



Date Aug. 8, 1988 Page 1 of 7

Project Rounds Estates

Item Drainage Plan Hydrology

I HYDROLOGY : USE Rational Formula $Q = CIA$

Determine "C"

<u>Node</u>	<u>Soil Type</u>	<u>Hyd. Grp</u>	<u>Land Use</u>	<u>C₂</u>	<u>C₁₀₀</u>
105	Ia, Rd	D	Res; 1/3 Ac.	0.46	0.73
104	Ia, Rd	D	Res; 1/3 Ac.	0.46	0.73
103	Ia, Rd	D	Res; 1/3 Ac.	0.46	0.73
102	Ia, Rd	D	Res; 1/3 Ac.	0.46	0.73
101	(Manhole)				
100	(Headwall)				

Determine "I"

<u>Node</u>	<u>"tc"</u>	<u>I₂</u>	<u>I₁₀₀</u>
105	15	3.83	7.37
104	15	3.83	7.37
103	15	3.83	7.37
102	15	3.83	7.37
101	(Manhole)		
100	(Headwall)		



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Project Rounds Estates

Item Drainage Plan Hydrology

Determine "A"

<u>Node</u>	<u>Plan. Units</u>	<u>Area SF</u>	<u>Area Ac.</u>
105	758	121,280	2.78
104	600	96,000	2.20
103	576	92,160	2.12
102	580	92,800	2.13
101	(Manhole)		
100	(Headwall)		

Determine "Q₂"

<u>Node</u>	<u>C₂</u>	<u>I₂</u>	<u>A</u>	<u>Q₂</u>
105	0.46	3.83	2.78	4.9
104	0.46	3.83	2.20	3.9
103	0.46	3.83	2.12	3.7
102	0.46	3.83	2.13	3.8
101	(Manhole)			
100	(Headwall)			



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Project Rounds Estates

Item Drainage Plan Hydrology

Determine "Q₁₀₀"

<u>Node</u>	<u>C₁₀₀</u>	<u>I₁₀₀</u>	<u>A</u>	<u>Q₁₀₀</u>
105	0.73	7.37	2.78	15.0
104	0.73	7.37	2.20	11.8
103	0.73	7.37	2.12	11.4
102	0.73	7.37	2.13	11.5
101	(Manhole)			
100	(Headwall)			



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Project Rounds Estates

Item Drainage Plan Hydrology

<u>II INLET SIZING (2-yr.)</u>						
<u>Node</u>	<u>Inlet Condition</u>	<u>Q₂</u>	<u>HW Max</u>	<u>Q_{max} 5' Inlet</u>	<u>Q_{max} 10' Inlet</u>	<u>Use L =</u>
105	Sump	4.9	0.92'	11.0	22.0	5'
104	Sump	3.9	0.92'	11.0	22.0	5'
103	Sump	3.7	0.92'	11.0	22.0	5'
102	Sump	3.8	0.92'	11.0	22.0	5'
101	(Manhole)					
100	(Headwall)					

100 j, 172.5000 100 3 6 5

110 t,rounds estates

120 t,drainage plan

130 t,storm water sewer system 100 analysis

140 i, 105 0.46 2.78 0.00 0.00 4.90 15.00 180.00

150 i, 104 0.46 2.20 0.00 0.00 3.90 15.00 180.00

160 i, 103 0.46 2.12 0.00 0.00 3.70 15.00 180.20

170 i, 102 0.46 2.13 0.00 0.00 3.80 15.00 180.20

180 m, 101 175.00

190 m, 100 172.50

200 p, 105 104 40.00 15 0.013 90.00 0.00

210 p, 104 103 300.00 18 0.013 90.00 0.00

220 p, 103 102 40.00 18 0.013 0.00 0.00

230 p, 102 101 160.00 24 0.013 45.00 0.00

240 p, 101 100 40.00 24 0.013 0.00 0.00

250 e

Date: 08-08-1988
Time: 17:15:04

Input File: round100

rounds estates
drainage plan
storm water sewer system 100 analysis

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node to	C	Area	Slope	Length	TC(0)	I(0)	Q(0)	TC	I	Q	Sum Q	Size	Velocity	Length	TT	TT+TC	
Node		(Ac)	(%)	(Ft)	(Min)	(In/Hr)	(CFS)	(Min)	(In/Hr)	(CFS)	(CFS)		(Ft/Sec)	(Ft)	(Min)	(Min)	
105	104	0.46	2.78	0.00	0.0	15.00	4.06	4.90	15.00	4.06	4.90	4.90	15"	3.99	40.00	0.17	15.17
104	103	0.46	2.20	0.00	0.0	15.00	4.06	3.90	15.17	4.04	3.88	8.78	18"	4.97	300.00	1.01	16.17
103	102	0.46	2.12	0.00	0.0	15.00	4.06	3.70	16.17	3.94	3.59	12.38	18"	7.00	40.00	0.10	16.27
102	101	0.46	2.13	0.00	0.0	15.00	4.06	3.80	16.27	3.93	3.68	16.06	24"	5.11	160.00	0.52	16.79
101	100	0.00	0.00	0.00	0.0	0.00	0.00	0.00	16.79	3.88	0.00	16.06	24"	5.11	40.00	0.13	16.92

Date: 08-08-1988
Time: 17:15:04

Input File: round100

rounds estates
drainage plan
storm water sewer system 100 analysis

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

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*****
Node      Hyd-Slope  Friction  Bend      Transition  Manhole  Deflection  Junction  Total  Hyd-61  Desired  Diff.
      (Ft/Ft)   (Ft)      (Ft)      (Ft)        (Ft)    (Ft)       (Ft)     (Ft)  Elevation Elevation (Ft)
*****
105      0.00575    0.2302    0.0000    0.0000      0.0000   0.0000     0.0000   0.2302  178.2938  180.0000  1.71
104      0.00699    2.0974    0.0000    0.0136      0.0000   0.1238     0.5325   2.7673  178.0636  180.0000  1.94
103      0.01388    0.5553    0.0000    0.0378      0.0000   0.1918     0.8097   1.5945  175.2963  180.2000  4.90
102      0.00504    0.8061    0.0000    0.0712      0.0000   0.0000     -0.0109  0.8664  173.7018  180.2000  6.50
101      0.00504    0.2015    0.0000    0.0000      0.0203   0.0883     0.0252   0.3353  172.8353  175.0000  2.16
100      0.00000    0.0000    0.0000    0.0000      0.0000   0.0000     0.0000   0.0000  172.5000  172.5000  0.00
*****

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Project Rounds Estates

Item Drainage Plan Street Flow

2-YR

<u>Node</u>	<u>Q₂</u>	<u>Distribution</u>	<u>street slope</u>	<u>d</u>	<u>d_{max}</u>	<u>Comment</u>
105	4.9	80% (N) = 3.9 20% (S) = 1.0	0.8% 0.32%	0.30' 0.22'	0.30' 0.30'	OK OK
104	3.9	75% (N) = 2.9 25% (S) = 1.0	0.7% 0.32%	0.28' 0.22'	0.30' 0.30'	OK OK
103	3.7	50% (S) = 1.9 50% (N) = 1.9	1.0% 0.5%	0.22' 0.25'	0.30' 0.30'	OK OK
102	3.8	80% (S) = 3.0 20% (N) = 0.8	1.0% 0.5%	0.26' 0.18'	0.30' 0.30'	OK OK
101	(Manhole)					
100	(Headwall)					

100 YR

<u>Location</u>	<u>Contrib. Area</u>	<u>Q₁₀₀</u>	<u>Q_{pipe}</u>	<u>Q_{street}</u>	<u>street slope</u>	<u>Q_{max}</u>	<u>Comment</u>
Approaching Nodes 103 + 102 (S)	50% 103 = 80% 102 =	5.7 9.2 14.9	0.0	14.9	1.0%	40.4	OK Roll Cb. 0.3' WK. Gr.
Approaching Nodes 104 + 105 (N)	80% 105 = 75% 104 =	12.0 8.9 20.9	0.0	20.9	0.8%	36.1	OK Roll Curb 0.3' WK. Gr.
Approaching Nodes 104 + 105 (S)	20% 105 = 25% 104 = 100% 103 = 100% 102 =	3.0 3.0 11.4 11.5 28.9	7.5*	21.4	0.32%	22.8	OK Roll Curb 0.3' WK. Gr.

* = Q₂ (Node 103) + Q₂ (Node 102)



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Project Rounds Estates

Item Drainage Plan Street Flow

<u>Location</u>	<u>Contrib. Area</u>	<u>Q₁₀₀</u>	<u>Q_{pipe}</u>	<u>Q_{street}</u>	<u>street slope</u>	<u>Q_{max}</u>	<u>Comment</u>
Approaching Gatewood St	100% 105	15.0					
	100% 104	11.8					
	100% 103	11.4					
	100% 102	11.5					
		<u>49.7</u>	16.3*	33.4	4.8%	88.5	OK Roll Curb 0.3' Wk. Gr.

* = ΣQ_2 Nodes 102 thru 105



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MEMBER ASSOCIATION
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WICHITA, KANSAS
ZIP CODE / 67211

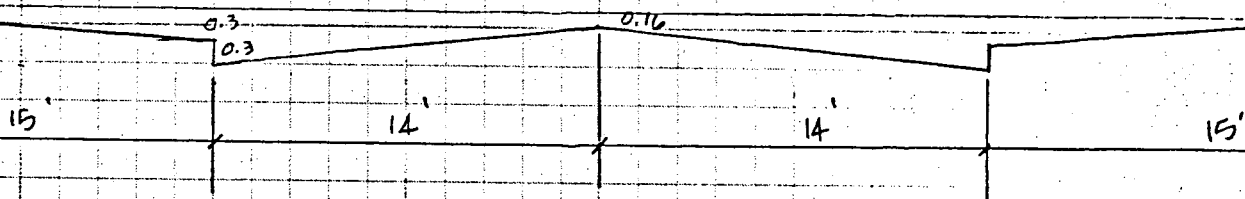
Date 8-9-88 Page 3 of 3

Project Rounds Estates

Item Drainage Plan

Determine capacities of Roll-curb streets w/
various Walk Grades for 100-year storm analysis
(58' R-O-W)

0.3'
Walk Grade



$$n = \frac{(2 \times 14.5 \times 0.03) + (2 \times 2.8 \times 0.013) + (2 \times 12 \times 0.016)}{58.6}$$

$$= \frac{(0.87) + (0.0728) + (0.384)}{58.6} = \frac{1.3268}{58.6} = 0.0226$$

$$A = (2 \times \frac{1}{2} \times 15 \times 0.3) + (28 \times 0.16) + (2 \times \frac{1}{2} \times 14 \times 0.44)$$

$$= 4.5 + 4.48 + 6.16$$

$$= 15.14 \text{ SF}$$

$$p = 58.6$$

$$R = A/p = 15.14/58.6 = 0.258362$$

$$R^{2/3} = 0.40565$$

$$Q = \frac{1.486}{n} A R^{2/3} s^{1/2}$$

$$= \frac{1.486}{0.0226} \times 15.14 \times 0.40565 \times s^{1/2}$$

$$Q = 403.82 \sqrt{s}$$



Date Aug. 9, 1988 Page 1 of 1

Project Rounds Estates

Item Drainage Plan Pond Data

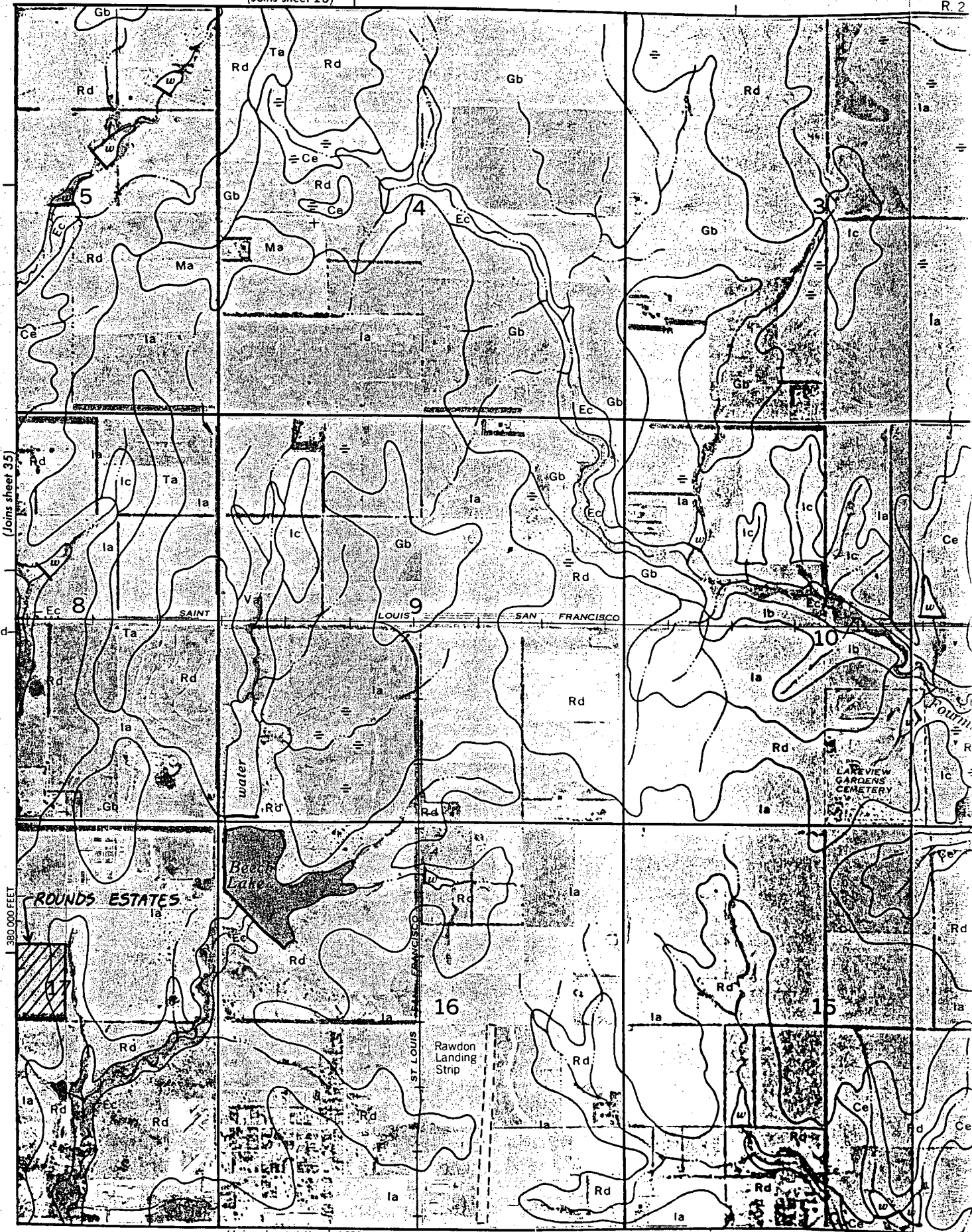
The proposed storm water sewer system for Rounds Estates will discharge into an existing pond in Autumn Chase Addition.

According to the Drainage Plan for Autumn Chase Add. prepared by Mid-Kansas Engineering Consultants, the design static pool elevation for this pond is 170.0. The 100-year design water surface for this pond is 172.5.

Elev. 172.5 was used as the starting Hydraulic Grade Line (HGL) Elev. in designing the storm water sewer system.

(Joins sheet 28)

R. 2



(Joins sheet 35)

(Joins sheet 44) 2 370 000 FEET

EXHIBIT NO. 1

SOIL LEGEND

<u>SYMBOL</u>	<u>HYDROLOGIC GROUP</u>	<u>NAME</u>
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loams, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loam, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loam
Cb	B	Canadian-Waldeck fine sandy loams
Cc	D	Carwile fine sandy loam
Cd	B	Clark-Ost clay loams, 1 to 4 percent slopes
Ce	C	Cline silty clay, 3 to 6 percent slopes
Ea	B	Elandco silt loam
Eb	B	Elandco silt loam, occasionally flooded
Ec	B	Elandco silt loam, frequently flooded
Fa	B	Farnum loam, 0 to 1 percent slopes
Fb	B	Farnum loam, 1 to 3 percent slopes
Fc	B	Farnum loam, sandy substratum, 0 to 1 percent slopes
Ga	D	Goessel silty clay, 0 to 1 percent slopes
Gb	D	Goessel silty clay, 1 to 2 percent slopes
Ia	D	Irwin silty clay loam, 1 to 3 percent slopes
Ib	D	Irwin silty clay loam, 3 to 6 percent slopes
Ic	D	Irwin silty clay loam, 2 to 6 percent slopes, eroded
La	C	Lesho loam
Lb	A	Lincoln soils
Ma	B	Milan loam, 1 to 3 percent slopes
Mb	B	Milan form, 3 to 6 percent slopes
Mc	B	Milan clay loam, 2 to 6 percent slopes, eroded
Na	B	Naron fine sandy loam
Oc	D	Owens clay loam, 1 to 3 percent slopes
Od	D	Owens-Rock outcrop complex, 3 to 10 percent slopes
Pa		Pits
Pb	D	Plevna fine sandy loam
Pc	A	Pratt loamy fine sand, undulating
Pd	A	Pratt-Tivoli complex, rolling
Ra	D	Renfrow silty clay loam, 1 to 3 percent slopes
Rb	D	Renfrow silty clay loam, 3 to 6 percent slopes
Rc	D	Renfrow-Owens clay loams, 1 to 4 percent slopes
Rd	D	Rosehill silty clay, 1 to 3 percent slopes
Sa	B	Shellabarger sandy loam, 1 to 3 percent slopes
Sb	B	Shellabarger sandy loam, 3 to 6 percent slopes
Sc	B	Shellabarger sandy loam, 3 to 6 percent slopes, eroded
Ta	D	Tabler silty clay loam
Tb	D	Tabler-Drummond complex
Ua	B	Urban land-Canadian complex
Ub	B	Urban land-Elandco complex
Uc	B	Urban land-Farnum complex, 0 to 3 percent slopes
Ud	D	Urban land-Irwin complex, 1 to 3 percent slopes
Ue	D	Urban land-Tabler complex
Va	B	Vanoss silt loam, 0 to 1 percent slopes
Vb	B	Vanoss silt loam, 1 to 3 percent slopes
Vc	B	Vanoss silt loam, 3 to 6 percent slopes
Vd	B	Vanoss silt loam, 3 to 6 percent slopes, eroded
Ve	D	Vernon sandy loam, 1 to 3 percent slopes
Vf	D	Vernon sandy loam, 3 to 6 percent slopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

RECOMMENDED RUNOFF COEFFICIENTS FOR RATIONAL METHOD
AND PERCENT IMPERVIOUS FOR UNIT HYDROGRAPH METHOD

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		2	5	10	100
1. Business:					
Downtown Areas	95	0.84	0.85	0.87	0.91
Neighborhood Areas	70	0.68	0.69	0.73	0.80
2. Residential:					
<u>Single Family (Soil Group D)</u>					
1/8 Acre	50	0.57	0.61	0.66	0.79
1/4 Acre	38	0.50	0.54	0.62	0.76
1/3 Acre	30	0.46	0.50	0.59	0.73
1/2 Acre	25	0.42	0.48	0.56	0.72
3/4 Acre	22	0.42	0.46	0.55	0.71
1 Acre	20	0.41	0.45	0.54	0.71
<u>Multi-Family (Soil Group D)</u>					
Multi-Unit (detached)	60	0.62	0.66	0.72	0.82
Multi-Unit (attached)	65	0.64	0.68	0.73	0.83
Apartments	75	0.70	0.73	0.79	0.86
<u>Single Family (Soil Group C)</u>					
1/8 Acre	50	0.55	0.58	0.64	0.73
1/4 Acre	38	0.48	0.51	0.57	0.68
1/3 Acre	30	0.43	0.46	0.53	0.65
1/2 Acre	25	0.40	0.43	0.50	0.63
3/4 Acre	22	0.39	0.42	0.49	0.62
1 Acre	20	0.37	0.40	0.48	0.61
<u>Multi-Family (Soil Group C)</u>					
Multi-Unit (detached)	60	0.60	0.63	0.69	0.77
Multi-Unit (attached)	65	0.63	0.66	0.71	0.79
Apartments	75	0.68	0.72	0.77	0.83
<u>Single-Family (Soil Group B)</u>					
1/8 Acre	50	0.52	0.54	0.59	0.67
1/4 Acre	38	0.44	0.46	0.52	0.61
1/3 Acre	30	0.39	0.41	0.47	0.57
1/2 Acre	25	0.36	0.38	0.44	0.54
3/4 Acre	22	0.34	0.36	0.42	0.52
1 Acre	20	0.33	0.35	0.40	0.51
<u>Multi-Family (Soil Group B)</u>					
Multi-Unit (detached)	60	0.58	0.60	0.65	0.72
Multi-Unit (attached)	65	0.61	0.64	0.68	0.75
Apartments	75	0.67	0.70	0.74	0.80

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Single Family (Soil Group A)</u>					
1/8 Acre	50	0.47	0.50	0.54	0.60
1/4 Acre	38	0.39	0.41	0.45	0.52
1/3 Acre	30	0.33	0.35	0.39	0.47
1/2 Acre	25	0.30	0.31	0.35	0.44
3/4 Acre	22	0.28	0.29	0.33	0.42
1 Acre	20	0.26	0.28	0.32	0.40
<u>Multi-Family (Soil Group A)</u>					
Multi-Unit (detached)	60	0.55	0.57	0.61	0.67
Multi-Unit (attached)	65	0.58	0.60	0.64	0.70
Apartments	75	0.65	0.68	0.72	0.77
3. Industrial:					
Light Areas	70	0.68	0.69	0.73	0.80
Heavy Areas	80	0.74	0.76	0.79	0.84
4. Playgrounds:					
	15	0.33	0.35	0.42	0.55
5. Schools:					
	40	0.49	0.51	0.56	0.66
6. Railroad Yard Areas:					
	30	0.43	0.45	0.50	0.62
7. Undeveloped Urban Areas:					
Offsite Flow Analysis (when land use not defined)	45	0.52	0.54	0.59	0.68
8. Streets:					
Paved	99	0.87	0.88	0.90	0.93
Gravel	00	0.24	0.26	0.33	0.48
9. Drive, Parking Lots and Walks:					
	96	0.87	0.87	0.88	0.89
10. Roofs:					
	90	0.80	0.85	0.90	0.93
11. Urban Lawn Areas (See Note No. 1 below):					
<u>Soil Group A</u>					
Slope less than 1%	00	0.08	0.09	0.13	0.23
Slope 1% to 4%	00	0.12	0.13	0.17	0.27
Slope more than 4%	00	0.16	0.17	0.21	0.31
<u>Soil Group B</u>					
Slope less than 1%	00	0.16	0.18	0.24	0.37
Slope 1% to 4%	00	0.20	0.22	0.28	0.41
Slope more than 4%	00	0.24	0.26	0.32	0.45
<u>Soil Group C</u>					
Slope less than 1%	00	0.24	0.27	0.35	0.51
Slope 1% to 4%	00	0.26	0.29	0.37	0.53
Slope more than 4%	00	0.28	0.31	0.39	0.55

Land Use or Surface Characteristics	Percent Impervious	Frequency			
		<u>2</u>	<u>5</u>	<u>10</u>	<u>100</u>
<u>Soil Group D</u>					
Slope less than 1%	00	0.28	0.33	0.43	0.63
Slope 1% to 4%	00	0.30	0.35	0.45	0.65
Slope more than 4%	00	0.32	0.37	0.47	0.67

Note No. 1: Coefficients shown in the above table are for pervious open space areas with thick turf which includes pervious areas in parks and cemeteries. Coefficients shown above must be increased 0.02 for use with agricultural pasture areas. Coefficients shown above must be reduced by 0.04 for use with agricultural cultivated areas. Group A soils are well-drained, coarse textured sands with high infiltration rates. Group B soils are moderately well-drained, moderately coarse textured soils with moderate infiltration rates. Group C soils are moderately poor-drained, moderately fine textured soils with slow infiltration rates. Group D soils are poor-drained, fine textured soils with very slow infiltration rates.

GENERAL NOTE: These Rational Formula Coefficients may not be valid for basins 320 acres or larger.

ATTACHMENT E

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

AVERAGE OVERLAND FLOW VELOCITY FOR USE WITH URBANIZED AREAS

Surface Type	VELOCITY IN FEET/SECOND FOR SLOPES IN PERCENT SHOWN																			
	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	20.0
Forest with Heavy Ground Litter or Meadow	0.03	0.04	0.06	0.07	0.08	0.09	0.10	0.11	0.12	0.13	0.16	0.21	0.28	0.33	0.39	0.46	0.53	0.60	0.72	1.10
Fallow or Minimum Tillage Cultivation	0.06	0.08	0.10	0.12	0.13	0.14	0.16	0.17	0.18	0.19	0.29	0.40	0.51	0.66	0.78	0.91	1.05	1.20	1.44	2.10
Short Grass Pasture or Lawns	0.09	0.13	0.15	0.18	0.20	0.21	0.23	0.25	0.26	0.28	0.45	0.60	0.77	0.96	1.17	1.33	1.50	1.68	1.98	3.20
Almost Bare Ground	0.16	0.22	0.28	0.31	0.35	0.38	0.41	0.44	0.46	0.49	0.70	0.85	1.05	1.26	1.50	1.75	2.03	2.32	2.79	4.40
Grassed Waterway	0.35	0.48	0.58	0.67	0.77	0.84	0.91	0.98	1.05	1.12	1.54	1.82	2.10	2.38	2.78	3.20	3.66	4.14	4.56	7.00
Paved Areas (Sheet Flow) or Shallow Gutter Flow	0.44	0.62	0.77	0.91	1.05	1.12	1.19	1.26	1.33	1.40	2.00	2.55	3.20	3.83	4.41	5.04	5.70	6.00	6.20	9.00

April 15, 1986

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

CITY OF WICHITA, KANSAS

RAINFALL INTENSITY TABLE FOR SEDGWICK COUNTY, KANSAS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour

DURATION IN MINUTES	RETURN PERIODS OF						
	1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
11	3.27	4.36	5.16	5.89	6.81	7.61	8.27
12	3.18	4.21	4.99	5.71	6.60	7.38	8.02
13	3.05	4.08	4.84	5.53	6.41	7.17	7.79
14	2.96	3.95	4.69	5.37	6.23	6.97	7.57
15	2.87	3.83	4.56	5.22	6.06	6.78	7.37
16	2.78	3.72	4.43	5.08	5.90	6.60	7.18
17	2.71	3.61	4.31	4.95	5.75	6.44	7.00
18	2.63	3.51	4.20	4.83	5.61	6.29	6.84
19	2.56	3.42	4.10	4.71	5.47	6.14	6.68
20	2.50	3.33	4.00	4.60	5.35	6.00	6.53
21	2.44	3.25	3.90	4.50	5.23	5.87	6.39
22	2.38	3.17	3.81	4.40	5.12	5.75	6.26
23	2.32	3.10	3.73	4.31	5.01	5.63	6.13
24	2.27	3.03	3.65	4.22	4.91	5.52	6.01
25	2.22	2.96	3.57	4.13	4.81	5.41	5.90
26	2.20	2.90	3.50	4.05	4.72	5.31	5.79
27	2.16	2.84	3.43	3.98	4.63	5.21	5.69
28	2.14	2.78	3.37	3.90	4.55	5.12	5.59
29	2.11	2.72	3.30	3.83	4.47	5.03	5.49
30	2.08	2.67	3.24	3.76	4.39	4.94	5.40
31	2.05	2.62	3.19	3.70	4.32	4.86	5.32
32	2.02	2.57	3.10	3.63	4.25	4.79	5.22
33	1.99	2.52	3.05	3.57	4.18	4.71	5.14
34	1.96	2.48	3.01	3.51	4.11	4.63	5.07
35	1.93	2.44	2.98	3.46	4.05	4.56	5.00
36	1.91	2.39	2.93	3.41	3.99	4.50	4.93
37	1.89	2.35	2.88	3.36	3.93	4.43	4.86
38	1.87	2.32	2.84	3.31	3.87	4.37	4.79
39	1.85	2.28	2.80	3.26	3.82	4.31	4.73
40	1.83	2.24	2.76	3.22	3.76	4.25	4.66
41	1.81	2.21	2.72	3.17	3.71	4.19	4.60
42	1.79	2.18	2.68	3.13	3.66	4.13	4.54
43	1.77	2.14	2.64	3.09	3.61	4.08	4.49
44	1.75	2.11	2.61	3.05	3.57	4.03	4.43
45	1.73	2.08	2.57	3.01	3.52	3.98	4.38

ATTACHMENT A CONTINUED
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<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
46	1.70	2.05	2.54	2.97	3.48	3.93	4.33
47	1.67	2.02	2.50	2.93	3.44	3.88	4.28
48	1.66	2.00	2.47	2.90	3.39	3.84	4.23
49	1.64	1.97	2.44	2.86	3.35	3.79	4.18
50	1.61	1.95	2.41	2.83	3.32	3.75	4.13
51	1.59	1.92	2.38	2.79	3.28	3.71	4.09
52	1.56	1.89	2.35	2.76	3.24	3.67	4.05
53	1.54	1.86	2.33	2.73	3.20	3.63	4.00
54	1.52	1.84	2.30	2.70	3.17	3.59	3.96
55	1.50	1.81	2.27	2.67	3.14	3.55	3.92
56	1.47	1.79	2.25	2.64	3.10	3.51	3.88
57	1.45	1.76	2.22	2.61	3.07	3.48	3.84
58	1.43	1.74	2.20	2.59	3.04	3.44	3.81
59	1.42	1.72	2.18	2.56	3.01	3.41	3.77
60	1.40	1.69	2.15	2.53	2.98	3.37	3.73
61	1.38	1.67	2.13	2.51	2.95	3.34	3.70
62	1.36	1.65	2.11	2.48	2.92	3.31	3.67
63	1.34	1.63	2.09	2.46	2.89	3.28	3.63
64	1.33	1.61	2.07	2.44	2.86	3.25	3.60
65	1.31	1.59	2.05	2.41	2.84	3.22	3.57
66	1.30	1.57	2.03	2.39	2.81	3.19	3.54
67	1.28	1.56	2.01	2.37	2.79	3.16	3.51
68	1.26	1.54	1.99	2.35	2.76	3.13	3.48
69	1.25	1.52	1.97	2.33	2.74	3.10	3.45
70	1.24	1.50	1.95	2.31	2.71	3.08	3.42
71	1.22	1.49	1.93	2.28	2.69	3.05	3.39
72	1.21	1.47	1.92	2.26	2.67	3.02	3.36
73	1.20	1.46	1.90	2.25	2.64	3.00	3.34
74	1.18	1.44	1.88	2.23	2.63	2.98	3.31
75	1.17	1.43	1.86	2.21	2.61	2.95	3.29
76	1.16	1.41	1.85	2.19	2.58	2.93	3.26
77	1.15	1.40	1.83	2.17	2.55	2.90	3.24
78	1.13	1.38	1.82	2.15	2.53	2.88	3.22
79	1.12	1.37	1.80	2.14	2.50	2.86	3.19
80	1.11	1.36	1.79	2.12	2.48	2.84	3.16
81	1.10	1.34	1.77	2.10	2.46	2.82	3.13
82	1.09	1.33	1.76	2.08	2.43	2.79	3.10
83	1.08	1.32	1.74	2.06	2.41	2.76	3.07
84	1.07	1.31	1.73	2.04	2.39	2.74	3.04
85	1.06	1.30	1.72	2.02	2.37	2.71	3.01
86	1.05	1.28	1.70	2.00	2.34	2.69	2.99
87	1.04	1.27	1.69	1.99	2.32	2.66	2.96
88	1.03	1.26	1.68	1.97	2.30	2.64	2.93
89	1.02	1.25	1.68	1.95	2.28	2.62	2.91
90	1.01	1.24	1.66	1.93	2.26	2.59	2.88

ATTACHMENT A CONTINUED
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<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
91	1.00	1.23	1.65	1.92	2.24	2.57	2.86
92	1.00	1.22	1.63	1.90	2.22	2.55	2.83
93	0.99	1.21	1.62	1.89	2.20	2.53	2.81
94	0.98	1.20	1.61	1.87	2.19	2.51	2.79
95	0.97	1.19	1.59	1.85	2.17	2.49	2.76
96	0.96	1.18	1.58	1.84	2.15	2.46	2.74
97	0.96	1.17	1.57	1.82	2.13	2.44	2.72
98	0.95	1.16	1.56	1.81	2.12	2.42	2.70
99	0.94	1.15	1.54	1.80	2.10	2.41	2.67
100	0.93	1.14	1.53	1.78	2.08	2.39	2.65
101	0.93	1.13	1.52	1.77	2.07	2.39	2.65
102	0.92	1.13	1.51	1.75	2.05	2.35	2.61
103	0.91	1.12	1.50	1.74	2.04	2.33	2.59
104	0.90	1.11	1.49	1.73	2.02	2.31	2.57
105	0.90	1.10	1.47	1.72	2.01	2.30	2.55
106	0.89	1.09	1.46	1.70	1.99	2.28	2.54
107	0.88	1.09	1.45	1.69	1.98	2.26	2.52
108	0.88	1.08	1.44	1.68	1.96	2.25	2.50
109	0.87	1.07	1.43	1.67	1.95	2.23	2.48
110	0.87	1.06	1.42	1.65	1.93	2.21	2.46
111	0.86	1.06	1.41	1.64	1.92	2.20	2.45
112	0.85	1.05	1.40	1.63	1.91	2.18	2.43
113	0.85	1.04	1.39	1.62	1.89	2.17	2.41
114	0.84	1.03	1.38	1.61	1.88	2.15	2.40
115	0.84	1.03	1.37	1.60	1.87	2.14	2.38
116	0.83	1.02	1.36	1.59	1.86	2.12	2.36
117	0.82	1.01	1.36	1.58	1.84	2.11	2.35
118	0.82	1.01	1.35	1.57	1.83	2.09	2.33
119	0.81	1.00	1.34	1.56	1.82	2.08	2.32
120	0.81	0.99	1.33	1.55	1.81	2.07	2.30

<u>DURATION IN HOURS</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
2	0.81	0.99	1.33	1.55	1.81	2.07	2.30
3	0.59	0.72	0.97	1.13	1.32	1.51	1.68
4	0.47	0.58	0.78	0.91	1.06	1.21	1.35
5	0.40	0.49	0.66	0.77	0.89	1.02	1.14
6	0.35	0.42	0.57	0.67	0.78	0.89	0.99
8	0.28	0.34	0.46	0.53	0.62	0.71	0.79
10	0.23	0.29	0.39	0.45	0.52	0.60	0.67
12	0.20	0.25	0.33	0.39	0.45	0.52	0.58
18	0.15	0.18	0.24	0.28	0.33	0.38	0.42
24	0.12	0.15	0.20	0.23	0.27	0.31	0.34

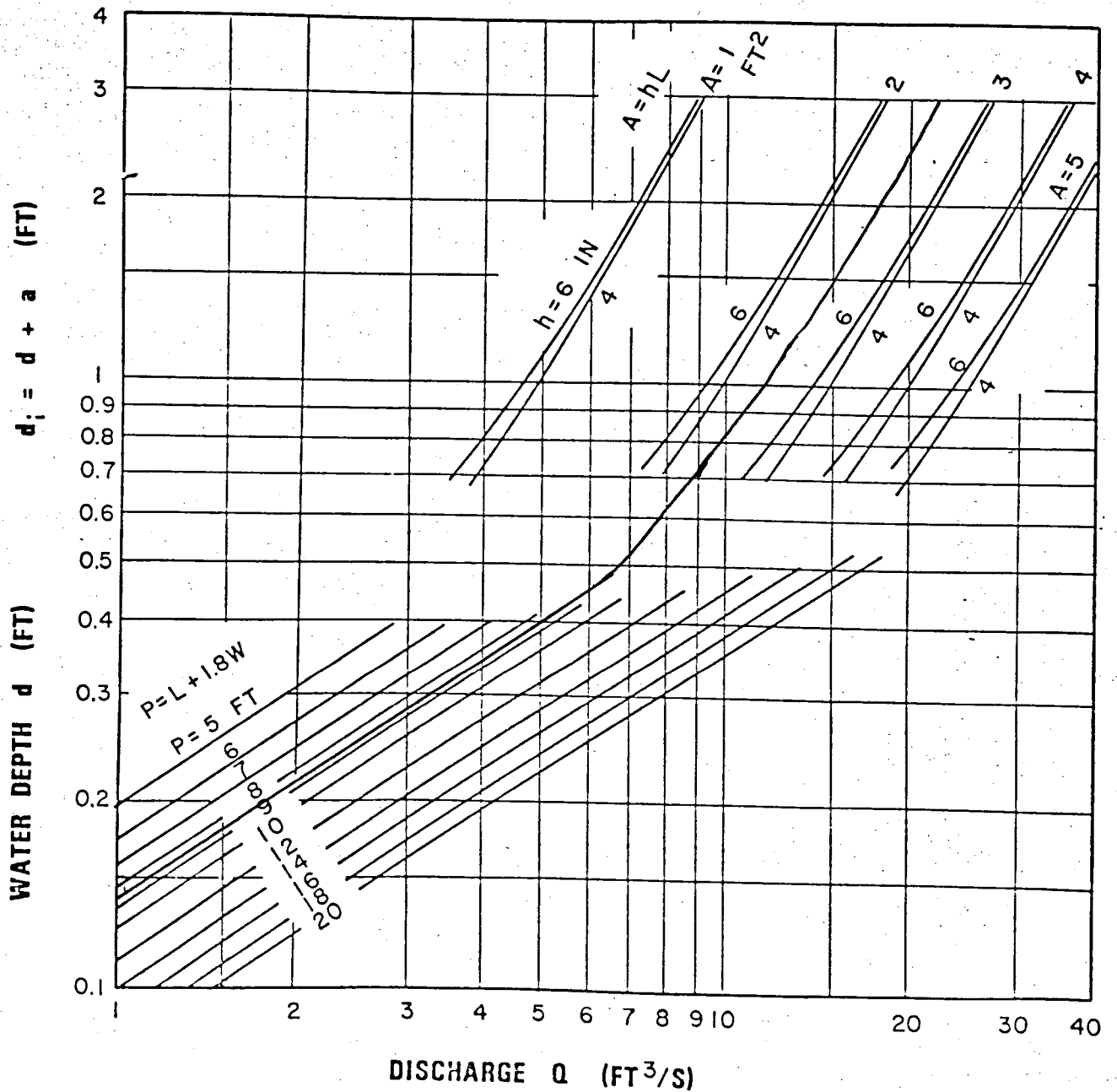
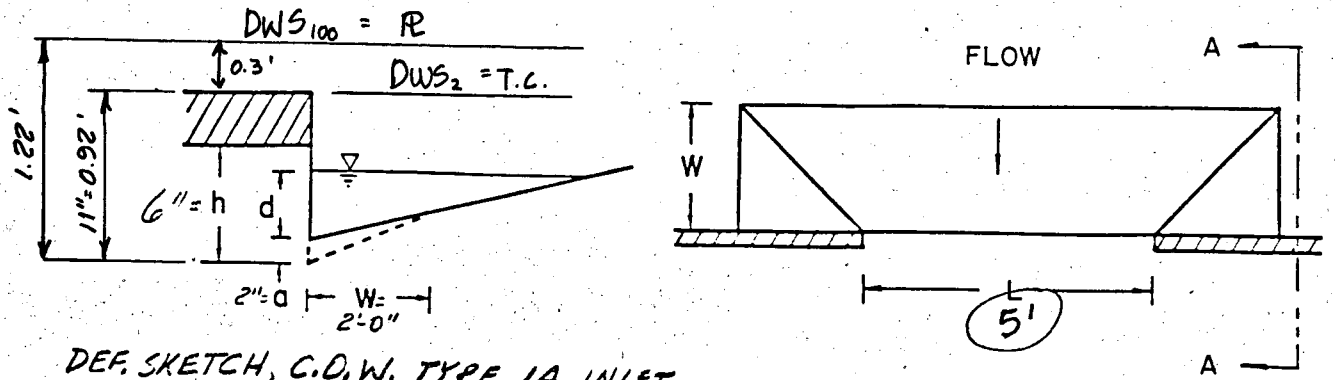


CHART 12. Depressed curb-opening inlet capacity in sump locations.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAR, 1974

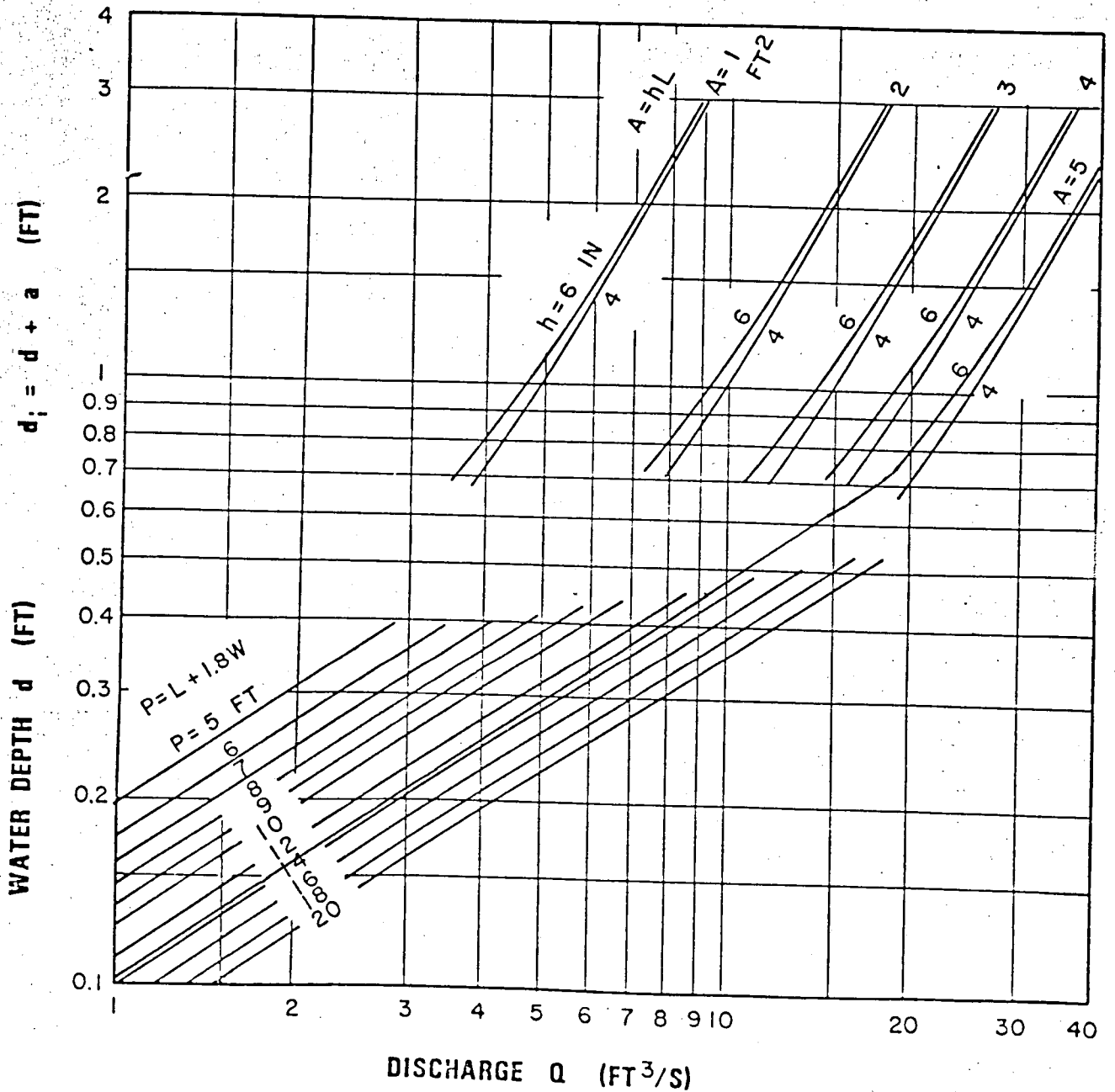
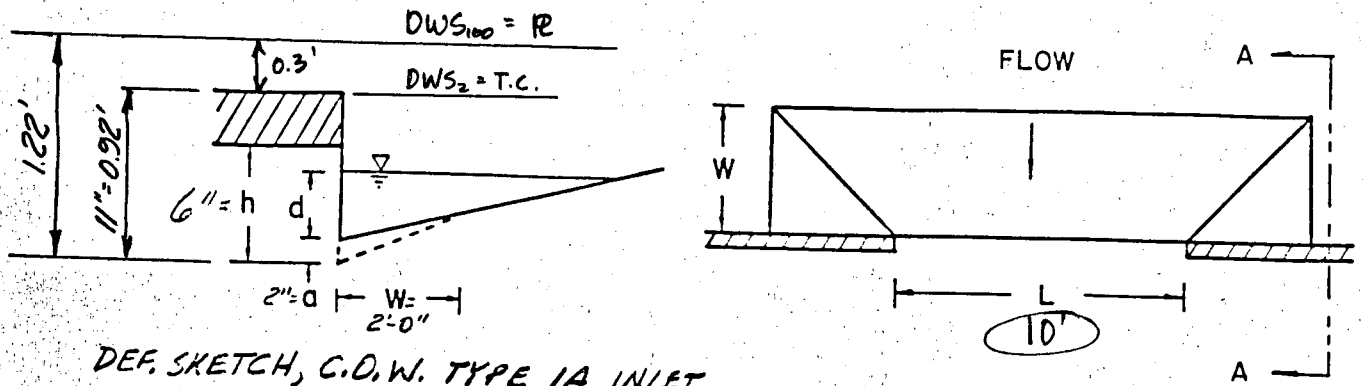


CHART 12. Depressed curb-opening inlet capacity in sump locations.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, FHWA, MAR., 1984

Rounds Estates

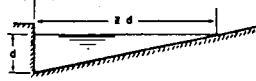
X-slope = $\frac{3}{10} \text{"/ft} = 0.03125 \text{"/}$

$z = \frac{1}{x-s} = \frac{1}{0.03125} = 32$

$n = 0.016$

$z/n = \frac{32}{0.016} = 2000$

Chart 1

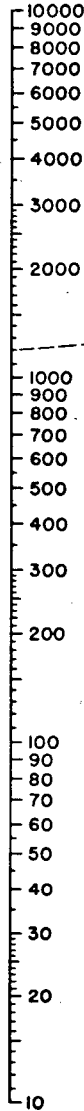


EQUATION: $Q = 0.56 \left(\frac{z}{n}\right) s^{3/2} d^{5/2}$
 n IS ROUGHNESS COEFFICIENT IN MANNING
 FORMULA APPROPRIATE TO MATERIAL IN
 BOTTOM OF CHANNEL
 z IS RECIPROCAL OF CROSS SLOPE
 REFERENCE: H. R. B. PROCEEDINGS 1948,
 PAGE 150, EQUATION (14)

EXAMPLE (SEE INSTRUCTION 1)

GIVEN: $s = 0.03$
 $z = 32$
 $n = .02$ } $z/n = 1200$
 $Q = 20 \text{ CFS}$
 FIND: $d = 0.22$ BY FOLLOWING
 DASHED LINES

RATIO z/n



TURNING LINE

INSTRUCTIONS

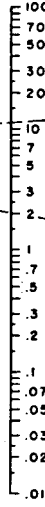
1. CONNECT z/n RATIO WITH SLOPE (S)
 AND CONNECT DISCHARGE (Q) WITH POINT
 WHERE LINE CROSSES TURNING LINE READ DEPTH
 AT CURB (d). Q CAN BE FOUND FROM d BY
 CONNECTING d WITH CROSSING OF TURNING
 LINE.

2. FOR SHALLOW
 V-SHAPED CHANNEL
 AS SHOWN USE NOMOGRAPH AS EXPLAINED
 IN INSTRUCTION 1 BUT WITH $z = \frac{1}{d}$.

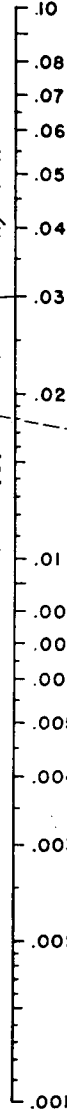
3. TO DETERMINE
 DISCHARGE Q_x IN
 PORTION OF CHANNEL
 HAVING WIDTH X:
 DETERMINE DEPTH d FOR TOTAL DISCHARGE IN
 ENTIRE SECTION AS EXPLAINED IN 1. THEN USE NOMOGRAPH TO
 DETERMINE Q_b IN SECTION OF WIDTH D FOR DEPTH
 $d' = d \left(\frac{x}{d}\right)$. THEN $Q_x = Q - Q_b$.

4. TO DETERMINE DISCHARGE
 (Q_x) IN COMPOSITE SECTION:-
 FOLLOW INSTRUCTION 3. TO
 OBTAIN DISCHARGE (Q_a) IN
 SECTION a AT ASSUMED DEPTH
 d BASED ON AN EXTENSION OF SLOPE RATIO z_a TO
 INTERSECT WATER SURFACE; OBTAIN Q_b FOR SLOPE RATIO z_b
 AND DEPTH d' ; $d' = d - \frac{x}{z_b}$. THEN $Q_x = Q_a + Q_b$.

DISCHARGE (Q) IN CFS



SLOPE OF CHANNEL (S) IN FT./FT.



DEPTH AT CURB OR DEEPEST POINT (d) IN FT.

