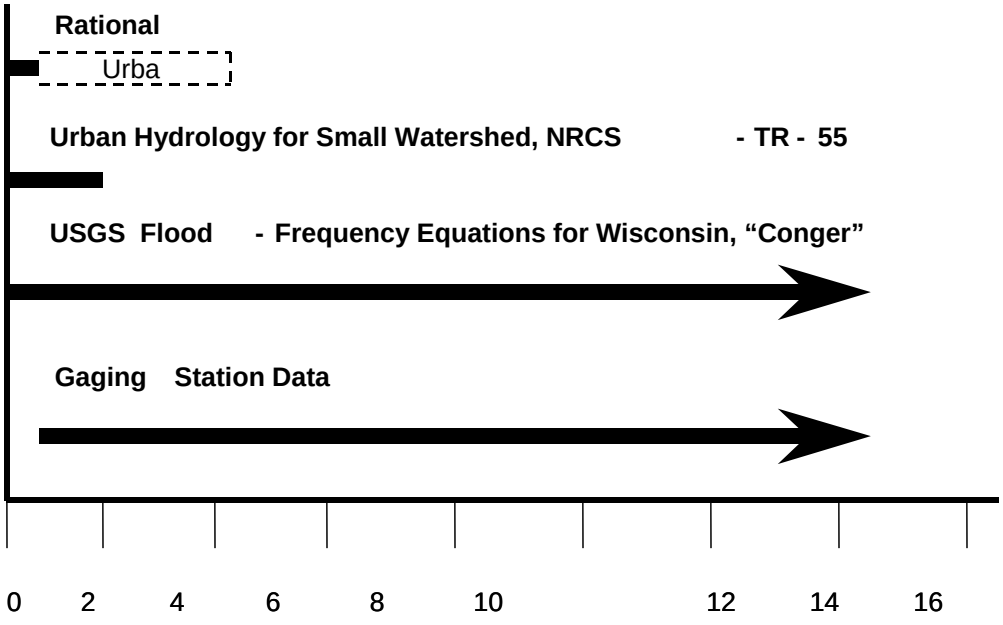
Area Limits for Peak Discharge Methods



Basin Area in 1000's of Acres

Detail A - Runoff Coefficients (C), Rational Formula

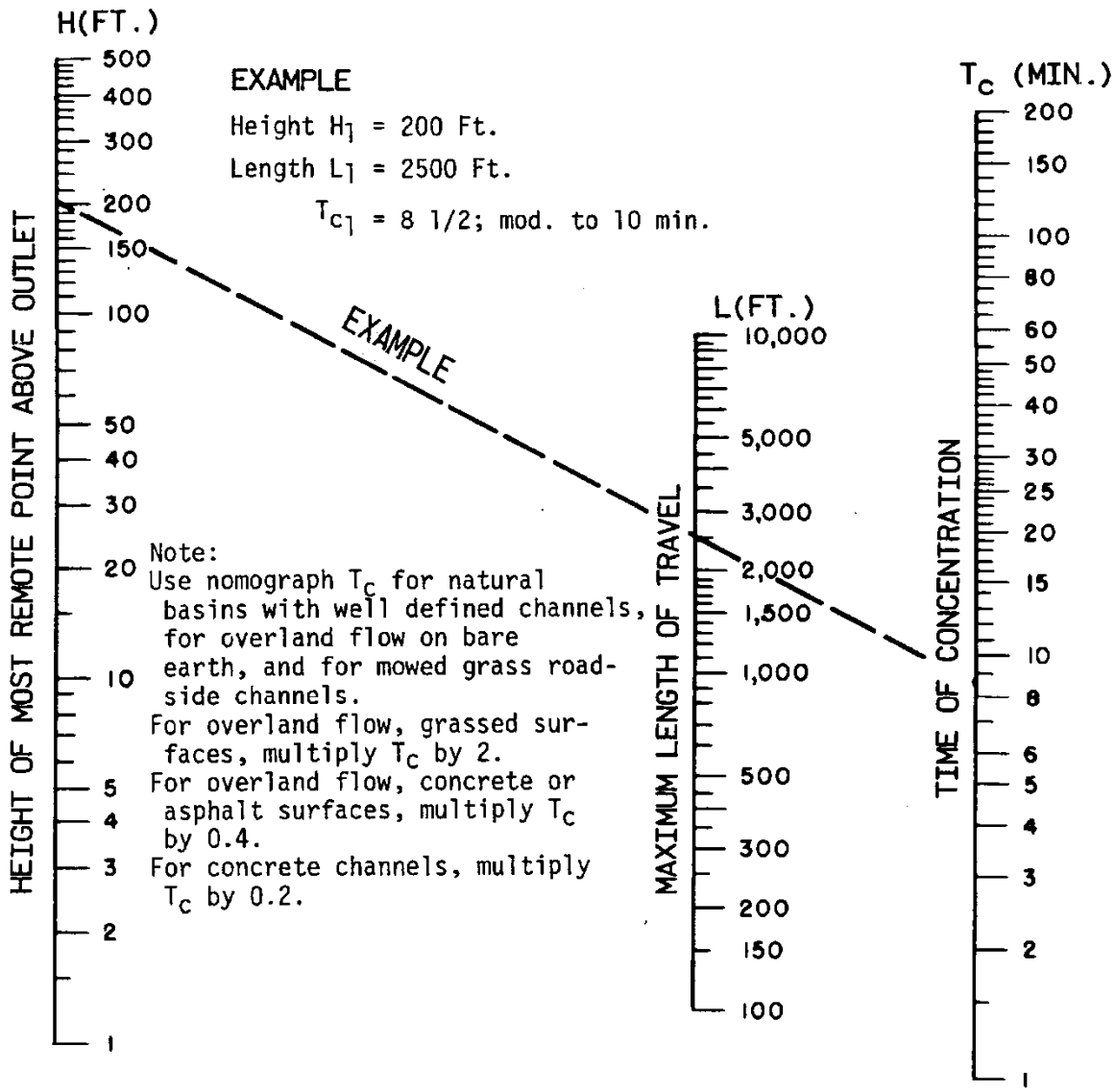
Land Use	Percent Impervious Area	Hydrologic Soil Group											
		A			B			C			D		
		Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
		0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Industrial	90	0.67 0.85	0.68 0.85	0.68 0.86	0.68 0.85	0.68 0.86	0.69 0.86	0.68 0.86	0.69 0.86	0.69 0.87	0.69 0.86	0.69 0.86	0.70 0.88
Commercial	95	0.71 0.88	0.71 0.89	0.72 0.89	0.71 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.89	0.72 0.90	0.72 0.89	0.72 0.89	0.72 0.90
High Density Residential	60	0.47 0.58	0.49 0.60	0.50 0.61	0.48 0.59	0.50 0.61	0.52 0.64	0.49 0.60	0.51 0.62	0.54 0.66	0.51 0.62	0.53 0.64	0.56 0.69
Med. Density Residential	30	0.25 0.33	0.28 0.37	0.31 0.40	0.27 0.35	0.30 0.39	0.35 0.44	0.30 0.38	0.33 0.42	0.38 0.49	0.33 0.41	0.36 0.45	0.42 0.54
Low Density Residential	15	0.14 0.22	0.19 0.26	0.22 0.29	0.17 0.24	0.21 0.28	0.26 0.34	0.20 0.28	0.25 0.32	0.31 0.40	0.24 0.31	0.28 0.35	0.35 0.46
Agriculture	5	0.08 0.14	0.13 0.18	0.16 0.22	0.11 0.16	0.15 0.21	0.21 0.28	0.14 0.20	0.19 0.25	0.26 0.34	0.18 0.24	0.23 0.29	0.31 0.41
Open Space	2	0.05 0.11	0.10 0.16	0.14 0.20	0.08 0.14	0.13 0.19	0.19 0.26	0.12 0.18	0.17 0.23	0.24 0.32	0.16 0.22	0.21 0.27	0.28 0.39
Freeways & Expressways	70	0.57 0.70	0.59 0.71	0.60 0.72	0.58 0.71	0.60 0.72	0.61 0.74	0.59 0.72	0.61 0.73	0.63 0.76	0.60 0.73	0.62 0.75	0.64 0.78

Detail B - Runoff Coefficients for Specific Land Use

Land Use	Hydrologic Soil Group											
	A			B			C			D		
	Slope Range Percent			Slope Range Percent			Slope Range Percent			Slope Range Percent		
	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over	0-2	2-6	6 & over
Row Crops	.08 .22	.16 .30	.22 .38	.12 .26	.20 .34	.27 .44	.15 .30	.24 .37	.33 .50	.19 .34	.28 .41	.38 .56
Median Stripturf	.19 .24	.20 .26	.24 .30	.19 .25	.22 .28	.26 .33	.20 .26	.23 .30	.30 .37	.20 .27	.25 .32	.30 .40
Side Slopeturf			.25 .32			.27 .34			.28 .36			.30 .38
PAVEMENT												
Asphalt	.70 - .95											
Concrete	.80 - .95											
Brick	.70 - .80											
Drives, Walks	.75 - .85											
Roofs	.75 - .95											
Gravel Roads Shoulders	.40 - .60											

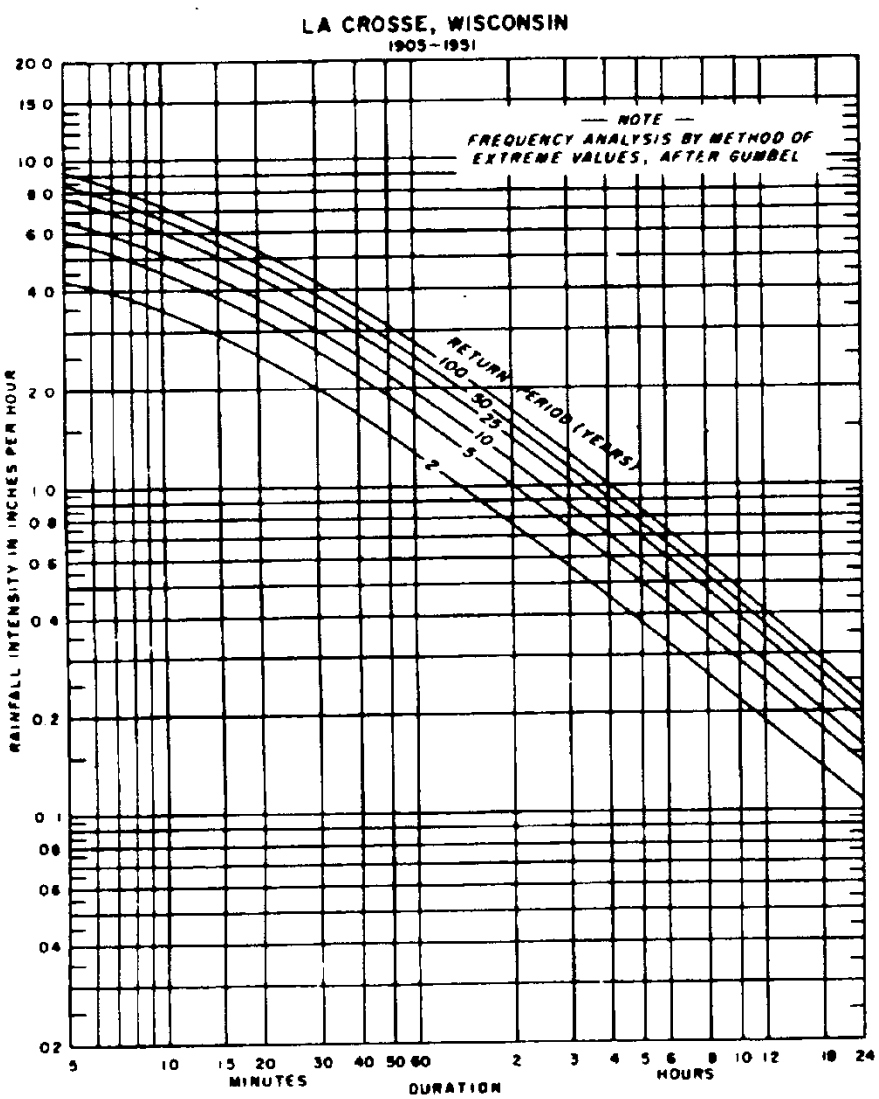
NOTE: The lower C values in each range should be used with the relatively low intensities associated with 2 to 10 year design recurrence intervals whereas the higher C values should be used for intensities associated with the longer 25 to 100 year deign recurrence intervals.

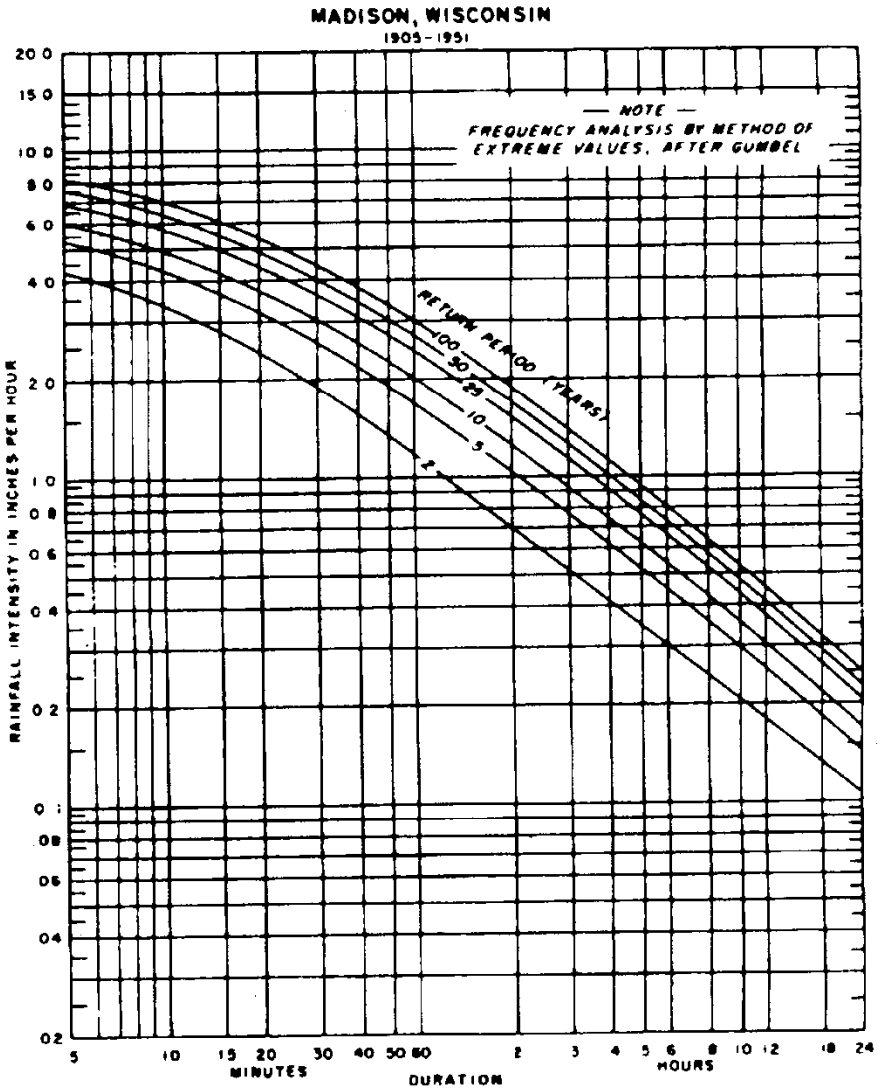
TIME OF CONCENTRATION OF SMALL T_c DRAINAGE BASINS



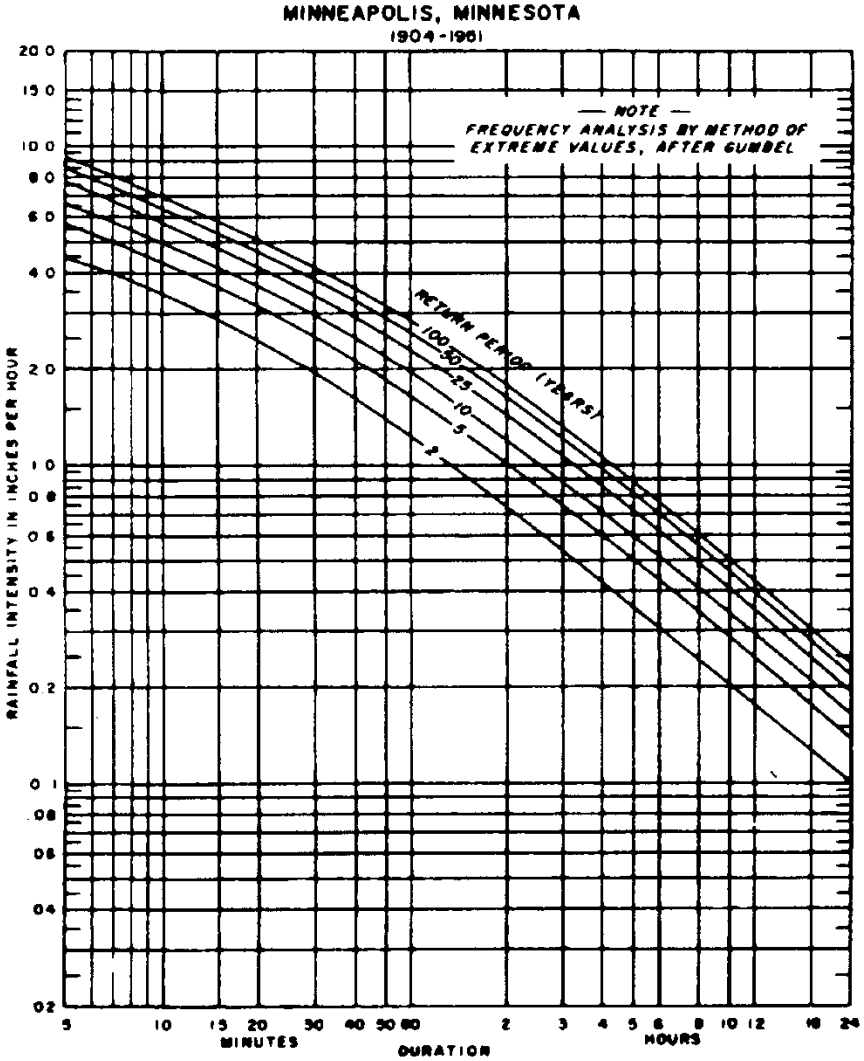
Note:
Use nomograph T_c for natural basins with well defined channels, for overland flow on bare earth, and for mowed grass roadside channels.
For overland flow, grassed surfaces, multiply T_c by 2.
For overland flow, concrete or asphalt surfaces, multiply T_c by 0.4.
For concrete channels, multiply T_c by 0.2.

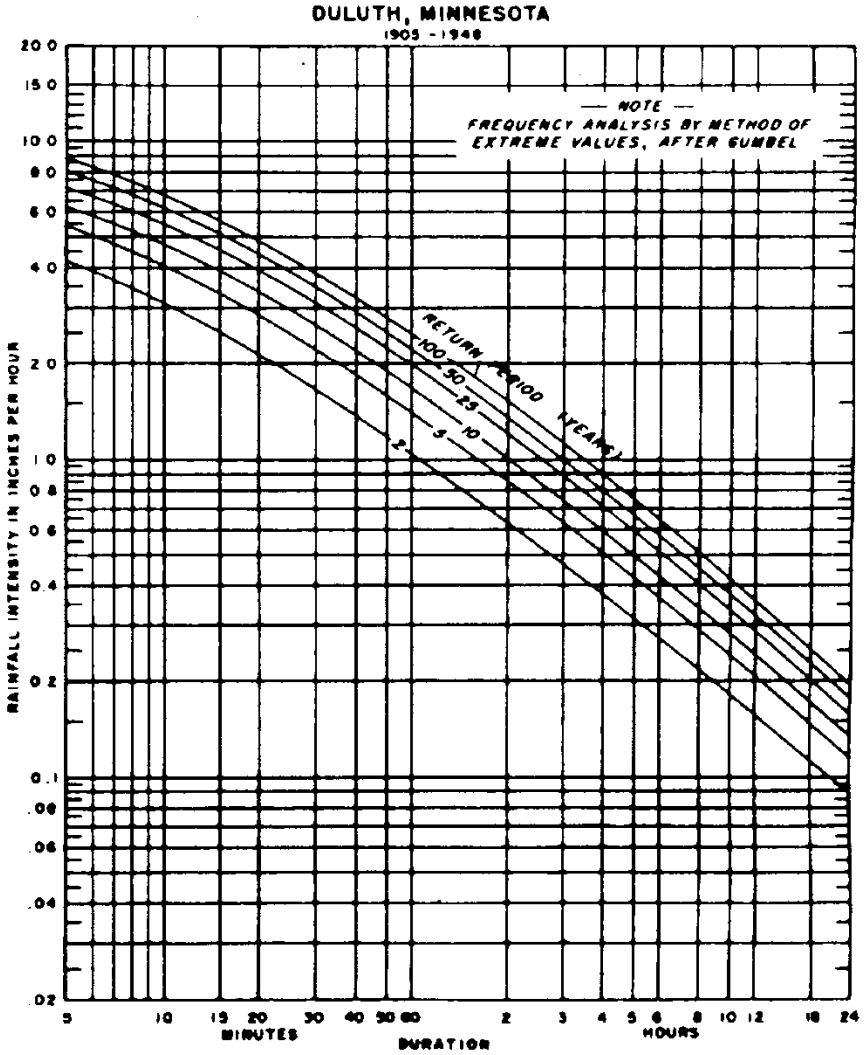
Based on study by P. Z. Kirpich,
Civil Engineering, Vol. 10, No. 6, June 1940, p.362



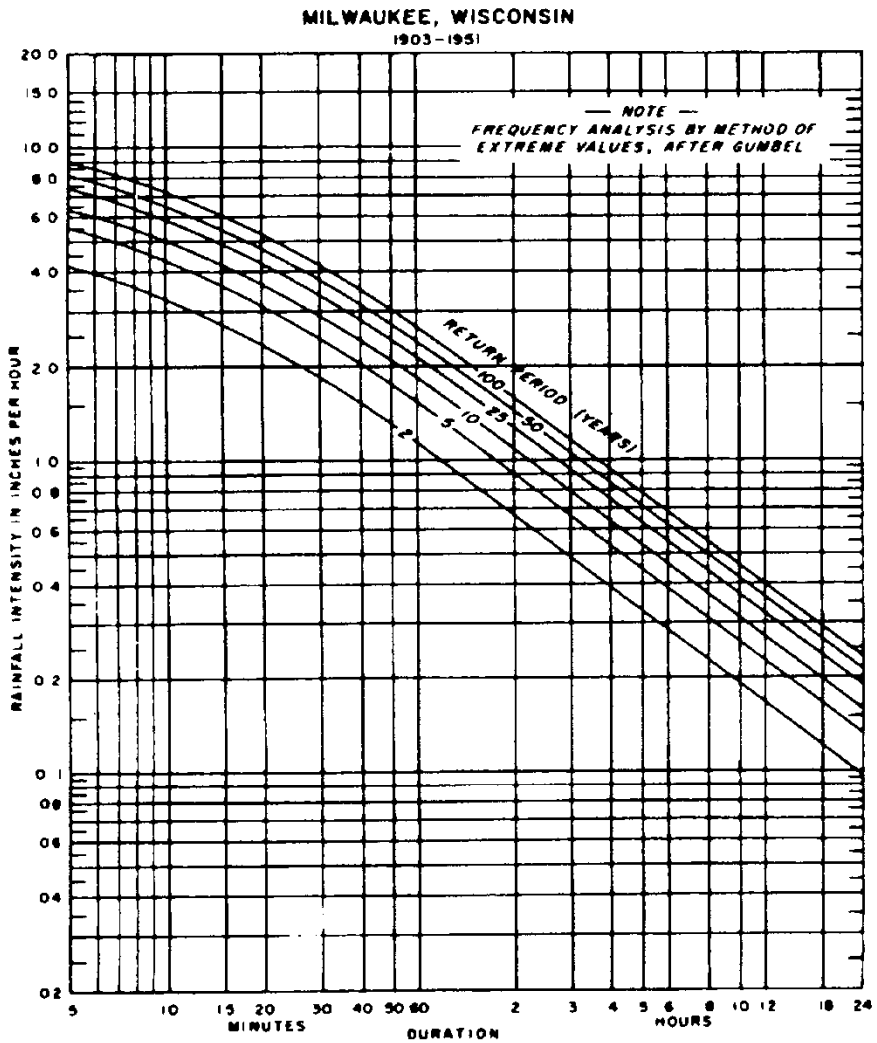


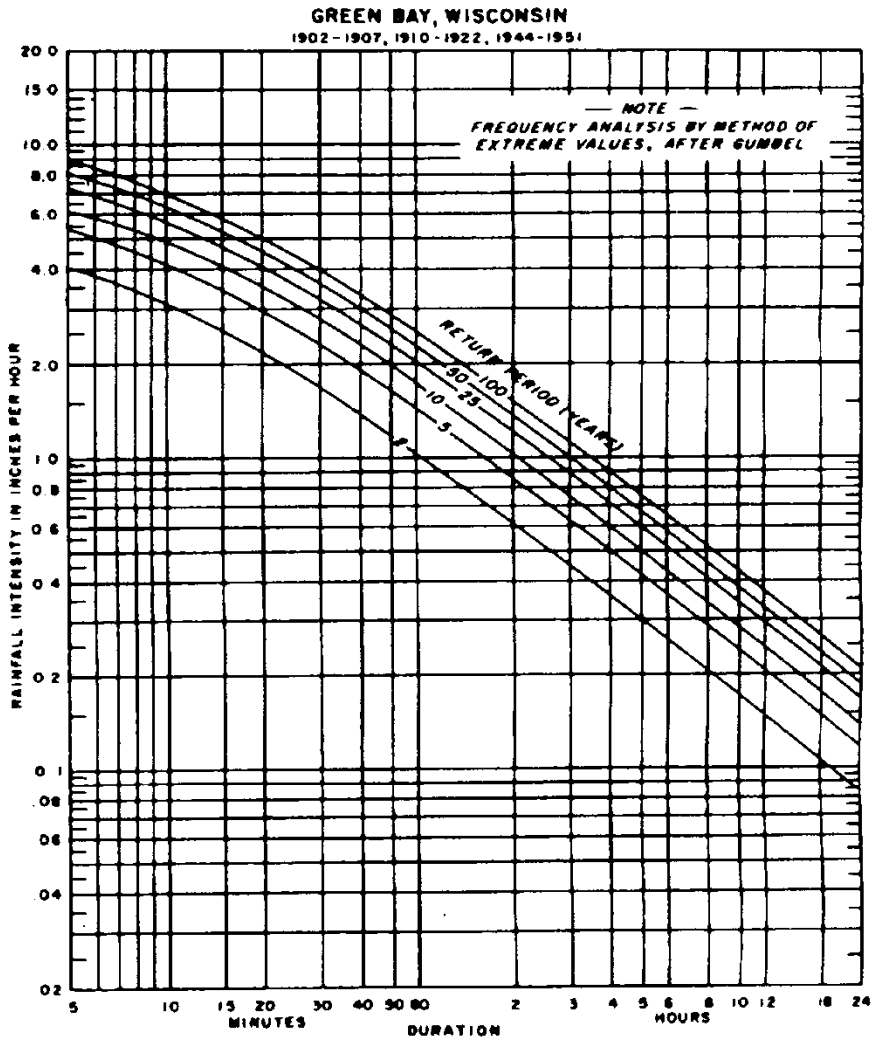
RAINFALL INTENSITY – DURATION – FREQUENCY CURVES





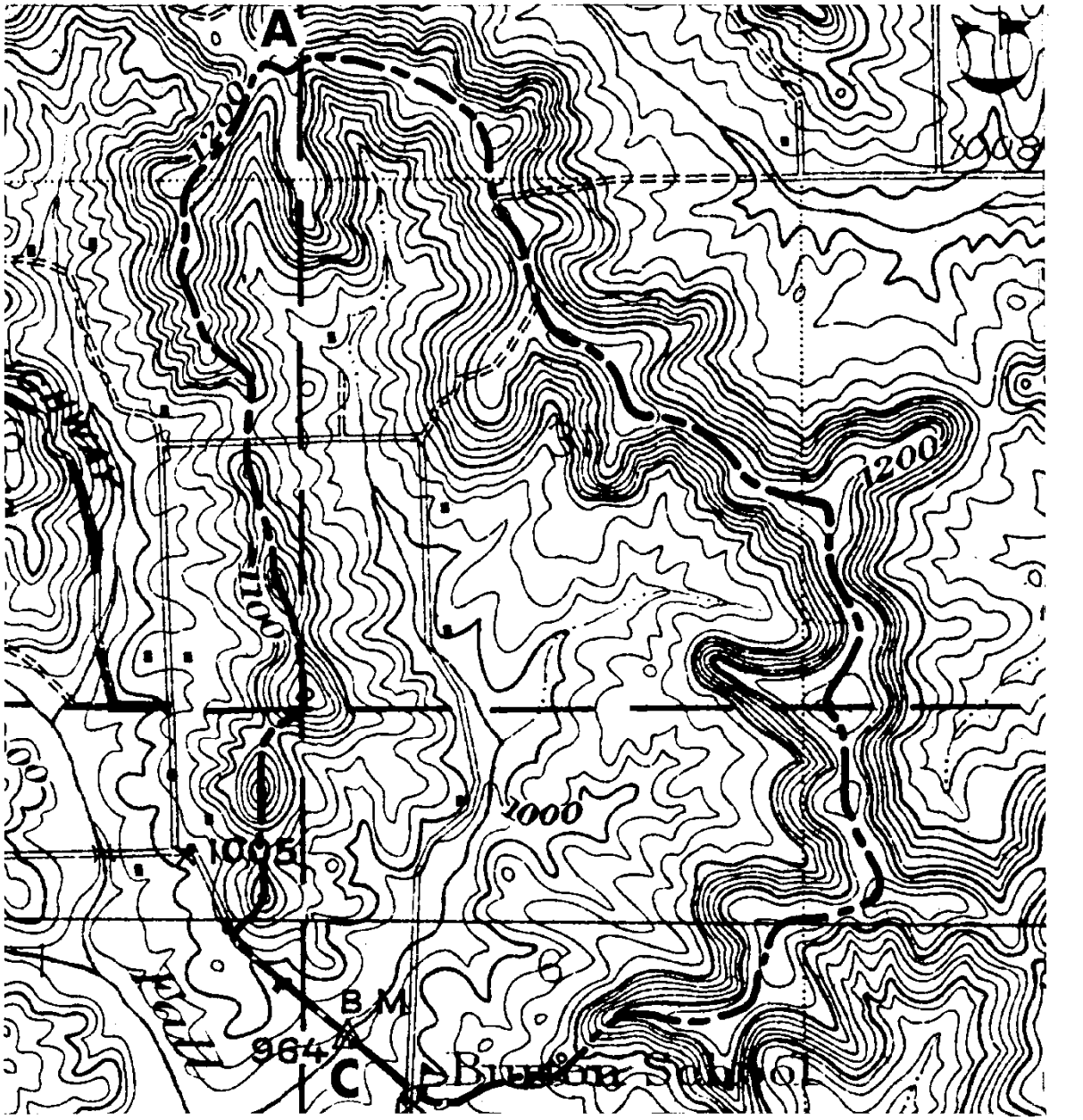
RAINFALL INTENSITY – DURATION – FREQUENCY CURVES





RAINFALL INTENSITY – DURATION – FREQUENCY CURVES

CONTOUR MAP FOR EXAMPLE PROBLEM



Location	- NW Jackson County
Drainage Basin Area	- 1067 Acres
Length	- 10,800 ft. = 2.05 mi., from inlet (C) along natural waterway to most remote point (A)
Soil	- Sandy silt loams over sand and limestone
Cover(estimated)	- 40% woods, 60% mixed cover
Design frequency	- 50 years
Contour interval	- 20 foot

Runoff Curve CN NRCS - TR55 Method
Soil Types

A. (Lowest runoff potential). Includes deep sands with very little silt and clay, also deep, rapidly permeable loess.
B. Mostly sandy soils less deep than A, and loess less deep or less aggregated than A, but the type has above average infiltration after thorough wetting.
C. Comprises shallow soils and soil containing considerable clay and colloid, through less than D.
D. (Highest runoff potential). Includes mostly clays of high swelling percent, but the group also includes some shallow soils with nearly impermeable sub-horizons near the surface.

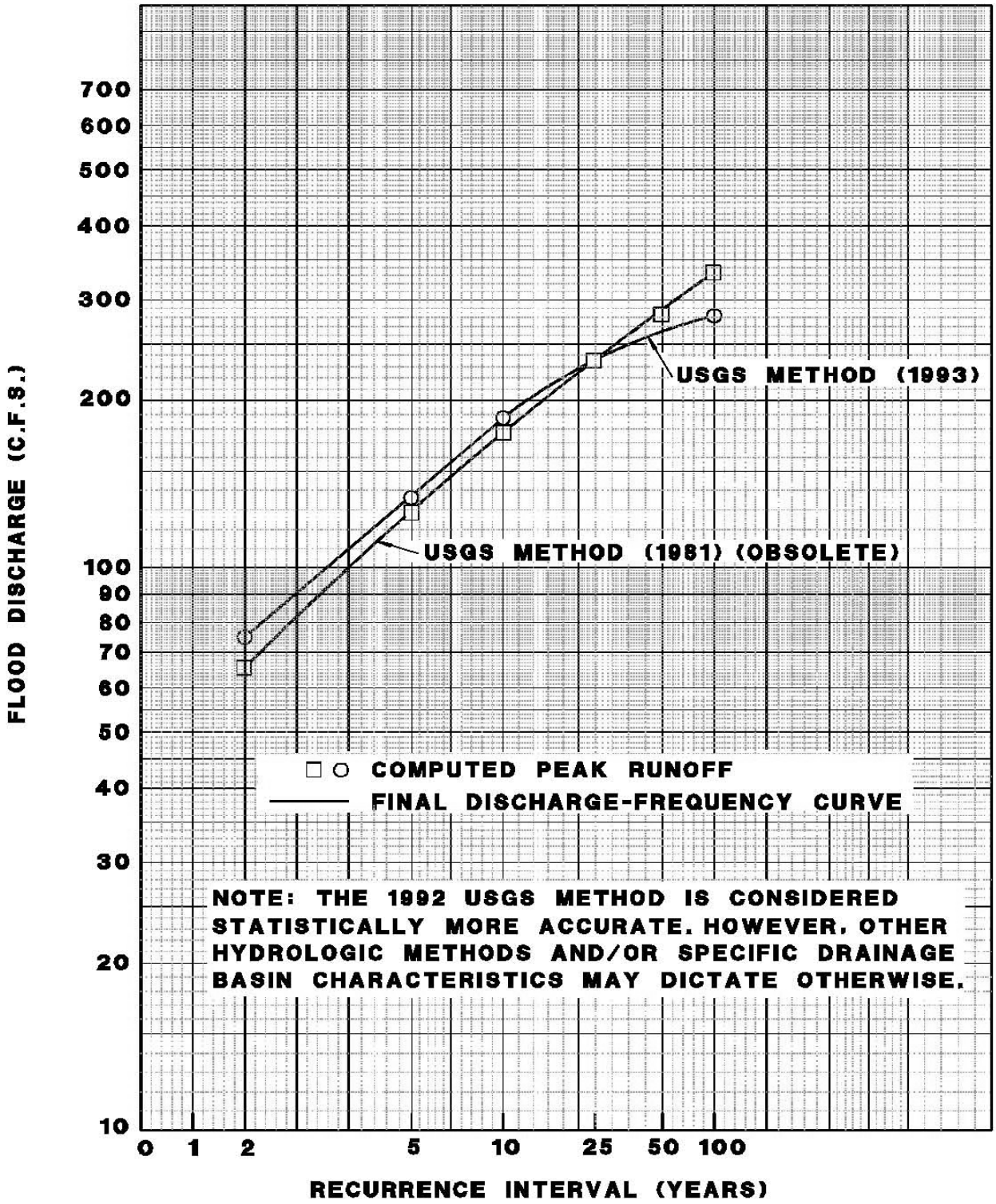
Runoff Curve Number CN

Cover	Surface Condition	Soil Type A	B	C	D
Fallow	Straight Row	77	86	91	94
Row Crops	Straight Row	70	80	87	90
	Contoured	67	77	83	87
	Contoured & Terraced	64	73	79	82
Small Grains	Straight Row	64	76	84	88
	Contoured	62	74	82	85
	Contoured & Terraced	60	71	79	82
Lequmes or Rotation Meadow	Straight Row	62	75	83	87
	Contoured	60	72	81	84
	Contoured & Terraced	57	70	78	82
Native Pasture or Range	Poor	68	79	86	89
	Normal	49	69	79	84
	Good	39	61	74	80
	Contoured, Poor	47	67	81	88
	Contoured, Normal	25	59	75	83
	Contoured, Good	6	35	70	79
Meadow (Permanent)	Normal	30	58	71	78
Woods (farm wood lot)	Sparse	45	66	77	83
	Normal	36	60	73	79
	Dense	25	55	70	77
Farmsteads	Normal	59	74	82	86
Roads	Dirt	72	82	87	89
	Hard Surface	74	84	90	92
Forest	Very Sparse	56	75	86	91
	Sparse	46	68	78	84
	Normal	36	60	70	76
	Dense	26	52	62	69
	Very Dense	15	44	54	61
Impervious Surface		100	100	100	100
Suburban Areas	Range depending on density or impervious areas as roofs, street, asphalt lots, etc.	50 to 67	67 to 80	80 to 85	85 to 90

TR-55 Graphical Discharge Method Version 1.11

Project: Example Problem User : DOT Date: 03-14-95
County: Jackson State: WI Checked: _____ Date: _____

Data: Drainage Area : 1067 Acres
Runoff Curve Number : 70
Time of Concentration : 1.43 Hours
Rainfall Type : II
Pond and Swamp Area : None

Storm Number	**1**	**2**	**3**	**4**	**5**	**6**	**7**
Frequency (yrs)	1	2	5	10	25	50	100
24-Hr Rainfall (in)	2.4	2.8	3.6	4.2	4.8	5.3	6
I_a/P Ratio	0.36	0.31	0.24	0.20	0.18	0.16	0.14
Runoff (in)	0.41	0.61	1.07	1.46	1.89	2.26	2.81
Unit Peak Discharge (cfs/acre/in)	0.322	0.358	0.388	0.402	0.412	0.419	0.427
Pond and Swamp Factor 0.0% Ponds Used	1.00	1.00	1.00	1.00	1.00	1.00	1.00
Peak Discharge (cfs)	140	232	443	628	831	1011	1277

DISCHARGE FREQUENCY GRAPH
N/W JACKSON COUNTY