Montgomery County Government

Drainage Design Criteria

Department of Transportation

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Excerpted pages submitted for reference

Exhibit 88(a)
OZAH Case No: H-159

1.3 Right-of-Way, Easements, Ownership, and Maintenance

1.3.1 General Policy

County storm drain systems require right-of-way or easements to allow construction and long term maintenance of the storm drain systems. Typically, a storm drain system consists of ditches, inlets, storm drains, culverts, channels, and/or riprap. The entire storm drain must be contained within project right-of-way or an easement. Adequate width must be obtained for storm drain systems including headwalls, end sections, inlets, and riprap.

Any concentrated flow of ≥ 3 cubic feet per second (cfs) entering or crossing a right-of-way or entering a site, shall be contained in an engineered ditch, channel, culvert, or enclosed storm drain system and contained within public or private easement.

1) County storm drain systems parallel to roadway
   a) Where possible, storm drains shall be located within the right-of-way specified for context sensitive design standards. Where this is not possible, any storm drain system parallel to the roadway typical section on MCDOT projects shall be considered for right-of-way acquisition. Consideration for acquisition of right-of-way will be required where:
      - the easement would overlap right-of-way
      - the easement is within 10 feet of existing or proposed right-of-way
   b) Right-of-way shall have a minimum clearance of 5 feet from the outside of the drainage pipe/structure to the right-of-way line. Additional clearance is required for deep storm drain systems.
   c) Where possible, storm drain systems shall be kept off lots along the road frontage to minimize right-of-way acquisition along road frontage. Storm drain easements, herein referred to as S.D. easements may be utilized for storm drain system maintenance.
2) County storm drain systems crossing roadway right-of-way
   a) Any County storm drain crossing the roadway shall be contained within right-of-way or have an easement for construction and long term maintenance of the system. Where any storm drain extends beyond the limit of project right-of-way, the portion of the system outside of right-of-way will be contained in an S.D. Easement (as required in Section 1.3.2). S.D. Easements shall have adequate width for the pipe or channel plus width for a 10-foot wide (minimum) equipment access from one side of the storm drain system and a 2-foot offset from the other side of the storm drain. Easements shall extend a minimum of 20 feet upstream or downstream of the facility inlet or outlet for countermeasures and maintenance. Where the outfall riprap calculations dictate the need for more than 20' of riprap beyond the R/W, additional easement shall be procured for riprap outfall maintenance.
   b) Subsurface drainage facilities which convey discharge from a public right-of-way shall be enclosed within a public storm drain easement (as required in Section 1.3.2) unless the County stipulates other limits to their maintenance responsibility.
   c) Easements may be shortened to avoid impacts to or lengthened to protect environmental features. Environmental features may include wetlands, trees, natural channel banks, rock outcrops, and springs. The designer shall include adequate notes and details (i.e. symbols for wetland limits/buffer, tree details, rock limits) on the plans to indicate why the easement was modified.
3) Stormwater management features
   a) Any stormwater management facilities to be maintained by Montgomery County are to be included in roadway right-of-way per Standard No. 040.00 – Stormwater Management in the Context Sensitive Road Design Standards.
   b) Stormwater management facilities outside of right-of-way that are to be maintained by

3.2.3.2 Correction Factor

A frequency-of-event correction factor, Cf, is used as a modifier to the Rational formula runoff coefficient. The intent of the correction factor is to compensate for the reduced effect of infiltration and other hydrologic abstractions during less frequent, higher intensity storms. The frequency-of-event correction factor, Cf, is multiplied by the runoff coefficient, C, to produce an adjusted runoff coefficient. Adjustment factors are tabulated by design storm below.

Table 3-6 – Correction Factor

Design Storm	Correction Factor
≤ 25-Years	1.00
25-Years	1.10
50-Years	1.20
100-Years	1.25

(Table from HEC-22)

3.2.3.3 Rainfall Intensity

Rainfall intensity, duration, and frequency (IDF) curves are necessary to use the Rational method. The IDF Curve Data for Montgomery County is shown in Table 3-8.

Table 3-7 – Intensity.-.Duration - Frequency (IDF) Data

Time of Conc. *(min.)*	FREQUENCY 2 YR. *(in/hr)*	5 YR. *(in/hr)*	10 YR. *(in/hr)*	25 YR. *(in/hr)*	50 YR. *(in/hr)*	100 YR *(in/hr)*
5	5.52	6.39	7.07	8.05	8.89	9.60
6	5.21	6.10	6.78	7.76	8.57	9.30
7	4.94	5.83	6.52	7.49	8.28	9.01
8	4.70	5.59	6.28	7.23	8.01	8.74
9	4.48	5.37	6.06	6.99	7.75	8.48
10	4.28	5.16	5.85	6.77	7.51	8.24
11	4.11	4.98	5.66.	6.56	7.28	8.01
12	3.95	4.80	5.48	6.37	7.07	7.79
13	3.80	4.64	5.31	6.18	6.87	7.58
14	3.67	4.50	5.15	6.01	6.68	7.39
15	3.54	4.36	5.00	5.84	6.50	7.20
16	3.43	4.23	4.86	5.68	6.33	7.02
17	3.32	4.11	4.73	5.54	6.16	6.85
18	3.22	3.99	4.60	5.40	6.01	6.68
19	3.13	3.89	4.48	5.26	5.86	6.52
20	3.04	3.78	4.37	5.13	5.72	6.37
21	2.96	3.69	4.26	5.01	5.59	6.23
22	2.88	3.60	4.16	4.90	5.46	6.09
23	2.81	3.51	4.06	4.79	5.34	5.96
24	2.74	3.43	3.97	4.68	5.22	5.83
25	2.67	3.36	3.88	4.58	5.11	5.71

Time of Conc. (min.)	FREQUENCY 2 YR. (in/hr)	5 YR. (in/hr)	10 YR. (in/hr)	25 YR. (in/hr)	50 YR. (in/hr)	100 YR (in/hr)
26	2.61	3.28	3.79	4.48	5.01	5.59
27	2.55	3.21	3.71	4.39	4.90	5.48
28	2.50	3.15	3.64	4.30	4.80	5.37
29	2.45	3.08	3.56	4.21	4.71	5.26
30	2.40	3.02	3.49	4.13	4.62	5.16
31	2.35	2,96	3.42	4.05	4.53	5.06
32	2.30	2.91	3.36	3.97	4.45	4.97
33	2.26	2.85	3.29	3.90	4.37	4.87
34	2.22	2.80	3.23	3.83	4.29	4.78
35	2.18	2.75	3.17	3.76	4.21	4.70
36	2.14	2.71	3.12	3.70	4.14	4.62
37	2.10	2.66	3.06	3.63	4.07	4.54
38	2.06	2.62	3.01	3.57	4.00	4.46
39	2.03	2.57	2.96	3.51	3.93	4.38
40	2.00	2.53	2.91	3.45	3.87	4.31
41	1.97	2.49	2.86	3.40	3.81	4.24
42	1.94	2.45	2.82	3.34	3.75	4.17
43	1.91	2.42	2.77	3.29	3.69	4.10
44	1.88	2.38	2.73	3.24	3.63	4.04
45	1.85	2.35	2.69	3.19	3.58	3.97
46	1.82	2.31	2.65	3.14	3.52	3.91
47	1.80	2.28	2.61	3.10	3.47	3.85
48	1.77	2.25	2.57	3.05	3.42	3,80
49	1.75	2.22	2.54	3.01	3.37	3.74
50	1.72	2.19	2.50	2.97	3.33	3.69
51	1,70	2.16	2.47	2.92	3.28	3.63
52	1.68	2.13	2.43	2.88	3.24	3.58
53	1.66	2.10	2.40	2.84	3.19	3.53
54	1.64	2.08	2.37	2.81	3.15	3.48
55	1.62	2.05	2.34	2.77	3.11	3.43
56	1.60	2.03	2.31	2.73	3.07	3.38
57	1.58	2.00	2.28	2.70	3.03	3.34
58	1.56	1.98	2.25	2.65	2.99	3.29
59	1.54	1.96	2.22	2.63	2.95	3.25
60	1.52	1.93	2,19	2.60	2.92	3.21

The Montgomery County rainfall data is based on the rainfall intensity data for Montgomery County MD (*dated June 20, 1988*).

3.2.4 NRCS Method

3.2.4.1 General Information

The NRCS, formerly the Soil Conservation Service (SCS), peak flow method calculates peak flow as a function of drainage basin area, potential watershed storage, and the time of concentration. The graphical approach to this method can be found in TR-55. This rainfall-runoff relationship separates total rainfall into direct runoff, retention, and initial abstraction to yield the following equation for rainfall runoff: