Volume 1, Chapter 4 – Rainfall

Users' Guidance:

If a UDFCD *Section* number in this chapter is **skipped**:
It was adopted as is; please refer to that Section in the **corresponding UDFCD Manual**, Volume, Chapter and *Section.*

If a UDFCD *Section* number in this chapter is **amended or a new COFC *Section* in this Chapter is added**:
It is **listed below**; please refer to it in **this document**.

If a UDFCD *Section* in this chapter is **deleted then** it was **not** adopted by the City of Fort Collins;
The deleted UDFCD *Section* number will be **identified as deleted in the text below**.

(1) *Section 1.0* is deleted in its entirety.

(2) A new *Section 1.1* is added, to read as follows:

1.1 General Design Storms

All drainage system design and construction must take into consideration three separate and distinct drainage problems.

The first is the eightieth (80^{th}) percentile storm event or the rain event for which 80% of all rain events have an equal or smaller depth of rain. This storm event is used to design water quality features. The second is the "Minor" or "Initial Storm", which is the 2-year storm in the city of Fort Collins. This is the storm that has a probability of occurring, on the average, once every two (2) years (or one that has a fifty percent chance probability of exceedance every year). The third is the "Major Storm", which is the 100-year storm in the city of Fort Collins. This is the storm that has a probability of occurring, on the average, once every one hundred (100) years (or one that has a one percent probability of exceedance every year). In some instances the 100-year storm routing of runoff will not be the same as that for the 2-year storm.

(3) A new *Section 1.2* is added, to read as follows:

1.2 Minor (2-Year) Storm Provisions

The objectives of such drainage system planning are to minimize inconvenience, to protect against recurring minor damage and to reduce maintenance costs in order to create an orderly drainage system at a reasonable cost. The 2-year storm drainage system may include such facilities as curb and gutter, storm sewer, open channels, drainageways, ponds, rivers, streams, and detention facilities.

(4) A new Section 1.3 is added, to read as follows:

1.3 Major (100-Year) Storm Provisions

The objectives of the 100-year storm drainage system planning are to eliminate substantial loss of life or property damage. Major drainage systems may include storm sewers, open channels, drainageways, ponds, rivers, streams, and detention facilities. The correlation between the minor and major storm system must be analyzed to ensure that a well coordinated drainage system is designed and constructed.

(5) *Section 2.0* is deleted in its entirety.

(6) *Section 2.1* is deleted in its entirety.

(7) *Section 2.2* is deleted in its entirety.

(8) *Section 3.0* is deleted in its entirety.

(9) *Section 3.1* is deleted in its entirety.

(10) *Section 3.2* is deleted in its entirety.

(11) *Section 4.0* is amended to read as follows:

4.0 Intensity-Duration-Frequency Curves for Rational Method:

The one-hour rainfall Intensity-Duration-Frequency tables for use the Rational Method of runoff analysis are provided in Table RA-7 and in Table RA-8.

Table RA-7 -- City of Fort Collins

Rainfall Intensity-Duration-Frequency Table for Use with the Rational Method

(5 minutes to 30 minutes)

Duration (min)	**2-Year Intensity** (in/hr)	**10-Year Intensity** (in/hr)	**100-Year Intensity** (in/hr)
5	2.85	4.87	9.95
6	2.67	4.56	9.31
7	2.52	4.31	8.8
8	2.4	4.1	8.38
9	2.3	3.93	8.03
10	2.21	3.78	7.72
11	2.13	3.63	7.42
12	2.05	3.5	7.16
13	1.98	3.39	6.92
14	1.92	3.29	6.71
15	1.87	3.19	6.52
16	1.81	3.08	6.3
17	1.75	2.99	6.1
18	1.7	2.9	5.92
19	1.65	2.82	5.75
20	1.61	2.74	5.6
21	1.56	2.67	5.46
22	1.53	2.61	5.32
23	1.49	2.55	5.2
24	1.46	2.49	5.09
25	1.43	2.44	4.98
26	1.4	2.39	4.87
27	1.37	2.34	4.78
28	1.34	2.29	4.69
29	1.32	2.25	4.6
30	1.3	2.21	4.52

Table RA-8 -- City of Fort Collins

Rainfall Intensity-Duration-Frequency Table
for Use with the Rational Method

(31 minutes to 60 minutes)

Duration (min)	**2-Year Intensity** (in/hr)	**10-Year Intensity** (in/hr)	**100-Year Intensity** (in/hr)
31	1.27	2.16	4.42
32	1.24	2.12	4.33
33	1.22	2.08	4.24
34	1.19	2.04	4.16
35	1.17	2.0	4.08
36	1.15	1.96	4.01
37	1.16	1.93	3.93
38	1.11	1.89	3.87
39	1.09	1.86	3.8
40	1.07	1.83	3.74
41	1.05	1.8	3.68
42	1.04	1.77	3.62
43	1.02	1.74	3.56
44	1.01	1.72	3.51
45	0.99	1.69	3.46
46	0.98	1.67	3.41
47	0.96	1.64	3.36
48	0.95	1.62	3.31
49	0.94	1.6	3.27
50	0.92	1.58	3.23
51	0.91	1.56	3.18
52	0.9	1.54	3.14
53	0.89	1.52	3.1
54	0.88	1.5	3.07
55	0.87	1.48	3.03
56	0.86	1.47	2.99
57	0.85	1.45	2.96
58	0.84	1.43	2.92
59	0.83	1.42	2.89
60	0.82	1.4	2.86

(12) A new *Section 4.1* is added, to read as follows:

4.1 Intensity-Duration-Frequency Curves for SWMM:

The hyetograph input option must be selected when creating SWMM input files. Hyetographs for the 2-, 5-, 10-, 25-, 50-, and 100-year City of Fort Collins rainfall events are provided in Table RA-9.

Table RA-9 – City of Fort Collins

Rainfall Intensity-Duration-Frequency Table

for Use with SWMM

Duration (min)	**2-Year Intensity** (in/hr)	**5-Year Intensity** (in/hr)	**10-Year Intensity** (in/hr)	**25-Year Intensity** (in/hr)	**50-Year Intensity** (in/hr)	**100-Year Intensity** (in/hr)
5	0.29	0.40	0.49	0.63	0.79	1.00
10	0.33	0.45	0.56	0.72	0.90	1.14
15	0.38	0.53	0.65	0.84	1.05	1.33
20	0.64	0.89	1.09	1.41	1.77	2.23
25	0.81	1.13	1.39	1.80	2.25	2.84
30	1.57	2.19	2.69	3.48	4.36	5.49
35	2.85	3.97	4.87	6.30	7.90	9.95
40	1.18	1.64	2.02	2.61	3.27	4.12
45	0.71	0.99	1.21	1.57	1.97	2.48
50	0.42	0.58	0.71	0.92	1.16	1.46
55	0.35	0.49	0.60	0.77	0.97	1.22
60	0.30	0.42	0.52	0.67	0.84	1.06
65	0.20	0.28	0.39	0.62	0.79	1.00
70	0.19	0.27	0.37	0.59	0.75	0.95
75	0.18	0.25	0.35	0.56	0.72	0.91
80	0.17	0.24	0.34	0.54	0.69	0.87
85	0.17	0.23	0.32	0.52	0.66	0.84
90	0.16	0.22	0.31	0.50	0.64	0.81
95	0.15	0.21	0.30	0.48	0.62	0.78
100	0.15	0.20	0.29	0.47	0.60	0.75
105	0.14	0.19	0.28	0.45	0.58	0.73
110	0.14	0.19	0.27	0.44	0.56	0.71
115	0.13	0.18	0.26	0.42	0.54	0.69
120	0.13	0.18	0.25	0.41	0.53	0.67

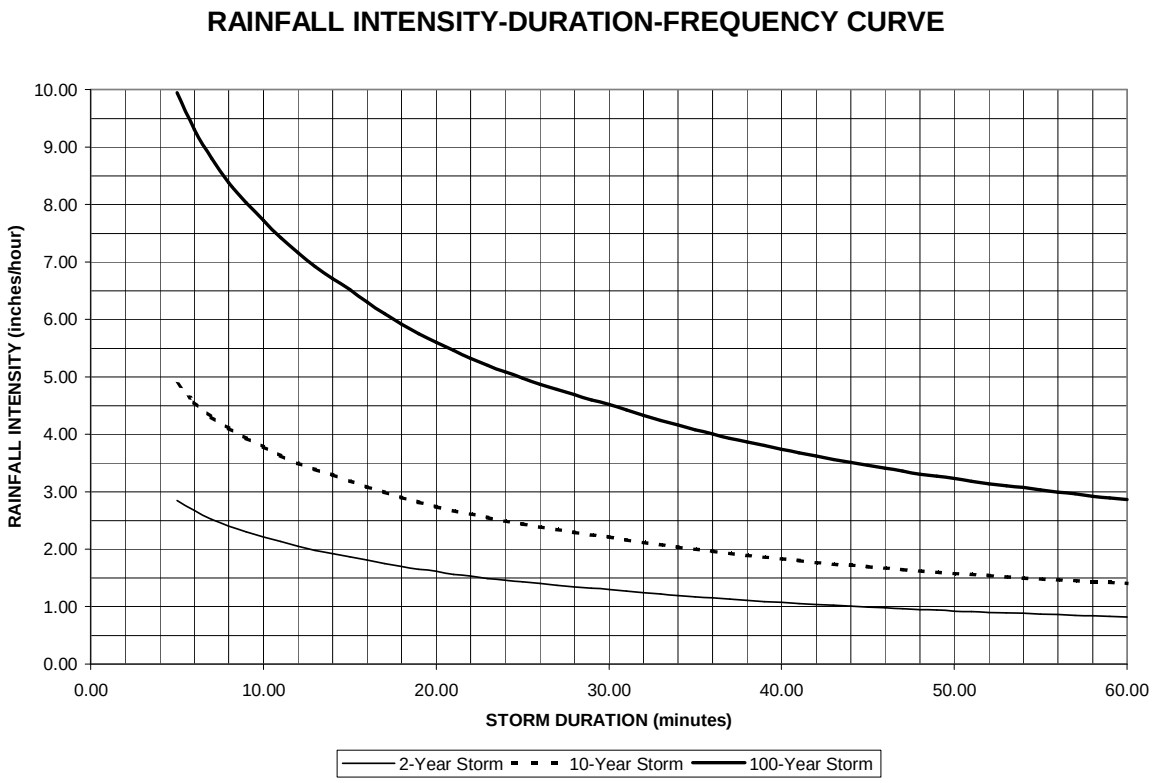

Figure RA-16 City of Fort Collins Rainfall Intensity-Duration-Frequency Curves

(13) *Section 5.0* is deleted in its entirety.

(14) *Section 6.0* is deleted in its entirety.

(15) *Section 7.0* is deleted in its entirety.

(16) *Section 7.1* is deleted in its entirety.

(17) *Section 7.2* is deleted in its entirety.

(18) *Section 7.3* is deleted in its entirety.

(19) *Section 8.0* is deleted in its entirety.

(20) *Table RA-1* is deleted in its entirety.

(21) *Table RA-2* is deleted in its entirety.

(22) *Table RA-3* is deleted in its entirety.

(23) *Table RA-4* is deleted in its entirety.

(24) *Table RA-5* is deleted in its entirety.

(25) *Table RA-6* is deleted in its entirety.

(26) *Table RA-7*—City of Fort Collins Rainfall Intensity-Duration-Frequency Table for use with the Rational Method (5minutes to 30 minutes) is added.

(27) *Table RA-8*—City of Fort Collins Rainfall Intensity-Duration-Frequency Table for use with the Rational Method (31 minutes to 60 minutes) is added.

(28) *Table RA-9*—City of Fort Collins Rainfall Intensity-Duration-Frequency Table for use with SWMM is added.

(29) *Figure RA-1* is deleted in its entirety.

(30) *Figure RA-2* is deleted in its entirety.

(31) *Figure RA-3* is deleted in its entirety.

(32) *Figure RA-4* is deleted in its entirety.

(33) *Figure RA-5* is deleted in its entirety.

(34) *Figure RA-6* is deleted in its entirety.

(35) *Figure RA-7* is deleted in its entirety.

(36) *Figure RA-8* is deleted in its entirety.

(37) *Figure RA-9* is deleted in its entirety.

(38) *Figure RA-10* is deleted in its entirety.

(39) *Figure RA-11* is deleted in its entirety.

(40) *Figure RA-12* is deleted in its entirety.

(41) *Figure RA-13* is deleted in its entirety.

(42) *Figure RA-14* is deleted in its entirety.

(43) *Figure RA-15* is deleted in its entirety.

(44) *Figure RA-16* is added

Figure RA-16—City of Fort Collins Rainfall Intensity-Duration-Frequency Curves.