NORTHRIDGE LAKES ADDITION

February 19, 1996

Enclosed herein are the computations and supporting data for the revised Volume II of the NorthRidge Lakes Drainage Plan Volume II dated May 1, 1995. Note that several drainage systems on the East side of the property remain unchanged from the original drainage plan because construction has already taken place, specifically system 4, system 5 and system 7 and all drainage structures pertinent to detention ponds discussed in Volume 1 of the reference plan.

NorthRidge Lakes Addition is single family residential development in Northwest Wichita encompassing approximately 67 acres. The Rational Method has been used for hydrologic analysis of all storm sewer systems that serve the residential streets and yards. Portions of the drainage system have been designed for the major storm, or 100 year storm. Systems designed for the minor storm have major storm overflows directed through pipes at sump locations to the ponds.

For street conveyance, curb-deep flow is tolerable for the minor, or 2 year storm. For each inlet, street flooding and inlet capacity has been checked for the minor storm. It has been assumed that 3-5/8" roll curb and gutter will be used throughout, except on Pepper Ridge and Meadow Pass which require standard 6-5/8" curb. City of Wichita Type 1A street inlets and 3/8 in./ft. street cross-slope were assumed. Minimum walk grade has been assumed to be 0.3 above top of curb unless otherwise noted. Standard 4' x 2' grate inlets were assumed for back yard drains.

To simplify analysis the following assumptions were made:

1. The time of concentration is identical for both pipe flow and street flow for both major and minor storm; a conservative estimate since pipe velocities generally exceed gutter velocities.

2. Street conveyance was analyzed using only the street width. Depths above curb up to the walk grade were used, but the conveyance of the parking was neglected. In general, the parking area conveyance is quite small, due to a relatively higher "n" factor.

Hydraulic computations for the pipe system were performed using Manning's Equation. All pipes were assumed to be reinforced concrete with a Manning's "n" factor of 0.013. It is desirable to keep the hydraulic grade line approximately one foot below the top of curb elevations for the minor storm.

A 1"=100' scale drainage map is enclosed in the pocket.

2/19/96

NORTHRIDGE LAKES ADDITION

HYDROLOGY

36-95054-3466

BASIN #	AREA (ac)	C2 *	C100 *	tc	i2 (in/hr)	i100 (in/hr)	Q2 (cfs)	Q100 (cfs)
A	0.68	0.39	0.57	15	3.83	7.37	1.02	2.88
B	0.84	0.39	0.57	15	3.83	7.37	1.26	3.56
C	1.10	0.39	0.57	15	3.83	7.37	1.66	4.66
D	0.84	0.39	0.57	15	3.83	7.37	1.26	3.56
E	1.11	0.39	0.57	15	3.83	7.37	1.67	4.70
G	2.44	0.39	0.57	15	3.83	7.37	3.67	10.33
H	1.70	0.39	0.57	15	3.83	7.37	2.56	7.20
J	0.56	0.39	0.57	15	3.83	7.37	0.84	2.37
K	0.59	0.39	0.57	15	3.83	7.37	0.89	2.50
L	0.74	0.39	0.57	15	3.83	7.37	1.11	3.13
M	0.22	0.39	0.57	15	3.83	7.37	0.33	0.93
N	0.62	0.39	0.57	15	3.83	7.37	0.93	2.63
O	1.03	0.39	0.57	15	3.83	7.37	1.55	4.36
P	0.81	0.39	0.57	15	3.83	7.37	1.22	3.43
Q	4.33	0.39	0.57	15	3.83	7.37	6.52	18.34
R	1.17	0.39	0.57	15	3.83	7.37	1.76	4.95
S	0.54	0.39	0.57	15	3.83	7.37	0.81	2.29
T	1.27	0.39	0.57	15	3.83	7.37	1.91	5.38
U	2.13	0.39	0.57	15	3.83	7.37	3.21	9.02
V	1.07	0.39	0.57	15	3.83	7.37	1.61	4.53
W	1.15	0.39	0.57	15	3.83	7.37	1.73	4.87
X	3.29	0.39	0.57	15	3.83	7.37	4.95	13.93
Y	2.30	0.39	0.57	15	3.83	7.37	3.46	9.74
Z	1.62	0.39	0.57	15	3.83	7.37	2.44	6.86
AA	1.34	0.39	0.57	15	3.83	7.37	2.02	5.67
BB	1.09	0.39	0.57	15	3.83	7.37	1.64	4.62
CC	2.25	0.39	0.57	15	3.83	7.37	3.39	9.53
DD	1.03	0.39	0.57	15	3.83	7.37	1.55	4.36
EE	1.36	0.39	0.57	15	3.83	7.37	2.05	5.76
FF	1.11	0.39	0.57	15	3.83	7.37	1.67	4.70
GG	1.31	0.39	0.57	15	3.83	7.37	1.97	5.55
HH	0.48	0.39	0.57	15	3.83	7.37	0.72	2.03
II	0.96	0.39	0.57	15	3.83	7.37	1.45	4.07
JJ	0.92	0.39	0.57	15	3.83	7.37	1.39	3.90
LL	6.10	0.39	0.57	15	3.83	7.37	9.18	25.83
MM	1.24	0.39	0.57	15	3.83	7.37	1.87	5.25
NN	0.88	0.39	0.57	15	3.83	7.37	1.32	3.73
OO	0.67	0.39	0.57	15	3.83	7.37	1.01	2.84
PP	1.23	0.39	0.57	15	3.83	7.37	1.85	5.21
QQ	7.69	0.39	0.57	15	3.83	7.37	11.58	32.56

* - Runoff coefficient "C" based on class B soils and 1/3 acre residential lots.

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Date 1-26-96 Page ____ of ____ Comp by PDM

Project North Ridge Lakes 96064-3466 VMS

Item Q_2 System 100 - Street INLETS

z/n = 2000

INLET CAPACITY

$Z = \frac{1}{S_x}$

n = .016 (MANNING)

NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_b+Q_b cfs	APPROACHING FLOW chart 3 S_o o/o	S_x in/ft	d ft (1/2) <.32	T ft	INLET TYPE	INLET L	ON-GRADE COMP Lt ft	L/Lt	E ft	SUMP COMP. di ft	$d=d_i-.167$ ft	$T=\frac{d}{S_x}$ ft	Q_i cfs	Q_b cfs
				3/8"												
101	1.02		1.12	|	.19	6	1A	5'				.16	—	OK	1.02	—
102	1.26		1.12	|	.20	6.9	1A	5'				.19	.02	.6	1.26	—
103	1.66		1.12	|	.23	7.9	1A	5'				.22	.05	1.6	1.66	—

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Project Northridge Lakes 96064-3466

Item Q_2 System 200 - Street Inlets

z/n = 2000

INLET CAPACITY

MWS 1/31/97

NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_o+Q_b cfs	APPROACHING FLOW S_o o/o	S_x in/ft	d ft	T ft	INLET TYPE	L	ON-GRADE COMP Lt ft	L/Lt	E ft	SUMP COMP. di ft	d ft	T ft	Q_i cfs	Q_b cfs
R	11.58		.54	3/8"	.47	13.44	→		→	flow	to	(209)			0	11.58
208	0.93		.86	3/8"	.19	6	1A	5'				.15	—	OK	1.2	
209	1.55	13.13	.86	3/8"	.48	14	1A	10'				.57 <11 ft	.40 but	12.78 overflow	13.13 →	ø (208)
212	.33		.32	3/8"	.056	5.1	1A	5'				—	—	OK	.4	
	Q_{100}															
204	4.95		.5	3/8"	.35	12	1A	5'				.40	.33	10.5	4.95	
Q_{100}	overflow		to		30'		ESMT	NEAR	(208)							

Q_2

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Project NorthRidge Lakes 96064-3466

Item Q System 300 Street Inlets.

z/n =

INLET CAPACITY

NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_b+Q_b cfs	APPROACHING FLOW S_o o/o	APPROACHING FLOW S_x in/ft	APPROACHING FLOW d ft	APPROACHING FLOW T ft	INLET TYPE	INLET L	ON-GRADE COMP Lt ft	ON-GRADE COMP L/Lt	ON-GRADE COMP E ft	SUMP COMP. di ft	SUMP COMP. d ft	SUMP COMP. T ft	Q_i cfs	Qb cfs
305	3.67		.65	3/8"	.31		1A	5'						Q_2 {	3.67	
304	2.56		.73	3/8"	.27		1A	5'							2.56	-0-
By Pass	(Qion-	Q_2)	from	System 200	to		System 300.									
	10.33		.65	3/8"			1A	5							3.67	6.66
	18.34		1.35	3/8"			B.Y.	Drain							6.52	11.82
														E to (303)	=	18.48
Q_{100} 303	3.56	22.04	.47	3/8"	.62	21	1A	2-5'				.77	.6	19.17	22.04	0
	7.20		.73	3/8"			1A	5							2.56	4.64 → (302)
Q_{100} 302	4.70	9.34	.47	3/8"	.52	16	1A	2-5' OKED	W/	MWB		.60	.43	13.74	13.38	8

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Project Northridge Lakes 95054-3466

Item Q_2 System 600 - Street Inlets.

✓ DRC 2.10.96

z/n = 2000

INLET CAPACITY

N	NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_o+Q_b cfs	APPROACHING FLOW S_o o/o	APPROACHING FLOW S_x in/ft	APPROACHING FLOW d ft	APPROACHING FLOW T ft	INLET TYPE	INLET L	ON-GRADE COMP Lt ft	ON-GRADE COMP L/Lt	ON-GRADE COMP E ft	SUMP COMP. di ft	SUMP COMP. d ft	SUMP COMP. T ft	Q_i cfs	Q_b cfs
'	602	4.95		1.1	3/8"	.31	11.0	1A	5'				.41	.24	7.7	4.95	
'	603	3.46		1.1	3/8"	.27	8.0	1A	5'				.32	.15	4.8	3.46	
D	605	1.55		.5	3/8"	.22	7.9	1A	5'				.18	.01	—	1.55	
F	606	1.67		.5	3/8"	.23	8.1	1A	5'				.19	.02	—	1.67	
B	611	2.02		.33	3/8"	.25	9.0	1A	5'				.21	.04	—	2.02	
A	613	1.64		.33	3/8"	.27	9.5	1A	5'				.19	.02	—	1.64	

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Project Northridge Lakes 95054-3466

Item Q100 System 800 Street Inlets

✓ DRC 2-16-96

z/n = 2000

INLET CAPACITY

	NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_o+Q_b cfs	APPROACHING FLOW S_o o/o	APPROACHING FLOW S_x in/ft	APPROACHING FLOW d ft	APPROACHING FLOW T ft	INLET TYPE	INLET L	ON-GRADE COMP Lt ft	ON-GRADE COMP L/Lt	ON-GRADE COMP E ft	SUMP COMP. di ft	SUMP COMP. d ft	SUMP COMP. T ft	Q_i cfs	Q_b cfs
IN																	
1	803	9.02		2.76	3/8"	.33	11	1A	5'				.67	.50	16.0	9.02	∅
—	802	5.38		2.76	3/8"	.25	9	1A	5'				.45	.28	8.9	5.38	∅

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Project Northridge Lakes 96054-3466

Item Q100 System 900 Street Inlets.

z/n =

INLET CAPACITY

	NODE No.	HYDROLOGY Q_o cfs	HYDROLOGY Q_o+Q_b cfs	APPROACHING FLOW S_o o/o	APPROACHING FLOW S_x in/ft	APPROACHING FLOW d ft	APPROACHING FLOW T ft	INLET TYPE	INLET L	ON-GRADE COMP Lt ft	ON-GRADE COMP L/Lt	ON-GRADE COMP E ft	SUMP COMP. di ft	SUMP COMP. d ft	SUMP COMP. T ft	Q_i cfs	Q_b cfs
SIN																	
/	902	4.53		1.11	3/8"	.31	10'	1A	5				.38	.21	—	4.53	Ø
V	903	4.87		1.2	3/8"	.31	10'	1A	5				.39	.22	—	4.87	Ø

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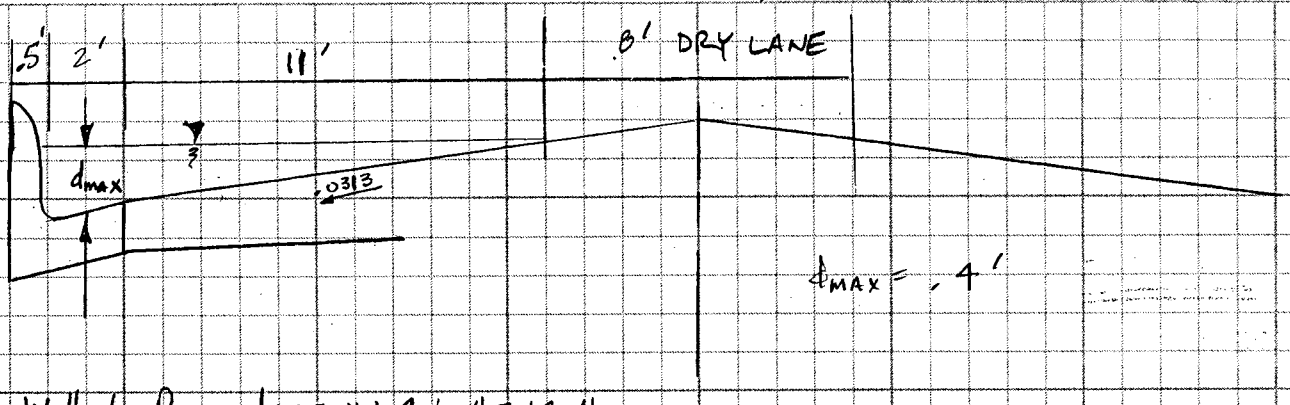
Date 2-5-96 Page ____ of ____

Project Northridge Lakes

Item 2 yr Street flow Check

3 5/8" Roll Curb on 64' ROW → 35' BK-BK



P = Wetted Perimeter = 11 + 2 + .4 = 13.4

$A = \frac{1}{2}(13)(.4) = 2.6$ ft²

$Q = \frac{1.49}{n} A R^{2/3} S^{1/2}$

Where $R = \frac{A}{P}$ & S = Slope in ft/ft.

$Q = \frac{1.49}{.016}(2.6)\left(\frac{2.6}{13.4}\right)^{2/3} S^{1/2}$

$Q = 81.15\sqrt{S}$

LOCATION	S (%)	Q_{max} (cfs)	Q (cfs)	Comment
103	1.12	8.59	1.26	ok
208	.86	7.53	.93	ok
N of 302	.47	5.56	2.5	ok
502	.5	5.74	1.45	ok
Lot 37, Blk 3	1.04	8.27	9.18	ok
06	.5	5.74	1.67	ok
611	.39	5.07	1.64	ok
903	1.2%	8.96	1.73	

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Time: 10:03:51

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NorthRidge Lakes
SWS System 2
pdm 2/7/96

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
214	213	.00	.00	.00	.0	15.00	3.83	6.52	15.00	3.83	6.52	6.52	18"	3.69	70.00	.32	15.32
213	212	.00	.00	.00	.0	.00	.00	.00	15.32	3.79	.00	6.52	18"	3.69	150.00	.68	15.99
212	209	.00	.00	.00	.0	15.00	3.83	.33	15.99	3.72	.32	6.84	18"	3.87	60.00	.26	16.25
211	210	.00	.00	.00	.0	15.00	3.83	1.22	15.00	3.83	1.22	1.22	15"	.99	105.00	1.76	16.76
210	209	.00	.00	.00	.0	.00	.00	.00	16.76	3.64	.00	1.22	15"	.99	80.00	1.34	18.10
209	208	.00	.00	.00	.0	15.00	3.83	13.13	16.25	3.69	12.65	20.59	30"	4.19	45.00	.18	16.43
208	205	.00	.00	.00	.0	15.00	3.83	.93	16.43	3.67	.89	21.48	30"	4.38	130.00	.50	16.93
207	206	.00	.00	.00	.0	15.00	3.83	.83	15.00	3.83	.83	.83	15"	.68	180.00	4.44	19.44
206	205	.00	.00	.00	.0	15.00	3.83	.89	19.44	3.38	.79	1.62	15"	1.32	190.00	2.40	21.84
205	203	.00	.00	.00	.0	15.00	3.83	3.13	16.93	3.62	2.96	25.69	30"	5.23	185.00	.59	17.52
204	203	.00	.00	.00	.0	15.00	3.83	4.95	15.00	3.83	4.95	4.95	15"	4.03	130.00	.54	15.54
203	202	.00	.00	.00	.0	15.00	3.83	2.29	17.52	3.56	2.13	32.50	36"	4.60	185.00	.67	18.19
202	201	.00	.00	.00	.0	.00	.00	.00	18.19	3.50	.00	32.50	36"	4.60	30.00	.11	18.29

Date: 02-07-1996
Time: 10:03:51

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NorthRidge Lakes
SWS System 2
pdm 2/7/96

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
201	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	54.0000	54.0000	.00
202	.00237	.0712	.0000	.0000	.0164	.1319	.0119	.2314	54.2314	57.0000	2.77
203	.00237	.4393	.0000	.0194	.0000	.0000	.0935	.5522	54.7836	57.0000	2.22
204	.00587	.7633	.0000	.0000	.0000	.0000	.0000	.7633	55.5470	59.7000	4.15
205	.00392	.7259	.0000	.0128	.0000	.0000	.2732	1.0120	55.7956	57.0000	1.20
206	.00063	.1189	.0000	.0020	.0000	.0000	.0417	.1627	55.9583	57.0000	1.04
207	.00017	.0297	.0000	.0000	.0000	.0000	.0000	.0297	55.9880	57.0000	1.01
208	.00274	.3566	.0000	.0024	.0000	.0159	.0616	.4365	56.2321	62.0000	5.77
209	.00252	.1134	.0000	.0041	.0000	.0935	.5808	.7917	57.0238	62.0000	4.98
211	.00036	.0375	.0000	.0000	.0000	.0000	.0000	.0375	57.0985	63.4000	6.30
210	.00036	.0285	.0000	.0000	.0008	.0062	.0018	.0373	57.0611	62.6000	5.54
212	.00424	.2544	.0000	.0021	.0000	.0174	.0629	.3369	57.3607	62.0000	4.64
214	.00385	.2697	.0000	.0000	.0000	.0000	.0000	.2697	58.3438	60.0000	1.66
213	.00385	.5779	.0000	.0000	.0106	.1057	.0193	.7135	58.0741	60.7000	2.63

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NorthRidge Lakes
SWS System 3
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
305	304	.00	.00	.00	.0	15.00	7.37	3.67	15.00	7.37	3.67	3.67	18"	2.08	45.00	.36	15.36
304	303	.00	.00	.00	.0	15.00	7.37	2.56	15.36	7.30	2.54	6.21	24"	1.98	295.00	2.49	17.85
303	302	.00	.00	.00	.0	15.00	7.37	18.00	15.00	7.37	18.00	23.22	36"	3.28	45.00	.23	15.23
302	301	.00	.00	.00	.0	15.00	7.37	13.38	15.23	7.32	13.30	36.51	42"	3.80	50.00	.22	15.45

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NorthRidge Lakes
SWS System 3
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDRAULICS* * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
301	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	55.0000	55.0000	.00
302	.00132	.0659	.0000	.0056	.0000	.0098	.2388	.3200	55.3200	56.2000	.88
303	.00121	.0545	.0000	.0107	.0000	.0243	.3949	.4844	55.8044	56.2000	.40
304	.00075	.2220	.0000	.0013	.0000	.0269	.0637	.3139	56.1183	56.5000	.38
305	.00122	.0549	.0000	.0000	.0000	.0000	.0000	.0549	56.1732	56.5000	.33

Date: 02-07-1996
Time: 11:10:22

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NorthRidge Lakes
SWS System 6
pdm 2/7/96

Storm Frequency = 2-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
613	611	.00	.00	.00	.0	15.00	3.83	2.02	15.00	3.83	2.02	2.02	15"	1.65	45.00	.46	15.46
612	611	.00	.00	.00	.0	15.00	3.83	3.39	15.00	3.83	3.39	3.39	15"	2.76	145.00	.87	15.87
611	609	.00	.00	.00	.0	15.00	3.83	1.64	15.87	3.73	1.60	6.98	15"	5.69	270.00	.79	16.67
610	609	.00	.00	.00	.0	15.00	3.83	1.55	15.00	3.83	1.55	1.55	15"	1.26	110.00	1.45	16.45
609	606	.00	.00	.00	.0	.00	.00	.00	16.67	3.65	.00	8.52	18"	4.82	120.00	.41	17.08
608	607	.00	.00	.00	.0	15.00	3.83	2.05	15.00	3.83	2.05	2.05	15"	1.67	110.00	1.10	16.10
607	606	.00	.00	.00	.0	.00	.00	.00	16.10	3.71	.00	2.05	15"	1.67	50.00	.50	16.60
606	605	.00	.00	.00	.0	15.00	3.83	1.67	17.08	3.60	1.57	12.12	18"	6.86	50.00	.12	17.20
604	603	.00	.00	.00	.0	15.00	3.83	2.44	15.00	3.83	2.44	2.44	15"	1.99	120.00	1.01	16.01
605	603	.00	.00	.00	.0	15.00	3.83	1.85	17.20	3.59	1.74	13.85	24"	4.41	210.00	.79	18.00
603	602	.00	.00	.00	.0	15.00	3.83	3.46	18.00	3.51	3.18	19.34	24"	6.16	45.00	.12	18.12
602	601	.00	.00	.00	.0	15.00	3.83	4.95	18.12	3.50	4.53	23.87	24"	7.60	170.00	.37	18.49

Date: 02-07-1996
Time: 11:10:22

Input File: nr

NorthRidge Lakes
SWS System 6
pdm 2/7/96

Storm Frequency = 2-Year

* * * HYDRAULICS * * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
601	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	46.0000	46.0000	.00
607	.00101	.0504	.0000	.0000	.0022	.0217	.0050	.0792	52.0355	63.2000	11.16
602	.01113	1.8920	.0000	.0308	.0000	.0000	.6629	2.5856	48.5856	60.5000	11.91
603	.00731	.3288	.0000	.0286	.0000	.1510	.5533	1.0617	49.6474	60.5000	10.85
604	.00143	.1712	.0000	.0000	.0000	.0000	.0000	.1712	49.8186	58.5000	8.68
605	.00375	.7875	.0000	.0856	.0000	.0000	-.2362	.6369	50.2843	62.9000	12.62
606	.01331	.6654	.0000	.0369	.0000	.1806	.7890	1.6719	51.9562	63.3000	11.34
608	.00101	.1108	.0000	.0000	.0000	.0000	.0000	.1108	52.1462	58.6000	6.45
609	.00658	.7901	.0000	.0283	.0000	.0180	.0744	.9108	52.8670	63.5000	10.63
610	.00058	.0633	.0000	.0000	.0000	.0000	.0000	.0633	52.9304	58.9000	5.97
611	.01169	3.1553	.0000	.0384	.0000	.0754	.7915	4.0606	56.9277	63.9000	6.97
612	.00275	.3993	.0000	.0000	.0000	.0000	.0000	.3993	57.3270	58.9000	1.57
613	.00098	.0440	.0000	.0000	.0000	.0000	.0000	.0440	56.9717	63.9000	6.93

Date: 02-07-1996
Time: 15:01:32

Input File: nrlsys8.stm

NorthRidge Lakes
SWS System 800
100 yr
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
803	802	.00	.00	.00	.0	15.00	7.37	9.02	15.00	7.37	9.02	9.02	24"	2.87	45.00	.26	15.26
802	801	.00	.00	.00	.0	15.00	7.37	5.38	15.26	7.32	5.34	14.36	24"	4.57	65.00	.24	15.50

Date: 02-07-1996
Time: 15:01:32

Input File: nrlsys8.stm

NorthRidge Lakes
SWS System 800
100 yr
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDRAULICS* * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
801	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	55.5000	55.5000	.00
802	.00403	.2620	.0000	.0197	.0000	.0075	.4079	.6971	56.1971	56.2000	.00
803	.00159	.0715	.0000	.0000	.0000	.0000	.0000	.0715	56.2686	56.2000	-.07

Date: 02-07-1996
Time: 15:09:39

Input File: nrlsys9.stm

NorthRidge Lakes
SWS System 9
100 yr
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDROLOGY * * *

Tributary Area									Hydrology Summation				Conduit Data				
Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(0) (Min)	I(0) (In/Hr)	Q(0) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
903	902	.00	.00	.00	.0	15.00	7.37	4.84	15.00	7.37	4.84	4.84	15"	3.94	45.00	.19	15.19
902	901	.00	.00	.00	.0	15.00	7.37	4.53	15.19	7.33	4.51	9.35	15"	7.62	160.00	.35	15.54

Date: 02-07-1996
Time: 15:09:39

Input File: nrlsys9.stm

NorthRidge Lakes
SWS System 9
100 yr
pdm 2/7/96

Storm Frequency = 100-Year

* * * HYDRAULICS* * *

Node	Hyd-Slope (Ft/Ft)	Friction (Ft)	Bend (Ft)	Transition (Ft)	Manhole (Ft)	Deflection (Ft)	Junction (Ft)	Total (Ft)	Hyd-Gl Elevation	Desired Elevation	Diff. (Ft)
901	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	54.0000	54.0000	.00
902	.02094	3.3502	.0000	.0659	.0000	.0000	1.3876	4.8037	58.8037	64.5000	5.70
903	.00561	.2526	.0000	.0000	.0000	.0000	.0000	.2526	59.0563	64.5000	5.44

Pipe Design

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
Page 2

DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
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.[illegible]
63	1.34	1.63	2.09	2.46	2.89	3.28	3[illegible]

TABLE 3

FULL FLOW COEFFICIENT VALUES
CIRCULAR CONCRETE PIPE

D Pipe Diameter (inches)	A Area (Square Feet)	R Hydraulic Radius (Feet)	Value of $C_1 = \frac{1.486}{n} \times A \times R^{2/3} = K$ n=0.010	n=0.011	n=0.012	n=0.013
~~8~~	0.349	0.167	15.8	14.3	13.1	12.1
10	0.545	0.208	28.4	25.8	23.6	21.8
~~12~~	0.785	0.250	46.4	42.1	38.6	35.7
15	1.227	0.312	84.1	76.5	70.1	64.7
18	1.767	0.375	137	124	114	105
21	2.405	0.437	206	187	172	158
24	3.142	0.500	294	267	245	226
~~27~~	~~3.976~~	~~0.562~~	~~402~~	~~366~~	~~335~~	~~310~~
30	4.909	0.625	533	485	444	410
~~33~~	~~5.940~~	~~0.688~~	~~686~~	~~624~~	~~574~~	~~530~~
36	7.069	0.750	867	788	722	666
42	9.621	0.875	1308	1189	1090	1006
48	12.566	1.000	1867	1698	1556	1436
54	15.904	1.125	2557	2325	2131	1967
60	19.635	1.250	3385	3077	2821	2604
66	23.758	1.375	4364	3967	3636	3357
72	28.274	1.500	5504	5004	4587	4234
78	33.183	1.625	6815	6195	5679	5242
84	38.485	1.750	8304	7549	6920	6388
90	44.170	1.875	9985	9078	8321	7681
96	50.266	2.000	11850	10780	9878	9119
102	56.745	2.125	13940	12670	11620	10720
108	63.617	2.250	16230	14760	13530	12490
114	70.882	2.375	18750	17040	15620	14420
120	78.540	2.500	21500	19540	17920	16540
126	86.590	2.625	24480	22260	20400	18830
132	95.033	2.750	27720	25200	23100	21330
138	103.870	2.875	31210	28370	26010	24010
144	113.100	3.000	34960	31780	29130	26890

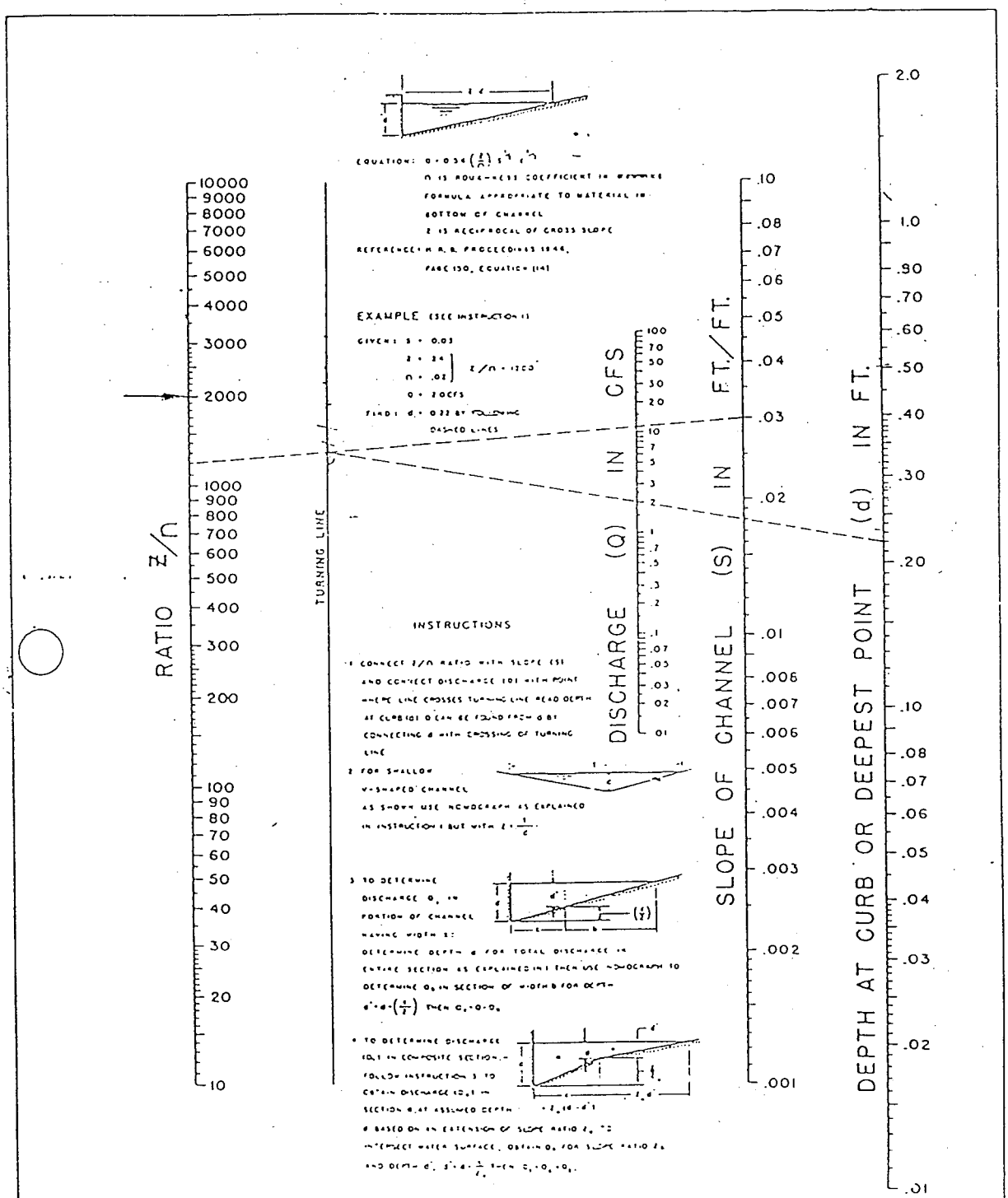
$Q = KS$

$K = \frac{Q}{\sqrt{S}}$ $\quad S = \frac{Q^2}{K^2}$

$= 1/x\text{-slope} = 1/0.03125 = 32$

$= 0.016$

$1/n = 32/0.016 = 2000$



BUREAU OF PUBLIC ROADS
REV. JAN 1968

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

DRAINAGE PLAN

DRAINAGE PLAN

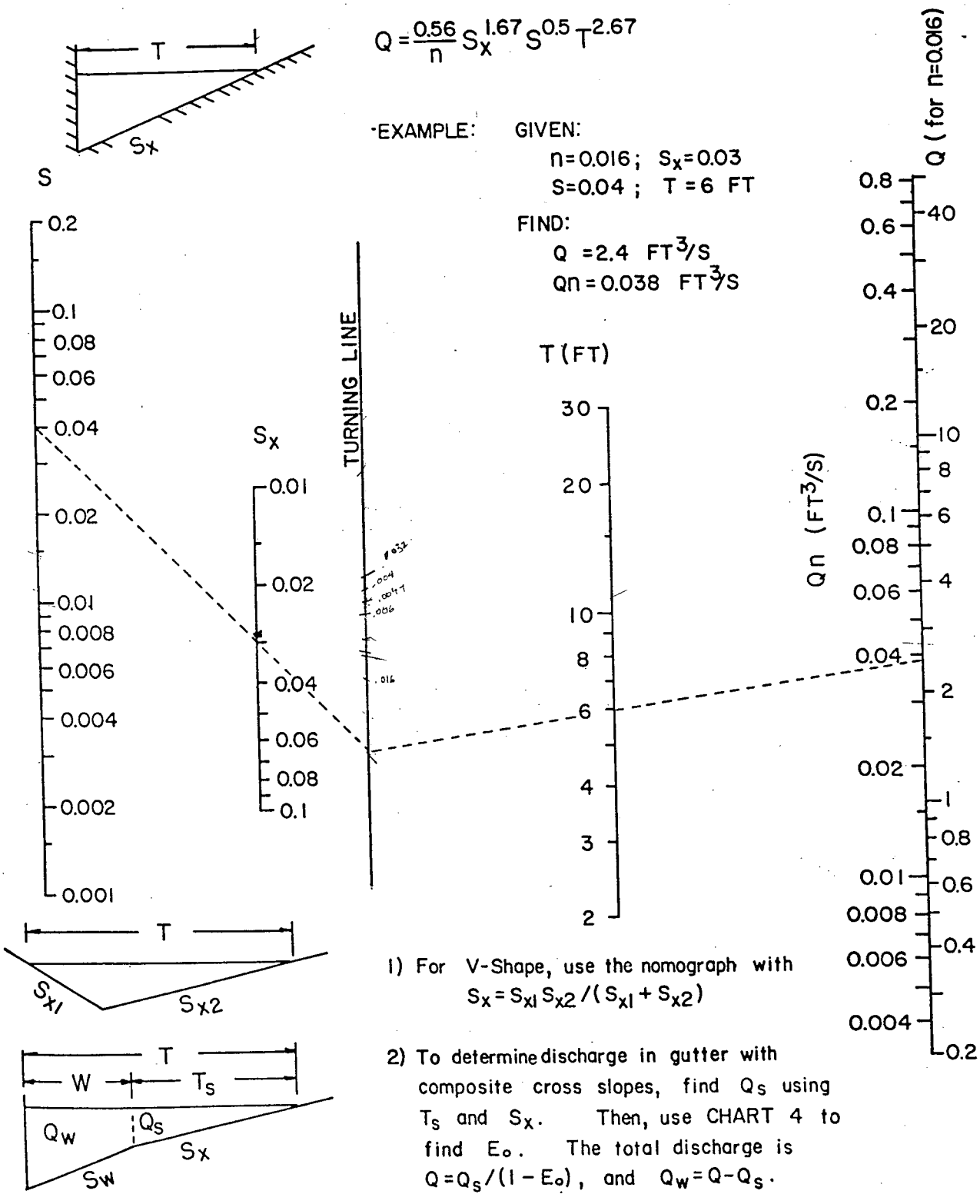
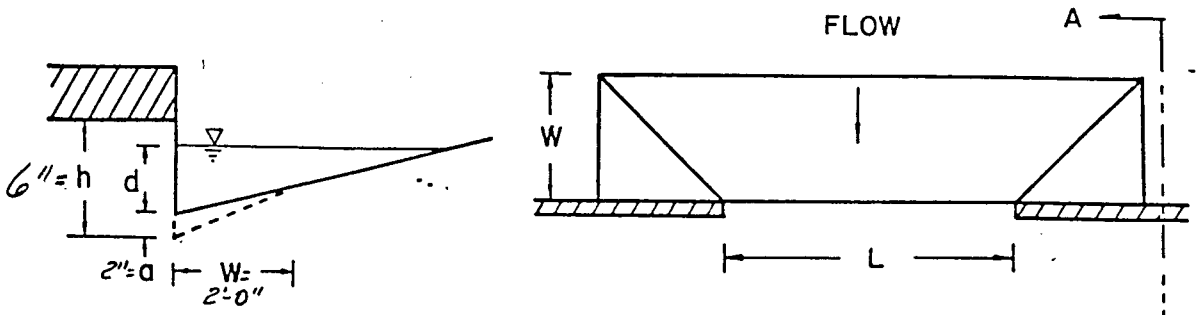


CHART 3. Flow in triangular gutter sections.

FROM: HEC-12: DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., Mar. 1984



DEF. SKETCH, C.O.W. TYPE 1A INLET

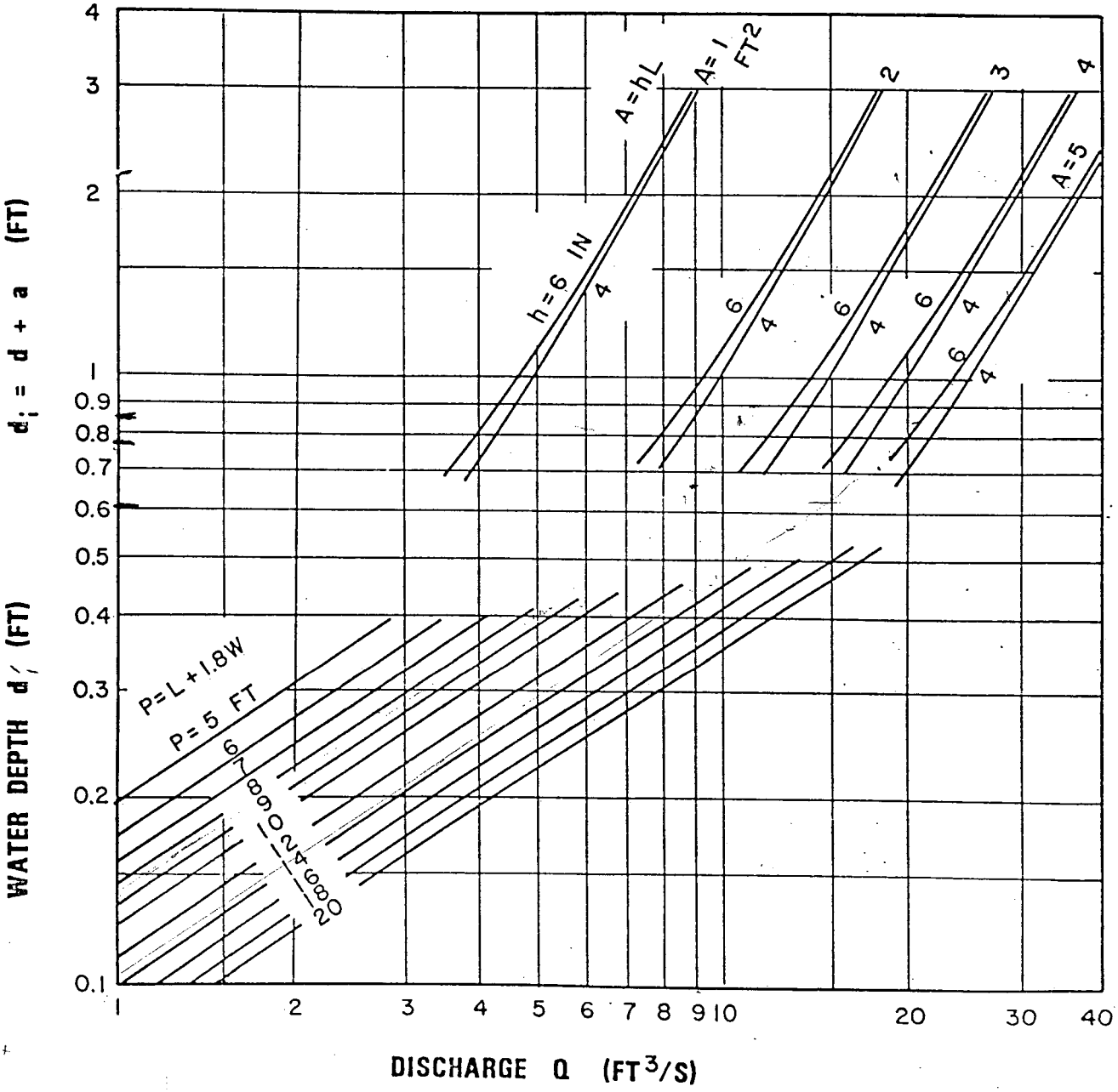


CHART 12. Depressed curb-opening inlet capacity in sump locations.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR., 1984

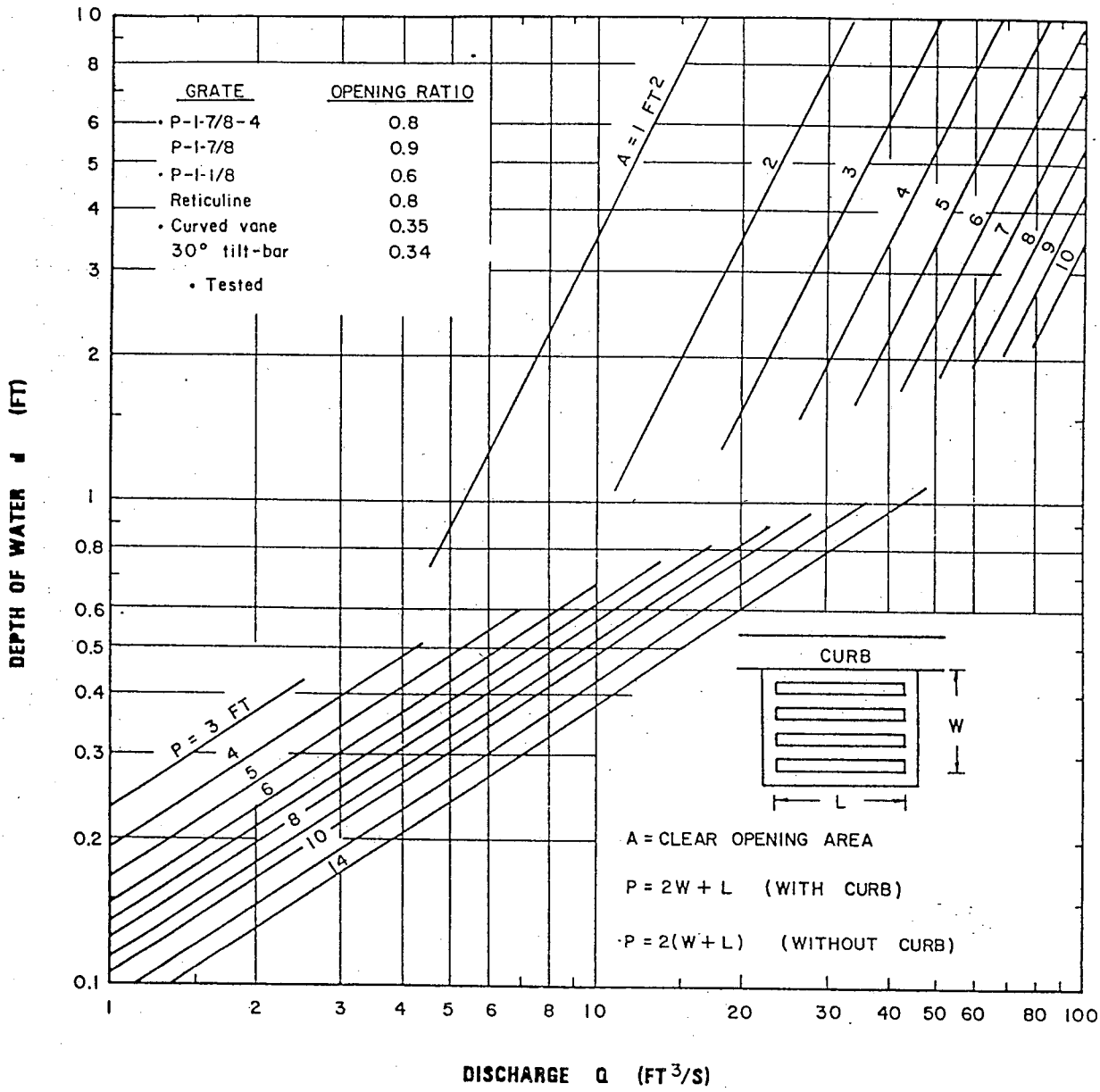


CHART 11. Grate inlet capacity in sump conditions.

FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR. 1984