CITY OF LEBANON
Storm Drainage Master Plan

CHAPTER 6

6.0 RUNOFF ANALYSIS

Runoff from each sub-basin was determined using the Corps of Engineers' HEC-1 hydrologic computer model. This model uses the input parameters presented in Chapter 4, "Basin Delineation and Model Parameters", to compute estimated peak flows from each sub-basin. Flows from each sub-basin were routed as previously shown in Chapter 4 by Figure 4.1, "Major Basin and Sub-Basin Map".

6.1 PEAK SUB-BASIN FLOWS

Peak flows from each sub-basin were computed for the 2, 5, and 10-year frequency events. Design flows for 2, 5, and 10 year frequencies are adequate for the design of local drainage systems. The results of this analysis for each *individual* sub-basin under both existing and future development conditions are presented in Table 6.1, "Sub-Basin Flows". These flows should be used when estimating local flows generated from part of an individual sub-basin.

6.2 PEAK CUMULATIVE FLOWS

Hydrographs from each sub-basin were routed and combined using the HEC-1 computer program to estimate the peak in-stream flows. Peak flows were computed at each sub-basin node (as shown in Figure 4.1) and represent the combined flow due to all upstream basins. The peak flows for the 10, 25, 50 and 100-year design storms are presented in Table 6.2, "Peak Drainageway Flows."

6.3 PARTIAL SUB-BASIN FLOWS

For minor reaches within a sub-basin, such as a storm drain which contributes to the main drainageway, an easy method to estimate peak flow is needed. The smaller the catchment area, the smaller the lag time and the higher the flows assuming all other factors remain equal. Therefore, partial sub-basin flow can only be estimated as a non-linear function of sub-basin area. For the purpose of estimating flows for catchment areas which are less than a sub-basin in size, either the Rational Method or the following method may be used:

(1) For the point of interest, find the appropriate sub-basin using Figure 7.0b then the appropriate plan view in Chapter 7.

(2) For the sub-basin and storm frequency of interest, find the peak sub-basin flow using Table 6.1, "Sub-Basin Flows".

(3) Estimate the area draining to the point of interest as a percentage of the total sub-basin area.

(4) Refer to Figure 6.1, "Calculation of Flow in Minor Reaches". Using the percentage of sub-basin area drained, find the percentage of sub-basin flow.

(5) Multiply the total sub-basin peak flow determined in Step #2 above by the percentage of sub-basin flow determined in Step #4.

For determining storm flows from a single site, use the Rational Method. See Chapter 10.

TABLE 6.1

SUB-BASIN FLOWS

		EXISTING FLOWS			FUTURE FLOWS		
SUB-BASIN	DRAINAGE AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)
COX CREEK BASIN							
C-A0	218.8	25	38	46	85	110	125
C-AL	124.0	14	23	28	49	63	72
C-A10	108.0	4	9	12	39	51	59
C-B	74.1	5	9	11	13	18	21
C-BR	52.4	5	9	11	13	18	21
C-0	170.3	16	26	32	70	90	102
C-0R	96.4	6	11	14	36	47	54
C-10	112.1	16	24	29	48	62	71
C-20	80.4	17	24	29	21	28	33
C-20L	72.7	14	21	24	14	21	24
C-20LL	27.5	13	17	19	13	17	19
C-20L1	54.0	14	19	23	14	19	23
C-30	69.1	12	18	21	16	23	26
C-30L	45.2	13	17	20	13	17	20
C-40	47.8	9	13	15	9	13	15
C-50	54.3	7	11	13	15	20	23
C-50L	39.0	9	12	14	10	14	16
C-50L1	41.8	10	14	17	10	14	17
C-60	67.8	9	13	16	19	26	30
C-70	65.7	12	17	20	19	26	29
C-70L	40.4	7	10	12	7	10	12
C-70L1	44.2	21	28	33	21	28	33
C-70L1R	65.9	5	9	12	5	9	12
C-70L2	37.1	2	4	5	2	4	5
C-70L3	150.4	6	11	14	6	11	14
C-80	43.5	6	9	11	12	16	18
C-90	40.0	7	11	13	9	13	15
C-100	69.0	13	19	23	15	22	26
C-110	33.5	7	10	12	9	12	14
C-120	70.5	21	28	33	23	31	35
C-130	74.2	12	17	21	27	35	41
C-130L	51.0	25	39	48	45	62	72
C-140	83.5	12	18	22	19	27	32

TABLE 6.1
(Continued)
SUB-BASIN FLOWS

		EXISTING FLOWS			FUTURE FLOWS		
SUB-BASIN	DRAINAGE AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)
CROWN CREEK BASIN							
X-0	41.9	2	3	5	2	3	5
X-10	49.5	2	5	7	16	21	23
X-10R	30.1	7	10	12	7	10	12
X-20	42.6	8	11	13	8	11	14
LEBANON-ALBANY CANAL							
L-0	74.6	5	9	12	12	17	20
L-10	20.8	6	8	9	6	8	9
L-20	52.5	13	18	21	13	18	21
L-20L	110.2	15	23	28	19	28	33
L-30	54.0	14	19	22	14	19	22
MARKS SLOUGH BASIN							
M-0	137.5	4	6	9	53	68	76
M-10	59.2	32	40	46	8	10	11
M-10L	73.8	12	17	19	12	17	20
M-20	56.7	19	24	28	19	24	28
SOUTH SANTIAM BASIN							
S-A	41.5	1	1	1	11	14	16
S-B	48.1	4	5	6	8	10	11
S-C	59.1	2	3	5	8	12	15
S-D	133.3	15	18	21	50	63	70
S-E	460.5	11	26	39	89	120	140
S-F	114.0	3	7	11	28	38	45
S-G	123.0	4	8	11	26	35	41
S-H	312.2	78	103	118	101	128	144
LITTLE OAK CREEK BASIN							
LO-A	255.3	20	33	42	94	122	139
LO-B	188.1	14	25	32	51	67	78

TABLE 6.1
(Continued)
SUB-BASIN FLOWS

		EXISTING FLOWS			FUTURE FLOWS		
SUB-BASIN	DRAINAGE AREA (ACRES)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)	Q2 (CFS)	Q5 (CFS)	Q10 (CFS)
OAK CREEK BASIN							
O-A	203.0	32	51	63	92	118	134
O-B	142.1	14	25	32	14	25	32
O-C	51.0	5	8	10	18	25	29
O-D	102.1	1	18	22	16	23	28
O-D10	71.6	7	11	14	14	20	24
O-E0	96.4	8	13	16	21	29	34
O-E0L	92.8	11	17	21	17	24	28
O-E10	215.1	17	29	37	35	49	58
O-E10R	221.7	16	29	36	48	66	76
O-F	143.9	6	12	16	26	36	42
O-G	138.1	13	24	31	38	51	60
O-H	1932.8	117	201	256	117	201	256
O-I	2240	189	336	431	189	336	431
O-J	5292	298	507	643	298	507	643

TABLE 6.2

PEAK DRAINAGEWAY FLOWS

BASIN Node	UPSTREAM DRAINAGE (ACRES)	EXISTING FLOWS Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)	FUTURE FLOWS (WITHOUT IMPROVEMENTS) Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
COX CREEK BASIN									
Confluence of C-AL & C-A	550.4	101	128	157	180	286	334	384	423
C-AL	121.6	28	35	43	49	72	84	96	105
C-A0	428.8	79	100	123	141	214	250	288	318
Confluence of C-A & C-B	211.2	33	44	56	65	91	107	124	138
Confluence of C-A & C-BR	160	23	30	39	46	75	88	102	113
C-A10	108.8	12	17	22	27	59	68	79	87
C-0	1997.3	424	521	627	711	573	685	805	900
C-0R	96.4	14	19	24	28	54	63	72	80
C-10	1730.6	380	466	558	632	490	590	697	781
C-20	1618.5	353	433	521	590	459	553	653	732
C-20L	154.2	60	71	83	92	60	71	83	92
C-20LL	27.5	19	22	24	27	19	22	24	27
C-20L1	54.0	38	44	51	56	38	44	51	56
C-30	1383.9	290	357	430	488	385	462	546	611
Confluence of 30L & Cox Cr.	79.8	276	339	408	463	365	439	517	578
C-30L	45.2	20	23	27	30	20	24	27	30
C-40	1269.6	264	325	391	443	351	421	496	555
C-50	1221.8	253	312	376	426	339	406	478	535
C-50L	80.8	31	37	43	48	33	39	46	51
C-50L1	41.8	17	20	23	26	17	20	23	26
C-60	1086.7	220	271	327	371	295	353	416	464
C-70	1018.9	205	252	303	344	273	327	384	429
Confluence of C-70L & C-80	953.2	189	233	280	317	252	302	355	397
C-70L	335.1	52	60	70	77	52	61	70	78
C-70L1	294.7	45	52	59	65	45	52	59	65
C-70L1R	65.9	12	15	19	22	12	15	19	22
C-70L2	185.6	15	17	19	23	15	17	19	23
C-70L3	147.2	10	10	13	19	10	10	13	19
C-80	618.1	138	170	208	236	200	238	282	315
C-90	574.6	133	165	199	226	191	228	268	300
C-100	534.6	125	154	187	212	179	214	251	280
C-110	465.6	112	138	167	189	159	190	222	247
C-120	432.1	103	128	154	175	148	177	207	230
C-130	361.6	86	107	130	147	123	146	171	191
C-130L	203.9	48	59	72	82	72	85	100	111
C-140	83.5	22	27	33	38	32	38	45	50

TABLE 6.2

(Continued)

PEAK DRAINAGEWAY FLOWS

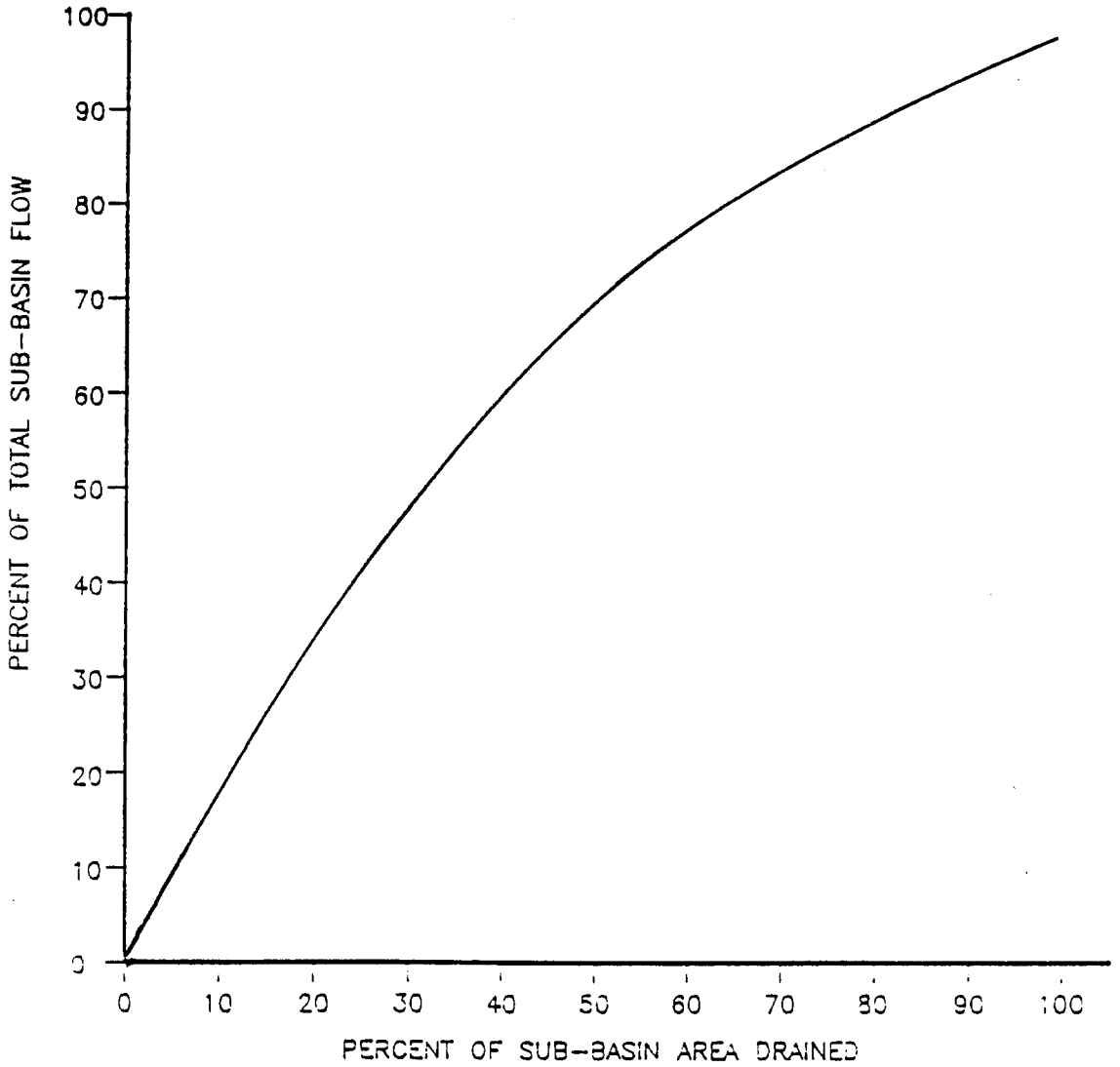
BASIN Node	UPSTREAM DRAINAGE (ACRES)	EXISTING FLOWS Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)		FUTURE FLOWS (WITHOUT IMPROVEMENTS) Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
X CREEK BASIN										
X-0	164.1	34	43	53	61		50	59	70	78
X-10	122.2	32	39	48	54		48	56	65	73
Confluence of X-10R & X-20	72.7	25	30	35	40		25	30	35	40
X-10R	30.1	12	14	16	18		12	14	16	18
X-20	42.6	13	16	19	22		14	16	19	22
LEBANON-ALBANY CANAL										
L-0	258.1	99	120	143	161		111	133	157	177
L-10	203.1	88	106	125	139		93	112	131	146
L-20	162.7	70	85	100	113		75	90	106	119
L-20L	110.2	28	35	43	49		33	40	48	55
L-30	54.0	22	26	30	33		22	26	30	33
MARKS SLOUGH BASIN										
M-0	307.2	48	55	65	72		103	120	139	154
M-10	169.7	46	51	59	65		49	58	67	75
M-10L	73.8	37	41	48	52		37	45	52	58
M-20	36.7	18	19	22	24		18	21	24	26
SOUTH SANTIAM BASIN										
S-A	41.5	1	1	1	2		16	18	20	22
S-B	48.1	6	6	8	9		11	13	15	16
S-C	59.1	5	7	9	12		15	18	22	26
S-D	133.3	21	24	28	32		70	80	90	99
S-E	460.5	39	60	85	105		140	169	200	224
S-F	114.0	11	17	25	31		45	54	64	72
S-G	123.0	11	16	21	25		41	50	59	66
S-H	312.2	118	138	159	176		144	165	186	203

TABLE 6.2

(Continued)

PEAK DRAINAGEWAY FLOWS

		EXISTING FLOWS					FUTURE FLOWS (WITHOUT IMPROVEMENTS)			
BASIN Node	UPSTREAM DRAINAGE (ACRES)	Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)		Q10 (CFS)	Q25 (CFS)	Q50 (CFS)	Q100 (CFS)
LITTLE OAK CREEK BASIN										
LO-A	255.3	42	55	69	80		139	162	185	204
LO-B	188.1	32	42	53	61		78	92	106	118
OAK CREEK BASIN										
O-A	10944.0	1311	1692	2112	2448		1346	1722	2137	2468
O-B	142.1	1029	1328	1657	1921		1060	1358	1693	1964
O-D	8614.0	1007	1299	1620	1879		1032	1321	1642	1902
O-E	8442.0	981	1266	1580	1831		1005	1288	1598	1848
O-G	7814.0	896	1156	1442	1671		906	1166	1451	1679
O-J	5293.0	643	833	1042	1210		643	833	1042	1210
O-E0	626.0	110	141	176	203		192	231	273	305
O-E0L	92.8	21	26	31	35		28	34	40	45
O-E10	436.8	73	95	119	139		132	158	187	209
O-E10R	221.7	36	47	59	69		76	91	107	119
O-D0	173.7	36	45	55	63		50	60	71	80
O-D10	71.6	14	17	21	25		24	29	34	38



BASED ON SUB-BASINS WITH MIA ~ 60±

RANGE OF AREAS: 22 TO 135 ACRES

RANGE OF FLOWS: 11 TO 50 CFS

DESIGNED: DLS DN: BJS CKED: DWO PROJECT NO. 229 DP 12	DAVID J. NEWTON ASSOCIATES INCORPORATED CIVIL & GEOLOGICAL ENGINEERING 1201 S.W. 12TH AVE., SUITE 620 PORTLAND, ORE. 97205 • 228-7718	CALCULATION OF FLOW IN MINOR REACHES CITY OF LEBANON Storm Drainage Master Plan	DATE 1991 FIGURE 6.1

PROJECT NO. - PWG