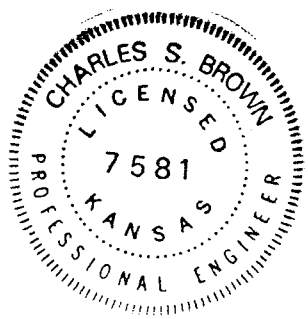
DRAINAGE PLAN
AND
SUPPORTING CALCULATIONS

PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION

FOR
REFLECTION RIDGE 7TH ADDITION
TO
WICHITA, SEDGWICK COUNTY, KANSAS

PREPARED BY
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
ENGINEERS
WICHITA, KANSAS



AUGUST 9, 1991

303 S. TOPEKA
WICHITA, KANSAS 67202
(316) 262-2691
FAX (316) 262-3003

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

Date 8/9/91 Page 1 of 11

Project Reflection Ridge 7th

Item Drainage Plan - System 100

I HYDROLOGY

Use Rational Method $Q = cIA$

Determine "c"

Node	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
116	Sa, Cc	B, D	Res. 1/4 Ac.	0.46	0.63
115	Sa	B	Res; 1/4 Ac	0.44	0.61
114	Sa, Cc, Sc	B, D	Res; 1/4 Ac	0.46	0.63
113	Sa, Cc, Sc.	B, D.	Golf Driv. Range Open Space	0.20	0.41
112	Sa	B	Res; 1/4 Ac.	0.44	0.61
111	Sa	B	Res; 1/4 Ac.	0.44	0.61
110	(Manhole)			-	-
109	Sa	B	Res; 1/4 Ac.	0.44	0.61
108	Sa		Res; 1/4 Ac.	0.44	0.61
107	(Manhole)			-	-
106	Sa	B	Res; 1/4 Ac	0.44	0.61
105	Sa	B	Patio Homes Golf Course	0.44	0.61
104	Sa	B	Res; 1/4 Ac.	0.44	0.61
103	Sa	B	Golf Course	0.20	0.41
102	Sa	B	Res; 1/4 Ac.	0.44	0.61
101	Sa	B	Res; 1/4 Ac.	0.44	0.61
100	(SWS Connection Point)				

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

Date 8/9/91 Page 2 of 11

Project Reflection Ridge 7th Add.

Item Drainage Plan System 100

Determine "I"

Assume t_c = 15 minutes for all nodes except nodes 103, 105, & 113.

Node 103 golf course 300' @ 0.28 fps = 18
+ 900' @ 2 fps = 8
26

∴ $I_2 = 2.90$
$I_{100} = 5.79$

Node 105 same as node 103

Node 113 open space + golf driving range
300' @ 0.28 fps = 18 min
2000' @ 2 fps = 17
35 min.

∴ $I_2 = 2.44$
$I_{100} = 5.00$

All other nodes: $I_2 = 3.83$
$I_{100} = 7.37$

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

Date 8/9/91 Page 3 of 11

Project Reflection Ridge 7th Add.

Item Drainage Plan System 100

Determine "A"

Node	Plan Units	Area (SF)	Area (Ac.)	
116	38.50	385,000	8.84	
115	9.71	97,100	2.23	
114	7.50	75,000	1.72	
113	214.30	2,143,000	49.20	
112	9.00	90,000	2.07	
111	15.30	153,000	3.51	
110	(Manhole)		-	
109	11.92	119,200	2.73	
108	1.40	14,000	0.32	
107	(Manhole)		-	
106	1.68	16,800	0.39	
105	55.20	552,000	12.67	
104	2.17	21,700	0.50	$\Sigma = 20.1$
103	32.36	323,600	7.43	
102	1.00	10,000	0.23	
101	0.35	3,500	0.08	
100	(SWS Connection)			

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

Date 8/9/91 Page 4 of 11

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 100

Determine "Q_2"

Node	C_2	I_2	A	Q_2
116	0.46	3.83	8.84	15.6
115	0.44	3.83	2.23	3.8
114	0.46	3.83	1.72	3.0
113	0.20	2.44	49.20	24.0
112	0.44	3.83	2.07	3.5
111	0.44	3.83	3.51	5.9
110	(Manhole)			—
109	0.44	3.83	2.73	4.6
108	0.44	3.83	0.32	0.5
107	(Manhole)			—
106	0.44	3.83	0.39	0.7
105	0.44	2.90	12.67	16.1
104	0.44	3.83	0.50	0.8
103	0.20	2.90	7.43	4.3
102	0.44	3.83	0.23	0.4
101	0.44	3.83	0.08	0.1
100	(SWS Connection point)			

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

Date 8/9/91 Page 5 of

Project Reflection Ridge 7th Addition

Item Drainage Plan - System 100

Determine "Q_{100}"

Node	C_{100}	I_{100}	A	Q_{100}
116	0.63	7.37	8.84	41.0
115	0.61	7.37	2.23	10.0
114	0.63	7.37	1.72	8.0
113	0.41	5.00	49.20	100.9
112	0.61	7.37	2.07	9.3
111	0.61	7.37	3.51	15.8
110	(Manhole)			-
109	0.61	7.37	2.73	12.3
108	0.61	7.37	0.32	1.4
107	(Manhole)			-
106	0.61	7.37	0.39	1.8
105	0.61	5.79	12.67	44.7
104	0.61	7.37	0.50	2.2
103	0.41	5.79	7.43	17.6
102	0.61	7.37	0.23	1.0
101	0.61	7.37	0.08	0.4
100	(SWS Connection Point)			

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

Date 8/9/91 Page 6 of 11

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 100

II INLET SIZING (2-YR)

Node	Inlet Condition	Inlet L	Q approach #	Q intercept *	Q bypass	to Node #
116	Sump	10'	15.6	15.6	0.0	-
115	Sump.	5'	3.8	3.8	0.0	-
114	Sump	5'	3.0	3.0	0.0	-
113	Sump (in driving range)	N/A	24.0	24.0	0.0	-
112	Sump	5'	3.5	3.5	0.0	-
111	Sump	5'	5.9	5.9	0.0	-
110	(Manhole)	N/A	-	-	-	-
109	Sump	5'	4.6	4.6	0.0	-
108	On Grade	5'	0.5	0.2	0.3	106
107	(Manhole)	N/A	-	-	-	-
106	Sump	5'	0.7+0.3=1.0	1.0	0.0	-
105	Sump (in golf course)	N/A	16.1	16.1	0 0	-
104	Sump	5'	0.8	0.8	0.0	-
103	Sump (in golf course)	5'	4.3	4.3	0 0	-
102	On grade	5'	0.4	0.2	0.2	RR 6th
101	On grade	5'	0.1	0.0	0.1	RR 6th

$Q_{approach} = Q_2 + Q_{bypass}$ (if any)

* Q intercept = Input Q for "Storm" program.

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

Date 8/9/91 Page 7 of 11

Project Reflection Ridge 7th Addition

Item Drainage Plan

III Street Flow - 2yr.

Node	Q_2	Distribution	st. slope	d	d_{max}	Comment
116	15.6	50% (W) = 7.8	0.4%	0.44'	0.55'	OK
		50% (N) = 7.8	0.5	0.42'	0.55'	OK
115	3.8	≈ 100% (N) = 3.8	0.5	0.33'	0.55'	OK
114	3.0	≈ 100% (W) = 3.0	0.4	0.31'	0.55'	OK
113	(N/A)	- In Driving Range				
112	3.5	80% (N) = 2.8	0.5	0.28'	0.55'	OK
		20% (S) = 0.7	0.32	0.19'	0.55'	OK
111	5.9	80% (N) = 4.7	0.5	0.35'	0.55'	OK
		20% (S) = 1.2	0.32	0.23'	0.55'	OK
110	(N/A)	- Manhole				
109	4.6	≈ 100% (W) = 4.6	0.6	0.34'	0.55'	OK
108, 106, 104, 102, 101	< 1.0		1.00	< 0.20'	0.55'	OK
105	(N/A)	- In Golf Course				
103	(N/A)	- In Golf Course				
107	(N/A)	Manhole.				

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

Date 8/9/91 Page 8 of 11

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 100

IV Street Flow - 100-yr. ($Q_{street} = Q_{100} - Q_{pipe}$)

Location	Contrib. Nodes	Q_{100}	Q_{pipe}	Q_{street}	street slope	Comment
Approaching Nodes 116, 115 & 114 (N)	50% 116 =	20.5				
	100% 115 =	10.0				
		30.5	0.0	30.5	0.5	OK w/ std curb & 0.3' W.G.
Approaching Nodes 116, 115, 114 (N)	50% 116 =	20.5				
	100% 114 =	8.0				
		28.5	0.0	28.5	0.4	OK w/ Std. Cb. & 0.3' W.G
Approaching Nodes 107, 108, 109 (N)	100% 112 =	9.3				
	100% 111 =	15.8				
	100% 108 =	1.4				
	5% 109 =	0.6				
		27.1	9.4	17.7	0.32	OK w/ Std. Cb. & 0.3' W.G.
Approaching Nodes 107, 108, 109 (W)	100% 116 =	41.0				
	100% 115 =	10.0				
	100% 114 =	8.0				
	100% 109 =	12.3				
		71.3	22.4	48.9	0.60	OK w/ Std. Cb & 0.3' W.G.
Approaching Nodes 106, 105, 104 (W)	100% 116 =	41.0				
	100% 115 =	10.0				
	100% 114 =	6.0				
	100% 113 =	100.9				
	100% 112 =	9.3				
	100% 111 =	15.8				
	100% 109 =	12.3				
	100% 108 =	1.4				
	100% 106 =	1.8				
	100% 104 =	2.2				
		202.7	60.9	141.8	1.00	OK w/ Std. Cb. & 0.5' W.G

```
100 j, 1326.5000  100    6   17   16
110 t,DRAINAGE PLAN
120 t,REFLECTION RIDGE 7TH ADDITION
130 t,SYSTEM 100 ANALYSIS
140 t,PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
150 t,WICHITA, KANSAS
160 t,COMPUTED BY M. W. BERRY, P.E.     8/13/91
170 i,  116     0.46     8.84     0.00     0.00    15.60    15.00  1336.00
180 i,  115     0.44     2.23     0.00     0.00     3.80    15.00  1336.00
190 i,  114     0.46     1.72     0.00     0.00     3.00    15.00  1336.00
200 i,  113     0.20    49.20     0.00     0.00    24.00    35.00  1334.00
210 i,  112     0.44     2.07     0.00     0.00     3.50    15.00  1334.50
220 i,  111     0.44     3.51     0.00     0.00     5.90    15.00  1334.50
230 m,  110  1335.00
240 i,  109     0.44     2.73     0.00     0.00     4.60    15.00  1334.50
250 i,  108     0.44     0.32     0.00     0.00     0.20    15.00  1334.50
260 m,  107  1334.50
270 i,  106     0.44     0.39     0.00     0.00     1.00    15.00  1332.50
280 i,  105     0.44    12.67     0.00     0.00    16.10    26.00  1329.50
290 i,  104     0.44     0.50     0.00     0.00     0.80    15.00  1332.50
300 i,  103     0.20     7.43     0.00     0.00     4.30    26.00  1329.50
310 i,  102     0.44     0.23     0.00     0.00     0.20    15.00  1332.00
320 i,  101     0.44     0.08     0.00     0.00     0.00    15.00  1332.00
330 m,  100  1330.00
340 p,  116  114    75.00   18 0.013  30.00    0.00
350 p,  115  114    45.00   15 0.013  80.00    0.00
360 p,  114  107   500.00   30 0.013  20.00    0.00
370 p,  113  107    40.00   24 0.013  80.00    0.00
380 p,  112  111    35.00   18 0.013 110.00    0.00
390 p,  111  110   280.00   24 0.013  40.00    0.00
400 p,  110  108   120.00   24 0.013  45.00    0.00
410 p,  109  108    80.00   18 0.013  90.00    0.00
420 p,  108  107    35.00   24 0.013  90.00    0.00
430 p,  107  104   220.00   42 0.013  60.00    0.00
440 p,  106  104    35.00   15 0.013 120.00    0.00
450 p,  105  104    40.00   30 0.013  60.00    0.00
460 p,  104  101   150.00   42 0.013   5.00    0.00
470 p,  103  101    50.00   18 0.013  90.00    0.00
480 p,  102  101    35.00   15 0.013  90.00    0.00
490 p,  101  100   200.00   42 0.013  45.00    0.00
500 e
```

Date: 08-13-1991
Time: 12:00:51

Input File: RR7100.STM

DRAINAGE PLAN
REFLECTION RIDGE 7TH ADDITION
SYSTEM 100 ANALYSIS
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
WICHITA, KANSAS
COMPUTED BY M. W. BERRY, P.E. 8/13/91

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)
116	114	.46	18.84	.00	.0	15.00	3.83	15.60	15.00	3.83	15.60	15.60	18"	8.83	75.00	.14	15.14
115	114	.44	2.23	.00	.0	15.00	3.83	3.80	15.00	3.83	3.80	3.80	15"	3.10	45.00	.24	15.24
114	107	.46	1.72	.00	.0	15.00	3.83	3.00	15.14	3.81	2.99	22.36	30"	4.56	500.00	1.83	16.97
113	107	.20	49.20	.00	.0	35.00	2.44	24.00	35.00	2.44	24.00	24.00	24"	7.64	40.00	.09	35.09
112	111	.44	2.07	.00	.0	15.00	3.83	3.50	15.00	3.83	3.50	3.50	18"	1.98	35.00	.29	15.29
111	110	.44	3.51	.00	.0	15.00	3.83	5.90	15.29	3.79	5.85	9.35	24"	2.98	280.00	1.57	16.86
110	108	.00	.00	.00	.0	.00	.00	.00	16.86	3.63	.00	9.35	24"	2.98	120.00	.67	17.53
109	108	.44	2.73	.00	.0	15.00	3.83	4.60	15.00	3.83	4.60	4.60	18"	2.60	80.00	.51	15.51
108	107	.44	.32	.00	.0	15.00	3.83	.20	17.53	3.56	.19	13.88	24"	4.42	35.00	.13	17.67
107	104	.00	.00	.00	.0	.00	.00	.00	35.09	2.43	.00	48.57	42"	5.05	220.00	.73	35.81
106	104	.44	.39	.00	.0	15.00	3.83	1.00	15.00	3.83	1.00	1.00	15"	.81	35.00	.72	15.72
105	104	.44	12.67	.00	.0	26.00	2.90	16.10	26.00	2.90	16.10	16.10	30"	3.28	40.00	.20	26.20
104	101	.44	.50	.00	.0	15.00	3.83	.80	35.81	2.40	.50	63.12	42"	6.56	150.00	.38	36.19
103	101	.20	7.43	.00	.0	26.00	2.90	4.30	26.00	2.90	4.30	4.30	18"	2.43	50.00	.34	26.34
102	101	.44	.23	.00	.0	15.00	3.83	.20	15.00	3.83	.20	.20	15"	.16	35.00	3.58	18.58
101	100	.44	.08	.00	.0	15.00	3.83	.13	36.19	2.39	.08	66.91	42"	6.95	200.00	.48	36.67

Date: 08-13-1991
Time: 12:00:51

Input File: RR7100.STM

DRAINAGE PLAN
REFLECTION RIDGE 7TH ADDITION
SYSTEM 100 ANALYSIS
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
WICHITA, KANSAS
COMPUTED BY M. W. BERRY, P.E. 8/13/91

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)
116	.02206	1.6541	.0000	.0000	.0000	.0000	.0000	1.6541	1332.8730	1336.0000	3.1
115	.00346	.1557	.0000	.0000	.0000	.0000	.0000	.1557	1331.3750	1336.0000	4.6
114	.00297	1.4862	.0000	.1776	.0000	.1619	-.2904	1.5352	1331.2190	1336.0000	4.7
113	.01125	.4502	.0000	.0000	.0000	.0000	.0000	.4502	1330.1340	1334.0000	3.8
112	.00111	.0389	.0000	.0000	.0000	.0000	.0000	.0389	1331.2880	1334.5000	3.2
111	.00171	.4781	.0000	.0077	.0000	.0387	.2718	.7963	1331.2500	1334.5000	3.2
110	.00171	.2049	.0000	.0000	.0069	.0260	.0086	.2463	1330.4530	1335.0000	4.5
109	.00192	.1534	.0000	.0000	.0000	.0000	.0000	.1534	1330.3600	1334.5000	4.1
108	.00376	.1317	.0000	.0165	.0000	.0299	.3452	.5233	1330.2070	1334.5000	4.2
107	.00233	.5127	.0000	.1021	.0000	.3934	-.1313	.8769	1329.6840	1334.5000	4.8
106	.00024	.0084	.0000	.0000	.0000	.0000	.0000	.0084	1328.8150	1332.5000	3.6
105	.00154	.0616	.0000	.0000	.0000	.0000	.0000	.0616	1328.8680	1329.5000	.6
104	.00394	.5903	.0000	.0273	.0000	.1216	.4777	1.2170	1328.8070	1332.5000	3.6
103	.00168	.0838	.0000	.0000	.0000	.0000	.0000	.0838	1327.6730	1329.5000	1.8
102	.00001	.0003	.0000	.0000	.0000	.0000	.0000	.0003	1327.5900	1332.0000	4.4
101	.00442	.8845	.0000	.0083	.0000	.0104	.1866	1.0897	1327.5900	1332.0000	4.4
100	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	1326.5000	1330.0000	3.5

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

Date 8/9/91 Page 1 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 200

I HYDROLOGY

Use Rational Method $Q = CIA$

Determine "C"

Node	Soil Type	Hydrologic Group	Land Use	C_2	C_{100}
215	Sa, Ea	B	Res; 1/4 Ac.	0.44	0.61
214	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
213	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
212	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
211	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
210	(Manhole)				
209	Sa, Ea	B	Res; 1/4 Ac.	0.44	0.61
208	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
207	Sa, Ea	B	Res; 1/4 Ac.	0.44	0.61
206	Sa, Ea	B	Res; 1/4 Ac.	0.44	0.61
205	(Manhole)				
204	(Manhole)				
203	Sa, Ea	B	Res; 1/4 Ac.	0.44	0.61
202	Sa, Ea	B	Res; 1/4 Ac	0.44	0.61
201	(Manhole)				
200	(End Section)				

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

Date 8/9/91 Page 2 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 200

Determine "I"

Assume All Nodes T_c = 15 min ∴ I_2 = 3.83

I_{100} = 7.37

Determine "A"

Node	Plan. Units	Area (SF)	Area (Ac.)
215	4.00	40,000	0.92
214	27.60	276,000	6.33
213	3.50	35,000	0.80
212	8.80	88,000	2.02
211	12.60	126,000	2.89
210	(Manhole)		
209	9.30	93,000	2.13
208	24.73	247,300	5.68
207	11.80	118,000	2.71
206	17.75	177,500	4.07
205	(Manhole)		
204	(Manhole)		
203	10.90	109,000	2.50
202	7.00	70,000	1.61
201	(Manhole)		
200	(End Section)		

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

Date 8/9/01 Page 3 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan. - System 200

Determine "Q_2"

Node	C_2	I_2	A	Q_2
215	0.44	3.83	0.92	1.6
214	0.44	3.83	6.33	10.7
213	0.44	3.83	0.80	1.3
212	0.44	3.83	2.02	3.4
211	0.44	3.83	2.89	4.9
210	(Manhole)			
209	0.44	3.83	2.13	3.6
208	0.44	3.83	5.68	9.6
207	0.44	3.83	2.71	4.6
206	0.44	3.83	4.07	6.9
205	(Manhole)			
204	(Manhole)			
203	0.44	3.83	2.50	4.2
202	0.44	3.83	1.61	2.7
201	(Manhole)			
200	(End Section)			

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

Date 8/9/91 Page 4 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan System 200

Determine "Q_{100}"

Node	C_{100}	I_{100}	A	Q_{100}
215	0.61	7.37	0.92	4.1
214	0.61	7.37	6.33	28.5
213	0.61	7.37	0.80	3.6
212	0.61	7.37	2.02	9.1
211	0.61	7.37	2.89	13.0
210	(Manhole)			
209	0.61	7.37	2.13	9.6
208	0.61	7.37	5.68	25.5
207	0.61	7.37	2.71	12.2
206	0.61	7.37	4.07	18.3
205	(Manhole)			
204	(Manhole)			
203	0.61	7.37	2.50	11.2
202	0.61	7.37	1.61	7.2
201	(Manhole)			
200	(End Section)			

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

Date 8/9/91 Page 5 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan System 200

II INLET SIZING (2-YR)

Node	Inlet Condition	Inlet L	$Q_{approach}$ #	$Q_{intercept}$ #	Q_{bypass}	to Node #
215	Sump	5'	1.6	1.6	0.0	-
214	Sump	5'	10.7	10.7	0.0	-
213	Sump	5'	1.3	1.3	0.0	-
212	Sump	5'	3.4	3.4	0.0	-
211	Sump	5'	4.9	4.9	0.0	-
210	(Manhole)					
209	Sump	5'	3.6	3.6	0.0	-
208	Sump	5'	9.6	9.6	0.0	-
207	Sump	5'	4.6	4.6	0.0	-
206	Sump	5'	6.9	6.9	0.0	-
205	(Manhole)					
204	(Manhole)					
203	Sump	5'	4.2	4.2	0.0	-
202	On Grade	5'	2.7	1.7	1.0	Ditch
201	(Manhole)					
200	(End Section)					

$Q_{approach} = Q_2 + Q_{bypass}$ (if any)

$Q_{intercept}$ = input Q for "Storm" program.

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

Date 8/9/91 Page 6 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan - System 200

III STREET FLOW - 2 YR

Node	Q_2	Distribution	street slope	d	d_{max}	comment
215	1.6	60% (S) = 1.0	0.32%	0.21	0.55'	OK
		40% (N) = 0.6	0.32	0.18	0.55'	OK
214	10.7	85% (S) = 9.1	0.32	0.49	0.55'	OK
		15% (W) = 1.6	0.50	0.23	0.55'	OK
213	1.3	≈ 100% (W) = 1.3	0.50	0.20	0.55'	OK
212	3.4	≈ 100% (W) = 3.4	0.32	0.23	0.55'	OK
211	4.9	80% (W) = 3.9	1.60	0.26	0.55'	OK
		20% (S) = 1.0	1.60	0.16	0.55'	OK
210	N/A					
209	3.6	≈ 100% (S) = 3.6	0.32	0.24	0.55'	OK
208	9.6	90% (S) = 8.6	0.32	0.49	0.55'	OK
		10% (W) = 1.0	0.32	0.21	0.55'	OK
207	4.6	50% (W) = 3.2	0.32	0.22	0.55'	OK
		50% (N) = 3.2	0.32	0.22	0.55'	OK
206	6.9	95% (S) = 6.6	0.32	0.42	0.55'	OK
		5% (N) = 0.3	0.32	0.13	0.55'	OK
205	N/A					
204	N/A					
203	4.2	70% (S) = 2.9	0.32	0.32	0.55'	OK
		30% (E) = 1.3	0.32	0.23	0.55'	OK
202	2.7	≈ 100% (E) = 2.7	0.32	0.31	0.55'	OK
201	N/A					
200	N/A					

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

Date 8/9/91 Page 7 of 10

Project Reflection Ridge 7th Add.

Item Drainage Plan System 200

IV STREET FLOW (100-YR) $Q_{street} = Q_{100} - Q_{pipe}$

Location	Contrib. Nodes	Q_{100}	Q_{pipe}	Q_{street}	street slope	comment
Approaching Nodes 208, 206 (S)	±100% 208 =	25.5				
	±100% 206 =	18.3				
		43.8	0.0	43.8	0.32%	OK w/ std Cb. ±0.3' W.G.
Approaching Nodes 203, 202 (E)	100% 208 =	25.5				
	100% 207 =	12.2				
	100% 206 =	18.3				
	100% 202 =	7.2				
		63.2	21.1	42.1	0.32%	"
Approaching Nodes 214, 215 (S)	60% 215 =	2.5				
	85% 214 =	24.2				
		26.7	0.0	26.7	0.32%	"
Approaching Nodes 209, 203 (S)	100% 215 =	4.1				
	100% 214 =	28.5				
	100% 213 =	3.6				
	100% 212 =	9.1				
	100% 211 =	13.0				
	100% 209 =	9.6				
	70% 203 =	7.8				
		75.7	21.9	53.8	0.32%	OK w/ Std Cb ±0.4 WG

```
100 j, 1327.0000  200    5   16   15
110 t,REFLECTION RIDGE SEVENTH ADDITION DRAINAGE PLAN
120 t,SYSTEM 200 ANALYSIS    2 YR
130 t,PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
140 t,WICHITA, KANSAS
150 t,COMPUTED BY M. W. BERRY, P.E.   8-13-91   FILE:\RR7200.STM
160 i,  215     0.44     0.92     0.00     0.00     1.60    15.00  1337.00
170 i,  214     0.44     6.33     0.00     0.00    10.70    15.00  1337.00
180 i,  213     0.44     0.80     0.00     0.00     1.30    15.00  1337.00
190 i,  212     0.44     2.02     0.00     0.00     3.40    15.00  1336.00
200 i,  211     0.44     2.89     0.00     0.00     4.90    15.00  1332.00
210 m,  210  1331.50
220 i,  209     0.44     2.13     0.00     0.00     3.60    15.00  1330.50
230 i,  208     0.44     5.68     0.00     0.00     9.60    15.00  1331.70
240 i,  207     0.44     2.71     0.00     0.00     4.60    15.00  1331.70
250 i,  206     0.44     4.07     0.00     0.00     6.90    15.00  1331.70
260 m,  205  1331.70
270 m,  204  1331.20
280 i,  203     0.44     2.50     0.00     0.00     4.20    15.00  1330.50
290 i,  202     0.44     1.61     0.00     0.00     1.70    15.00  1330.50
300 m,  201  1330.00
310 m,  200  1330.00
320 p,  215  214    35.00   15 0.013  90.00   0.00
330 p,  214  213    75.00   18 0.013   5.00   0.00
340 p,  213  212   200.00   24 0.013  30.00   0.00
350 p,  212  211   250.00   24 0.013  15.00   0.00
360 p,  211  210   250.00   30 0.013  15.00   0.00
370 p,  210  209   120.00   30 0.013   0.00   0.00
380 p,  209  202   100.00   30 0.013  30.00   0.00
390 p,  208  207    70.00   18 0.013 140.00   0.00
400 p,  207  206    40.00   24 0.013 140.00   0.00
410 p,  206  205   340.00   36 0.013  60.00   0.00
420 p,  205  204   180.00   36 0.013  45.00   0.00
430 p,  204  202   140.00   36 0.013  80.00   0.00
440 p,  203  202    70.00   18 0.013   0.00   0.00
450 p,  202  201   100.00   42 0.013  45.00   0.00
460 p,  201  200    40.00   42 0.013  45.00   0.00
470 e
```

Date: 08-13-1991
Time: 09:37:27

Input File: RR7200.STM

REFLECTION RIDGE SEVENTH ADDITION DRAINAGE PLAN
SYSTEM 200 ANALYSIS 2 YR
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
WICHITA, KANSAS
COMPUTED BY M. W. BERRY, P.E. 8-13-91 FILE:\RR7200.STM

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)
215	214	.44	.92	.00	.0	15.00	3.83	1.60	15.00	3.83	1.60	1.60	15"	1.30	35.00	.45	15.45
214	213	.44	6.33	.00	.0	15.00	3.83	10.70	15.00	3.83	10.70	12.25	18"	6.93	75.00	.18	15.18
213	212	.44	.80	.00	.0	15.00	3.83	1.30	15.18	3.81	1.29	13.55	24"	4.31	200.00	.77	15.95
212	211	.44	2.02	.00	.0	15.00	3.83	3.40	15.95	3.72	3.31	16.85	24"	5.36	250.00	.78	16.73
211	210	.44	2.89	.00	.0	15.00	3.83	4.90	16.73	3.64	4.66	21.51	30"	4.38	250.00	.95	17.68
210	209	.00	.00	.00	.0	.00	.00	.00	17.68	3.54	.00	21.51	30"	4.38	120.00	.46	18.14
209	202	.44	2.13	.00	.0	15.00	3.83	3.60	18.14	3.50	3.29	24.80	30"	5.05	100.00	.33	18.47
208	207	.44	5.68	.00	.0	15.00	3.83	9.60	15.00	3.83	9.60	9.60	18"	5.43	70.00	.21	15.21
207	206	.44	2.71	.00	.0	15.00	3.83	4.60	15.21	3.80	4.57	14.17	24"	4.51	40.00	.15	15.36
206	205	.44	4.07	.00	.0	15.00	3.83	6.90	15.36	3.79	6.83	21.00	36"	2.97	340.00	1.91	17.27
205	204	.00	.00	.00	.0	.00	.00	.00	17.27	3.58	.00	21.00	36"	2.97	180.00	1.01	18.28
204	202	.00	.00	.00	.0	.00	.00	.00	18.28	3.49	.00	21.00	36"	2.97	140.00	.79	19.07
203	202	.44	2.30	.00	.0	15.00	3.83	4.20	15.00	3.83	4.20	4.20	18"	2.38	70.00	.49	15.49
202	201	.44	1.61	.00	.0	15.00	3.83	1.70	19.07	3.42	1.52	50.73	42"	5.27	100.00	.32	19.38
201	200	.00	.00	.00	.0	.00	.00	.00	19.38	3.39	.00	50.73	42"	5.27	40.00	.13	19.51

Date: 08-13-199
Time: 09:37:27

Input File: RR7200.STM

REFLECTION RIDGE SEVENTH ADDITION DRAINAGE PLAN
SYSTEM 200 ANALYSIS 2 YR
PROFESSIONAL ENGINEERING CONSULTANTS, P.A.
WICHITA, KANSAS
COMPUTED BY M. W. BERRY, P.E. 8-13-91 FILE:\RR7200.STM

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)
215	.00061	.0215	.0000	.0000	.0000	.0000	.0000	.0215	1335.0280	1337.0000	1.9
214	.01361	1.0206	.0000	.0720	.0000	.0132	1.7579	2.8637	1335.0060	1337.0000	1.9
213	.00359	.7172	.0000	.0916	.0000	.0116	-.2936	.5268	1332.1420	1337.0000	4.8
212	.00555	1.3873	.0000	.0158	.0000	.0386	.3396	1.7813	1331.6160	1336.0000	4.3
211	.00275	.6875	.0000	.0297	.0000	.0260	.0506	.7939	1329.8340	1332.0000	2.1
210	.00275	.3300	.0000	.0000	.0149	.0174	.0138	.3761	1329.0400	1331.5000	2.4
209	.00366	.3656	.0000	.0098	.0000	.0000	.2129	.5883	1328.6640	1330.5000	1.8
208	.00835	.5847	.0000	.0000	.0000	.0000	.0000	.5847	1330.4720	1331.7000	1.2
207	.00392	.1569	.0000	.0285	.0000	.3894	.1799	.7546	1329.8870	1331.7000	1.8
206	.00099	.3369	.0000	.0358	.0000	.2684	.0028	.6440	1329.1320	1331.7000	2.5
205	.00099	.1784	.0000	.0000	.0068	.0421	.0050	.2323	1328.4880	1331.7000	3.2
204	.00099	.1387	.0000	.0000	.0068	.0298	.0050	.1804	1328.2560	1331.2000	2.9
203	.00160	.1119	.0000	.0000	.0000	.0000	.0000	.1119	1328.1880	1330.5000	2.3
202	.00254	.2542	.0000	.0035	.0000	.0530	.5351	.8458	1328.0760	1330.5000	2.4
201	.00254	.1017	.0000	.0000	.0216	.0939	.0127	.2299	1327.2300	1330.0000	2.7
200	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	1327.0000	1330.0000	3.0

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

Date 8/9/91 Page 1 of

Project Reflection Ridge 7th

Item Drainage Plan Ditches

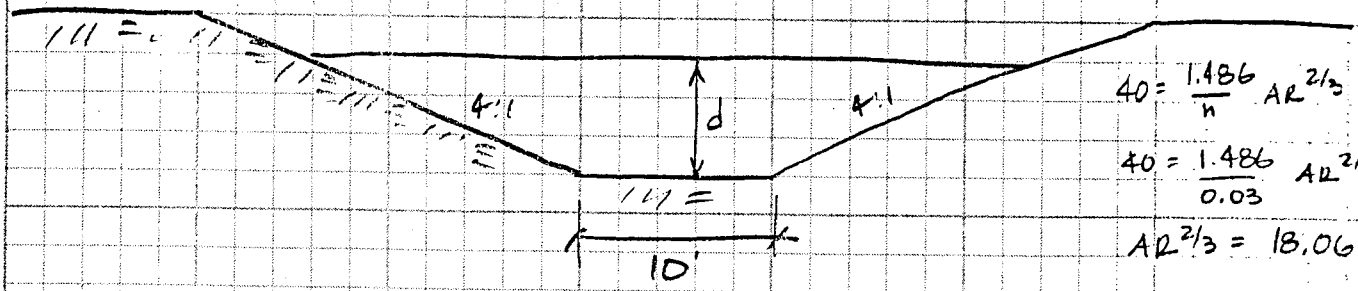
DITCH #1 (ALONG WEST ℄)

- to divert water northward to 29th

$Q = CIA$ (B soils - cultivation)

$= 0.20 \times 5.00 \times 40\,ac$ $t_c = 35$ min.

$= 40$ cfs



$40 = \frac{1.486}{n} AR^{2/3} S^{1/2}$

$40 = \frac{1.486}{0.03} AR^{2/3} (0.002)^{1/2}$

$AR^{2/3} = 18.06$

d	A	p	R	$R^{2/3}$	$AR^{2/3}$	
1.0	14.0	18.24	0.77	0.83	11.7	
1.1	15.4	19.07	0.81	0.87	13.4	
1.3	18.2	20.72	0.87	0.92	16.7	
1.4	19.6	21.54	0.91	0.94	18.4	← USE

$d = 1.4'$

$V = Q/A = \frac{40}{19.6} = 2.0$

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

Date 8/9/91 Page 2 of 2

Project Reflection Ridge 7th

Item Drainage Plan Ditches

DITCH #2 (ALONG 29TH ST. FROM STREET HOOKUP EASTWARD TO W.L. REFLECTION RIDGE 6TH)

USE SAME DITCH SECTION AS ON REFLECTION RIDGE 6TH.

SEDGWICK COUNTY, KANSAS — SHEET NUMBER 33

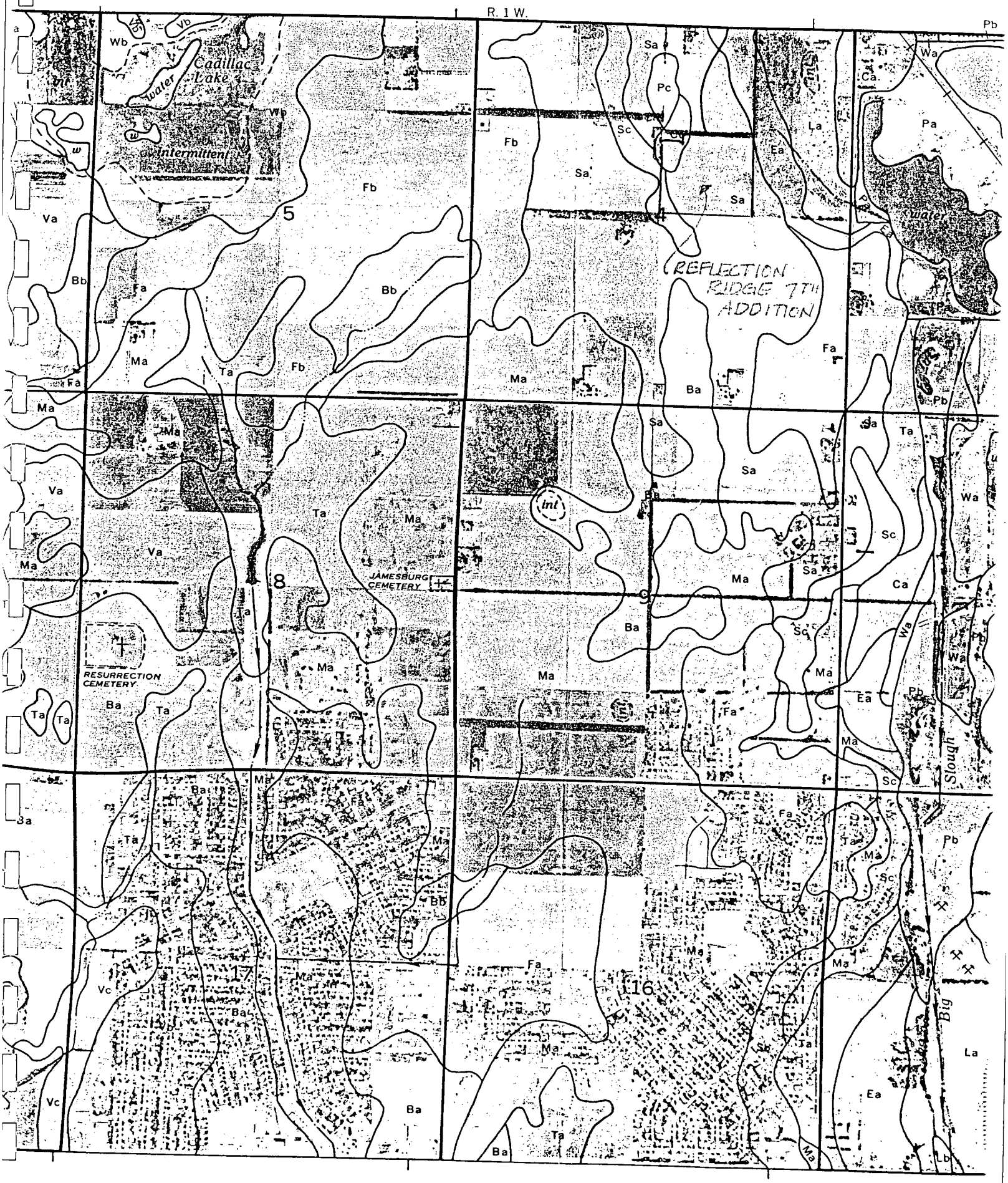


EXHIBIT NO. 1

SOIL LEGEND

SYMBOL	HYDROLOGIC GROUP	NAME
Aa	B	Albion-Shellabarger sandy loams, 1 to 4 percent slopes
Ab	B	Albion and Shellabarger sandy loans, 7 to 15 percent slopes
Ba	C	Blanket silt loam, 0 to 1 percent slopes
Bb	C	Blanket silt loan, 1 to 3 percent slopes
Ca	B	Canadian fine sandy loan
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	Clime 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 lopes
Wa	C	Waldeck sandy loam
Wb	D	Waurika silt loam

(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

Land Use or Surface 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
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):					
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

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.

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

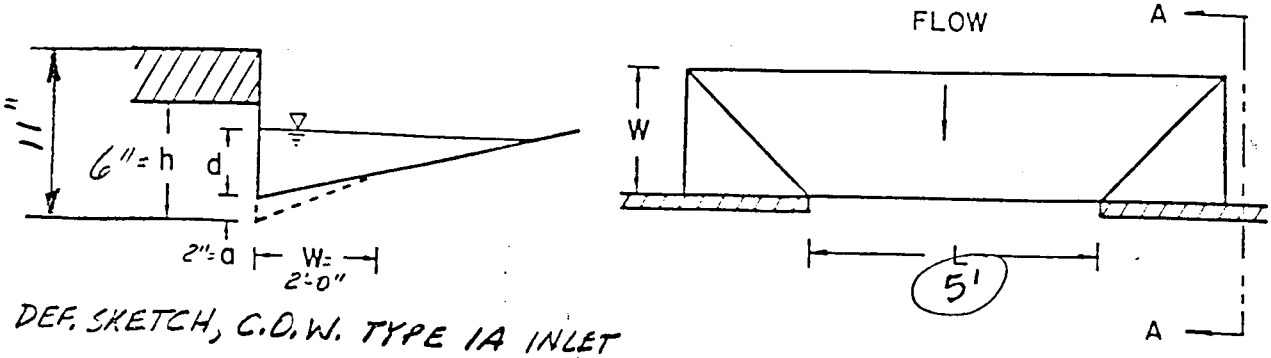
DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	4.18	5.57	6.53	7.41	8.52	9.48	10.32
6	3.99	5.32	6.25	7.09	8.16	9.09	9.89
7	3.81	5.09	5.99	6.81	7.84	8.74	9.50
8	3.66	4.89	5.75	6.55	7.55	8.42	9.15
9	3.52	4.70	5.54	6.31	7.28	8.13	8.83
10	3.39	4.52	5.34	6.09	7.04	7.86	8.54
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
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 1.25
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

DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
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

DURATION IN HOURS	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
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



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

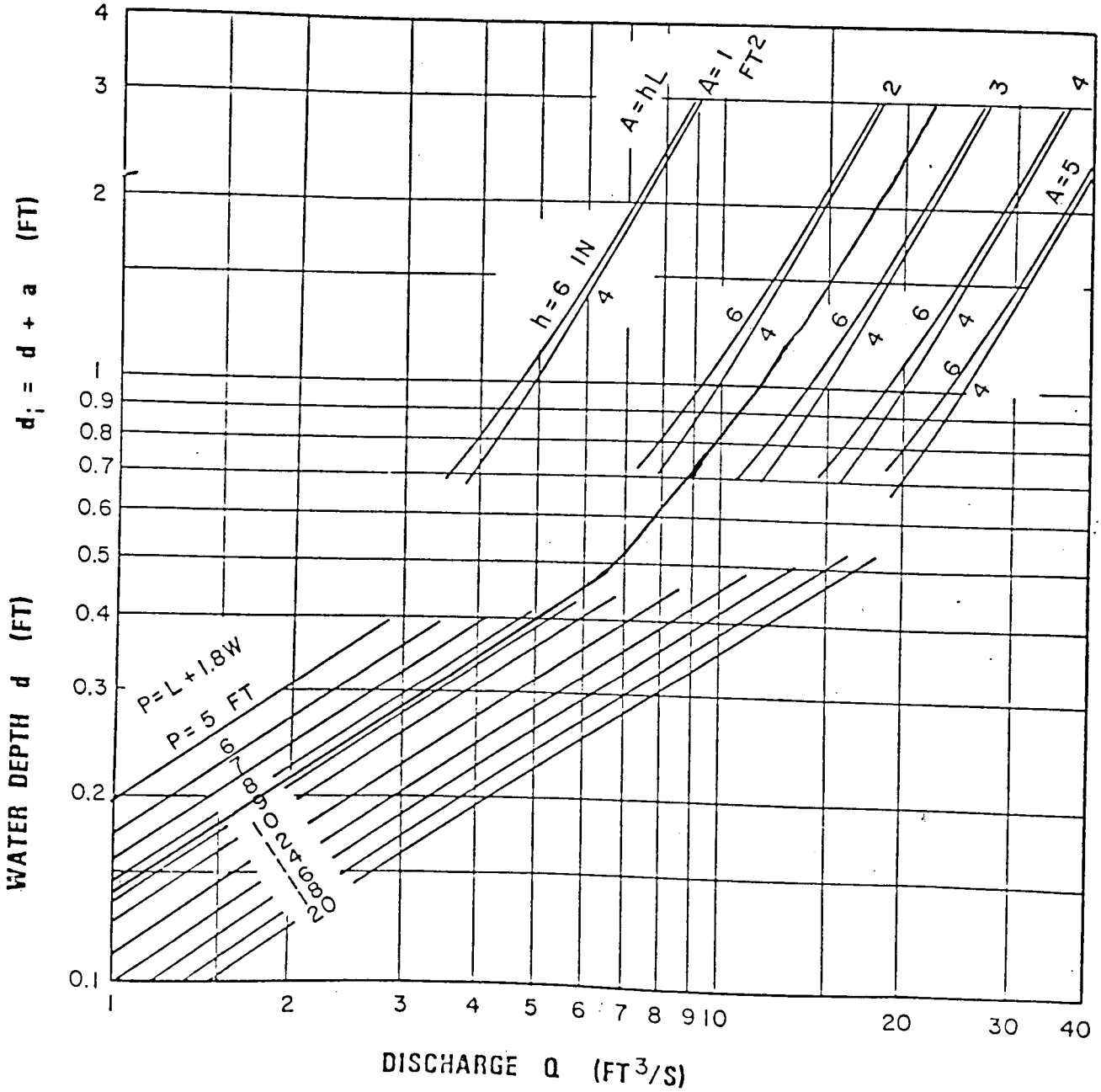
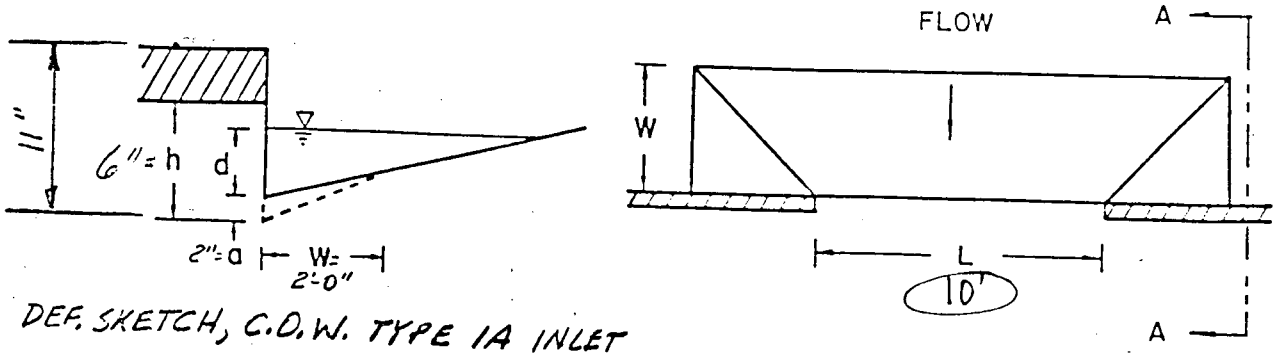


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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



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

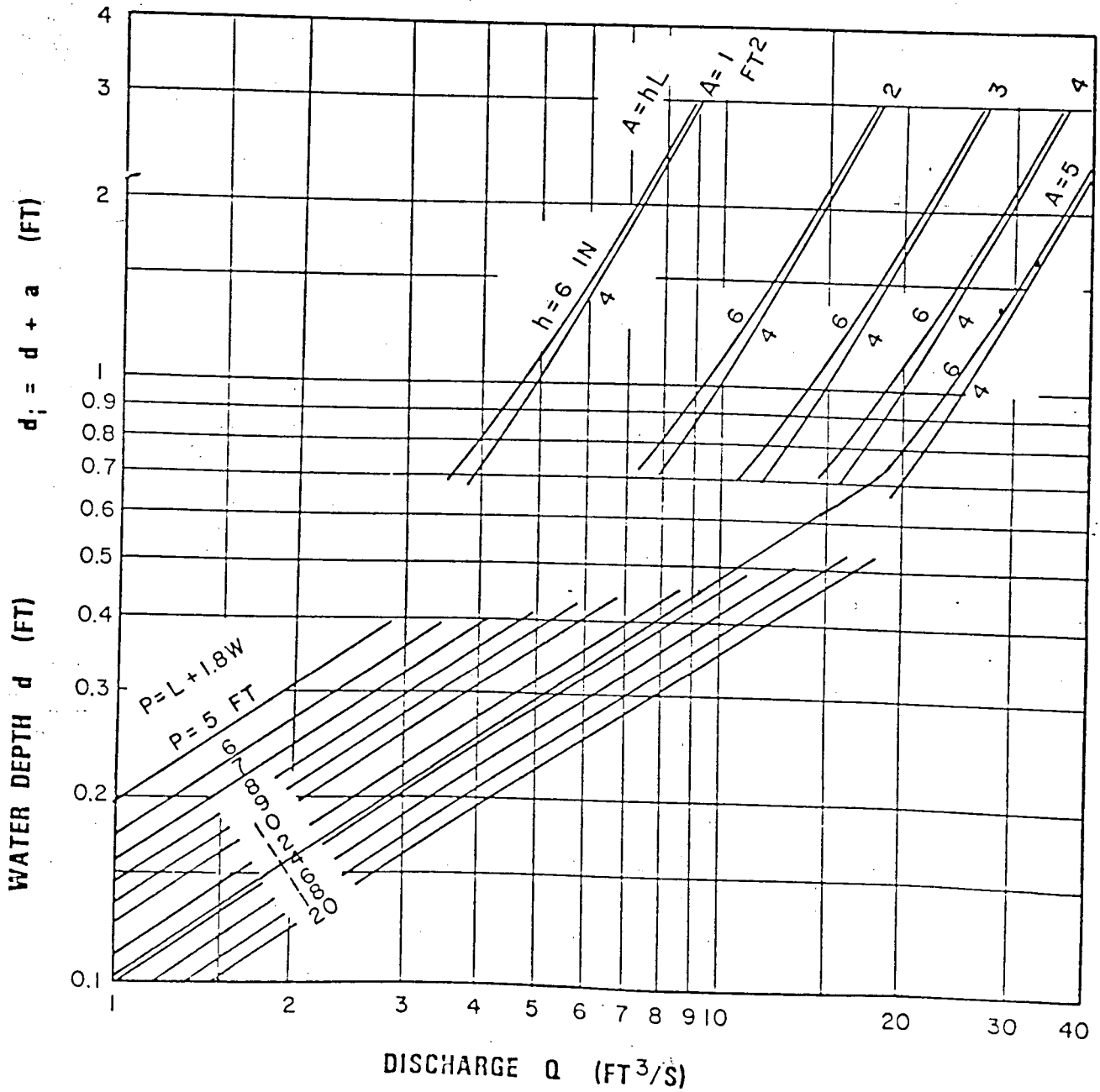


CHART 12. Depressed curb-opening inlet capacity in sump locations.

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

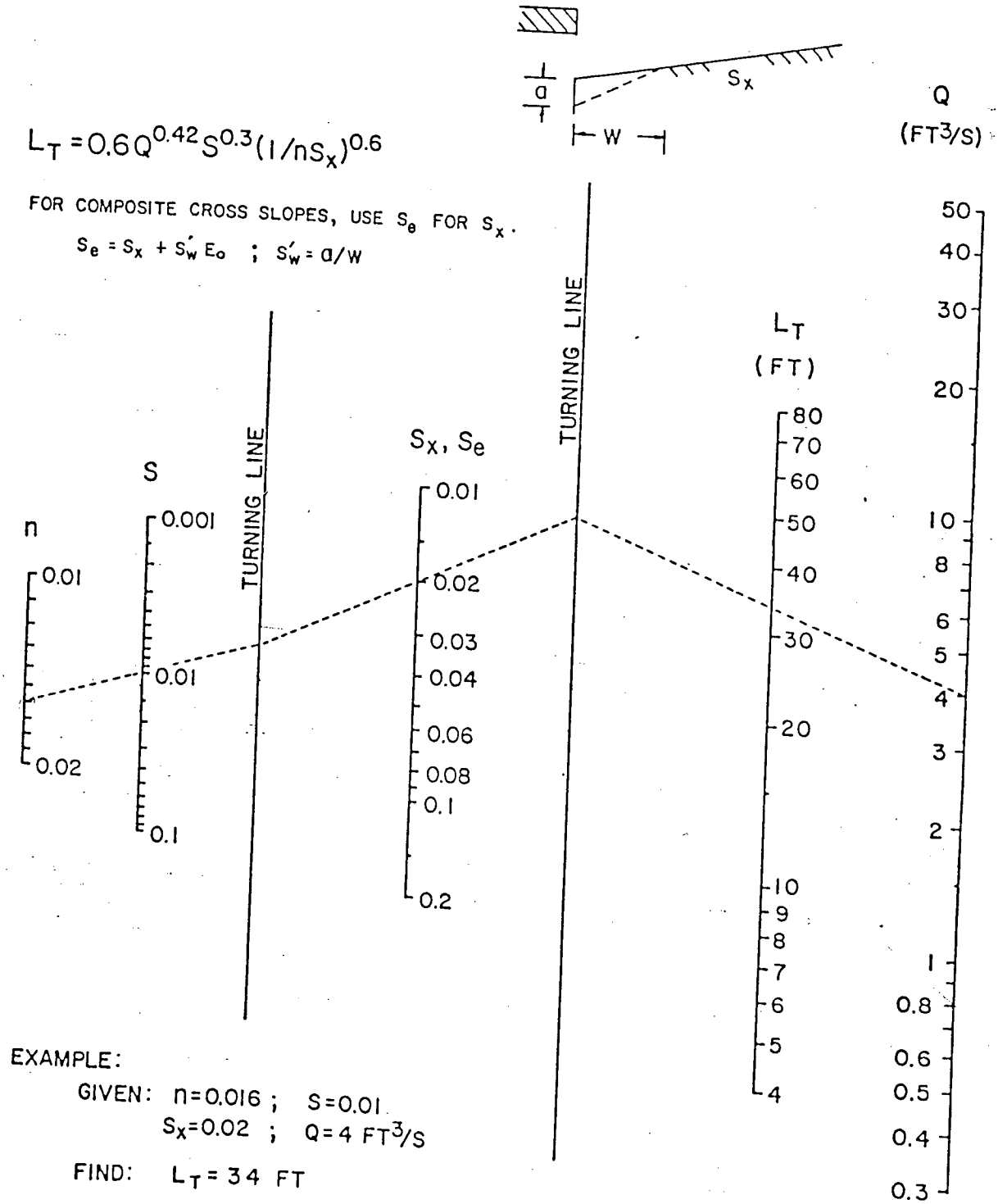


CHART 9. Curb-opening and slotted drain inlet length for total interception.

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

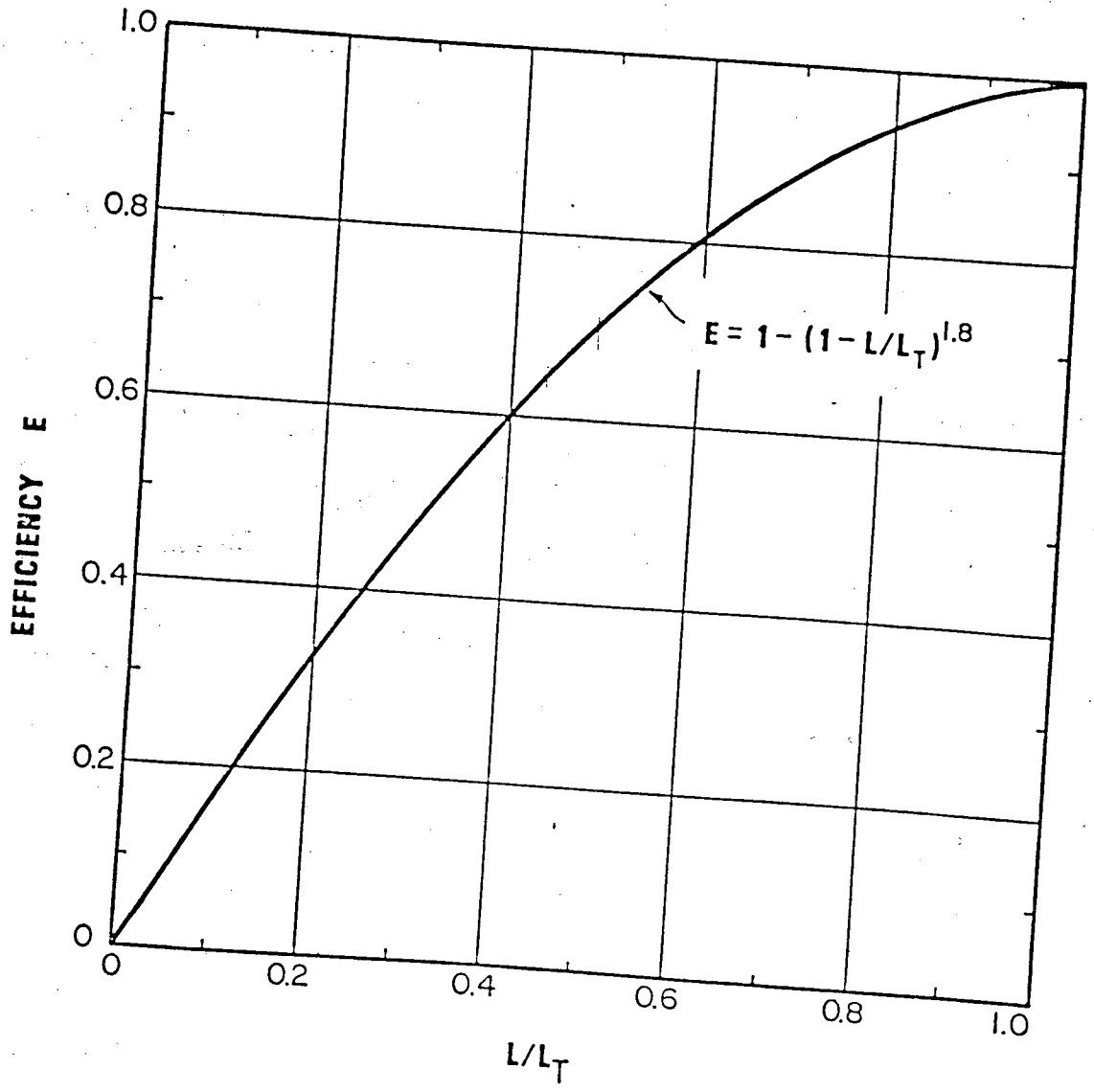


CHART 10. Curb-opening and slotted drain inlet interception efficiency.

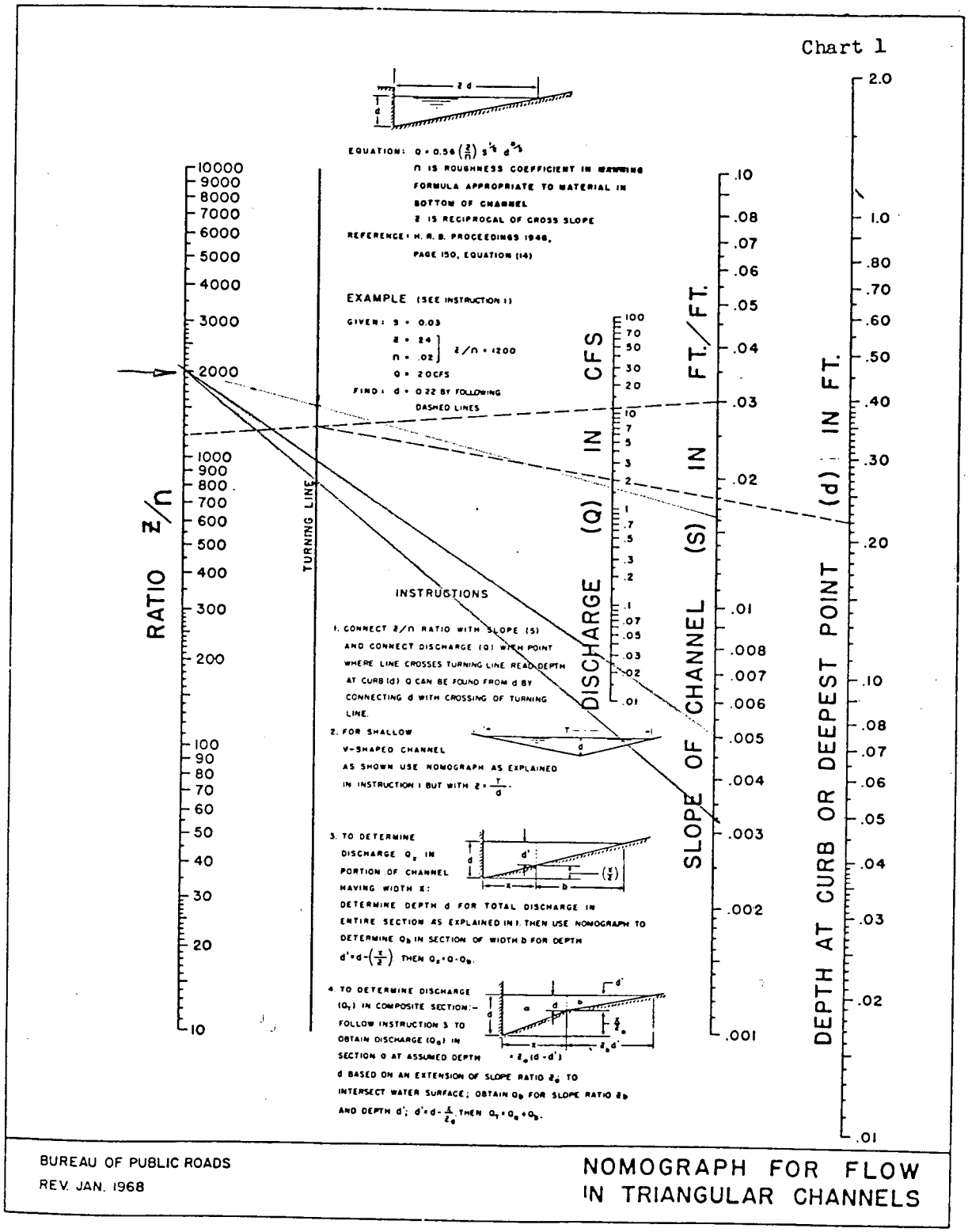
FROM: HEC-12, DRAINAGE OF HIGHWAY PAVEMENTS, F.H.W.A., MAR. 1984

X-slope = 3/8 "/Ft = 0.03125

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

$n = 0.016$

$z/n = 32/0.016 = 2000$



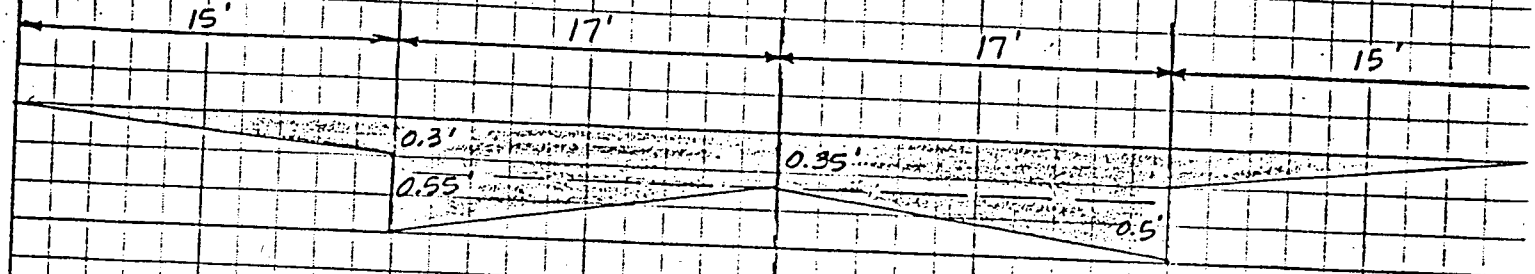
PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date _____ Page _____ of _____

Project _____

Item Drainage Plan -

Check Street Flow 100-yr (Walk Grade +0.3')



Determine Q_{max} in Street R-O-W

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

$$n = \frac{2(14.5 \times 0.030) + 2(1.05' \times 0.013) + 2(17 \times 0.016)}{65.1}$$

$n = 1.4413 / 65.1 = 0.0221$

$A = 2(1/2 \times 15 \times 0.3) + (34 \times 0.35) + 2(1/2 \times 0.5 \times 17)$
$= 24.90$ SF

$P = (2 \times 15) + (2 \times 17) + (2 \times 0.55)$
$= 65.1'$

$R = A/P = 24.9 / 65.1 = 0.38249$

$R^{2/3} = 0.527$

$Q = \frac{1.486}{0.0221} \times 24.90 \times 0.527 \times S^{1/2}$

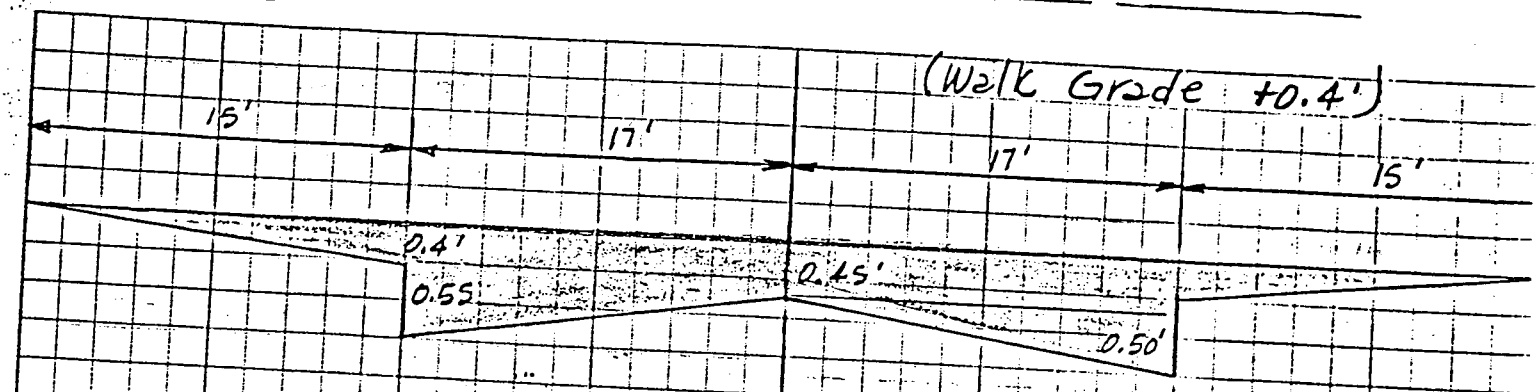
$Q = 887.3 \times S^{1/2}$

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date _____ Page _____ of _____

Project _____

Item Drainage Plan -



n: 0.0221 (see previous sheet)

$A = 2(\frac{1}{2} \times 15' \times 0.4') + (34 \times 0.45') + 2(\frac{1}{2} \times 17 \times 0.5')$

$= 29.8$ SF

$P = 65.1'$

$R = A/P = 29.8/65.1 = 0.4577$

$R^{2/3} = 0.594$

$Q = \frac{1.486}{0.0221} \times 29.8 \times 0.594 \times S^{1/2}$

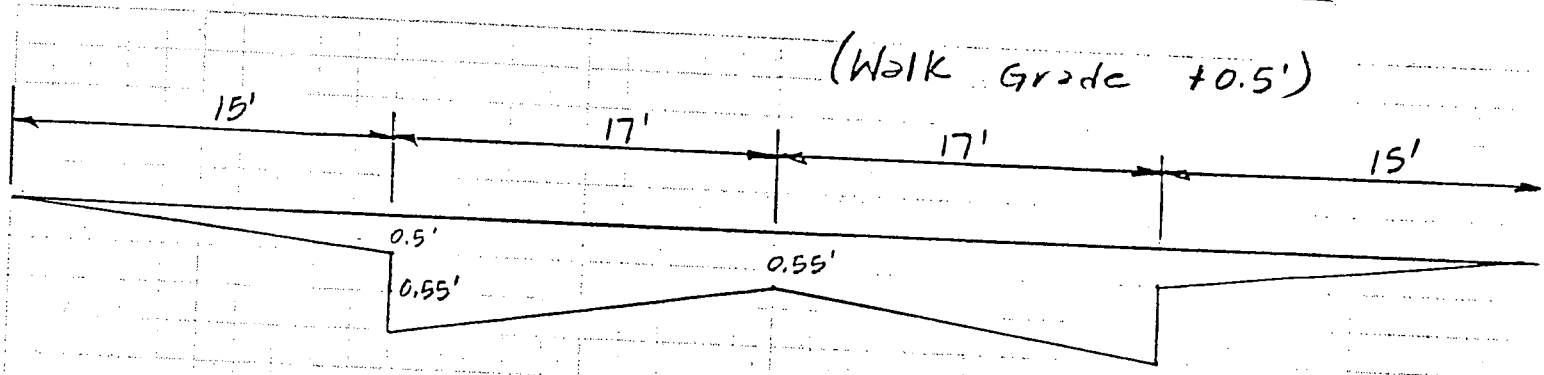
$Q = 1,190.2\ S^{1/2}$

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date _____ Page _____ of _____

Project _____

Item Drainage Plan



$n = 0.0221$ (see sheet 15)

$A = 2(1/2 \times 15 \times 0.5') + (34' \times 0.55') + 2(1/2 \times 17' \times 0.5')$

$= 34.7$ SF

$P = 65.1'$

$R = A/P = 34.7/65.1 = 0.53303$

$R^{2/3} = 0.6574$

$Q_{max} = \frac{1.486}{0.0221} \times 34.7 \times 0.6574 \times S^{1/2}$

$Q_{max} = 1,533.9\ S^{1/2}$

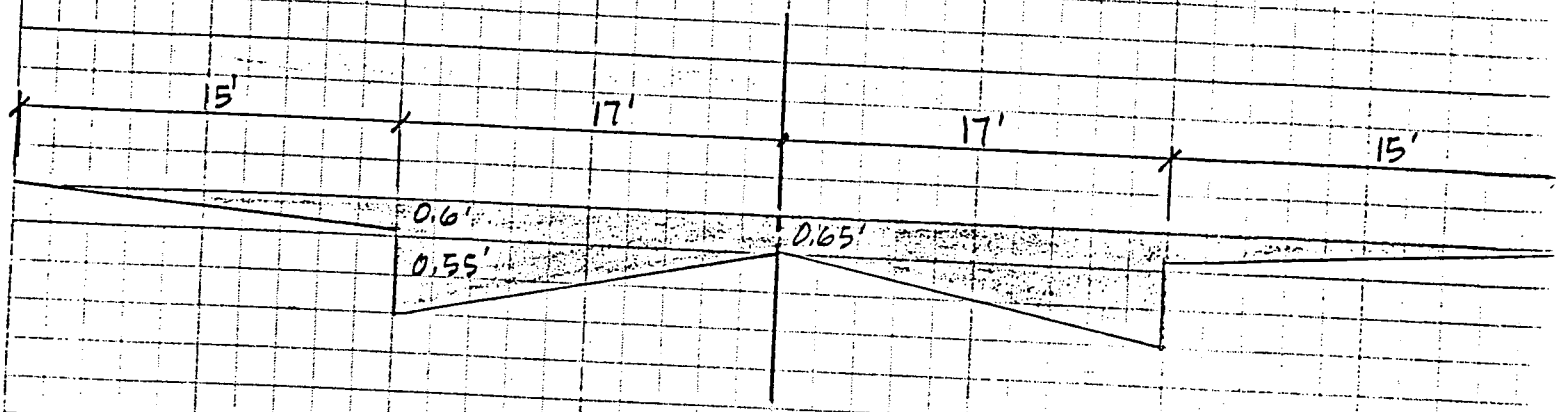
PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date _____ Page _____ of _____

Project _____

Item Drainage Plan

CHECK STREET FLOW 100-YEAR (WALK GRADE = 0.6')



n = 0.0221 (see previous sheet)

A = $2(1/2 \times 15 \times 0.6) + (34 \times 0.65) + 2(1/2 \times 17 \times 0.5)$

= 39.6 SF

P = 65.1 '

R = A/P = 39.6/65.1 = 0.6083

$R^{2/3}$ = 0.71792

$Q_{max} = \frac{1.486}{0.0221} \times 39.6 \times 0.71792 \times S^{1/2}$

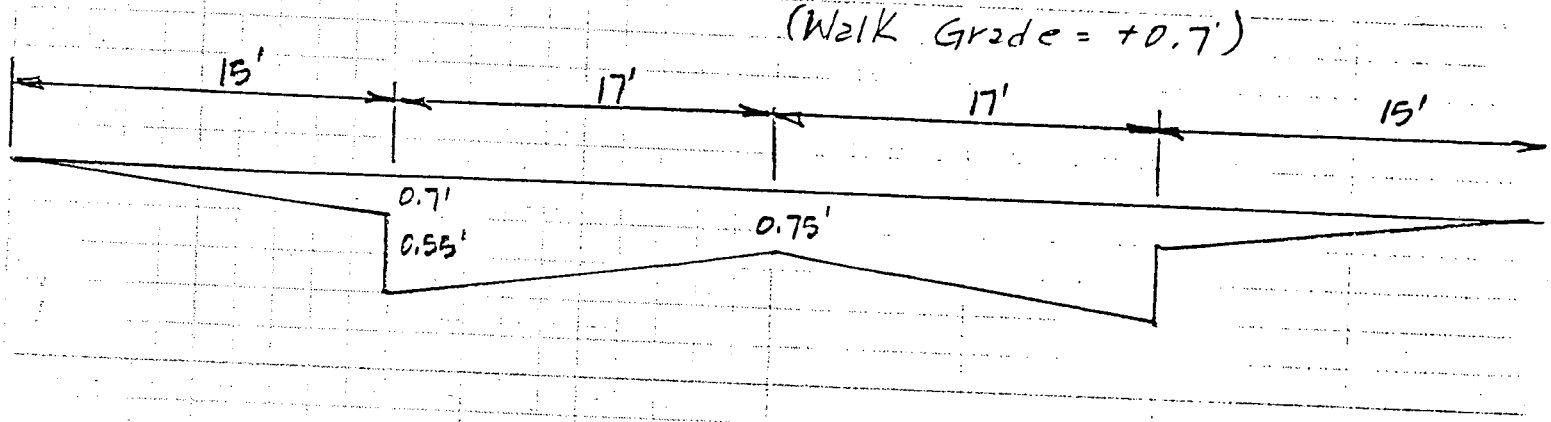
Q_{max} = 1,911.6 $S^{1/2}$

PROFESSIONAL ENGINEERING CONSULTANTS
PROFESSIONAL ASSOCIATION
1440 EAST ENGLISH
WICHITA, KANSAS
ZIP CODE / 67211

Date _____ Page _____ of _____

Project _____

Item Drainage Plan



$n = 0.0221$ (see sheet 15)

$A = 2(1/2 \times 15 \times 0.7) + (34 \times 0.75') + 2(1/2 \times 17 \times 0.5')$

$= 44.5$

$P = 65.1$

$R = A/P = 44.5/65.1 = 0.68356$

$R^{2/3} = 0.77598$

$$Q_{max} = \frac{1.486}{0.0221} \times 44.5 \times 0.77598 \times S^{1/2}$$

$Q_{max} = 2,321.9\ S^{1/2}$