PROFESSIONAL
ENGINEERING CONSULTANTS, PA
303 South Topeka
WICHITA, KANSAS 67202

(316) 262-2691

LETTER OF TRANSMITTAL

DATE 3-25-98	JOB NO. 36-97B37-3104
ATTENTION VICKY HUANG, P.E.	
RE: EVERGREEN ADDITION	

TO CITY OF WICHITA
455 N. MAIN - 7TH FLOOR
WICHITA, KS 67202

WE ARE SENDING YOU __X__ Attached ____ Under separate cover via _____ the following items:

____Shop drawings ____Prints ____Plans ____Samples ____Specifications

____Copy of letter ____Change order _____

COPIES	DATE	NO.	DESCRIPTION
2		1	DRAINAGE PLAN FOR REFERENCED ADDITION

THESE ARE TRANSMITTED as checked below:

____For approval ____Approved as submitted ____Resubmit _____ copies for approval

__X__For your use ____Approved as noted ____Submit _____ copies for distribution

____As requested ____Returned for corrections ____Return _____ corrected prints

____For review and comment ____ _____

____FOR BIDS DUE _____ 19_____ ____PRINTS RETURNED AFTER LOAN TO US

REMARKS _____

COPY TO Socora Village w/ 1 book; File w/ 1 book SIGNED Darwin R. Cronk, P.E.

If enclosures are not as noted, kindly notify us at once.

MEMO

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

TO: M.E. Lindebak, P.E.
455 N. Main, 7th Floor
Wichita, KS 67202

PROJECT NO. 36-97B37-3104
PROJECT: Evergreen Addition

COPIES TO:

ATTN: V.R. Huang, P.E.

DATE: 3-23-98

Socora Village

FROM: Darwin R. Cronk, P.E.

REFERENCE: Drainage Plan Computations

PLEASE ADVISE IMMEDIATELY OF ANY MISCONCEPTIONS OR OMISSIONS YOU BELIEVE TO BE CONTAINED HEREIN.

Attached hereto are the drainage computations for the referenced project

The publication Interim Drainage and Storm Sewer policy for Design Criteria and Documentation, City of Wichita, as revised 7/l/87 was used as the guideline for the hydrologic and hydraulic computations. This publication is hereinafter referred to as the Design Manual.

Manual #1, as referenced herein, refers to Design of Urban Highway Drainage - The State of the Art by Reitz & Jens, Inc., April 1980. Manual #2 refers to Drainage of Highway Pavements, Hydraulic Engineering Circular #12 by Tye Engineering, Inc., March 1984.

The analysis made herein is based on the available site data which includes the following:

HYDROLOGIC ANALYSIS FOR STORM WATER SEWERS

For storm sewer design, the Rational Method was used for the hydrologic analysis in accordance with the Design Manual. Runoff coefficients were estimated based on tables presented in the Design Manual.

For this development, a uniform assumption of the minimum time of concentration of 15 minutes was deemed appropriate.

Travel time for flow through defined channels, pipes, etc., for these basins was estimated on the basis of Manning's Equation.

HYDRAULIC ANALYSIS FOR STORM WATER SEWERS

For each inlet, street flooding and inlet capacity were checked for the minor storm. Conveyance in the street is based on the Modified Manning's Equation, as expressed in Manual #I, Equation (5-1), page 5-9. It has been assumed that Tc for street flow is equal for Tc for pipe flow. This is a simplifying, but conservative, assumption, since pipe flow velocities generally exceed street flow velocities.

For local streets, curb-deep flow is tolerable for the minor storm. For collector streets, a single eight-foot center lane should remain unflooded for the minor storm.

Inlet capacities were determined by the methods described in Manual #2, using Chart #12.

In this analysis, City of Wichita Type IA inlets and 3/8 inch per foot street cross slopes have been assumed. Minimum walk grade has been assumed to be 0.3 feet above the top of curb, unless otherwise noted. Streets have been assumed to have 6-5/8 inch standard curb, unless otherwise noted.

Storm sewers are designed for the minor storm, with major storm overflows to be routed through easements and rights-of-way to an appropriate outlet.

For residential areas, the minor storm has a recurrence interval of two years and in commercial areas has a recurrence interval of five years. The major storm evaluated has a recurrence interval of one hundred years.

To simplify hydraulic analysis, the following assumptions have been made:
1. The time of concentration is identical for both the major and the minor storms.

Hydraulic computation for the pipe system was performed using PEC's STORM computer program. This program uses Manning's Equation to calculate friction losses for pipes flowing full. Minor losses are computed by momentum principles at each structure. All pipe area assumed to be reinforced concrete with a Manning's "n" of 0.013. It is desirable to keep the hydraulic grade line at least one foot below the top of curb for the minor storm.

Runoff and storm sewer analysis for Lot 21, Block 9 and Lot 26, Block 7 have not been performed as part of this drainage plan. These lots are larger commercial and multi-family lots. The owner or developer of these lots will be required to perform individual drainage analyses for the lot based on the proposed development plan. Lot 26, Block 7 should be designed to discharge runoff to the pond in Reserve A., or the existing pond on the lot. Lot 21, Block 9, will be permitted to discharge to the existing pond on the lot.

HYDRAULIC MODELS FOR DETENTION

Detention storage computations were not performed as part of this drainage study. The drainage plan for New Market Square Addition includes the computations for the detention pond within Reserve A.

DESIGN AIDS

Charts, nomographs, etc. used in these computation are reprinted in this section

DRAINAGE PLAN MAP

A map at 1"=l 00' scale is include in the map pocket(s) at the back of the report.

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/21/98 Page 1 of 5

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #1

I. HYDROLOGY

Using Rational Method, $Q = CiA$

DETERMINE "C"

BASIN	NODE	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
1A	110	Vb	B	1/4 ac. Res	0.44	0.61
1B	120	Vb	B	1/4 ac. Res.	0.44	0.61
1C	130	Vb	B	1/4 ac. Res.	0.44	0.61

DETERMINE "I"

Assume T_c = 15 min. for all basins

$\therefore I_2 = 3.83$ in/hr $I_{100} = 7.37$ in/hr

DETERMINE "A"

BASIN	NODE	AREA (ac.)
1A	110	1.27
1B	120	3.57
1C	130	2.60

PROFESSIONAL ENGINEERING CONSULTANTS PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE/67202

Date 3/21/98 Page 2 of 5

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS#1

DETERMINE "Q_2"

BASIN	NODE	C_2	I_2	A	Q_2
1A	110	0.44	3.83	1.27	2.1
1B	120	0.44	3.83	3.57	6.0
1C	130	0.44	3.83	2.60	4.4

DETERMINE "Q_{100}"

BASIN	NODE	C_{100}	I_{100}	A	Q_{100}
1A	110	0.61	7.37	1.27	5.7
1B	120	0.61	7.37	3.57	16.0
1C	130	0.61	7.37	2.60	11.7

II. INLET SIZING / FLOOD ROUTING (2-YEAR)

BASIN	NODE	Inlet Condition	Q_2	Q_{max} (5' Inlet)	Q_{max} (10' Inlet)	$Q_{intercept}$ #	Q_{bypass}	USE L =
1A	110	Sump	2.1	11.0	22.0	2.1	—	5'
1B	120	Sump	6.0	11.0	22.0	6.0	—	5'
1C	130	Sump	4.4	11.0	22.0	4.4	—	5'

$Q_{intercept}$ = use as input data in storm sewer sizing program

PROFESSIONAL ENGINEERING CONSULTANTS PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 3 of 5

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #1

III. STREET FLOW

2-YEAR

NODE	BASIN	Q_2	Distribution	Street Slope	d	d_{max}	Comment
120	1B	6.0	70% (N) = 4.2	0.4%	0.35'	0.55'	OK
			30% (S) = 1.8	0.4%	0.26'	0.55'	OK

BY INSPECTION, ALL NODES ARE OK.

100-YEAR

$Q_{STREET} = Q_{100} - Q_{pipe}$

Location	Contributing Area		Q_{100}	Q_{pipe}	Q_{street}	Street Slope	Q_{max} ≠	Comment
Approaching Nodes 110 & 120 from N	50% 1A	=	2.9	0				
	60% 1B	=	9.6	0				
	100% 1C	=	11.7	4.4				
			24.2	4.4	19.8	0.5%	54.6	OK Std. Cb. Wk. Gr. = 0.3

BY INSPECTION, ALL LOCATIONS ARE OK.

≠ - See Design Aid

IV. OVERFLOW

100-YR FLOW AT NODES 110 & 120 WILL BE DESIGNED TO OVERTOP CURB AND SPILL INTO ADJACENT PROPOSED LAKE.

Date: 03-23-1998
Time: 10:00:21

Input File: C:\OUTPUT\EVGRN1.STM

EVERGREEN ADDITION
SWS #1
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R O L O G Y * * *

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)
130	120	.00	.00	.00	.0	15.00	3.83	4.40	15.00	3.83	4.40	4.40	15"	3.59	180.00	.84	15.84
120	110	.00	.00	.00	.0	15.00	3.83	6.00	15.84	3.73	5.85	10.25	18"	5.80	35.00	.10	15.94
110	100	.00	.00	.00	.0	15.00	3.83	2.10	15.94	3.72	2.04	12.30	24"	3.91	100.00	.43	16.36

Date: 03-23-1998
Time: 10:00:21

Input File: C:\OUTPUT\EVGRN1.STM

EVERGREEN ADDITION
SWS #1
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R A U L I C S * * *

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)
100	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	161.5000	161.5000	.00
110	.00295	.2954	.0000	.0570	.0000	.0430	-.1128	.2825	161.7825	165.6000	3.82
120	.00953	.3334	.0000	.0323	.0000	.0998	.9438	1.4093	163.1919	165.6000	2.41
130	.00464	.8351	.0000	.0000	.0000	.0000	.0000	.8351	164.0270	166.4000	2.37

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/21/98 Page 1 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #2

I. HYDROLOGY

DETERMINE "C"

BASIN	NODE	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
2A	210	Vb	B	1/4 ac Res.	0.44	0.61
2B	230	Vb	B	1/4 Ac. Res.	0.44	0.61
2C	220	Vb, Ta	60% B, 40% D	1/4 Ac. Res.	0.46	0.67
2D	280	Vb	B	1/4 ac. Res.	0.44	0.61
2E	290	Ta, Vb	90% D, 10% B	1/4 ac. Res.	0.49	0.75
2F	240	Ta, Vb	40% B, 60% D	1/4 ac. Res.	0.48	0.70
2G	250	Vb, Ta	70% B, 30% D	1/4 ac. Res.	0.46	0.66
2H	260	Vb, Ta	75% B, 25% D	1/4 ac. Res.	0.45	0.65
2I	270	Vb, Ta	80% B, 20% D	1/4 ac. Res.	0.45	0.64

DETERMINE "I"

Assume T_c = 15 min. for all basins

$\therefore$ I_2 = 3.83"/hr I_{100} = 7.37"/hr.

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/21/98 Page 2 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #2

DETERMINE "A"

BASIN	NODE	AREA (ac.)
2A	210	1.44
2B	230	1.89
2C	220	0.50
2D	280	0.98
2E	290	0.98
2F	240	6.62
2G	250	3.99
2H	260	2.00
2I	270	2.85

DETERMINE "Q_2"

BASIN	NODE	C_2	I_2	A	Q_2
2A	210	0.44	3.83	1.44	2.4
2B	230	0.44		1.89	3.2
2C	220	0.46		0.50	0.9
2D	280	0.44		0.98	1.6
2E	290	0.49		0.98	1.8
2F	240	0.48		6.62	12.2
2G	250	0.46		3.99	7.0
2H	260	0.45		2.00	3.4

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/21/98 Page 3 of

Project EVERGREEN ADDITION

Item DRAINAGE ADDITION SWS #2

DETERMINE "Q_{100}"

BASIN	NODE	C_{100}	I_{100}	A	Q_{100}
2A	210	0.61	7.37	1.44	6.5
2B	230	0.61		1.89	8.5
2C	220	0.67		0.50	2.5
2D	280	0.61		0.98	4.4
2E	290	0.75		0.98	5.4
2F	240	0.70		6.62	34.2
2G	250	0.66		3.99	19.4
2H	260	0.65		2.00	9.6
2I	270	0.64	7.37	2.85	13.4

- Q intercept = Use as input data in storm sewer sizing program

II. ~~DETERMINE~~ INLET SIZING / FLOOD ROUTING (2-YEAR)

BASIN	NODE	Inlet Condition	Q_2	Qmax (5' Inlet)	Qmax (10' Inlet)	# Q intercept	Q bypass	Use L =
2A	210	Sump	2.4	11.0	22.0	2.4		5'
2B	230	Sump	3.2			3.2		5'
2C	220	Sump	0.9			0.9		5'
2D	280	Sump	1.6			1.6		5'
2E	290	Sump	1.8			1.8		5'
2F	240	Sump	12.2			11.0	1.2 to (250)	5'
2G	250	Sump	7.0			7.0+1.2= 8.2		5'
2H	260	Sump	3.4			3.4		5'

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 4 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #2

III. STREET FLOW

2-YEAR

NODE	BASIN	Q_2	Distribution	Street Slope	d	d_{max}	Comment
240	2F	12.2	95% (S) = 11.6	0.4%	0.50'	0.55'	OK

BY INSPECTION, ALL NODES ARE OK

100-YEAR

$Q_{STREET} = Q_{100} - Q_{pipe}$

Location	Contributing Area		Q_{100}	Q_{pipe}	Q_{street}	Q_{max} ≠	Comment
Approaching Nodes 240 & 250 from S	95% 2F	=	32.5	0			
	70% 2G	=	13.6	0			
			46.1	0	46.1	54.9	OK Std. cb. wk Gr. = 0.3'
Approaching Nodes 210 & 230 from N	50% 2A	=	3~~2~~	0			
	40% 2B	=	3~~A~~6	0			
	100% 2C	=	2.5	0.9			
	100% 2D	=	4.4	1.6			
	100% 2E	=	5.4	1.8			
	100% 2F	=	34.2	11.0			
	100% 2G	=	19.4	8.2			
	100% 2H	=	9.6	3.4			
	100% 2I	=	13.4	4.9			
			95.5	31.8	63.7	74.3	OK Std. cb. 0.4' wk Gr.
			~~9~~2				

≠ - See Design Aid

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 5 of

Project

Item

IV. OVERFLOW CHANNEL

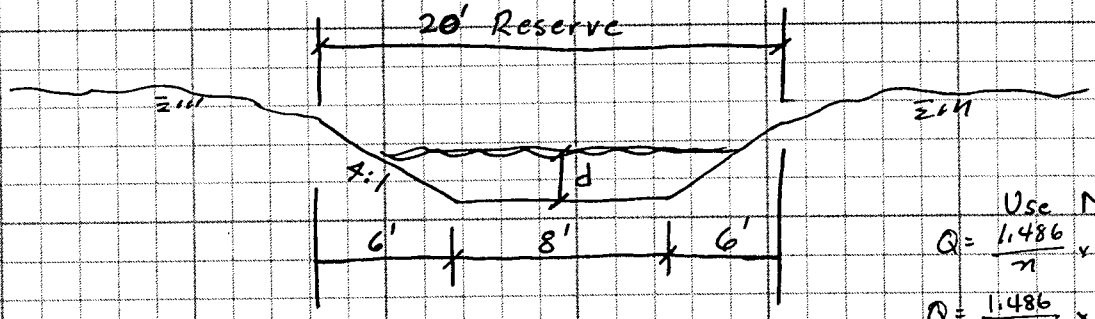
Q_2 IS DESIGNED TO FLOW THRU PIPES. $Q_{100} - Q_2$ FLOW MUST BE CARRIED OVERLAND BETWEEN LOTS 10 & 11, BLOCK 7 TO THE PROPOSED LAKE

FROM NODE 210 TO 200:

$Q_{OVERLAND} = Q_{100} - Q_{PIPE}$

$= 103.9 - 37.4 = 66.5$ cfs

Channel Section



Use Manning's Eq.

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

$Q = \frac{1.486}{.03} \times A \times R^{2/3} \times (.02)^{1/2}$

$Q = 7.0\, A R^{2/3}$

d	A	P	R	$R^{2/3}$	$AR^{2/3}$	Q
0.8'	8.96	14.6	0.614	0.72	6.45	45.2
1.0'	12.0	16.25	0.738	0.82	9.84	68.9 ← Q = 66.5, d ≅ 1.0'
1.2'	15.36	17.9	0.858	0.90	13.82	96.7

Use $d = 1.0'$ $V = Q/A = \frac{66.5}{12.0} = 5.54$ fps OK

Date: 03-23-1998
Time: 10:58:50

Input File: C:\OUTPUT\EVGRN2.STM

EVERGREEN ADDITION
SWS #2
DAR 3-23-98

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)
270	260	.00	.00	.00	.0	15.00	3.83	4.90	15.00	3.83	4.90	4.90	15"	3.99	35.00	.15	15.15
260	255	.00	.00	.00	.0	15.00	3.83	3.40	15.15	3.81	3.39	8.29	24"	2.64	355.00	2.24	17.39
255	240	.00	.00	.00	.0	.00	.00	.00	17.39	3.57	.00	8.29	24"	2.64	220.00	1.39	18.78
250	240	.00	.00	.00	.0	15.00	3.83	8.20	15.00	3.83	8.20	8.20	18"	4.64	40.00	.14	15.14
240	235	.00	.00	.00	.0	15.00	3.83	11.00	18.78	3.44	9.89	25.57	30"	5.21	225.00	.72	19.50
290	280	.00	.00	.00	.0	15.00	3.83	1.80	15.00	3.83	1.80	1.80	15"	1.47	40.00	.45	15.45
280	235	.00	.00	.00	.0	15.00	3.83	1.60	15.45	3.78	1.58	3.38	15"	2.75	130.00	.79	16.24
235	230	.00	.00	.00	.0	.00	.00	.00	19.50	3.38	.00	28.66	30"	5.84	355.00	1.01	20.51
230	210	.00	.00	.00	.0	15.00	3.83	3.20	20.51	3.29	2.75	31.42	36"	4.44	40.00	.15	20.66
220	215	.00	.00	.00	.0	15.00	3.83	.90	15.00	3.83	.90	.90	15"	.73	140.00	3.18	18.18
215	210	.00	.00	.00	.0	.00	.00	.00	18.18	3.50	.00	.90	15"	.73	110.00	2.50	20.68
210	200	.00	.00	.00	.0	15.00	3.83	2.40	20.66	3.28	2.06	34.37	36"	4.86	200.00	.69	21.35

Date: 03-23-1998
Time: 10:58:50

Input File: C:\OUTPUT\EVGRN2.STM

EVERGREEN ADDITION
SWS #2
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R A U L I C S * * *

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)
200	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	161.5000	161.5000	.00
210	.00266	.5311	.0000	.0060	.0000	.0110	.1327	.6808	162.1808	166.2000	4.02
220	.00019	.0272	.0000	.0000	.0000	.0000	.0000	.0272	162.2314	167.1000	4.87
230	.00222	.0887	.0000	.0446	.0000	.0190	-.1265	.0258	162.2066	166.2000	3.99
215	.00019	.0214	.0000	.0000	.0004	.0007	.0010	.0234	162.2042	166.6000	4.40
235	.00488	1.7338	.0000	.0108	.0000	.0000	.2384	1.9830	164.1896	168.5000	4.31
280	.00274	.3556	.0000	.0084	.0000	.0000	.1776	.5417	164.7313	166.9000	2.17
290	.00078	.0311	.0000	.0000	.0000	.0000	.0000	.0311	164.7623	166.9000	2.14
240	.00389	.8747	.0000	.0313	.0000	.0540	.5799	1.5399	165.7296	166.9000	1.17
250	.00609	.2438	.0000	.0000	.0000	.0000	.0000	.2438	165.9733	166.9000	.93
255	.00134	.2951	.0000	.0000	.0054	.0000	.0067	.3072	166.0368	168.2000	2.16
260	.00134	.4762	.0000	.0279	.0000	.1238	.0503	.6782	166.7149	168.3000	1.59
270	.00575	.2014	.0000	.0000	.0000	.0000	.0000	.2014	166.9163	168.3000	1.38

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 1 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #3

I. HYDROLOGY

DETERMINE "C"

BASIN	NODE	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
3A	310	Ta	D	1/4 ac. Res.	0.5	0.76
3B	320	Ta, Vb	60% D, 40% B	1/4 ac. Res.	0.48	0.70

DETERMINE "I"

Assume T_c = 15 min. for all basins
$\therefore$ I_2 = 3.83 in/hr I_{100} = 7.37 in/hr

DETERMINE "A"

BASIN	NODE	AREA (ac.)
3A	310	1.15
3B	320	6.54

DETERMINE "Q_2"

BASIN	NODE	C_2	I_2	A	Q_2
3A	310	0.5	3.83	1.15	2.2
3B	320	0.48	3.83	6.54	12.02

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 2 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #3

DETERMINE "Q_{100}"

BASIN	NODE	C_{100}	I_{100}	A	Q_{100}
3A	310	0.76	7.37	1.15	6.4
3B	320	0.70	7.37	6.54	33.7

II. INLET SIZING / FLOOD ROUTING

BASIN	NODE	Inlet Condition	Q_2	Qmax (5' Inlet)	Qmax (10' Inlet)	Q intercept ≠	Q bypass	Use L =
~~320~~ 3B	320	Sump	12.0	11.0	22.0	11.0	1.0 to (310)	5'
3A	310	Sump	2.2	11.0	22.0	2.2+1.0=3.2	—	5'

≠ - T_o be used in storm sewer sizing program

III. STREET FLOW

2-YEAR

NODE	BASIN	Q_2	Distribution	Street Slope	d	dmax	Comment
320	3B	12.0	60% (S) = 7.2	0.4%	0.42'	0.55'	OK

BY INSPECTION, ALL NODES ARE OK.

100-YEAR

$Q_{STREET} = Q_{100} - Q_{pipe}$

* - See Design Aid

Location	Contrib. Area	Q_{100}	Q_{pipe}	Q_{street}	Qmax*	Comment
Approaching Nodes 310 & 320 from S	60% 3A =	3.8	0			
	60% 3B =	20.2	0			
		24	0	24	54.9	OK. Std. Cb.

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE/67202

Date 3/22/98 Page 3 of

Project

Item SWS #3

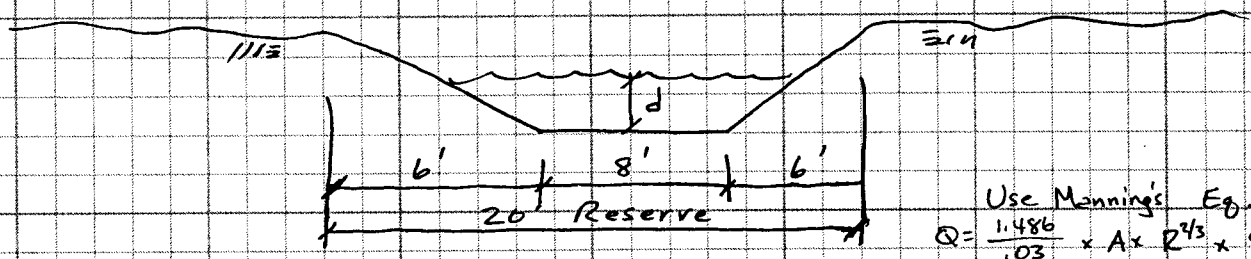
IV. OVERFLOW CHANNEL

Q_2 IS DESIGNED TO FLOW THRU PIPES. $Q_{100} - Q_2$ FLOW MUST BE CARRIED OVERLAND BETWEEN LOTS 19 & 20, BLOCK 7, TO THE PROPOSED LAKE.

FROM NODE 310 TO 300:

$Q_{OVERLAND} = Q_{100} - Q_{pipe}$
$= 40.1 - 14.2$
$= 25.9$ cfs

CHANNEL SECTION



Use Manning's Eq.

$Q = \frac{1.486}{.03} \times A \times R^{2/3} \times S^{1/2}$

$Q = 49.5 \times A \times R^{2/3} \times (.02)^{1/2}$

$Q = 7.0\, AR^{2/3}$

d	A	P	R	$R^{2/3}$	$AR^{2/3}$	Q
0.4'	3.84	11.3	0.3398	0.487	1.87	13.0
0.5'	5.0	12.12	0.4125	0.554	2.77	19.4
0.6'	6.24	12.95	0.4819	0.615	3.84	26.8 ← Q = 25.9 cfs

Use $d = 0.6'$ $V = 25.9/6.24 = 4.2$ fps OK

Date: 03-23-1998
Time: 11:08:00

Input File: C:\OUTPUT\EVGRN3.STM

EVERGREEN ADDITION
SWS #3
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R O L O G Y * * *

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)
320	310	.00	.00	.00	.0	15.00	3.83	11.00	15.00	3.83	11.00	11.00	18"	6.22	40.00	.11	15.11
310	300	.00	.00	.00	.0	15.00	3.83	3.20	15.11	3.82	3.19	14.19	24"	4.52	200.00	.74	15.85

Date: 03-23-1998
Time: 11:08:00

Input File: C:\OUTPUT\EVGRN3.STM

EVERGREEN ADDITION
SWS #3
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R A U L I C S * * *

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)
300	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	161.5000	161.5000	.00
310	.00393	.7869	.0000	.0570	.0000	.0000	-.0182	.8256	162.3256	166.2000	3.87
320	.01097	.4386	.0000	.0000	.0000	.0000	.0000	.4386	162.7643	166.2000	3.44

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE/67202

Date 3/22/98 Page 1 of

Project EVERGREEN ADDITION

Item DRAINAGE ADDITION SWS #4

I. HYDROLOGY

DETERMINE "C"

BASIN	NODE	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
4A	410	Ta	D	1/4 ac. Res.	0.5	0.76
4B	420	Ta	D	1/4 ac. Res.	0.5	0.76
4C	440	Vb, Ta	80% B/20% D	1/4 ac. Res.	0.45	0.64
4D	450	Vb, Ta	90% B, 10% D	1/4 ac. Res.	0.45	0.62
4E	430, 460	Vb, Ta	80% B, 20% D	1/4 ac. Res.	0.45	0.64
4F	470	Vb, Ta	80% B, 20% D	1/4 ac. Res.	0.45	0.64

DETERMINE "I"

Assume T_c = 15 min. for all basins
∴ I_2 = 3.83 in/hr I_{100} = 7.37 in/hr.

DETERMINE "A"

BASIN	NODE	AREA (ac.)
4A	410	1.02
4B	420	1.29
4C	440	8.20
4D	450	5.95
4E	430	3.83
	460	7.17

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/22/98 Page 2 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #4

DETERMINE "Q_2"

BASIN	NODE	C_2	I_2	A	Q_2
4A	410	0.5	3.83	1.02	2.0
4B	420	0.5		1.29	2.5
4C	440	0.45		8.20	14.1
4D	450	0.45		5.95	10.2
4E	430	0.45		3.83	6.6
	460	0.45		7.17	12.3
4F	470	0.45	3.83	2.53	4.4

DETERMINE "Q_{100}"

BASIN	NODE	C_{100}	I_{100}	A	Q_{100}
4A	410	0.76	7.37	1.02	5.7
4B	420	0.76		1.29	7.2
4C	440	0.64		8.20	38.7
4D	450	0.62		5.95	27.2
4E	430	0.64		3.83	18.1
	460	0.64		7.17	33.8
4F	470	0.64	7.37	2.53	11.9

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3/23/98 Page 3 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #4

II. INLET SIZING / FLOOD ROUTING - 2 YEAR

BASIN	NODE	Inlet Condition	Q_2	Qmax (5' Inlet)	Qmax (10' Inlet)	Qintercept #	Qbypass	Use L=
4A	410	Sump	2.0	11.0	22.0	2.0		5'
4B	420	Sump	2.5	11.0	22.0	2.5		5'
4E	430	Sump	6.6	11.0	22.0	6.6		5'
	460	Sump ~~On Grade (0.4%)~~	12.3	11.0	22.0	11.0	1.3 to (470)	5'
4F	470	Sump	4.4	11.0	22.0	4.4+1.3 = 5.7		5'
4C	440	Sump	14.1	11.0	22.0	14.1		10'
4D	450	Sump	10.2	11.0	22.0	10.2		5'

- To be used in storm sewer sizing program

III. STREET FLOW

2-YEAR

NODE	BASIN	Q_2	Distribution	Street Slope	d	dmax	Comment
440	4C	14.1	90% (N) = 12.7	0.4%	0.54'	0.55'	OK

BY INSPECTION, ALL NODES ARE OK.

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date 3.23.98 Page 4 of

Project EVERGREEN ADDITION

Item DRAINAGE PLAN SWS #4

100-YEAR

* - See Design Aid

Location	Contrib. Area	Q_{100}	Q_{pipe}	Q_{street}	Q_{max}*	Comment
Approaching Nodes 410 & 430 from W	60% 4A	= 3.4	0			
	75% 4E	= 38.9	11.0			
	4F	= 11.9	5.7			
		54.2	16.7	37.5	48.9	OK. Std. Cb. 0.3' Wk Gr.

IV. OVERFLOW

$Q_{100} - Q_2$ FLOW AT NODE 410 WILL BE ALLOWED TO OVERTOP CURB AND SPILL INTO ADJACENT PROPOSED LAKE.

Date: 03-23-1998
Time: 11:22:06

Input File: C:\OUTPUT\EVGRN4.STM

EVERGREEN ADDITION
SWS #4
DAR 3-23-98

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)
470	460	.00	.00	.00	.0	15.00	3.83	5.70	15.00	3.83	5.70	5.70	18"	3.23	35.00	.18	15.18
460	455	.00	.00	.00	.0	15.00	3.83	11.00	15.18	3.81	10.94	16.64	24"	5.30	140.00	.44	15.62
455	430	.00	.00	.00	.0	.00	.00	.00	15.62	3.76	.00	16.64	24"	5.30	170.00	.53	16.16
430	420	.00	.00	.00	.0	15.00	3.83	6.60	16.16	3.70	6.38	23.02	30"	4.69	35.00	.12	16.28
450	440	.00	.00	.00	.0	15.00	3.83	10.20	15.00	3.83	10.20	10.20	24"	3.25	35.00	.18	15.18
440	435	.00	.00	.00	.0	15.00	3.83	14.10	15.18	3.81	14.02	24.22	30"	4.93	270.00	.91	16.09
435	420	.00	.00	.00	.0	.00	.00	.00	16.09	3.71	.00	24.22	30"	4.93	270.00	.91	17.00
420	410	.00	.00	.00	.0	15.00	3.83	2.50	17.00	3.61	2.36	49.13	42"	5.11	40.00	.13	17.13
410	400	.00	.00	.00	.0	15.00	3.83	2.00	17.13	3.60	1.88	51.01	48"	4.06	100.00	.41	17.54

Date: 03-23-1998
Time: 11:22:06

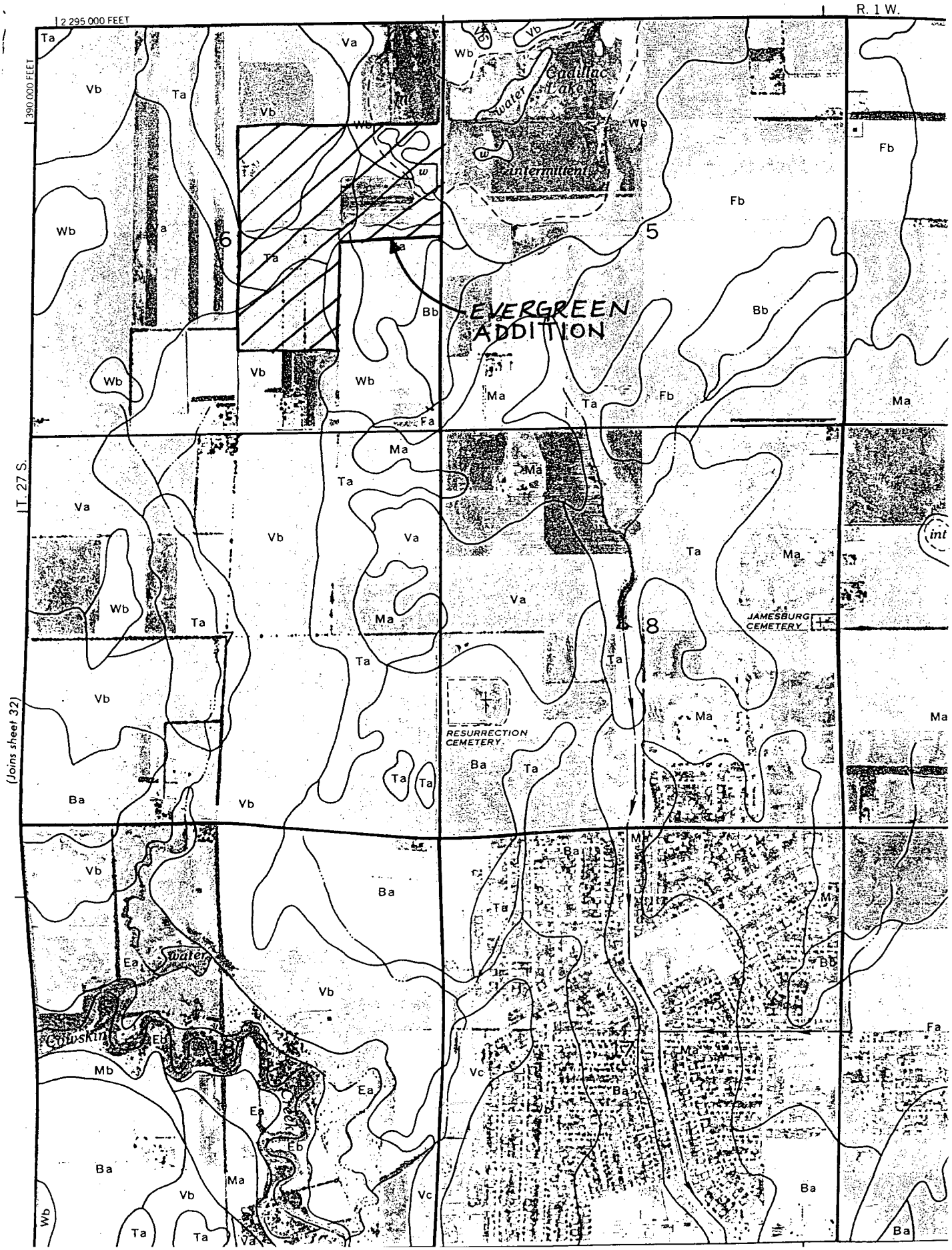
Input File: C:\OUTPUT\EVGRN4.STM

EVERGREEN ADDITION
SWS #4
DAR 3-23-98

Storm Frequency = 2-Year

* * * H Y D R A U L I C S * * *

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)
400	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	161.5000	161.5000	.00
410	.00126	.1261	.0000	.0298	.0000	.0000	-.1138	.0422	161.5422	165.6000	4.06
420	.00238	.0954	.0000	.0027	.0000	.0311	.7354	.8646	162.4067	165.6000	3.19
430	.00315	.1102	.0000	.0188	.0000	.0000	.1745	.3036	162.7103	165.5000	2.79
435	.00349	.9417	.0000	.0000	.0189	.0000	.0175	.9781	163.3848	167.2000	3.82
440	.00349	.9417	.0000	.0214	.0000	.0818	.6818	1.7269	165.1117	166.2000	1.09
450	.00203	.0712	.0000	.0000	.0000	.0000	.0000	.0712	165.1828	166.2000	1.02
455	.00541	.9198	.0000	.0000	.0218	.0468	.0271	1.0155	163.7258	166.3000	2.57
460	.00541	.7575	.0000	.0274	.0000	.0058	.9051	1.6958	165.4216	166.5000	1.08
470	.00294	.1031	.0000	.0000	.0000	.0000	.0000	.1031	165.5247	166.5000	.98


R. 1 W.
2 295 000 FEET
390 000 FEET
T. 27 S.
(Joins sheet 32)
Cadillac Lake
Water
Intermittent
EVERGREEN ADDITION
JAMESBURG CEMETERY
RESURRECTION CEMETERY
Gilbskin
Creek
5
6
8

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
3:15	0.54	0.69	0.90	1.05	1.26	1.42	1.58
3:30	0.51	0.65	0.85	0.99	1.19	1.34	1.49
3:45	0.48	0.61	0.80	0.94	1.12	1.27	1.41
4:00	0.46	0.58	0.76	0.89	1.07	1.21	1.34
4:15	0.44	0.55	0.73	0.85	1.02	1.15	1.28
4:30	0.42	0.53	0.70	0.81	0.98	1.10	1.23
4:45	0.40	0.51	0.67	0.78	0.94	1.06	1.18
5:00	0.38	0.49	0.64	0.75	0.90	1.02	1.13
5:15	0.37	0.47	0.62	0.72	0.87	0.98	1.09
5:30	0.35	0.45	0.60	0.70	0.83	0.94	1.05
5:45	0.34	0.44	0.58	0.67	0.81	0.91	1.01
6:00	0.33	0.42	0.56	0.65	0.78	0.88	0.98
6:30	0.31	0.40	0.52	0.61	0.73	0.83	0.92
7:00	0.30	0.38	0.50	0.58	0.69	0.78	0.87
7:30	0.28	0.36	0.47	0.55	0.66	0.74	0.83
8:00	0.27	0.34	0.45	0.52	0.62	0.70	0.78
8:30	0.26	0.33	0.43	0.50	0.60	0.67	0.75
9:00	0.25	0.31	0.41	0.48	0.57	0.64	0.72
9:30	0.24	0.30	0.39	0.46	0.55	0.62	0.69
10:00	0.23	0.29	0.38	0.44	0.52	0.59	0.66
10:30	0.22	0.28	0.36	0.42	0.50	0.57	0.63
11:00	0.21	0.27	0.35	0.41	0.49	0.55	0.61
11:30	0.21	0.26	0.34	0.39	0.47	0.53	0.59
12:00	0.20	0.25	0.33	0.38	0.45	0.51	0.57
13:00	0.19	0.24	0.31	0.36	0.43	0.48	0.53
14:00	0.18	0.22	0.29	0.34	0.40	0.45	0.50
15:00	0.17	0.21	0.27	0.32	0.38	0.43	0.47
16:00	0.16	0.20	0.26	0.30	0.36	0.40	0.45
17:00	0.15	0.19	0.25	0.29	0.34	0.38	0.43
18:00	0.15	0.18	0.24	0.27	0.33	0.37	0.41
19:00	0.14	0.18	0.23	0.26	0.31	0.35	0.39
20:00	0.14	0.17	0.22	0.25	0.30	0.34	0.37
21:00	0.13	0.16	0.21	0.24	0.29	0.32	0.36
22:00	0.13	0.16	0.20	0.23	0.28	0.31	0.34
23:00	0.12	0.15	0.19	0.22	0.27	0.30	0.33
24:00	0.12	0.15	0.19	0.22	0.26	0.29	0.32

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:46	1.67	2.04	2.58	2.96	3.50	3.92	4.34
0:47	1.65	2.01	2.55	2.92	3.46	3.87	4.29
0:48	1.63	1.98	2.51	2.88	3.41	3.82	4.23
0:49	1.60	1.96	2.48	2.85	3.37	3.78	4.18
0:50	1.58	1.93	2.45	2.81	3.33	3.73	4.13
0:51	1.56	1.91	2.42	2.78	3.29	3.68	4.08
0:52	1.54	1.88	2.39	2.74	3.25	3.64	4.03
0:53	1.52	1.86	2.36	2.71	3.21	3.60	3.98
0:54	1.50	1.84	2.33	2.68	3.17	3.55	3.94
0:55	1.48	1.81	2.30	2.65	3.13	3.51	3.89
0:56	1.46	1.79	2.28	2.62	3.10	3.47	3.85
0:57	1.45	1.77	2.25	2.59	3.06	3.43	3.80
0:58	1.43	1.75	2.23	2.56	3.03	3.40	3.76
0:59	1.41	1.73	2.20	2.53	3.00	3.36	3.72
1:00	1.39	1.71	2.18	2.50	2.96	3.32	3.68
1:05	1.32	1.62	2.06	2.37	2.81	3.15	3.49
1:10	1.25	1.53	1.96	2.25	2.67	3.00	3.33
1:15	1.18	1.46	1.87	2.15	2.55	2.86	3.17
1:20	1.13	1.39	1.78	2.05	2.44	2.74	3.04
1:25	1.07	1.33	1.70	1.97	2.34	2.63	2.91
1:30	1.03	1.27	1.63	1.89	2.24	2.52	2.80
1:35	0.98	1.22	1.57	1.81	2.16	2.43	2.69
1:40	0.94	1.17	1.51	1.75	2.08	2.34	2.60
1:45	0.91	1.13	1.46	1.69	2.01	2.26	2.51
1:50	0.87	1.09	1.41	1.63	1.94	2.18	2.42
1:55	0.84	1.05	1.36	1.57	1.88	2.11	2.35
2:00	0.81	1.02	1.32	1.52	1.82	2.05	2.28
2:05	0.79	0.98	1.28	1.48	1.76	1.99	2.21
2:10	0.76	0.95	1.24	1.43	1.71	1.93	2.14
2:15	0.74	0.92	1.20	1.39	1.67	1.88	2.08
2:20	0.72	0.90	1.17	1.36	1.62	1.82	2.03
2:25	0.70	0.87	1.14	1.32	1.58	1.78	1.98
2:30	0.68	0.85	1.11	1.29	1.54	1.73	1.93
2:35	0.66	0.83	1.08	1.25	1.50	1.69	1.88
2:40	0.64	0.81	1.05	1.22	1.46	1.65	1.83
2:45	0.62	0.79	1.03	1.19	1.43	1.61	1.79
2:50	0.61	0.77	1.00	1.17	1.40	1.57	1.75
2:55	0.59	0.75	0.98	1.14	1.37	1.54	1.71
3:00	0.58	0.73	0.96	1.12	1.34	1.51	1.68

RAINFALL INTENSITY TABLE

SEDGWICK COUNTY
KANSAS

THIS TABLE CONTAINS AVERAGE RAINFALL INTENSITIES
IN INCHES PER HOUR.

DURATION, HR:MIN	RETURN PERIOD 1 YR	2 YR	5 YR	10 YR	25 YR	50 YR	100 YR
0:05	4.77	5.52	6.56	7.32	8.44	9.32	10.20
0:06	4.53	5.26	6.27	7.02	8.11	8.96	9.81
0:07	4.33	5.04	6.03	6.76	7.82	8.65	9.48
0:08	4.16	4.85	5.82	6.52	7.55	8.36	9.17
0:09	4.00	4.67	5.61	6.30	7.30	8.09	8.87
0:10	3.85	4.50	5.42	6.08	7.06	7.82	8.58
0:11	3.71	4.34	5.23	5.88	6.83	7.56	8.30
0:12	3.58	4.19	5.06	5.69	6.60	7.32	8.04
0:13	3.45	4.05	4.90	5.51	6.40	7.10	7.79
0:14	3.34	3.92	4.75	5.34	6.21	6.89	7.57
0:15	3.23	3.80	4.61	5.19	6.04	6.70	7.36
0:16	3.13	3.69	4.48	5.05	5.88	6.53	7.17
0:17	3.03	3.58	4.36	4.92	5.73	6.37	7.00
0:18	2.94	3.48	4.25	4.80	5.60	6.22	6.84
0:19	2.86	3.39	4.14	4.69	5.47	6.09	6.70
0:20	2.78	3.30	4.05	4.58	5.35	5.96	6.56
0:21	2.70	3.21	3.95	4.48	5.24	5.84	6.43
0:22	2.63	3.14	3.87	4.39	5.14	5.72	6.30
0:23	2.56	3.06	3.78	4.30	5.04	5.61	6.19
0:24	2.50	2.99	3.71	4.21	4.94	5.51	6.07
0:25	2.44	2.93	3.63	4.13	4.85	5.41	5.97
0:26	2.38	2.86	3.56	4.05	4.76	5.31	5.86
0:27	2.33	2.80	3.49	3.98	4.68	5.22	5.76
0:28	2.28	2.75	3.43	3.91	4.59	5.13	5.66
0:29	2.23	2.69	3.36	3.84	4.52	5.04	5.57
0:30	2.19	2.64	3.30	3.77	4.44	4.96	5.48
0:31	2.14	2.59	3.24	3.71	4.37	4.88	5.39
0:32	2.10	2.54	3.19	3.64	4.30	4.80	5.31
0:33	2.06	2.50	3.14	3.58	4.23	4.73	5.22
0:34	2.02	2.45	3.08	3.53	4.16	4.65	5.14
0:35	1.99	2.41	3.03	3.47	4.10	4.58	5.07
0:36	1.95	2.37	2.99	3.42	4.03	4.51	4.99
0:37	1.92	2.33	2.94	3.36	3.97	4.45	4.92
0:38	1.89	2.30	2.89	3.31	3.91	4.38	4.84
0:39	1.86	2.26	2.85	3.27	3.86	4.32	4.77
0:40	1.83	2.23	2.81	3.22	3.80	4.26	4.71
0:41	1.80	2.19	2.77	3.17	3.75	4.20	4.64
0:42	1.77	2.16	2.73	3.13	3.70	4.14	4.58
0:43	1.75	2.13	2.69	3.08	3.65	4.08	4.52
0:44	1.72	2.10	2.65	3.04	3.60	4.03	4.46
0:45	1.70	2.07	2.62	3.00	3.55	3.97	4.40

Land Use or Surface Characteristics	Percent Impervious	Frequency 2	5	10	100
Soil Group D					
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.

Land Use or face Characteristics	Percent Impervious	Frequency 2	5	10	100
Single Family (Soil Group A)					
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
Multi-Family (Soil Group A)					
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
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):					
Soil Group A					
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
Soil Group B					
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
Soil Group C					
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

C values

(3 pages)

ATTACHMENT D

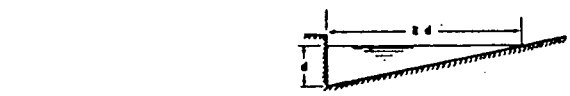
DRAINAGE CRITERIA

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:					
Single Family (Soil Group D)					
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
Multi-Family (Soil Group D)					
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
Single Family (Soil Group C)					
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
Multi-Family (Soil Group C)					
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
Single-Family (Soil Group B)					
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
Multi-Family (Soil Group B)					
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

NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS



EQUATION: $Q = 0.56\left(\frac{z}{n}\right) S^{\frac{1}{2}} d^{\frac{8}{3}}$

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 1946, PAGE 190, EQUATION (14)

EXAMPLE (SEE DASHED LINES)

GIVEN: S = 0.03
z = 24
n = .02
z/n = 1200
d = 0.22

FIND: Q = 2.0 CFS

RATIO z/n: 10000, 9000, 8000, 7000, 6000, 5000, 4000, 3000, 2000, 1000, 900, 800, 700, 600, 500, 400, 300, 200, 100, 90, 80, 70, 60, 50, 40, 30, 20, 10

TURNING LINE

DISCHARGE (Q) IN CFS: 100, 70, 50, 30, 20, 10, 7, 5, 3, 2, 1, .7, .5, .3, .2, .1, .07, .05, .03, .02, .01

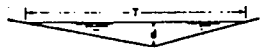
SLOPE OF CHANNEL (S) IN FT./FT.: .10, .08, .07, .06, .05, .04, .03, .02, .01, .008, .007, .006, .005, .004, .003, .002, .001

DEPTH AT CURB OR DEEPEST POINT (d) IN FT.: 2.0, 1.0, .80, .70, .60, .50, .40, .30, .20, .10, .08, .07, .06, .05, .04, .03, .02, .01

INSTRUCTIONS

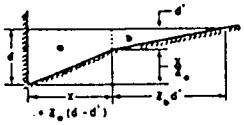
1. CONNECT z/n RATIO WITH SLOPE (S) AND CONNECT DISCHARGE (Q) WITH DEPTH (d). THESE TWO LINES MUST INTERSECT AT TURNING LINE FOR COMPLETE SOLUTION.

2. FOR SHALLOW V-SHAPED CHANNEL AS SHOWN USE NOMOGRAPH WITH $z = \frac{T}{d}$

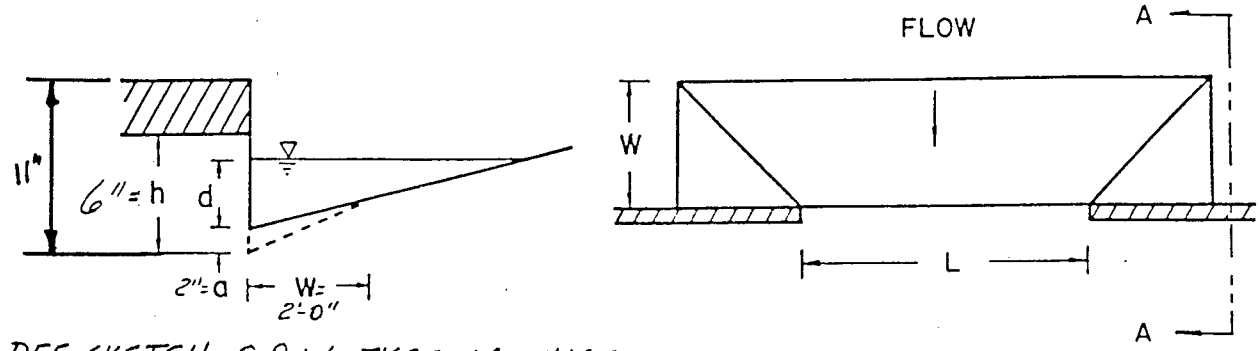


3. TO DETERMINE DISCHARGE Q_a IN PORTION OF CHANNEL HAVING WIDTH x:
DETERMINE DEPTH d FOR TOTAL DISCHARGE IN ENTIRE SECTION a. THEN USE NOMOGRAPH TO DETERMINE Q_b IN SECTION b FOR DEPTH $d' = d - \left(\frac{x}{z}\right)$

4. TO DETERMINE DISCHARGE IN COMPOSITE SECTION:- FOLLOW INSTRUCTION 3. TO OBTAIN DISCHARGE IN SECTION a AT ASSUMED DEPTH d; OBTAIN Q_b FOR SLOPE RATIO z_b AND DEPTH d'. THEN $Q_T = Q_a + Q_b$



One foot is 0.3048m
One cubic foot is 0.0283m^3



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

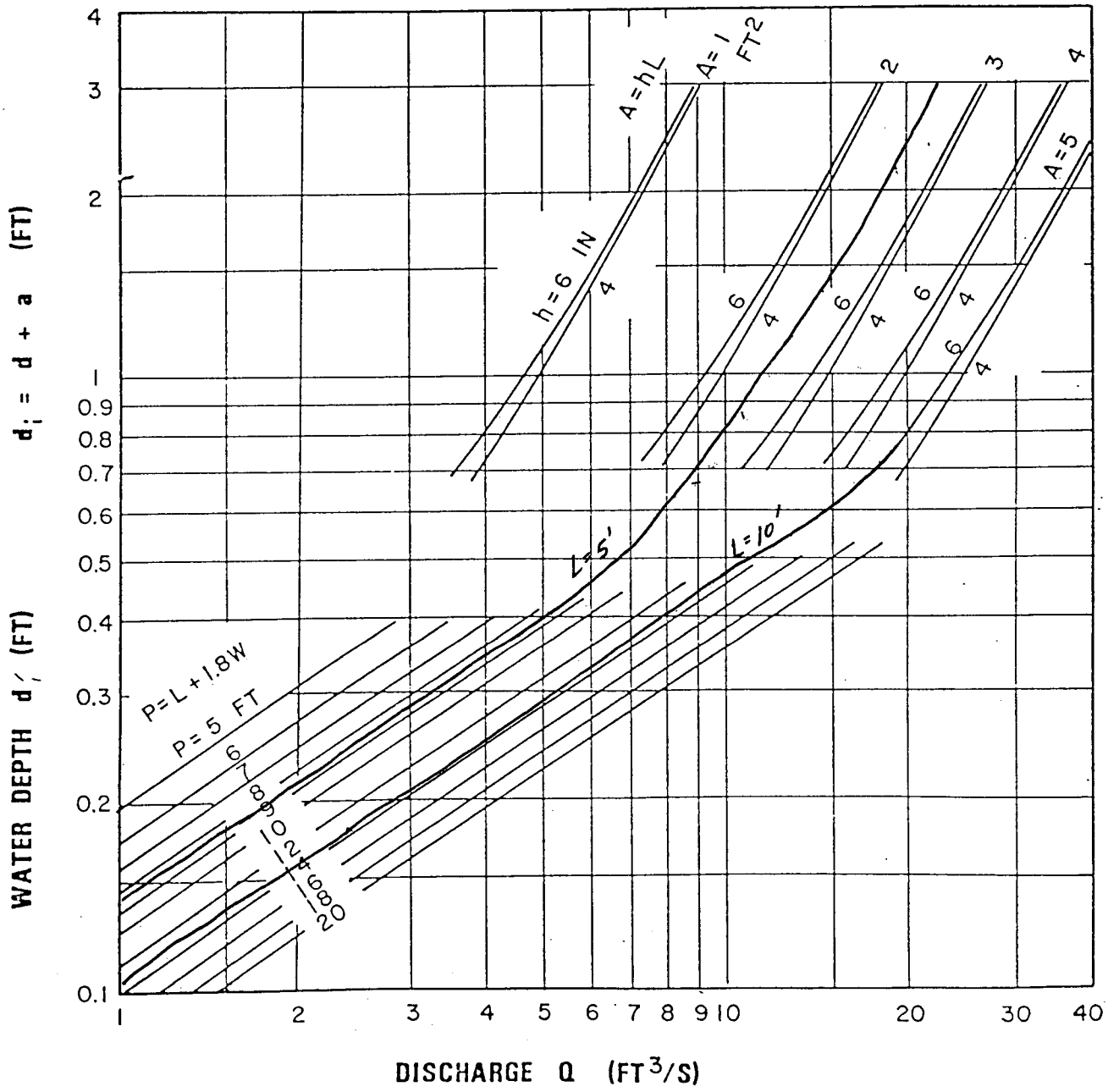


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

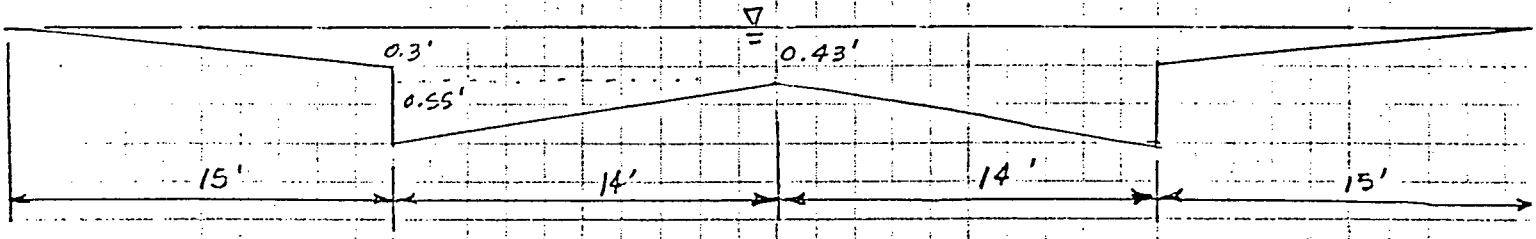
Date _____ Page _____ of _____

Project _____

Item _____

Determine Capacities of Standard Curb Streets w/ Various Walk Grades for 100-year storm analysis (58' R-O-W)

0.3' WALK GRADE



$$n = \frac{(2 \times 14.5 \times 0.03) + (2 \times 3.05 \times 0.013) + (2 \times 12 \times 0.016)}{59.1}$$

$$= \frac{(0.87) + (0.0793) + (0.384)}{59.1} = \frac{1.3333}{59.1} = 0.0226$$

$$A = (2 \times \tfrac{1}{2} \times 15 \times 0.3) + (28 \times 0.43) + (2 \times \tfrac{1}{2} \times 14 \times 0.42)$$

$$= (4.5) + (12.04) + (5.88)$$

$$= 22.42$$

$P = 59.1$

$R = A/P = 22.42/59.1 = 0.379357$ $\quad R^{2/3} = 0.52404$

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

$$Q = \frac{1.486}{0.0226} \times 22.42 \times 0.52404 \times S^{1/2}$$

$$Q = 772.5\sqrt{S}$$

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date _____ Page _____ of _____

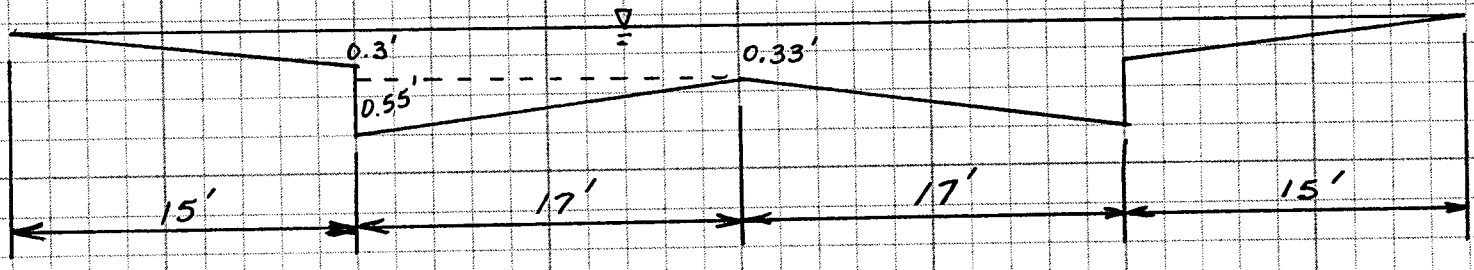
Project _____

Item _____

DETERMINE CAPACITIES OF STANDARD CURB STREETS W/ VARIOUS WALK GRADES FOR 100-YEAR STORM ANALYSIS

(64' R-O-W)

0.3' WALK GRADE



$$n = \frac{(2 \times 14.5 \times .03) + (2 \times 3.05 \times .013) + 2(15 \times .016)}{65.1}$$

$$= \frac{(0.87) + (0.0793) + (0.48)}{65.1}$$

$$= .02196$$

$$A = (2 \times \tfrac{1}{2} \times 15 \times 0.3) + (34 \times 0.33) + (2 \times \tfrac{1}{2} \times 17 \times 0.52)$$
$$= (4.5) + (11.22) + (8.84)$$
$$= 24.56 \text{ s.f.}$$

$P = 65.1$

$R = \frac{24.56}{65.1} = 0.377 \qquad R^{2/3} = 0.522$

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

$$Q = \frac{1.486}{.02196} \times 24.56 \times 0.522 \times S^{1/2}$$

$$Q = 867.5 \times S^{1/2}$$

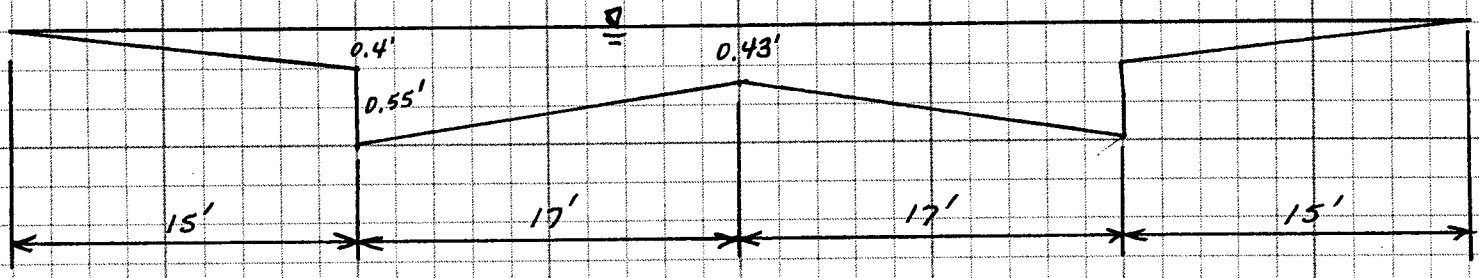
PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
303 S. TOPEKA
WICHITA, KANSAS
ZIP CODE / 67202

Date _____ Page _____ of _____

Project _____

Item _____

0.4' WALK - GRADE



$$n = \frac{(2 \times 14.5 \times .03) + (2 \times 3.05 \times .013) + (2 \times 15 \times .016)}{65.1}$$

$$= .02196$$

$$A = (2 \times \tfrac{1}{2} \times 15 \times 0.4) + (34 \times .43) + (2 \times \tfrac{1}{2} \times 17 \times 0.52)$$

$$= 6.0 + 14.62 + 8.84$$

$$= 29.46$$

$$P = 65.1'$$

$$R = \frac{29.46}{65.1} = 0.45243 \qquad R^{2/3} = 0.5894$$

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

$$= \frac{1.486}{.02196} \times 29.46 \times 0.5894 \times \sqrt{S}$$

$$Q = 1175.0 \sqrt{S}$$