1-7	7.01	0.33	67	8.4	10.4	14.2	18.0	24.6	31.1	39.4
10	18	0.70	0.56	17	3.9	4.9	6.6	8.4	11.5	14.5	18.4
11	17-18	1.09	0.55	27	4.2	5.3	7.2	9.1	12.5	15.8	20.0
12	16-18	1.55	0.51	37	4.4	5.5	7.5	9.5	13.0	16.5	20.9
13	15-18	1.73	0.50	49	3.9	4.9	6.7	8.5	11.6	14.7	18.6
14	14	0.46	0.56	28	1.8	2.2	3.0	3.8	5.2	6.6	8.4
15	13-14	0.80	0.54	42	1.7	2.1	2.8	3.6	4.9	6.2	7.8
16	1-7, 13-18	9.34	0.37	57	12.5	15.6	21.2	26.9	36.7	46.5	58.8
17	1-8, 13-18	10.01	0.36	80	11.4	14.2	19.4	24.6	33.6	42.5	53.8
18	12	0.56	0.52	27	2.1	2.6	3.5	4.4	6.1	7.7	9.7
19	1-8, 12-18	10.57	0.37	80	12.4	15.4	21.1	26.7	36.4	46.1	58.4
20	1-9, 12-18	10.65	0.37	85	11.9	14.9	20.3	25.7	35.1	44.4	56.2
21	10	1.63	0.48	63	3.0	3.7	5.0	6.4	8.7	11.0	13.9
22	1-10, 12-18	12.28	0.39	85	14.5	18.1	24.7	31.2	42.7	54.0	68.4
23	1-18	12.34	0.39	90	14.0	17.4	23.8	30.1	41.1	52.0	65.9

(Present Land Use)

Qued Hailouf Basin

Runoff Calculation by Rational Method

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo		to (min)	of vo (m/s)	L1 (v=1.5) (km)	t1 (min)	L2 (v=1.0) (km)	t2 (min)	Calc. to (min)	Design to (min)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq km)	
						S	I											
1	1	1.48	0.52	2,200	42	0.01909	1/52	33.49						33.49	33	103.49	22.1	14.9
2	2	1.94	0.28	1,400	29	0.02071	1/48	22.92	1.02					22.92	23	195.19	14.1	10.5
3	1-2	2.92	0.41	2,200	42	0.01909	1/52	33.49	1.09					33.49	33	103.49	33.2	11.9
4	1-3	3.37	0.40	3,200	53	0.01955	1/60	47.21	1.13					47.21	47	79.68	23.9	9.9
5	1-4	3.70	0.38	3,700	60	0.01522	1/62	53.22	1.16			0.250	4.17	57.39	57	69.07	27.0	7.3
6	6	1.51	0.24	1,900	30	0.01579	1/63	32.19	0.98					32.19	32	105.88	10.7	7.1
7	6-7	3.09	0.25	3,400	48	0.01412	1/71	52.60	1.08					52.60	53	72.69	18.3	5.3
8	1-4, 6-7	6.79	0.33	3,700	60	0.01522	1/62	53.22	1.16			0.250	4.17	57.39	57	69.07	43.0	6.3
9	1-7	7.01	0.33	3,700	60	0.01522	1/62	53.22	1.18			0.800	13.33	66.96	67	61.28	39.4	5.6
10	18	0.70	0.56	1,100	33	0.03000	1/38	16.50	1.11					16.50	17	169.08	18.4	26.3
11	17-18	1.09	0.55	1,100	33	0.03000	1/38	16.50	1.11			0.800	10.00	28.50	27	120.08	20.0	19.3
12	16-18	1.55	0.51	1,100	33	0.03000	1/38	16.50	1.11			1.250	20.83	37.34	37	96.09	20.9	13.5
13	15-18	1.73	0.50	1,100	33	0.03000	1/38	16.50	1.11			1.950	32.50	49.00	49	77.25	18.6	10.7
14	14	0.46	0.56	1,200	11	0.00917	1/109	27.66	0.72					27.66	28	116.87	8.4	18.2
15	13-14	0.80	0.54	1,900	15	0.00789	1/127	42.03	0.75					42.03	42	86.58	7.8	13.0
16	1-7, 13-18	9.34	0.37	3,700	60	0.01522	1/62	53.22	1.16			0.800	13.33	66.96	67	61.28	58.8	5.3
17	1-8, 13-18	10.01	0.38	3,700	60	0.01522	1/62	53.22	1.16			1.600	26.67	79.89	80	53.74	53.9	5.4
18	12	0.56	0.52	0,900	13	0.04393	1/23	5.27	0.95			1.300	21.67	26.93	27	120.06	9.7	17.3
19	1-8, 12-18	10.57	0.37	3,700	60	0.01522	1/62	53.22	1.18			1.600	26.67	79.89	80	53.74	58.4	5.5
20	1-8, 12-18	10.85	0.37	3,700	60	0.01522	1/62	53.22	1.16			1.900	31.67	84.99	85	61.39	56.2	5.3
21	10	1.53	0.48	1,100	8	0.00727	1/136	28.48	0.84			2.100	35.00	63.48	63	64.14	13.9	8.6
22	1-10, 12-18	12.28	0.39	3,700	60	0.01522	1/62	53.22	1.16			1.900	31.67	84.99	85	61.39	58.4	5.6
23	1-18	12.34	0.39	3,700	60	0.01522	1/62	53.22	1.16			2.200	36.67	89.89	90	49.28	65.9	5.3

Note:  $I((mm/h) = 287.4 \times T(year)^{0.34} / t(min)^{0.74}$

Runoff Calculation by Rational Method

Oued Hallouf Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. f	Design tc (min)	Calc. Q(1.05) (cu.m/s)	Calc. Q(2) (cu.m/s)	Calc. Q(5) (cu.m/s)	Calc. Q(10) (cu.m/s)	Calc. Q(25) (cu.m/s)	Calc. Q(50) (cu.m/s)	Calc. Q(100) (cu.m/s)
1	1	1.48	0.80	33	7.2	9.0	12.3	15.6	21.2	26.9	34.0
2	2	1.34	0.80	23	8.5	10.6	14.5	18.4	25.1	31.8	40.3
3	1-2	2.82	0.80	33	13.8	17.2	23.4	29.6	40.5	51.2	64.9
4	1-3	3.37	0.80	45	13.1	16.3	22.3	28.2	38.5	48.7	61.6
5	1-4	3.70	0.80	54	12.5	15.6	21.3	27.0	36.9	46.7	59.1
6	6	1.51	0.50	32	4.7	5.9	8.0	10.2	13.9	17.5	22.2
7	6-7	3.09	0.53	53	7.0	8.8	12.0	15.2	20.7	26.2	33.2
8	1-4, 6-7	6.79	0.68	54	19.6	24.4	33.3	42.1	57.6	72.8	92.2
9	1-7	7.01	0.68	63	18.0	22.5	30.7	38.8	53.0	67.1	84.9
10	18	0.70	0.80	17	5.6	7.0	9.5	12.0	16.4	20.8	26.3
11	17-18	1.09	0.80	27	6.2	7.7	10.5	13.3	18.2	23.0	29.1
12	16-18	1.55	0.80	37	7.0	8.7	11.8	15.0	20.4	25.9	32.8
13	15-18	1.73	0.80	49	6.3	7.9	10.7	13.6	18.5	23.5	29.7
14	14	0.46	0.80	28	2.5	3.2	4.3	5.5	7.5	9.4	11.9
15	13-14	0.60	0.80	42	2.4	3.1	4.2	5.3	7.2	9.1	11.5
16	1-7, 13-18	9.34	0.71	63	25.1	31.3	42.7	54.0	73.8	93.3	118.1
17	1-8, 13-18	10.01	0.70	77	22.8	28.5	38.9	49.2	67.2	85.0	107.6
18	12	0.56	0.80	27	3.2	4.0	5.4	6.8	9.3	11.8	14.9
19	1-8, 12-18	10.57	0.70	77	24.1	30.1	41.0	51.9	70.9	89.8	113.6
20	1-9, 12-18	10.65	0.70	82	23.2	28.9	39.5	50.0	68.2	86.3	109.3
21	10	1.63	0.68	63	4.2	5.2	7.1	9.0	12.3	15.6	19.7
22	1-10, 12-18	12.28	0.70	82	26.7	33.3	45.5	57.6	78.7	99.5	126.0
23	1-18	12.34	0.70	87	25.7	32.1	43.8	55.4	75.7	95.7	121.2

Runoff Calculation by Rational Method

Qued Halloul Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo	S	I	to (min)	cf. vo (m/s)	L1 (v=1.5) (km)	t1 (min)	L2 (v=1.0) (km)	t2 (min)	Calc. tc (min)	Design tc (min)	Calc. i(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq km)
1	1	1.45	0.80	2.200	42	0.01909	1/52	33.49	1.09						33.49	33	103.49	34.0	23.0
2	2	1.34	0.80	1.400	29	0.02071	1/46	22.92	1.02						22.92	23	135.19	40.3	30.0
3	1-2	2.82	0.80	2.200	42	0.01909	1/52	33.49	1.09						33.49	33	103.49	64.9	23.0
4	1-3	3.37	0.80	2.200	42	0.01909	1/52	33.49	1.09		1.000	11.11			44.60	45	82.27	61.6	18.3
5	1-4	3.70	0.80	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	0.250	4.17	54.33	54	71.99	59.1	16.0
6	6	1.51	0.50	1.900	30	0.01579	1/63	32.19	0.98						32.19	32	106.88	22.2	14.7
7	6-7	3.09	0.53	3.400	49	0.01412	1/71	52.60	1.08						52.60	53	72.89	33.2	10.7
8	1-4, 6-7	6.79	0.69	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	0.250	4.17	54.33	54	71.99	92.2	13.6
9	1-7	7.01	0.69	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	0.500	13.33	63.49	63	64.14	84.9	12.1
10	1-8	0.70	0.80	1.100	33	0.03000	1/33	16.50	1.11						16.50	17	169.08	26.3	37.5
11	17-18	1.09	0.80	1.100	33	0.03000	1/33	16.50	1.11				0.800	10.00	26.50	27	120.08	29.1	28.7
12	18-18	1.55	0.80	1.100	33	0.03000	1/33	16.50	1.11				1.250	20.83	37.34	37	96.09	38.6	21.1
13	15-18	1.73	0.80	1.100	33	0.03000	1/33	16.50	1.11				1.950	32.50	49.00	49	77.25	29.7	17.2
14	14	0.46	0.80	1.200	11	0.00917	1/109	27.86	0.72						27.86	28	115.97	11.9	26.0
15	13-14	0.50	0.80	1.900	15	0.00789	1/127	42.03	0.75						42.03	42	86.58	11.5	19.2
16	1-7, 13-18	9.34	0.71	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	0.800	13.33	63.49	63	64.14	118.1	12.6
17	1-8, 13-18	10.01	0.70	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	1.500	26.67	76.83	77	55.29	107.6	10.8
18	12	0.56	0.80	0.900	13	0.04393	1/23	5.27	0.95				1.300	21.67	26.93	27	120.06	14.9	26.7
19	1-8, 12-18	10.57	0.70	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	1.500	26.67	76.83	77	55.29	113.6	10.8
20	1-8, 12-18	10.85	0.70	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	1.800	31.67	81.83	82	52.77	109.3	10.3
21	10	1.93	0.68	1.100	8	0.00727	1/38	28.48	0.84				2.100	35.00	63.48	63	64.14	19.7	12.1
22	1-10, 12-18	12.28	0.70	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	1.900	31.67	81.83	82	52.77	125.0	10.3
23	1-18	12.34	0.70	2.200	42	0.01909	1/52	33.49	1.09		1.500	16.67	2.200	36.67	86.83	87	50.51	121.2	9.8

Note:  $i(mm/h) = 257.4 \times T(year)^{-0.34} / K(min)^{-0.74}$

## Runoff Calculation by Rational Method

## Oued Hamdoun Basin

## (Present Land Use)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design $t_c$ (min)	Calc. $Q(1.05)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)
1	1	120.30	0.22	402	25.4	31.8	43.2	54.7	74.7	94.5	119.6
2	1-2	144.40	0.22	458	27.7	34.5	47.1	59.8	81.4	103.0	130.4
3	3	13.00	0.22	136	8.1	7.6	10.4	13.2	18.0	22.8	28.8
4	1-3	157.40	0.22	458	30.2	37.8	51.3	65.0	88.7	112.3	142.1
5	1-4	170.80	0.22	500	30.8	38.2	52.1	66.0	90.1	114.0	144.4
6	5	7.80	0.20	114	3.8	4.7	6.3	8.2	11.2	14.2	17.9
7	1-5	178.40	0.22	500	32.0	39.9	54.5	69.0	94.2	118.3	151.0
8	1-6	178.00	0.22	509	31.8	38.8	54.1	68.4	93.5	118.3	149.7
9	7	11.30	0.20	118	5.4	8.7	9.1	11.6	15.8	20.0	25.3
10	1-7	180.30	0.22	508	33.8	42.1	57.5	72.8	99.4	125.7	159.2
11	1-8	193.10	0.22	548	32.4	40.4	55.2	69.8	95.3	120.8	152.7
12	18	21.70	0.22	142	9.9	12.3	16.8	21.3	28.1	36.8	46.6
13	Dam 1 (R.B.-A)	21.70	0.22	142	9.9	12.3	16.8	21.3	28.1	36.8	46.6
14	18-19	23.10	0.22	180	9.6	12.0	18.4	20.8	28.4	35.9	45.4
15	20	4.50	0.20	68	3.2	4.0	5.5	6.9	9.5	12.0	15.2
16	18-20	27.60	0.22	180	11.5	14.4	19.8	24.8	33.9	42.9	54.3
17	19-21	33.50	0.21	228	10.3	12.9	17.8	22.3	30.4	38.5	48.7
18	1-8,19-21	226.60	0.22	548	38.0	47.4	64.7	81.9	111.9	141.6	178.2
19	1-9,18-21	228.70	0.22	552	37.8	47.2	64.4	81.5	111.3	140.9	178.3
20	10	6.90	0.20	120	3.2	4.0	5.5	7.0	9.5	12.1	15.3
21	1-10,18-21	233.80	0.22	552	39.0	48.6	68.4	84.0	114.7	145.1	183.7
22	1-11,18-21	234.60	0.22	566	38.4	47.9	65.4	82.8	113.1	143.1	181.1
23	22	20.40	0.20	188	7.5	9.4	12.8	16.2	22.2	28.0	35.5
24	1-11,18-22	255.00	0.22	588	41.8	52.1	71.1	90.0	122.9	155.5	198.9
25	1-12,18-22	256.50	0.22	576	41.5	51.7	70.6	89.4	122.0	154.4	195.5
26	Dam 2 (R.B.-B)	256.50	0.22	576	41.5	51.7	70.6	89.4	122.0	154.4	195.5
27	1-13,18-22	285.40	0.22	604	41.4	51.7	70.5	89.3	121.9	154.3	195.3
28	14	7.50	0.20	86	4.5	5.8	7.7	9.7	13.3	16.8	21.2
29	1-14,18-22	272.90	0.22	604	42.8	53.1	72.5	91.8	125.4	158.8	200.8
30	1-15,18-22	284.80	0.22	672	41.1	51.2	70.0	88.8	120.9	153.0	193.7
31	16	26.20	0.22	174	10.3	12.8	17.5	22.1	30.2	38.3	48.4
32	1-16,18-22	311.10	0.22	672	44.9	58.0	78.4	98.7	132.1	167.1	211.5
33	1-22	312.80	0.22	692	44.2	55.1	75.2	95.1	129.8	164.4	208.1

Calc. Point	Sub-basin Combination	Total Area (sq. km)	Runoff Coeff. f	Lo (km)	Ho (m)	Average slope for Lo			to (min)	cf. vo (m/s)	L1 (km) (v=1.5)	ti (min)	L2 (km) (v=1.0)	t2 (min)	Calc. tc (min)	Design tc (min)	Calc. i(100) (mm/h)	Calc. Q(100) (cu. m/s)	Specific Discharge (cu. m/s/sq. km)
						S	i												
1	1	120.90	0.22	15.000	60	0.00400	1/250		402.07	0.82					402.07	402	16.27	119.6	1.0
2	1-2	144.40	0.22	15.000	60	0.00400	1/250		402.07	0.82					457.07	459	14.78	130.4	0.9
3	3	13.00	0.22	9.000	75	0.00393	1/120		136.35	1.10					136.35	136	96.29	28.8	2.2
4	1-3	157.40	0.22	15.000	60	0.00400	1/250		402.07	0.82					457.07	459	14.78	142.1	0.9
5	1-4	170.60	0.22	15.000	60	0.00400	1/250		402.07	0.82					500.40	500	13.65	144.4	0.8
6	6	7.80	0.20	8.000	95	0.01063	1/94		113.41	1.18					113.41	114	41.35	17.9	2.3
7	1-5	178.40	0.22	15.000	60	0.00400	1/250		402.07	0.82					500.40	500	13.65	151.0	0.8
8	1-6	179.00	0.22	15.000	60	0.00400	1/250		402.07	0.82					508.73	508	13.69	149.7	0.8
9	7	11.30	0.20	8.200	82	0.01000	1/100		118.32	1.16					118.32	118	40.31	25.9	2.2
10	1-7	190.30	0.22	15.000	60	0.00400	1/250		402.07	0.82					508.73	508	13.69	152.2	0.8
11	1-8	193.10	0.22	15.000	60	0.00400	1/250		402.07	0.82					547.07	548	12.94	152.7	0.8
12	18	21.70	0.22	6.500	25	0.00395	1/260		142.93	0.76					142.93	142	56.15	46.6	2.1
13	Dam 1 (R.B.-A)	21.70	0.22	6.500	25	0.00395	1/260		142.93	0.76					142.93	142	56.15	46.6	2.1
14	18-19	23.10	0.22	6.500	25	0.00395	1/260		142.93	0.76					159.59	160	32.18	45.4	2.0
15	20	4.50	0.20	4.500	55	0.01222	1/82		69.00	1.09					69.00	68	60.61	15.2	3.4
16	18-20	27.60	0.22	6.500	25	0.00395	1/260		142.93	0.76					159.59	160	32.18	54.3	2.0
17	18-21	33.50	0.21	6.500	25	0.00395	1/280		142.93	0.76					228.28	226	24.92	48.7	1.5
18	1-8,18-21	226.50	0.22	15.000	60	0.00400	1/250		402.07	0.82					547.07	548	12.94	179.2	0.8
19	1-9,18-21	228.70	0.22	15.000	60	0.00400	1/250		402.07	0.82					552.07	552	12.87	178.3	0.8
20	10	6.90	0.20	8.000	75	0.00398	1/107		119.01	1.12					119.01	120	39.81	15.9	2.2
21	1-10,18-21	233.60	0.22	15.000	60	0.00400	1/250		402.07	0.82					552.07	552	12.87	183.7	0.8
22	1-11,18-21	234.60	0.22	15.000	60	0.00400	1/250		402.07	0.82					556.40	556	12.83	181.1	0.8
23	22	30.40	0.20	5.500	53	0.00558	1/179		165.90	0.95					165.90	156	31.31	35.5	1.7
24	1-11,18-22	255.00	0.22	15.000	60	0.00400	1/250		402.07	0.82					566.40	568	12.83	198.9	0.8
25	1-12,18-22	258.50	0.22	15.000	60	0.00400	1/250		402.07	0.82					575.40	576	12.47	195.5	0.8
26	Dam 2 (R.B.-B)	258.50	0.22	15.000	60	0.00400	1/250		402.07	0.82					575.40	576	12.47	195.5	0.8
27	1-13,18-22	265.40	0.22	15.000	60	0.00400	1/250		402.07	0.82					603.73	604	12.04	185.3	0.7
28	14	7.50	0.20	6.000	75	0.01250	1/80		85.36	1.17					85.36	86	50.94	21.2	2.8
29	1-14,18-22	272.90	0.22	15.000	60	0.00400	1/250		402.07	0.82					603.73	604	12.04	200.8	0.7
30	1-15,18-22	284.90	0.22	15.000	60	0.00400	1/250		402.07	0.82					572.07	572	11.13	193.7	0.7
31	16	26.20	0.22	12.000	98	0.00775	1/129		174.86	1.14					174.86	174	30.24	46.4	1.8
32	1-16,18-22	311.10	0.22	15.000	60	0.00400	1/250		402.07	0.82					672.07	672	11.13	211.5	0.7
33	1-22	312.80	0.22	15.000	60	0.00400	1/250		402.07	0.82					692.07	692	10.89	209.1	0.7

Note:  $i_t(\text{mm/h}) = 257.4 \times T(\text{year})^{0.34} / t_t(\text{min})^{0.74}$

Runoff Calculation by Rational Method

Quied Hamdoun Basin

(Future Land Use Condition)

Calc. Point	Sub-basin Combination	Total Area (sq.km)	Runoff Coeff. $f$	Design $t_c$ (min)	Calc. $Q(1.03)$ (cu.m/s)	Calc. $Q(2)$ (cu.m/s)	Calc. $Q(5)$ (cu.m/s)	Calc. $Q(10)$ (cu.m/s)	Calc. $Q(25)$ (cu.m/s)	Calc. $Q(50)$ (cu.m/s)	Calc. $Q(100)$ (cu.m/s)
1	1	120.30	0.23	402	26.3	33.1	45.2	57.2	78.1	98.8	123.1
2	1-2	144.40	0.22	438	27.7	34.5	47.1	59.6	81.4	103.0	130.4
3	3	13.00	0.23	136	6.4	8.0	10.9	13.8	18.8	23.8	30.1
4	1-3	157.40	0.23	438	31.5	39.3	53.7	67.9	92.8	117.4	148.8
5	1-4	170.80	0.25	500	34.8	43.4	59.3	75.0	102.4	129.8	164.1
6	5	7.80	0.26	114	4.9	6.2	8.4	10.8	14.5	18.4	23.3
7	1-5	178.40	0.25	500	36.4	45.4	62.0	79.4	107.1	135.5	171.6
8	1-6	179.00	0.25	508	38.1	45.0	61.4	77.8	106.2	134.4	170.1
9	7	11.30	0.20	118	5.4	6.7	8.1	11.8	15.8	20.0	25.3
10	1-7	190.30	0.25	508	38.4	47.8	65.3	82.7	112.9	142.9	180.9
11	1-8	193.10	0.25	548	38.8	45.8	62.7	79.3	108.3	137.1	173.5
12	18	21.70	0.23	142	10.3	12.9	17.6	22.3	30.4	38.5	48.7
13	Dam 1 (R.B.-A)	21.70	0.23	142	10.3	12.9	17.6	22.3	30.4	38.5	48.7
14	18-19	23.10	0.23	160	10.1	12.6	17.2	21.7	29.6	37.5	47.5
15	20	4.50	0.20	88	3.2	4.0	5.5	6.9	9.5	12.0	15.2
16	18-20	27.60	0.23	180	12.0	15.0	20.5	25.9	35.4	44.8	56.7
17	18-21	33.50	0.26	228	12.8	16.0	21.8	27.6	37.6	47.8	60.3
18	1-8,18-21	228.80	0.25	548	43.2	53.9	73.5	93.1	127.1	160.9	203.8
19	1-9,18-21	226.70	0.25	532	43.0	53.6	73.2	92.8	126.5	160.1	202.6
20	10	6.80	0.20	120	3.2	4.0	5.5	7.0	9.5	12.1	15.3
21	1-10,18-21	233.80	0.25	532	44.3	55.2	75.4	95.4	130.3	164.9	209.8
22	1-11,18-21	234.80	0.25	568	43.7	54.4	74.3	94.1	128.5	162.6	205.8
23	22	20.40	0.26	186	9.8	12.2	16.7	21.1	28.8	36.4	46.1
24	1-11,18-22	255.00	0.25	566	47.5	59.2	80.8	102.3	139.7	176.7	223.7
25	1-12,18-22	256.50	0.25	576	47.1	58.8	80.2	101.5	138.7	175.5	222.1
26	Dam 2 (R.B.-B)	258.50	0.25	576	47.1	58.8	80.2	101.5	138.7	175.5	222.1
27	1-13,18-22	263.40	0.25	604	47.1	58.7	80.2	101.4	138.5	175.3	221.9
28	14	7.50	0.20	86	4.5	5.6	7.7	9.7	13.3	16.8	21.2
29	1-14,18-22	272.80	0.25	604	48.4	60.4	82.4	104.3	142.5	180.3	228.2
30	1-15,18-22	284.80	0.25	672	46.7	58.2	78.5	100.8	137.4	173.8	220.1
31	16	26.20	0.23	174	10.7	13.4	18.3	23.1	31.6	40.0	50.6
32	1-18,18-22	311.10	0.25	672	51.0	63.8	86.8	109.9	150.1	189.9	240.4
33	1-22	312.80	0.25	682	50.2	62.6	85.4	108.1	147.6	186.8	236.3

Runoff Calculation by Rational Method																			Qued Haradoun Basin												(Future Land Use Condition)													
Calc. Point	Sub-basin Combination	Total Area (sq km)	Runoff Coeff. I	Lo (km)	Ho (m)	Average slope for Lo		to (min)	cf. vo (m/s)	L1 (v=1.5) (km)	t1 (min)	L2 (v=1.0) (km)	t2 (min)	Calc. to (min)	Design to (min)	Calc. l(100) (mm/h)	Calc. Q(100) (cu m/s)	Specific Discharge (cu m/s/sq km)																										
						S	I																																					
1	1	120.30	0.23	15.000	60	0.00400	1/250	402.07	0.62					402.07	402	16.27	125.1	1.0																										
2	1-2	144.40	0.22	15.000	60	0.00400	1/250	402.07	0.62			3.300	55.00	457.07	458	14.75	130.4	0.9																										
3	3	13.00	0.23	9.000	75	0.00393	1/120	136.35	1.10					136.35	136	36.29	30.1	2.3																										
4	1-3	157.40	0.23	15.000	60	0.00400	1/250	402.07	0.62			3.300	55.00	457.07	458	14.75	148.6	0.9																										
5	1-4	170.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			5.900	98.33	500.40	500	13.95	164.1	1.0																										
6	5	7.80	0.26	8.000	85	0.01063	1/94	113.41	1.18					113.41	114	41.35	23.3	3.0																										
7	1-5	178.40	0.25	15.000	60	0.00400	1/250	402.07	0.62			5.900	98.33	500.40	500	13.95	171.6	1.0																										
8	1-6	179.00	0.25	15.000	60	0.00400	1/250	402.07	0.62			6.400	106.67	508.73	508	13.69	170.1	1.0																										
9	7	11.30	0.20	8.200	82	0.01000	1/100	118.32	1.15					118.32	118	40.31	25.3	2.2																										
10	1-7	190.30	0.25	15.000	60	0.00400	1/250	402.07	0.62			6.400	106.67	508.73	508	13.69	180.9	1.0																										
11	1-8	193.10	0.25	15.000	60	0.00400	1/250	402.07	0.62			8.700	145.00	547.07	548	12.94	173.5	0.9																										
12	18	21.70	0.23	6.500	25	0.00395	1/260	142.93	0.75					142.93	142	35.15	48.7	2.2																										
13	Dam 1 (R.B.-A)	21.70	0.23	6.500	25	0.00395	1/260	142.93	0.75					142.93	142	35.15	48.7	2.2																										
14	19-19	23.10	0.23	6.500	25	0.00395	1/260	142.93	0.75			1.000	16.67	159.59	160	32.18	47.5	2.1																										
15	20	4.50	0.20	4.500	55	0.01222	1/82	59.00	1.09					59.00	58	60.51	15.2	3.4																										
16	19-20	27.60	0.23	6.500	25	0.00395	1/260	142.93	0.75			1.000	16.67	159.59	160	32.18	56.7	2.1																										
17	18-21	33.50	0.26	6.500	25	0.00395	1/260	142.93	0.75			5.000	83.33	226.28	226	24.92	50.9	1.8																										
18	1-8,18-21	226.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			8.700	145.00	547.07	548	12.94	203.6	0.9																										
19	1-9,18-21	226.70	0.25	15.000	60	0.00400	1/250	402.07	0.62			9.000	150.00	552.07	552	12.87	202.6	0.9																										
20	10	6.90	0.20	8.000	75	0.00936	1/107	119.01	1.12					119.01	120	39.81	15.3	2.2																										
21	1-10,18-21	233.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			9.000	150.00	552.07	552	12.87	208.6	0.9																										
22	1-11,18-21	234.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			9.500	163.33	565.40	566	12.83	205.9	0.9																										
23	22	20.40	0.26	9.500	53	0.00558	1/179	165.90	0.95					165.90	166	31.31	46.1	2.3																										
24	1-11,18-22	255.00	0.25	15.000	60	0.00400	1/250	402.07	0.62			9.500	163.33	565.40	566	12.83	223.7	0.9																										
25	1-12,18-22	256.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			10.400	173.33	575.40	576	12.47	222.1	0.9																										
26	Dam 2 (R.B.-B)	256.60	0.25	15.000	60	0.00400	1/250	402.07	0.62			10.400	173.33	575.40	576	12.47	222.1	0.9																										
27	1-13,18-22	265.40	0.25	15.000	60	0.00400	1/250	402.07	0.62			12.100	201.67	603.73	604	12.04	221.9	0.8																										
28	14	7.50	0.20	6.000	75	0.01250	1/80	85.36	1.17					85.36	86	50.94	21.2	2.8																										
29	1-14,18-22	272.90	0.25	15.000	60	0.00400	1/250	402.07	0.62			12.100	201.67	603.73	604	12.04	228.2	0.8																										
30	1-15,18-22	284.90	0.25	15.000	60	0.00400	1/250	402.07	0.62			16.200	270.00	672.07	672	11.13	220.1	0.8																										
31	16	26.20	0.23	12.000	93	0.00775	1/129	174.96	1.14					174.96	174	30.24	50.6	1.9																										
32	1-16,18-22	311.10	0.25	15.000	60	0.00400	1/250	402.07	0.62			16.200	270.00	672.07	672	11.13	240.4	0.8																										
33	1-22	312.80	0.25	15.000	60	0.00400	1/250	402.07	0.62			17.400	290.00	692.07	692	10.89	236.5	0.8																										

Note:  $I((mm/h) = 287.4 \times T(year)^{0.34} / t(min)^{0.74}$