Avalon Park 3rd Addition
Wichita, Sedgwick County, Kansas
12/6/04

Avalon Park 3rd is a 61.8 acre, single family, residential development north of Wichita in Sedgwick County, Kansas. The 85 lot development consists of streets, storm sewer and detention ponds. This site was originally platted as part of the Avalon Park Addition. This report contains a drawing of the drainage plan, supporting calculations and data for the Avalon Park 3rd Addition Drainage Plan.

Hydrology

The proposed plat lies in the SW 1/4, Section 28, T26S, R1W. The soil on-site is comprised of Carwile fine sandy loam, Lesho loam, and Plevna fine sandy loam, which are all classified in hydrologic group D. The land is currently used for agricultural purposes and has short grass and bare ground throughout. The site is bordered to the north by 96 Highway, to the east by agricultural land, to the south by the Avalon Park Addition, and to the west by the Kansas and Oklahoma Railroad and Tyler Road. The site generally drains to the east to the Big Slough which cuts through this site from the north property line to the southeast corner.

Part of the site is in the 100-year floodplain. The Base Flood Elevation was determined to be 1334 N.G.V.D. (146.6 City Datum) using the FEMA Flood Insurance Rate Map. The minimum openings were designed to be 3 feet above B.F.E.

Under proposed conditions, this site along with Avalon Park and Avalon Park 2nd will drain to a total of 11 ponds all connected with equalizer pipes. Outfall from the site will occur via a 6 ft weir on Pond 5 which discharges to the Big Slough. Under proposed conditions, the 100-year storm discharge will be 74 CFS which is the same as the existing conditions runoff at this location (Basin A5). Note that this weir is the only outfall for the entire developed system. Copies of the original drainage maps for Avalon Park and Avalon Park 2nd are included in the Design Aids section.

The Rational Method was used to calculate runoff quantities. Runoff coefficients were estimated based on tables presented in the Design Aids section of this report using fully developed conditions. Time of concentration was based on slope, flow velocity and length of flow through each basin and was not allowed to be less than 15 minutes. The HEC-1 computer program was used to route the runoff through the ponds and determine the post-development conditions leaving the site.

The analysis was made based on the available site data which includes the following: 1" = 100' topographic map with 1' contours of the site, a Sedgwick County Soil Survey Map and noted references.

Culvert Design

The Federal Highway Administration's culvert program, HY8 Version 6.1, was used to aid in the design of the equalizing pipes and outfall between ponds. The program output is included in the Proposed Conditions section. The culvert under the entrance at Tyler Road was sized to match the existing culverts near this location.

Storm Sewer Design

For the storm sewer hydrologic analysis, the Rational Method was again used. Runoff coefficients were estimated using the charts in the design aids section of this report. 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.

In the hydraulic analysis, the 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. The minor storm has a recurrence interval of two years. The major storm evaluated has a recurrence interval of one hundred years. To simplify this analysis, the time of concentration is identical for both the major and minor storms.

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 the Design of Urban Highway Drainage – The State of the Art, Equation (5-1), pages 5-9. It has been assumed that Tc for street flow is equal to 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 lane should remain unflooded for the minor storm.

Inlet capacities were determined by the methods described in Drainage of Highway Pavements, Hydraulic Engineering Circular #12, using Chart #12 as found in the Design Aids section. City of Wichita Type 1A inlets and 3/8 inch per foot 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 with 64' R.O.W. and 58' R.O.W. have been assumed to have 6-5/8 inch standard curb and 3-5/8 inch roll curb, respectively.

Hydraulic computation for the storm sewer 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 is 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. The calculations and the STORM analyses for the storm sewers are included in this report. Please note that SWS Line #2 was sized as an equalizer pipe and only checked with the STORM program.

Design Aids

This section includes material used to assist in designing the drainage system. A 1" = 100' scale Drainage Plan map (Attachment A) and a 1" = 100' scale Four-Corner Plan map (Attachment B) are enclosed in the pockets.

References

Design of Urban Highway Drainage – The State of the Art, by Reitz & Jens, Inc., April 1980.

Drainage of Highway Pavements, Hydraulic Engineering Circular #12, by Tye Engineering, Inc., March 1984.

Interim Drainage and Storm Sewer Policy for Design Criteria and Documentation, City of Wichita, Kansas, 1985.

Soil Survey of Sedgwick County, Kansas, US Department of Agriculture, Soil Conservation Service, 1979.

Project: Avalon Park
Project No.: 36-03601-5459
Date: 11/15/2004
Subject: Existing Hydrology (Rational Method)

Basin	Area (Ac.)	C_2	C_{100}	T_c (min)	i_2 (in/hr)	i_{100} (in/hr)	Q_2 (cfs)	Q_{100} (cfs)
A1	0.7	0.26	0.37	27	2.81	5.80	1	2
A2	62.6	0.28	0.62	195	0.66	1.57	12	61
A3	7.5	0.26	0.41	35	2.41	5.10	5	16
A4	25.6	0.27	0.59	28	2.75	5.71	19	86
A5	17.7	0.28	0.63	20	3.30	6.60	16	74
A6	2.2	0.28	0.63	19	3.39	6.74	2	9

Professional Engineering Consultants, P.A.
3 S. TOPEKA ▪ WICHITA, KANSAS 67202
316-262-2691 ▪ FAX 316-262-3003
www.pec1.com ▪ designers@pec1.com

Project ______________________ Date __________

Item ______________________ By __________

SAMPLE CALCULATION

BASIN A1

A = 0.7 AC

SOIL TYPE Ea. HYDROLOGIC GROUP "B"

LAND USE: URBAN LAWNS/PASTURE
SLOPE < 1%

$C_2 = 0.26$
$C_{100} = 0.37$

Tc => L = 720'
VEL = 0.45 F/S (ATTACHMENT E)

$S = \frac{36.12 - 33.11}{720} = 0.42\%$

$T_C = \frac{720'}{} \bigg| \frac{SEC}{.45F} \bigg| \frac{1\,MIN}{60\,SEC} = 26.7\ MIN \approx 27\ MIN$

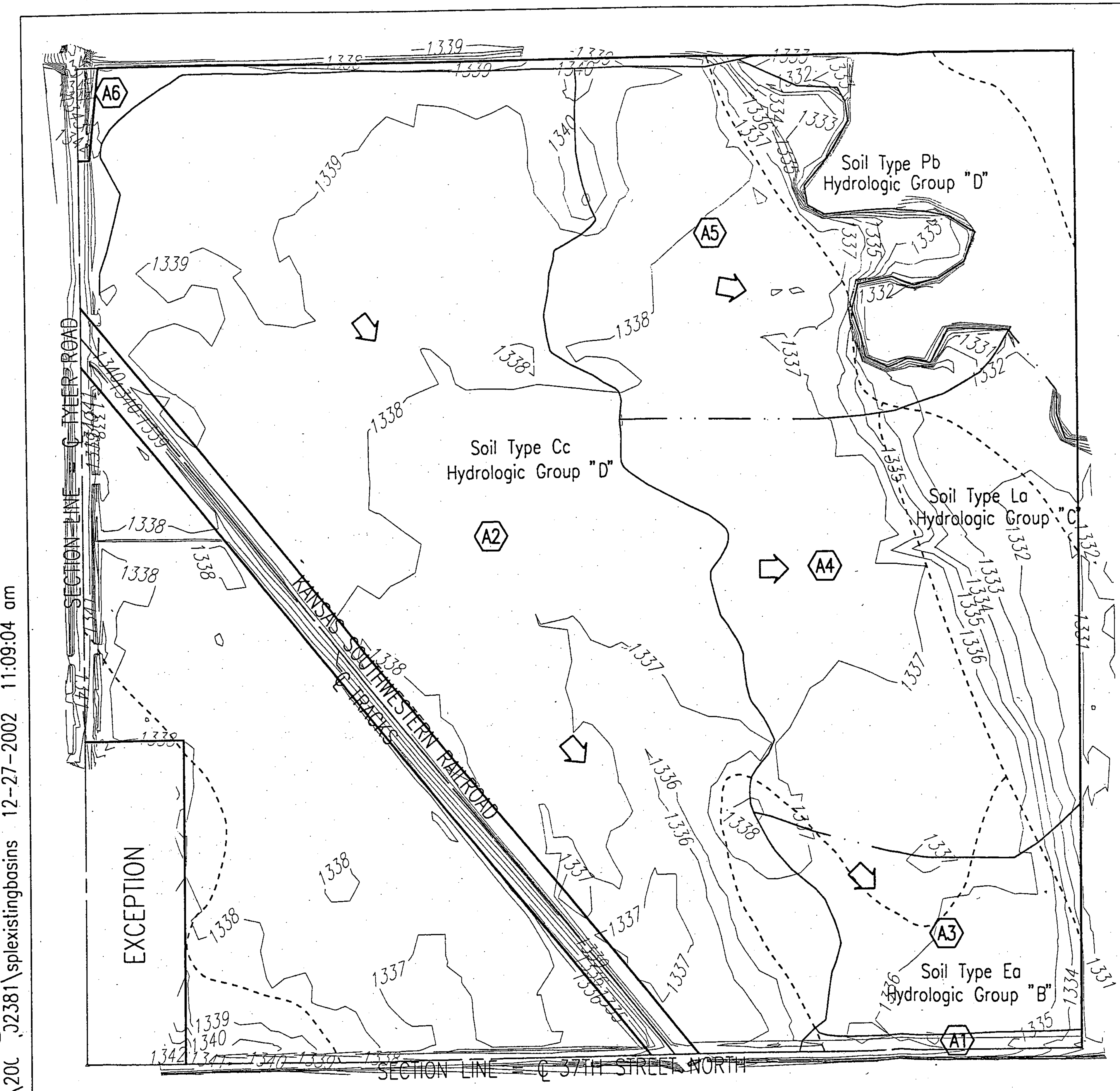
$i_2 = 2.81\ ^{IN}/_{HR}$ $i_{100} = 5.80\ ^{IN}/_{HR}$

$Q_2 = C_2 i_2 A = 0.26(2.81)(0.7) = 0.5\ CFS$

$Q_{100} = 0.37(5.80)(0.7) = 1.5\ CFS$

AVALON PARK

DRAINAGE BASINS FOR EXISTING CONDITIONS



SCALE:

300 0 300 600

LEGEND

SOIL GROUP BOUNDARY

3A BASIN IDENTIFIER

BASIN BOUNDARY

MAJOR STORM WATER OVERFLOW

Professional **E**ngineering **C**onsultants, P.A.
303 S. TOPEKA • WICHITA, KANSAS 67202
316-262-2691 • FAX 316-262-3003

DSNR: PER: SPL SCALE: 1=300.00
Q:\20C .02381\splexistingbasins 12-27-2002 11:09:04 am

Project:	**Avalon Park 3rd Addition**
Date:	11/15/2004
Prep. By:	BLB

Manual Input

Basin 1

Total Area 2.96 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	2.96	2.96

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	50%	50%	0%
Acres	0.00	0.00	0.00	1.48	1.48	0.00

	Future	
Length of Flow	540	ft
Slope	1.12	%
Waterflow Desc	lawns / pond	
Avg Velocity	0.30	ft/sec
Tc	0.50	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	2.67	2.96	3.91
5	0.53	3.24	2.96	5.03
10	0.59	3.76	2.96	6.57
25	0.63	4.39	2.96	8.12
50	0.66	4.94	2.96	9.65
100	0.71	5.40	2.96	11.35

Project: **Avalon Park 3rd Addition**
Date: 11/15/2004-
Prep. By: BLB

Manual Input

Basin 2

Total Area 8.33 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	8.33	8.33

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)
Future	0%	0%	0%	25%	75%	0%
Acres	0.00	0.00	0.00	2.08	6.25	0.00

	Future	
Length of Flow	1460	ft
Slope	0.43	%
Waterflow Desc	lawns / pond	
Avg Velocity	0.20	ft/sec
Tc	2.03	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	0.99	8.33	4.10
5	0.53	1.33	8.33	5.90
10	0.61	1.55	8.33	7.81
25	0.64	1.81	8.33	9.69
50	0.68	2.07	8.33	11.73
100	0.74	2.30	8.33	14.08

Project: **Avalon Park 3rd Addition**
Date: 11/15/2004
Prep. By: BLB

Manual Input

Basin 3

Total Area 15.73 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	15.73	15.73

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	30%	70%	0%
Acres	0.00	0.00	0.00	4.72	11.01	0.00

	Future	
Length of Flow	1775 ft	
Slope	0.81 %	
Waterflow Desc	lawns / short grass	15 min <= Tc <= 24 hrs
Avg Velocity	0.50 ft/sec	
Tc	0.99 hours	

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	1.69	15.73	13.21
5	0.53	2.15	15.73	17.96
10	0.60	2.53	15.73	23.96
25	0.64	2.98	15.73	29.95
50	0.68	3.37	15.73	35.83
100	0.73	3.73	15.73	42.83

Project: **Avalon Park 3rd Addition**
Date: 11/15/2004
Prep. By: BLB

Manual Input

Basin 4

Total Area 7.66 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	7.66	7.66

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	50%	50%	0%
Acres	0.00	0.00	0.00	3.83	3.83	0.00

	Future	
Length of Flow	1465	ft
Slope	0.47	%
Waterflow Desc	lawns / pavement	
Avg Velocity	0.50	ft/sec
Tc	0.81	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	1.97	7.66	7.47
5	0.53	2.44	7.66	9.81
10	0.59	2.86	7.66	12.93
25	0.63	3.35	7.66	16.04
50	0.66	3.79	7.66	19.16
100	0.71	4.18	7.66	22.73

Project: **Avalon Park 3rd Addition**
Date: 11/15/2004-
Prep. By: BLB

Manual Input

Basin 5

Total Area 9.39 Acres

Soil Group	**A**	**B**	**C**	**D**	**Total**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	9.39	9.39

Land Use	**Commercial**	**Industrial**	**Multi-Family**	**Public**	**Single Family**	**Vacant/Agriculture**
	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)	(% of Total Area)
Future	0%	0%	0%	20%	80%	0%
Acres	0.00	0.00	0.00	1.88	7.51	0.00

	Future	
Length of Flow	1560	ft
Slope	0.92	%
Waterflow Desc	lawns / pavement	
Avg Velocity	0.50	ft/sec
Tc	0.87	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.50	1.89	9.39	8.84
5	0.53	2.35	9.39	11.78
10	0.61	2.76	9.39	15.76
25	0.65	3.24	9.39	19.65
50	0.68	3.67	9.39	23.57
100	0.74	4.05	9.39	28.14

Project: **Avalon Park 3rd Addition**
Date: 11/15/2004
Prep. By: BLB

Manual Input

Basin 6

Total Area 17.71 Acres

Soil Group	**A** (% of Total Area)	**B** (% of Total Area)	**C** (% of Total Area)	**D** (% of Total Area)	**Total**
	0%	0%	0%	100%	100%
Acres	0.00	0.00	0.00	17.71	17.71

Land Use	**Commercial** (% of Total Area)	**Industrial** (% of Total Area)	**Multi-Family** (% of Total Area)	**Public** (% of Total Area)	**Single Family** (% of Total Area)	**Vacant/Agriculture** (% of Total Area)
Future	0%	0%	0%	0%	10%	90%
Acres	0.00	0.00	0.00	0.00	1.77	15.94

	Future	
Length of Flow	3835	ft
Slope	0.55	%
Waterflow Desc	lawns / short grass	
Avg Velocity	0.24	ft/sec
Tc	4.44	hours

15 min <= Tc <= 24 hrs

Runoff Coefficients * Used Soil Group D To Be Conservative

Return Period (Years)	Commercial	Industrial	Multi-Family	Public	Single Family	Vacant/Agriculture
2	0.68	0.68	0.70	0.49	0.50	0.54
5	0.69	0.69	0.73	0.51	0.54	0.56
10	0.73	0.73	0.79	0.56	0.62	0.61
25	0.75	0.75	0.81	0.59	0.66	0.64
50	0.77	0.77	0.83	0.62	0.70	0.67
100	0.80	0.80	0.86	0.66	0.76	0.70

Future Conditions

Return Period (Years)	Runoff Coefficient *	Rainfall Intensity (in/hr)	Area (Acres)	Runoff (cfs)
2	0.54	0.54	17.71	5.13
5	0.56	0.72	17.71	7.12
10	0.61	0.84	17.71	9.09
25	0.64	0.98	17.71	11.14
50	0.67	1.12	17.71	13.35
100	0.71	1.26	17.71	15.75

SUB-BASIN CALCULATIONS

Runoff Coefficients

C2	0.50
C100	0.76

Intensity

Tc	15 min
i2	3.5 in/hr
i100	7.8 in/hr

Basin	Node	Area	Q2	Q100
2A	N/A	3.69	6.46	38.28
2B	310	0.75	1.31	7.78
2C	410	0.61	1.07	6.33
2D	420	0.86	1.51	8.92
2E	430	0.75	1.31	7.78
2F	440	0.71	1.24	7.37
2G	450	0.96	1.68	9.96
3A	N/A	7.35	12.86	76.25
3B	610	0.65	1.14	6.74
3C	620	0.67	1.17	6.95
3D	630	1.05	1.84	10.89
3E	510	1.49	2.61	15.46
3F	710	0.80	1.40	8.30
3G	820	1.91	3.34	19.81
3H	830	1.83	3.20	18.98
4A	N/A	4.64	8.12	48.14
4B	220	1.57	2.75	16.29
4C	230	1.44	2.52	14.94
5A	N/A	1.73	3.03	17.95
5B	121	1.27	2.22	13.17
5C	141	0.93	1.63	9.65
5D	142	0.77	1.35	7.99
5E	143	1.18	2.07	12.24
5F	151	1.28	2.24	13.28
5G	180	0.89	1.56	9.23
5H	190	0.58	1.02	6.02
5I	191	0.76	1.33	7.88

STREET FLOW CHECKS

Basin	Node	Q2	Q100
2B	310	1.31	7.78
3E	510	2.61	15.46
3F	710	1.40	8.30
3G	820	3.34	19.81
3H	830	3.20	18.98
4B	220	2.75	16.29
4C	230	2.52	14.94
5B	121	2.22	13.17
5F	151	2.24	13.28

2 Year

Node	Q2	Street Slope	d	dmax	Comment
820	3.34	0.54	0.30	0.55	OK
510	2.61	0.50	0.28	0.30	OK

* By inspection, all nodes are OK

100 Year

Location	Q100	Qpipe	Qstreet	S	Qmax	Comment
Approaching node 820	19.81	3.34	16.47	0.54	60.10	OK
Approaching node 510	15.46	2.61	12.85	0.52	32.14	OK

* By inspection, all nodes are OK

INLET SIZING

Curb Inlets

Node	Q_2	Q_{max} (L=5')	Q_{max} (L=10')	Use L=
121	2.22	11	22	5
151	2.24	11	22	5
220	2.75	11	22	5
230	2.52	11	22	5
310	1.31	11	22	5
510	2.61	11	22	5
710	1.40	11	22	5
820	3.34	11	22	5
830	3.20	11	22	5

Area Inlets

Node	Q_2	Size	Perimeter	Ponding Depth
141	1.63	2' x 2'	8	0.17
142	1.35	2' x 2'	8	0.15
143	2.07	2' x 2'	8	0.20
180	1.56	2' x 2'	8	0.16
190	1.02	2' x 2'	8	0.12
191	1.33	2' x 2'	8	0.15
410	1.07	2' x 2'	8	0.13
420	1.51	2' x 2'	8	0.16
430	1.31	2' x 2'	8	0.14
440	1.24	2' x 2'	8	0.14
450	1.68	2' x 2'	8	0.17
610	1.14	2' x 2'	8	0.13
620	1.17	2' x 2'	8	0.13
630	1.84	2' x 2'	8	0.18

Neenah R4826 2' x 2' Area Inlet
1.3 SF of open area
8 F Perimeter

Professional Engineering Consultants, P.A.

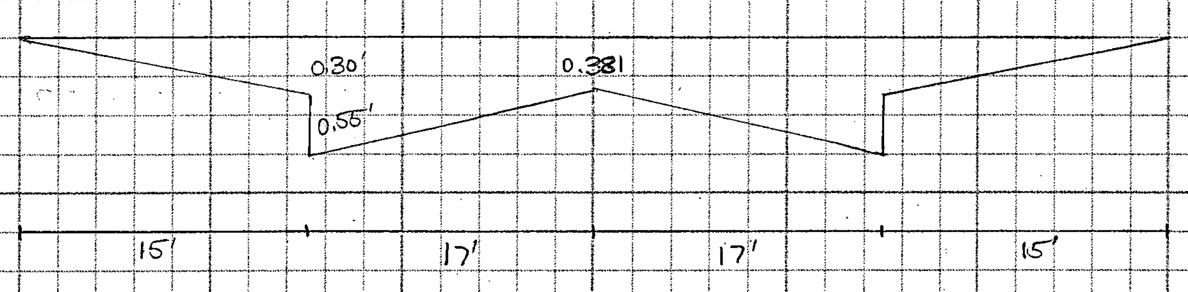
Page ____ of ____

303 S. TOPEKA ▪ WICHITA, KANSAS 67202
-262-2691 ▪ FAX 316-262-3003
www.pec1.com ▪ designers@pec1.com

Project ______________________ Date ________

Item ______________________ By ________

DETERMINE CAPACITIES OF STANDARD CURB STREETS W/ 0.3' WALK GRADE FOR 100-YR STORM ANALYSIS (64' ROW, 35' BK-BK)



$$\frac{(2 \times 14.5 \times 0.030) + (2 \times 3.05 \times 0.013) + (2 \times 15 \times 0.016)}{65.1} = 0.02196 = n$$

$(2 \times \frac{1}{2} \times 15 \times 0.30) + (32 \times 0.85) - (2 \times \frac{1}{2} \times 17 \times 0.469) = 23.7\ SF = A$

$65.1 = P$

$23.7/65.1 = 0.364 = R$

$(0.364)^{2/3} = 0.510 = R^{2/3}$

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

$\left(\frac{1.486}{0.02196}\right)(23.7)(0.510)(S^{1/2}) = \underline{817.91\ (S^{1/2}) = Q}$

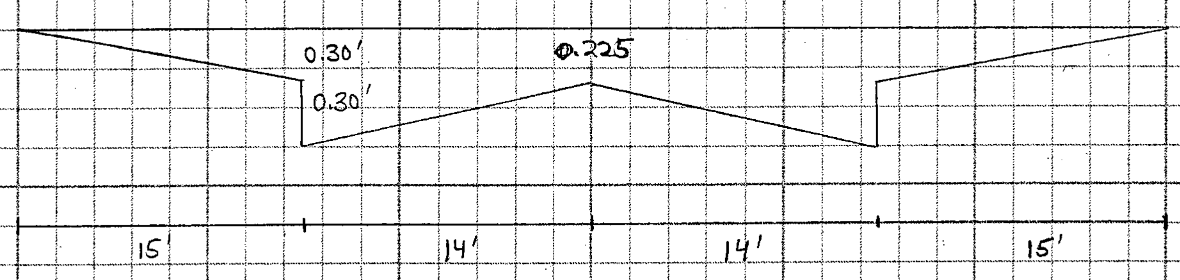
Professional Engineering Consultants, P.A.

...3 S. TOPEKA • WICHITA, KANSAS 67202
...-262-2691 • FAX 316-262-3003
www.pec1.com • designers@pec1.com

Project ______________________ Date __________

Item ______________________ By __________

DETERMINE CAPACITIES OF ROLL CURB STREETS W/0.3' WALK GRADE FOR 100-YR STORM ANALYSIS (58' ROW, 29' BK-BK)



$$\frac{(2\times14.5\times0.030)+(2\times3.05\times0.013)+(2\times12\times0.016)}{59.1} = 0.02256 = n$$

$59.1 = P$

$(2\times\frac{1}{2}\times15\times0.30)+(28\times0.60)-(2\times\frac{1}{2}\times14\times0.375) = 16.1\ SF = A$

$16.1/59.1 = 0.272 = R$

$(0.272)^{2/3} = 0.420 = R^{2/3}$

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

$\left(\frac{1.486}{0.02256}\right)(16.1)(0.420)(S^{1/2}) = \underline{445.65\,(S^{1/2}) = Q}$

100.0 Maximum Q (cfs)
6.000 Weir Width (feet)
1331.40 Weir Elevation
2.900 Weir Flow Coeffecient (Never > 3.089)

Q (cfs)	Weir Width (feet)	Weir Elevation	q	Weir Flow Coeff.	Energy Head (feet)	**Water Surface Elevation**
0.0	6.000	1331.40	0.0	2.900	0.00	**1331.40**
10.0	6.000	1331.40	1.7	2.900	0.69	**1332.09**
20.0	6.000	1331.40	3.3	2.900	1.10	**1332.50**
30.0	6.000	1331.40	5.0	2.900	1.44	**1332.84**
40.0	6.000	1331.40	6.7	2.900	1.74	**1333.14**
50.0	6.000	1331.40	8.3	2.900	2.02	**1333.42**
60.0	6.000	1331.40	10.0	2.900	2.28	**1333.68**
70.0	6.000	1331.40	11.7	2.900	2.53	**1333.93**
80.0	6.000	1331.40	13.3	2.900	2.76	**1334.16**
90.0	6.000	1331.40	15.0	2.900	2.99	**1334.39**
100.0	6.000	1331.40	16.7	2.900	3.21	**1334.61**

CURRENT DATE: 06-09-2004
CURRENT TIME: 08:34:19

FILE DATE: 06-09-2004
FILE NAME: AVWEST

FHWA CULVERT ANALYSIS
HY-8, VERSION 6.1

C U L V NO.	SITE DATA INLET ELEV. (ft)	OUTLET ELEV. (ft)	CULVERT LENGTH (ft)	CULVERT SHAPE, MATERIAL, INLET BARRELS SHAPE MATERIAL	SPAN (ft)	RISE (ft)	MANNING n	INLET TYPE
1	1325.70	1325.60	100.00	1 RCP	3.00	3.00	.012	CONVENTIONAL
2								
3								
4								
5								
6								

SUMMARY OF CULVERT FLOWS (cfs) FILE: AVWEST DATE: 06-09-2004

ELEV (ft)	TOTAL	1	2	3	4	5	6	ROADWAY	ITR
1330.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1330.04	8.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1330.14	16.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1330.32	24.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1330.58	32.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1330.90	40.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1331.30	48.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1331.77	56.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1332.31	64.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1332.92	72.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
1333.61	80.0	0.0	0.0	0.0	0.0	0.0	0.0	0.00	0
0.00	0.0	0.0	0.0	0.0	0.0	0.0	0.0	OVERTOPPING	

SUMMARY OF ITERATIVE SOLUTION ERRORS FILE: AVWEST DATE: 06-09-2004

HEAD ELEV (ft)	HEAD ERROR (ft)	TOTAL FLOW (cfs)	FLOW ERROR (cfs)	% FLOW ERROR
1330.00	0.000	0.00	0.00	0.00
1330.04	0.000	8.00	0.00	0.00
1330.14	0.000	16.00	0.00	0.00
1330.32	0.000	24.00	0.00	0.00
1330.58	0.000	32.00	0.00	0.00
1330.90	0.000	40.00	0.00	0.00
1331.30	0.000	48.00	0.00	0.00
1331.77	0.000	56.00	0.00	0.00
1332.31	0.000	64.00	0.00	0.00
1332.92	0.000	72.00	0.00	0.00
1333.61	0.000	80.00	0.00	0.00

<1> TOLERANCE (ft) = 0.010 <2> TOLERANCE (%) = 1.000

CURRENT DATE: 06-09-2004
CURRENT TIME: 08:34:19

FILE DATE: 06-09-2004
FILE NAME: AVWEST

PERFORMANCE CURVE FOR CULVERT 1 - 1(3.00 (ft) BY 3.00 (ft)) RCP

DIS-CHARGE FLOW (cfs)	HEAD-WATER ELEV. (ft)	INLET CONTROL DEPTH (ft)	OUTLET CONTROL DEPTH (ft)	FLOW TYPE <F4>	NORMAL DEPTH (ft)	CRIT. DEPTH (ft)	OUTLET DEPTH (ft)	TW DEPTH (ft)	OUTLET VEL. (fps)	TW VEL. (fps)
0.00	1330.00	0.00	4.30	0-NF	0.00	0.00	0.00	4.40	0.00	0.00
8.00	1330.04	1.18	4.34	4-FFt	1.22	0.89	3.00	4.40	1.13	0.00
16.00	1330.14	1.80	4.44	4-FFt	1.85	1.27	3.00	4.40	2.26	0.00
24.00	1330.32	2.27	4.62	4-FFt	2.64	1.57	3.00	4.40	3.40	0.00
32.00	1330.58	2.68	4.88	4-FFt	3.00	1.83	3.00	4.40	4.53	0.00
40.00	1330.90	3.09	5.20	4-FFt	3.00	2.06	3.00	4.40	5.66	0.00
48.00	1331.30	3.54	5.60	4-FFt	3.00	2.25	3.00	4.40	6.79	0.00
56.00	1331.77	4.05	6.07	4-FFt	3.00	2.42	3.00	4.40	7.92	0.00
64.00	1332.31	4.66	6.61	4-FFt	3.00	2.55	3.00	4.40	9.05	0.00
72.00	1332.92	5.35	7.22	4-FFt	3.00	2.68	3.00	4.40	10.19	0.00
80.00	1333.61	6.13	7.91	4-FFt	3.00	2.81	3.00	4.40	11.32	0.00

El. inlet face invert 1325.70 ft El. outlet invert 1325.60 ft
El. inlet throat invert 0.00 ft El. inlet crest 0.00 ft

***** SITE DATA ***** CULVERT INVERT **************

INLET STATION	0.00 ft
INLET ELEVATION	1325.70 ft
OUTLET STATION	100.00 ft
OUTLET ELEVATION	1325.60 ft
NUMBER OF BARRELS	1
SLOPE (V/H)	0.0010
CULVERT LENGTH ALONG SLOPE	100.00 ft

***** CULVERT DATA SUMMARY ************************

BARREL SHAPE	CIRCULAR
BARREL DIAMETER	3.00 ft
BARREL MATERIAL	CONCRETE
BARREL MANNING'S n	0.012
INLET TYPE	CONVENTIONAL
INLET EDGE AND WALL	GROOVED END PROJECTION
INLET DEPRESSION	NONE

CURRENT DATE: 06-09-2004 FILE DATE: 06-09-2004
CURRENT TIME: 08:34:19 FILE NAME: AVWEST

TAILWATER

CONSTANT WATER SURFACE ELEVATION
1330.00

ROADWAY OVERTOPPING DATA

ROADWAY SURFACE	GRAVEL
EMBANKMENT TOP WIDTH	20.00 ft
CREST LENGTH	100.00 ft
OVERTOPPING CREST ELEVATION	1338.00 ft

```
1*****************************************                               ****************************************
 *                                       *                               *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                               *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998                *                               *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                 *                               *         609 SECOND STREET            *
 *                                       *                               *      DAVIS, CALIFORNIA 95616         *
 *   RUN DATE   06DEC04  TIME  14:41:06  *                               *         (916) 756-1104               *
 *                                       *                               *                                      *
 *****************************************                               ****************************************


                    X     X  XXXXXXX   XXXXX          X
                    X     X  X        X     X        XX
                    X     X  X        X               X
                    XXXXXXX  XXXX     X       XXXXX   X
                    X     X  X        X               X
                    X     X  X        X     X         X
                    X     X  XXXXXXX   XXXXX         XXX


 THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL   LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1                                       HEC-1 INPUT                                              PAGE  1

      LINE       ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

         1       ID      Avalon Park, Avalon Park 2nd & Avalon Park 3rd
         2       ID      Total Proposed Drainage to the Big Slough
         3       ID
*** LIST ***
*** FREE ***
                 *DIAGRAM
         4       IT      15 27SEP99    1200       0 28SEP99    2000
         5       IN      15 27SEP99    1200
         6       IO       0       5
                 *
                 *    100-YEAR, 6-HOUR STORM USING MODIFIED SCS TYPE 2 RAINFALL DISTRIBUTION
         7       JR    PREC     2.5     3.4     4.0     4.7     5.3     5.9
                 *

         8       KK  W-BAS1
                 *
                 *      UNDEVELOPED 38.5 ACRES WEST OF TYLER ROAD (VERY FLAT TOPOGRAPHY)
                 *
         9       KO       5
        10       BA  .06016
        11       PB    1.00
        12       PC  0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
```

```
 13      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 14      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 15      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.010  0.022  0.033  0.046
 16      PC   0.059  0.076  0.091  0.114  0.135  0.170  0.204  0.352  0.744  0.795
 17      PC   0.846  0.874  0.899  0.919  0.938  0.953  0.967  0.979  0.989  1.000
 18      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 19      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 20      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 21      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000
 22      LS       0     80      0
 23      UD    0.90
         *
         *

 24      KK  W-BAS2
         *
         *  ASSUMED 30.0 ACRES EAST OF TYLER ROAD, WEST OF THE R/R TRACKS TO BE DEVELOPED
         *  (AVALON 2ND)
         *
 25      KO       5
 26      BA  .04688
 27      PB    1.00
 28      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 29      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 30      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000  0.000
 31      PC   0.000  0.000  0.000  0.000  0.000  0.000  0.010  0.022  0.033  0.046
 32      PC   0.059  0.076  0.091  0.114  0.135  0.170  0.204  0.352  0.744  0.795
 33      PC   0.846  0.874  0.899  0.919  0.938  0.953  0.967  0.979  0.989  1.000
 34      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 35      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 36      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000  1.000
 37      PC   1.000  1.000  1.000  1.000  1.000  1.000  1.000
 38      LS       0     80     38
1                                 HEC-1 INPUT                                   PAGE  2

LINE     ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 39      UD    0.20
         *
         *

 40      KK  W-COMB
         *
         *   TOTAL 100-YEAR FLOW PASSING THROUGH CONNECTING STRUCTURE UNDER R/R TRACKS
         *   THIS STRUCTURE MUST BE SIZED TO PASS THE 100-YEAR STORM
         *
 41      KO       5
 42      HC       2      0
         *
         *

 43      KK    EAST
         *
         *     TOTAL AREA EAST OF RAILROAD 101.4 ACRES (AVALON & AVALON 3RD)
         *     CONSERVATIVELY ACCOUNT FOR ENTIRE OUTFLOW TO GO OVER WEIR AT POND 5
         *     TOP OF WEIR ELEVATION 144.0
         *  STATIC LEVEL WILL BE AT 144.0 BASED ON AN ASSUMED LOW FLOW OUTFLOW STRUCTURE
         *
 44      KO       5
 45      BA  .15844
```

```
          46           PB    1.00
          47           PC   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
          48           PC   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
          49           PC   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000   0.000
          50           PC   0.000   0.000   0.000   0.000   0.000   0.000   0.010   0.022   0.033   0.046
          51           PC   0.059   0.076   0.091   0.114   0.135   0.170   0.204   0.352   0.744   0.795
          52           PC   0.846   0.874   0.899   0.919   0.938   0.953   0.967   0.979   0.989   1.000
          53           PC   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
          54           PC   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
          55           PC   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000   1.000
          56           PC   1.000   1.000   1.000   1.000   1.000   1.000   1.000
          57           LS       0      80      38
          58           UD    0.20
                       *
                       *

          59           KK  TOTALQ
          60           KO       5
          61           HC       2       0
                       *
                       *

          62           KK   PONDS
                       *
                       *    STORAGE RELATIONSHIPS USE THE TOTAL POND STORAGE FOR ALL 11 PONDS.
                       *    OUTFLOW IS ROUTED OVER A 6 WIDE RECTANGULAR WEIR AT ELEV. 144.0
                       *
          63           KO       5
          64           RS       1    ELEV   144.0
          65           SA    14.7    19.3
          66           SE   142.6   147.6
                       *
1                                                 HEC-1 INPUT                                                PAGE  3

        LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

          67           SQ       0      10      20      30      40      50      60      70      80      90
          68           SQ     100
          69           SE   144.0  144.69  145.10  145.44  145.74  146.02  146.28  146.53  146.76  146.99
          70           SE   147.2
                       *
                       *
                       *
          71           ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.       (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

    8       W-BAS1
                .
                .
                .       W-BAS2
                .            .
                .            .
   40       W-COMB...........
                .
                .
```

```
 43          .       EAST
             .          .
             .          .
 59      TOTALQ...........
             V
             V
 62      PONDS

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*              JUN   1998                *
*            VERSION 4.1                 *
*                                        *
*  RUN DATE   06DEC04  TIME  14:41:06    *
*                                        *
******************************************

                                              ***************************************
                                              *                                     *
                                              *    U.S. ARMY CORPS OF ENGINEERS     *
                                              *    HYDROLOGIC ENGINEERING CENTER    *
                                              *          609 SECOND STREET          *
                                              *       DAVIS, CALIFORNIA 95616       *
                                              *           (916) 756-1104            *
                                              *                                     *
                                              ***************************************


                          Avalon Park, Avalon Park 2nd & Avalon Park 3rd
                          Total Proposed Drainage to the Big Slough


  6 IO          OUTPUT CONTROL VARIABLES
                      IPRNT          0  PRINT CONTROL
                      IPLOT          5  PLOT CONTROL
                      QSCAL         0.  HYDROGRAPH PLOT SCALE

    IT          HYDROGRAPH TIME DATA
                       NMIN         15  MINUTES IN COMPUTATION INTERVAL
                      IDATE    27SEP99  STARTING DATE
                      ITIME       1200  STARTING TIME
                         NQ        129  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE    28SEP99  ENDING DATE
                     NDTIME       2000  ENDING TIME
                      ICENT         19  CENTURY MARK

                COMPUTATION INTERVAL     .25 HOURS
                     TOTAL TIME BASE   32.00 HOURS

        ENGLISH UNITS
             DRAINAGE AREA          SQUARE MILES
             PRECIPITATION DEPTH    INCHES
             LENGTH, ELEVATION      FEET
             FLOW                   CUBIC FEET PER SECOND
             STORAGE VOLUME         ACRE-FEET
             SURFACE AREA           ACRES
             TEMPERATURE            DEGREES FAHRENHEIT

    JP          MULTI-PLAN OPTION
                     NPLAN           1  NUMBER OF PLANS

    JR          MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                  2.50      3.40      4.00      4.70      5.30      5.90
```

```
*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
   8 KK    *   W-BAS1   *
           *            *
           **************

   9 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          5  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
  24 KK    *   W-BAS2   *
           *            *
           **************

  25 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          5  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
  40 KK    *   W-COMB   *
           *            *
           **************

  41 KO        OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          5  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***

           **************
           *            *
     KK    *    EAST    *
           *            *
           **************

  44 KO        OUTPUT CONTROL VARIABLES
```

```
                IPRNT          5  PRINT CONTROL
                IPLOT          5  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
```

*** ***

```
           **************
           *            *
  59 KK    *   TOTALQ   *
           *            *
           **************

  60 KO        OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          5  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
```

*** ***

```
           **************
           *            *
  62 KK    *   PONDS    *
           *            *
           **************

  63 KO        OUTPUT CONTROL VARIABLES
                IPRNT          5  PRINT CONTROL
                IPLOT          5  PLOT CONTROL
                QSCAL         0.  HYDROGRAPH PLOT SCALE
```

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS
FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES
TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
					2.50	3.40	4.00	4.70	5.30	5.90
HYDROGRAPH AT										
+	W-BAS1	.06	1	FLOW	17.	30.	40.	52.	63.	74.
				TIME	13.00	13.00	12.75	12.75	12.75	12.75
HYDROGRAPH AT										
+	W-BAS2	.05	1	FLOW	47.	73.	90.	112.	130.	149.
				TIME	12.00	12.00	12.00	12.00	12.00	12.00
COMBINED AT										
+	W-COMB	.11	1	FLOW	49.	78.	98.	122.	144.	166.
				TIME	12.00	12.00	12.00	12.00	12.00	12.00
HYDROGRAPH AT										
+	EAST	.16	1	FLOW	159.	245.	305.	377.	440.	503.

				TIME	12.00	12.00	12.00	12.00	12.00	12.00
2 COMBINED AT										
+	TOTALQ	.27	1	FLOW	208.	323.	403.	500.	584.	669.
				TIME	12.00	12.00	12.00	12.00	12.00	12.00
ROUTED TO										
+	PONDS	.27	1	FLOW	16.	29.	38.	51.	62.	74.
				TIME	14.75	14.50	14.25	14.25	14.00	14.00
			** PEAK STAGES IN FEET **							
			1	STAGE	144.94	145.39	145.69	146.04	146.34	146.63
				TIME	14.75	14.50	14.25	14.25	14.00	14.00

*** NORMAL END OF HEC-1 ***

```
100 j,  144.0000  100    2   16   15
110 t,Avalon Park 3rd Addition
120 t,SWS Line #1
130 i,  191     0.00     0.00     0.00     0.00     1.33    15.00   150.30
140 i,  190     0.00     0.00     0.00     0.00     1.02    15.00   149.90
150 i,  180     0.00     0.00     0.00     0.00     1.56    15.00   149.50
160 i,  151     0.00     0.00     0.00     0.00     2.24    15.00   153.47
170 i,  143     0.00     0.00     0.00     0.00     2.07    15.00   151.33
180 i,  142     0.00     0.00     0.00     0.00     1.35    15.00   150.93
190 i,  141     0.00     0.00     0.00     0.00     1.63    15.00   149.70
200 i,  121     0.00     0.00     0.00     0.00     2.22    15.00   153.52
210 m,  170   150.60
220 m,  160   150.70
230 m,  150   150.40
240 m,  140   150.40
250 m,  130   150.30
260 m,  120   149.70
270 m,  110   147.60
280 m,  100   144.00
290 p,  191  190   160.00   15 0.013   0.00   0.00
300 p,  190  180   160.00   15 0.013   0.00   0.00
310 p,  180  170   225.00   15 0.013  45.00   0.00
320 p,  170  160   115.00   15 0.013  45.00   0.00
330 p,  160  150   100.00   15 0.013   0.00   0.00
340 p,  151  150   145.00   15 0.013  60.00   0.00
350 p,  150  140   100.00   15 0.013  90.00   0.00
360 p,  143  142   160.00   15 0.013   0.00   0.00
370 p,  142  141   180.00   15 0.013   0.00   0.00
380 p,  141  140   135.00   15 0.013   0.00   0.00
390 p,  140  130   105.00   24 0.013  60.00   0.00
400 p,  130  120   145.00   24 0.013   0.00   0.00
410 p,  121  120   155.00   15 0.013 100.00   0.00
420 p,  120  110    35.00   24 0.013  30.00   0.00
430 p,  110  100   100.00   24 0.013   0.00   0.00
440 e
```

STORM11.OUT

Date: 11-15-2004
Time: 15:34:49

Input File: c:\storm\sws1

Avalon Park 3rd Addition
SWS Line #1

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(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
191	190	.00	.00	.00	.0	15.00	3.83	1.33	15.00	3.83	1.33	1.33	15"	1.08	160.00	2.46	17.46
190	180	.00	.00	.00	.0	15.00	3.83	1.02	17.46	3.57	.95	2.28	15"	1.86	160.00	1.44	18.90
180	170	.00	.00	.00	.0	15.00	3.83	1.56	18.90	3.43	1.40	3.68	15"	3.00	225.00	1.25	20.15
170	160	.00	.00	.00	.0	.00	.00	.00	20.15	3.32	.00	3.68	15"	3.00	115.00	.64	20.79
160	150	.00	.00	.00	.0	.00	.00	.00	20.79	3.27	.00	3.68	15"	3.00	100.00	.56	21.34
151	150	.00	.00	.00	.0	15.00	3.83	2.24	15.00	3.83	2.24	2.24	15"	1.83	145.00	1.32	16.32
150	140	.00	.00	.00	.0	.00	.00	.00	21.34	3.22	.00	5.64	15"	4.60	100.00	.36	21.71
143	142	.00	.00	.00	.0	15.00	3.83	2.07	15.00	3.83	2.07	2.07	15"	1.69	160.00	1.58	16.58
142	141	.00	.00	.00	.0	15.00	3.83	1.35	16.58	3.66	1.29	3.36	15"	2.74	180.00	1.10	17.68
141	140	.00	.00	.00	.0	15.00	3.83	1.63	17.68	3.54	1.51	4.87	15"	3.97	135.00	.57	18.24
140	130	.00	.00	.00	.0	.00	.00	.00	21.71	3.20	.00	10.10	24"	3.21	105.00	.54	22.25
130	120	.00	.00	.00	.0	.00	.00	.00	22.25	3.15	.00	10.10	24"	3.21	145.00	.75	23.00
121	120	.00	.00	.00	.0	15.00	3.83	2.22	15.00	3.83	2.22	2.22	15"	1.81	155.00	1.43	16.43
120	110	.00	.00	.00	.0	.00	.00	.00	23.00	3.10	.00	11.97	24"	3.81	35.00	.15	23.16
110	100	.00	.00	.00	.0	.00	.00	.00	23.16	3.09	.00	11.97	24"	3.81	100.00	.44	23.59

Date: 11-15-2004
Time: 15:34:49

Avalon Park 3rd Addition
SWS Line #1

Input File: c:\storm\sws1

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)
191	.00042	.0678	.0000	.0000	.0000	.0000	.0000	.0678	148.3987	150.3000	1.90
190	.00125	.1993	.0000	.0035	.0000	.0000	.0750	.2779	148.3309	149.9000	1.57
180	.00324	.7294	.0000	.0086	.0000	.0000	.1833	.9212	148.0530	149.5000	1.45
151	.00120	.1744	.0000	.0000	.0000	.0000	.0000	.1744	146.5020	153.4700	6.97
143	.00103	.1643	.0000	.0000	.0000	.0000	.0000	.1643	147.0629	151.3300	4.27
142	.00270	.4867	.0000	.0072	.0000	.0000	.1539	.6478	146.8986	150.9300	4.03
141	.00568	.7667	.0000	.0128	.0000	.0000	.2775	1.0570	146.2508	149.7000	3.45
121	.00118	.1831	.0000	.0000	.0000	.0000	.0000	.1831	144.7722	153.5200	8.75
170	.00324	.3728	.0000	.0000	.0070	.0304	.0162	.4264	147.1317	150.6000	3.47
160	.00324	.3242	.0000	.0000	.0070	.0304	.0162	.3777	146.7054	150.7000	3.99
150	.00762	.7621	.0000	.0188	.0000	.0000	.3529	1.1338	146.3276	150.4000	4.07
140	.00199	.2091	.0000	.0335	.0000	.1639	-.1579	.2486	145.1938	150.4000	5.21
130	.00199	.2888	.0000	.0000	.0080	.0493	.0100	.3561	144.9452	150.3000	5.35
120	.00280	.0980	.0000	.0065	.0000	.0000	.1492	.2537	144.5891	149.7000	5.11

110	.00280	.2800	.0000	.0000	.0113	.0302	.0140	.3354	144.3354	147.6000	3.26
100	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

****

```
100 j,  144.0000  200    2    5    4
110 t,Avalon Park 3rd Addition
120 t,SWS Line #2
130 i,  240      0.00      0.00      0.00      0.00     10.00     15.00   144.00
140 i,  230      0.00      0.00      0.00      0.00      2.52     15.00   147.60
150 i,  220      0.00      0.00      0.00      0.00      2.75     15.00   147.60
160 m,  210   148.30
170 m,  200   144.00
180 p,  240  230     90.00    36 0.013  45.00   0.00
190 p,  230  220     35.00    36 0.013   0.00   0.00
200 p,  220  210     25.00    36 0.013   0.00   0.00
210 p,  210  200     80.00    36 0.013  60.00   0.00
220 e
```

STORM11.OUT

Date: 11-15-2004
Time: 15:41:14

Input File: c:\storm\sws2

Avalon Park 3rd Addition
SWS Line #2

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)
240	230	.00	.00	.00	.0	15.00	3.83	10.00	15.00	3.83	10.00	10.00	36"	1.41	90.00	1.06	16.06
230	220	.00	.00	.00	.0	15.00	3.83	2.52	16.06	3.71	2.44	12.44	36"	1.76	35.00	.33	16.39
220	210	.00	.00	.00	.0	15.00	3.83	2.75	16.39	3.67	2.64	15.08	36"	2.13	25.00	.20	16.59
210	200	.00	.00	.00	.0	.00	.00	.00	16.59	3.65	.00	15.08	36"	2.13	80.00	.62	17.21

Date: 11-15-2004
Time: 15:41:14

Input File: c:\storm\sws2

Avalon Park 3rd Addition
SWS Line #2

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)
240	.00022	.0202	.0000	.0000	.0000	.0000	.0000	.0202	144.1859	144.0000	-.19
230	.00035	.0122	.0000	.0017	.0000	.0068	.0356	.0562	144.1656	147.6000	3.43
220	.00051	.0128	.0000	.0023	.0000	.0000	.0474	.0624	144.1094	147.6000	3.49
210	.00051	.0409	.0000	.0000	.0035	.0000	.0026	.0470	144.0470	148.3000	4.25
200	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  300    2    2    1
110 t,Avalon Park 3rd Addition
120 t,SWS Line #3
130 i,  310      0.00     0.00      0.00      0.00      1.31     15.00   153.35
140 m,  300   144.00
150 p,  310  300   185.00   15 0.013   0.00   0.00
160 e
```

STORM11.OUT

Date: 11-15-2004
Time: 15:46:50

Input File: c:\storm\sws3

Avalon Park 3rd Addition
SWS Line #3

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(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
310	300	.00	.00	.00	.0	15.00	3.83	1.31	15.00	3.83	1.31	1.31	15"	1.07	185.00	2.89	17.89

STORM12.OUT

Date: 11-15-2004
Time: 15:46:50

Input File: c:\storm\sws3

Avalon Park 3rd Addition
SWS Line #3

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)
310	.00041	.0761	.0000	.0000	.0000	.0000	.0000	.0761	144.0761	153.3500	9.27
300	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  400    2    6    5
110 t,Avalon Park 3rd Addition
120 t,SWS Line #4
130 i,  450      0.00      0.00      0.00      0.00      1.68     15.00    151.73
140 i,  440      0.00      0.00      0.00      0.00      1.24     15.00    151.33
150 i,  430      0.00      0.00      0.00      0.00      1.31     15.00    150.88
160 i,  420      0.00      0.00      0.00      0.00      1.51     15.00    150.65
170 i,  410      0.00      0.00      0.00      0.00      1.07     15.00    150.25
180 m,  400   144.00
190 p,  450  440   160.00   15 0.013   0.00   0.00
200 p,  440  430   165.00   15 0.013   0.00   0.00
210 p,  430  420   130.00   15 0.013  45.00   0.00
220 p,  420  410   160.00   15 0.013   0.00   0.00
230 p,  410  400   260.00   15 0.013   0.00   0.00
240 e
```

STORM11.OUT

Date: 11-15-2004
Time: 15:52:51

Input File: c:\storm\sws4

Avalon Park 3rd Addition
SWS Line #4

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)
450	440	.00	.00	.00	.0	15.00	3.83	1.68	15.00	3.83	1.68	1.68	15"	1.37	160.00	1.95	16.95
440	430	.00	.00	.00	.0	15.00	3.83	1.24	16.95	3.62	1.17	2.85	15"	2.32	165.00	1.18	18.13
430	420	.00	.00	.00	.0	15.00	3.83	1.31	18.13	3.50	1.20	4.05	15"	3.30	130.00	.66	18.79
420	410	.00	.00	.00	.0	15.00	3.83	1.51	18.79	3.44	1.36	5.41	15"	4.41	160.00	.61	19.39
410	400	.00	.00	.00	.0	15.00	3.83	1.07	19.39	3.39	.95	6.35	15"	5.18	260.00	.84	20.23

Date: 11-15-2004
Time: 15:52:51

Input File: c:\storm\sws4

Avalon Park 3rd Addition
SWS Line #4

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)
450	.00068	.1082	.0000	.0000	.0000	.0000	.0000	.1082	149.5175	151.7300	2.21
440	.00195	.3215	.0000	.0055	.0000	.0000	.1163	.4433	149.4093	151.3300	1.92
430	.00393	.5109	.0000	.0085	.0000	.0000	.1855	.7050	148.9661	150.8800	1.91
420	.00700	1.1208	.0000	.0132	.0000	.0368	.2925	1.4633	148.2611	150.6500	2.39
410	.00967	2.5147	.0000	.0115	.0000	.0000	.2717	2.7978	146.7978	150.2500	3.45
400	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  500    2    2    1
110 t,Avalon Park 3rd Addition
120 t,SWS Line #5
130 i,  510     0.00     0.00     0.00     0.00     2.61    15.00   153.25
140 m,  500   144.00
150 p,  510  500   220.00   15 0.013   0.00   0.00
160 e
```

Date: 11-15-2004
Time: 15:57:22

Input File: c:\storm\sws5

Avalon Park 3rd Addition
SWS Line #5

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(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
510	500	.00	.00	.00	.0	15.00	3.83	2.61	15.00	3.83	2.61	2.61	15"	2.13	220.00	1.72	16.72

STORM12.OUT

Date: 11-15-2004
Time: 15:57:22

Input File: c:\storm\sws5

Avalon Park 3rd Addition
SWS Line #5

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)
510	.00163	.3591	.0000	.0000	.0000	.0000	.0000	.3591	144.3591	153.2500	8.89
500	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  600    2    4    3
110 t,Avalon Park 3rd Addition
120 t,SWS Line #6
130 i,  630     0.00     0.00     0.00     0.00     1.84    15.00   150.45
140 i,  620     0.00     0.00     0.00     0.00     1.17    15.00   150.05
150 i,  610     0.00     0.00     0.00     0.00     1.14    15.00   149.80
160 m,  600   144.00
170 p,  630  620   160.00   15 0.013   0.00   0.00
180 p,  620  610   135.00   15 0.013  45.00   0.00
190 p,  610  600   270.00   15 0.013   0.00   0.00
200 e
```

Date: 11-15-2004
Time: 16:02:38

Input File: c:\storm\sws6

Avalon Park 3rd Addition
SWS Line #6

Storm Frequency = 2-Year

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

Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
Tributary Area									Hydrology Summation				Conduit Data				
630	620	.00	.00	.00	.0	15.00	3.83	1.84	15.00	3.83	1.84	1.84	15"	1.50	160.00	1.78	16.78
620	610	.00	.00	.00	.0	15.00	3.83	1.17	16.78	3.63	1.11	2.95	15"	2.40	135.00	.94	17.71
610	600	.00	.00	.00	.0	15.00	3.83	1.14	17.71	3.54	1.05	4.01	15"	3.26	270.00	1.38	19.09

STORM12.OUT

Date: 11-15-2004
Time: 16:02:38

Input File: c:\storm\sws6

Avalon Park 3rd Addition
SWS Line #6

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)
630	.00081	.1298	.0000	.0000	.0000	.0000	.0000	.1298	145.7656	150.4500	4.68
620	.00209	.2817	.0000	.0055	.0000	.0000	.1172	.4044	145.6358	150.0500	4.41
610	.00384	1.0380	.0000	.0076	.0000	.0195	.1664	1.2315	145.2315	149.8000	4.57
600	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  700    2    2    1
110 t,Avalon Park 3rd Addition
120 t,SWS Line #7
130 i,  710     0.00     0.00     0.00     0.00     1.40    15.00   153.25
140 m,  700   144.00
150 p,  710  700   210.00   15 0.013   0.00   0.00
160 e
```

Date: 11-15-2004
Time: 16:06:03

Input File: c:\storm\sws7

Avalon Park 3rd Addition
SWS Line #7

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(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
710	700	.00	.00	.00	.0	15.00	3.83	1.40	15.00	3.83	1.40	1.40	15"	1.14	210.00	3.07	18.07

STORM12.OUT

Date: 11-15-2004
Time: 16:06:03

Input File: c:\storm\sws7

Avalon Park 3rd Addition
SWS Line #7

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)
710	.00047	.0986	.0000	.0000	.0000	.0000	.0000	.0986	144.0986	153.2500	9.15
700	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

```
100 j,  144.0000  800    2    4    3
110 t,Avalon Park 3rd Addition
120 t,SWS Line #8
130 i,  830      0.00      0.00      0.00      0.00      3.20     15.00   150.38
140 i,  820      0.00      0.00      0.00      0.00      3.34     15.00   150.38
150 m,  810   147.60
160 m,  800   144.00
170 p,  830  820     35.00    15 0.013   0.00   0.00
180 p,  820  810    180.00    18 0.013  45.00   0.00
190 p,  810  800     75.00    18 0.013   0.00   0.00
200 e
```

STORM11.OUT

Date: 11-15-2004
Time: 16:11:20

Input File: c:\storm\sws8

Avalon Park 3rd Addition
SWS Line #8

Storm Frequency = 2-Year

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

Node	to Node	C	Area (Ac)	Slope (%)	Length (Ft)	TC(O) (Min)	I(O) (In/Hr)	Q(O) (CFS)	TC (Min)	I (In/Hr)	Q (CFS)	Sum Q (CFS)	Size	Velocity (Ft/Sec)	Length (Ft)	TT (Min)	TT+TC (Min)
		Tributary Area							Hydrology Summation				Conduit Data				
830	820	.00	.00	.00	.0	15.00	3.83	3.20	15.00	3.83	3.20	3.20	15"	2.61	35.00	.22	15.22
820	810	.00	.00	.00	.0	15.00	3.83	3.34	15.22	3.80	3.32	6.52	18"	3.69	180.00	.81	16.04
810	800	.00	.00	.00	.0	.00	.00	.00	16.04	3.71	.00	6.52	18"	3.69	75.00	.34	16.38

STORM12.OUT

Date: 11-15-2004
Time: 16:11:20

Input File: c:\storm\sws8

Avalon Park 3rd Addition
SWS Line #8

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)
830	.00245	.0859	.0000	.0000	.0000	.0000	.0000	.0859	145.4959	150.3800	4.88
820	.00385	.6930	.0000	.0106	.0000	.0000	.3419	1.0455	145.4100	150.3800	4.97
810	.00385	.2887	.0000	.0000	.0106	.0460	.0193	.3646	144.3645	147.6000	3.24
800	.00000	.0000	.0000	.0000	.0000	.0000	.0000	.0000	144.0000	144.0000	.00

County	Expected 24-hour Storm Rainfall in Inches: Storm Frequency in Years 100	50	25	10	5	2	Normal Annual Precipitation Inches
Pawnee	6.6	6.0	5.2	4.5	3.7	2.8	23.3
Phillips	6.0	5.5	4.8	4.1	3.4	2.5	23.6
Pottawatomie	7.5	6.6	5.9	5.1	4.3	3.4	33.6
Pratt	7.2	6.4	5.6	4.8	4.1	3.0	24.6
Rawlins	5.5	5.0	4.3	3.6	3.1	2.3	21.0
Reno	7.4	6.6	5.8	5.0	4.2	3.2	27.7
Republic	6.8	6.0	5.4	4.6	3.9	2.9	28.6
Rice	7.3	6.4	5.6	4.8	4.1	3.0	26.6
Riley	7.4	6.5	5.8	5.1	4.3	3.3	33.5
Rooks	6.1	5.7	4.9	4.1	3.4	2.5	23.9
Rush	6.5	5.9	5.0	4.3	3.6	2.7	23.3
Russell	6.7	5.9	5.2	4.4	3.7	2.8	26.8
Saline	7.3	6.4	5.7	4.9	4.1	3.1	28.4
Scott	5.7	5.3	4.5	3.8	3.2	2.4	20.2
Sedgwick	7.8	7.0	6.1	5.3	4.5	3.5	30.6
Seward	6.0	5.7	4.8	4.2	3.5	2.6	19.8
Shawnee	7.8	6.8	6.1	5.3	4.5	3.5	34.7
Sheridan	5.7	5.3	4.5	3.8	3.2	2.4	21.3
Sherman	5.3	4.8	4.2	3.5	3.0	2.2	16.7
Smith	6.3	5.7	5.0	4.2	3.5	2.6	24.4
Stafford	7.1	6.2	5.5	4.7	4.0	2.9	25.1
Stanton	5.6	5.2	4.5	3.8	3.2	2.4	15.8
Stevens	5.9	5.5	4.7	4.1	3.4	2.5	19.7
Sumner	8.0	7.1	6.2	5.4	4.6	3.6	34.0

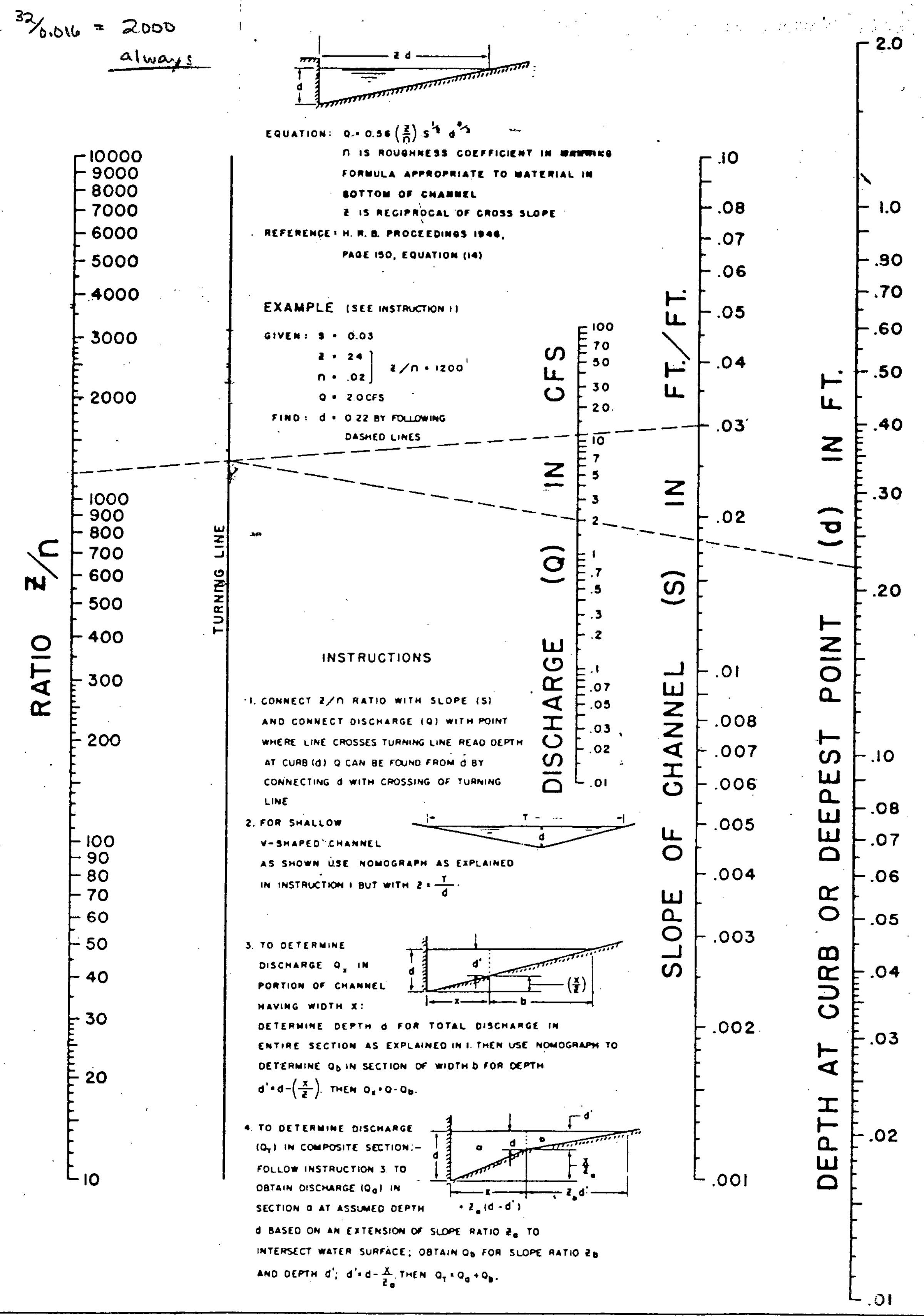
x-slope = $3/8''/1' = 0.03125\%$

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

$n = 0.016$

$z/n = 32/0.016 = 2000$

always



BUREAU OF PUBLIC ROADS
REV. JAN. 1968

NOMOGRAPH FOR FLOW
IN TRIANGULAR CHANNELS

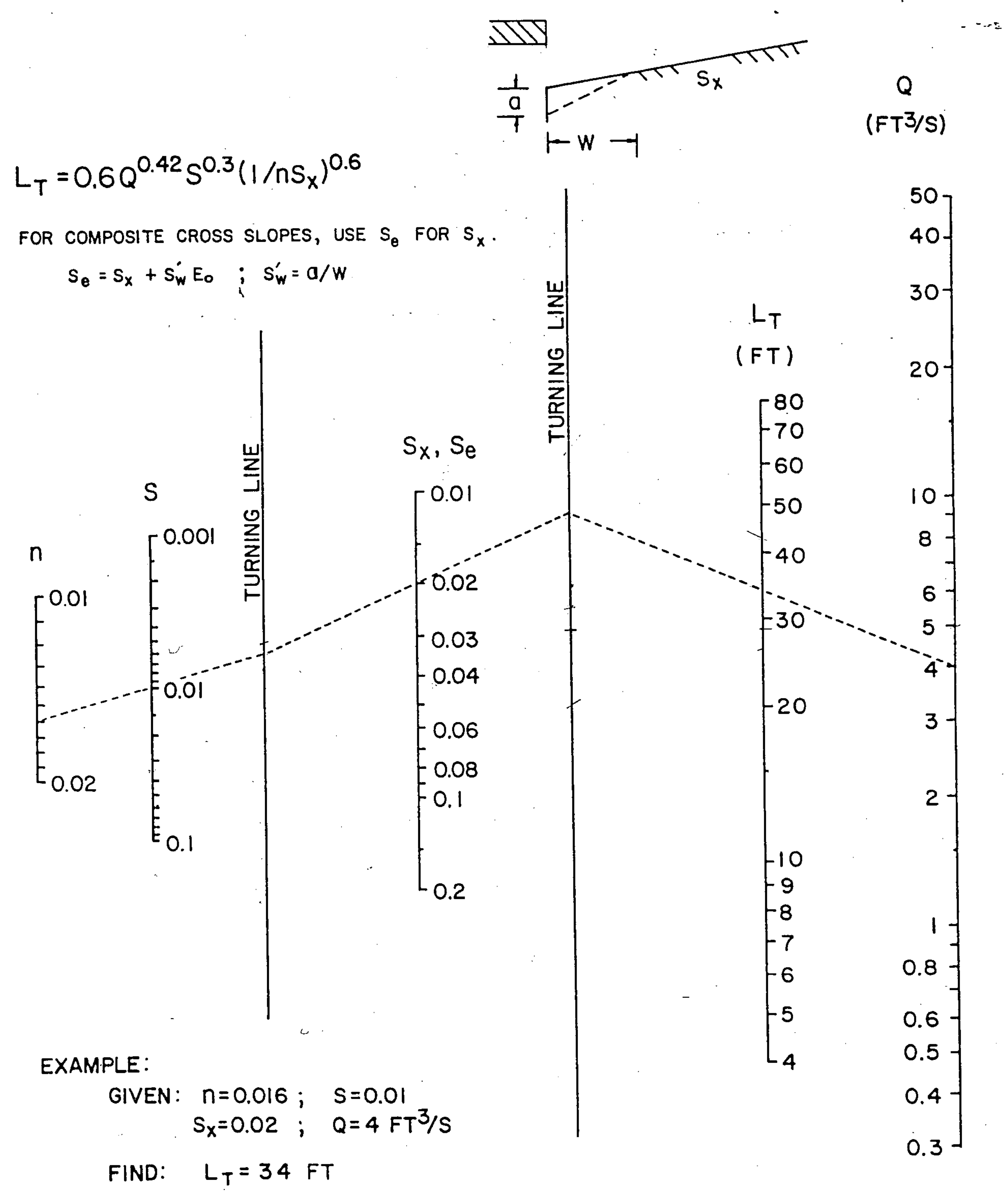


CHART 9. Curb–opening and slotted drain inlet length for total interception.

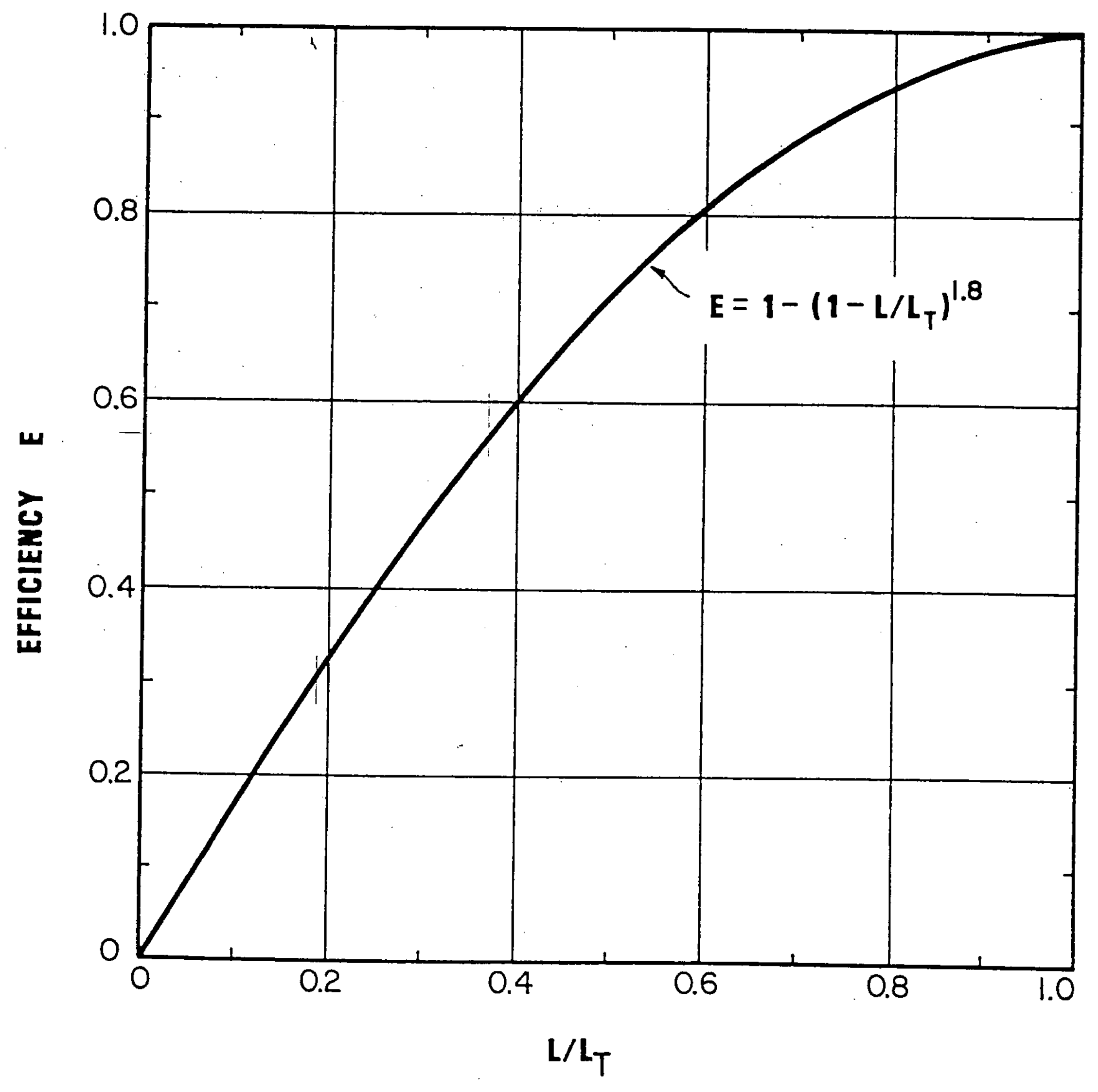


CHART 10. Curb–opening and slotted drain inlet interception efficiency.

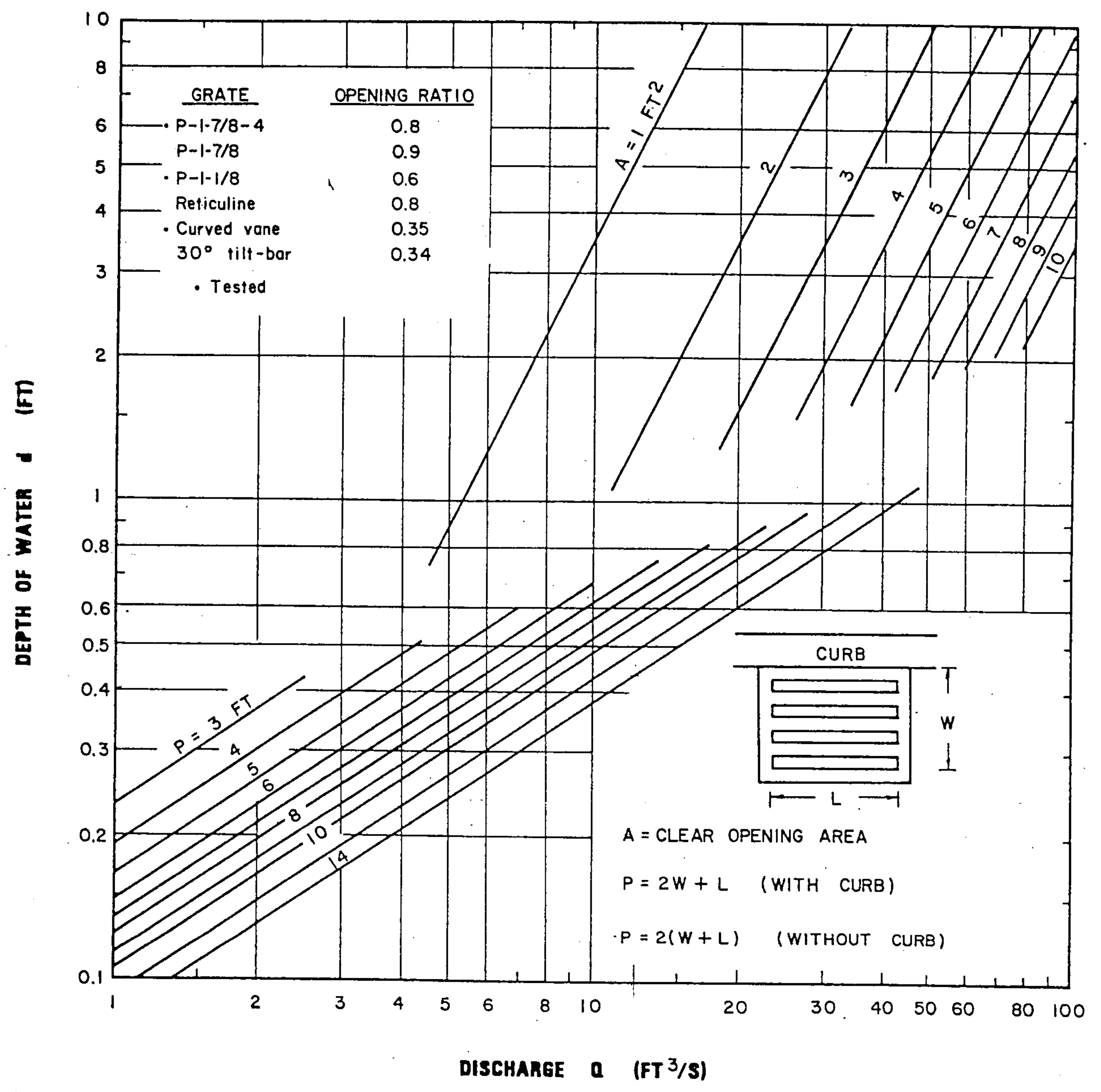


CHART 11. Grate inlet capacity in sump conditions.

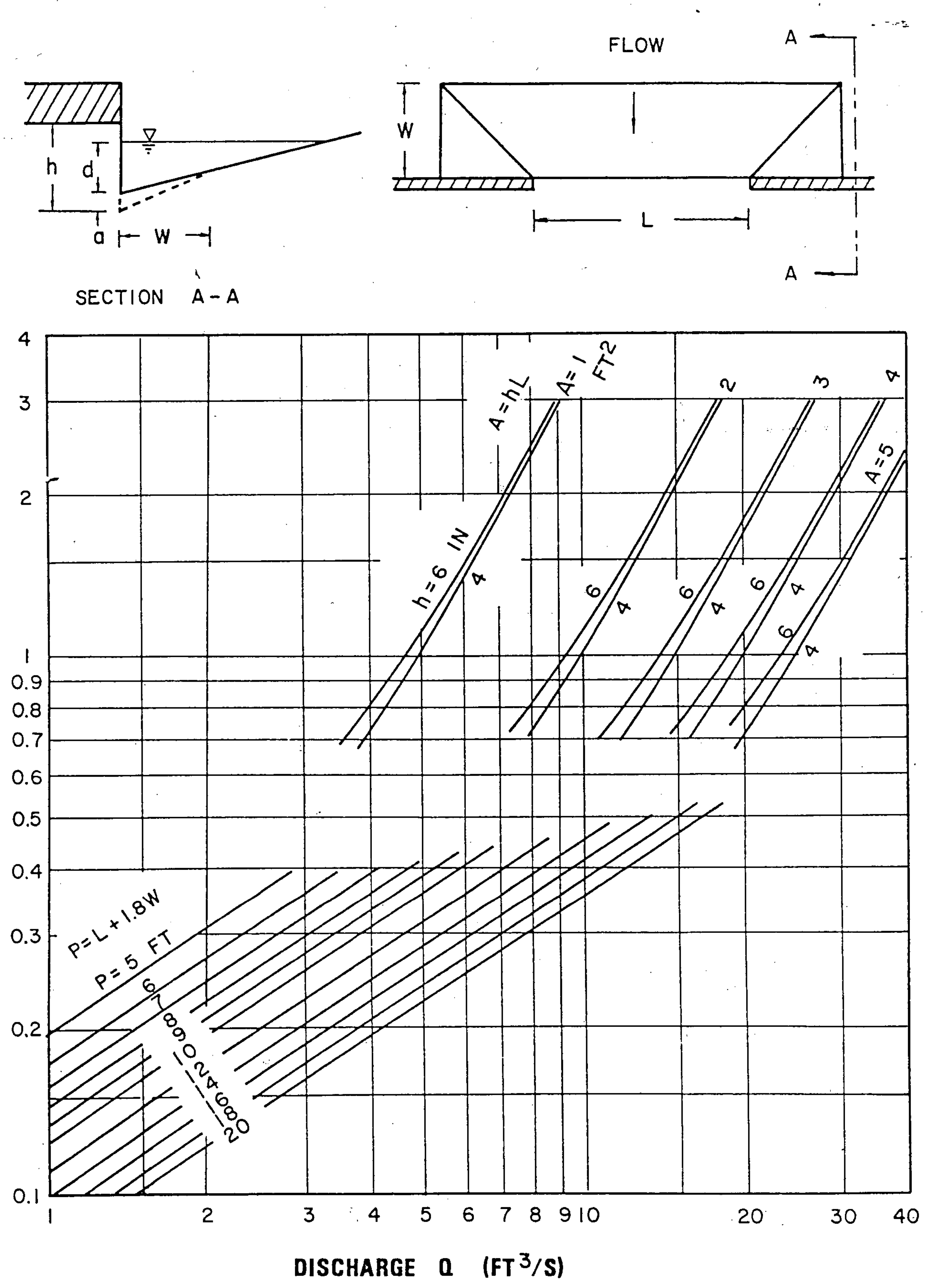


CHART 12. Depressed curb–opening inlet capacity in sump locations.

April 15, 1986

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

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

(t_c) DURATION IN MINUTES	RETURN PERIODS OF 1-YR	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	i = 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

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	3.67
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

ATTACHMENT B

DRAINAGE CRITERIA MANUAL

INCREMENTAL INFILTRATION VALUES IN INCHES

Time Minutes**	SCS Hydrologic Soil Group A	B	C	D
5	.33	.26	.19	.12
10	.25	.17	.09	.04
15	.18	.11	.05	.02
20	.13	.07	.03	.02
25	.10	.05	.03	.02
30	.08	.05	.03	.02
35	.08	.05	.03	.02
40	.08	.05	.03	.02
45	.08	.05	.03	.02
50	.08	.05	.03	.02
55	.08	.05	.03	.02
60	.08	.05	.03	.02
65	.08	.05	.03	.02
70	.08	.05	.03	.02
75	.08	.05	.03	.02
80	.08	.05	.03	.02
85	.08	.05	.03	.02
90	.08	.05	.03	.02
95	.08	.05	.03	.02
100	.08	.05	.03	.02
105	.08	.05	.03	.02
110	.08	.05	.03	.02
115	.08	.05	.03	.02
120	.08	.05	.03	.02

**Time at end of the time increment

NOTE: Values for 125 minutes and additional 5 minute increments shall be the same as those shown for 120 minutes.

ATTACHMENT C

DRAINAGE CITERIA MANUAL

DEPRESSION STORAGE LOSSES

Surface Type	Total Loss (Inches)
Impervious:	
Paved Areas	0.1
Flat Roofs	0.1
Sloped Roofs	0.05
Pervious:	
Lawns and Grass	0.3
Wooded Areas and Open Fields	0.4

(3 pages)

ATTACHMENT D

DRAINAGE CRITERIA

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
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 rface 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

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

ATTACHMENT F

DETERMINATION OF DIMENSIONLESS
WATERSHED CONVEYANCE FACTOR (Ø)

$$\emptyset = \emptyset_1 + \emptyset_2$$

$\emptyset_1$	Classification
0.6	Extensive channel improvement and storm sewer system, closed conduit channel system
0.7	Moderate channel improvement and storm sewer system.
0.8	Some channel improvement and storm sewers, mainly cleaning and enlargement of existing channel.
0.9	Little channel improvement and storm sewers.
1.0	Natural channel conditions.

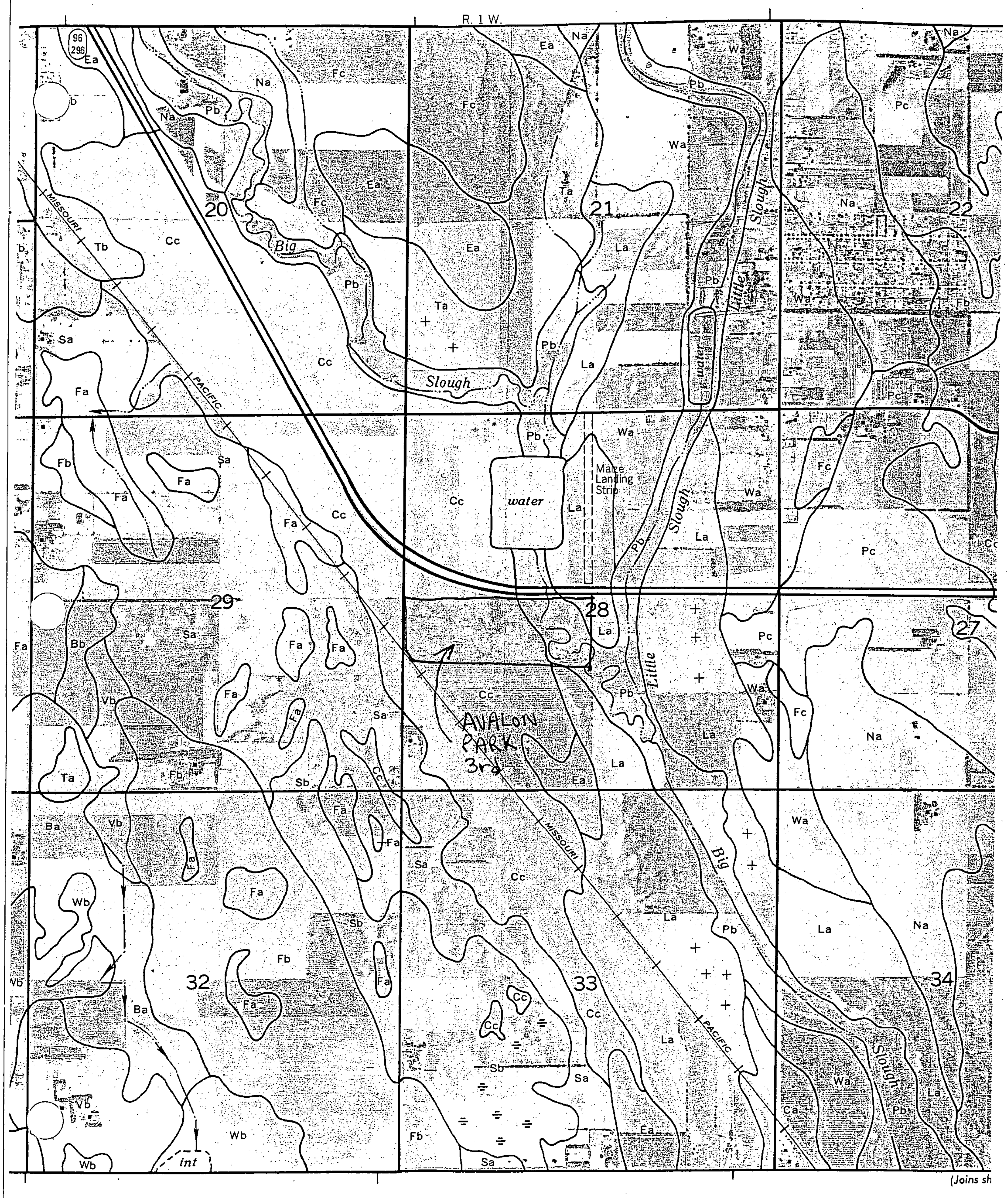
$\emptyset_2$	Classification
0.0	No channel vegetation.
0.1	Light channel vegetation.
0.2	Moderate channel vegetation.
0.3	Heavy channel vegetation.

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

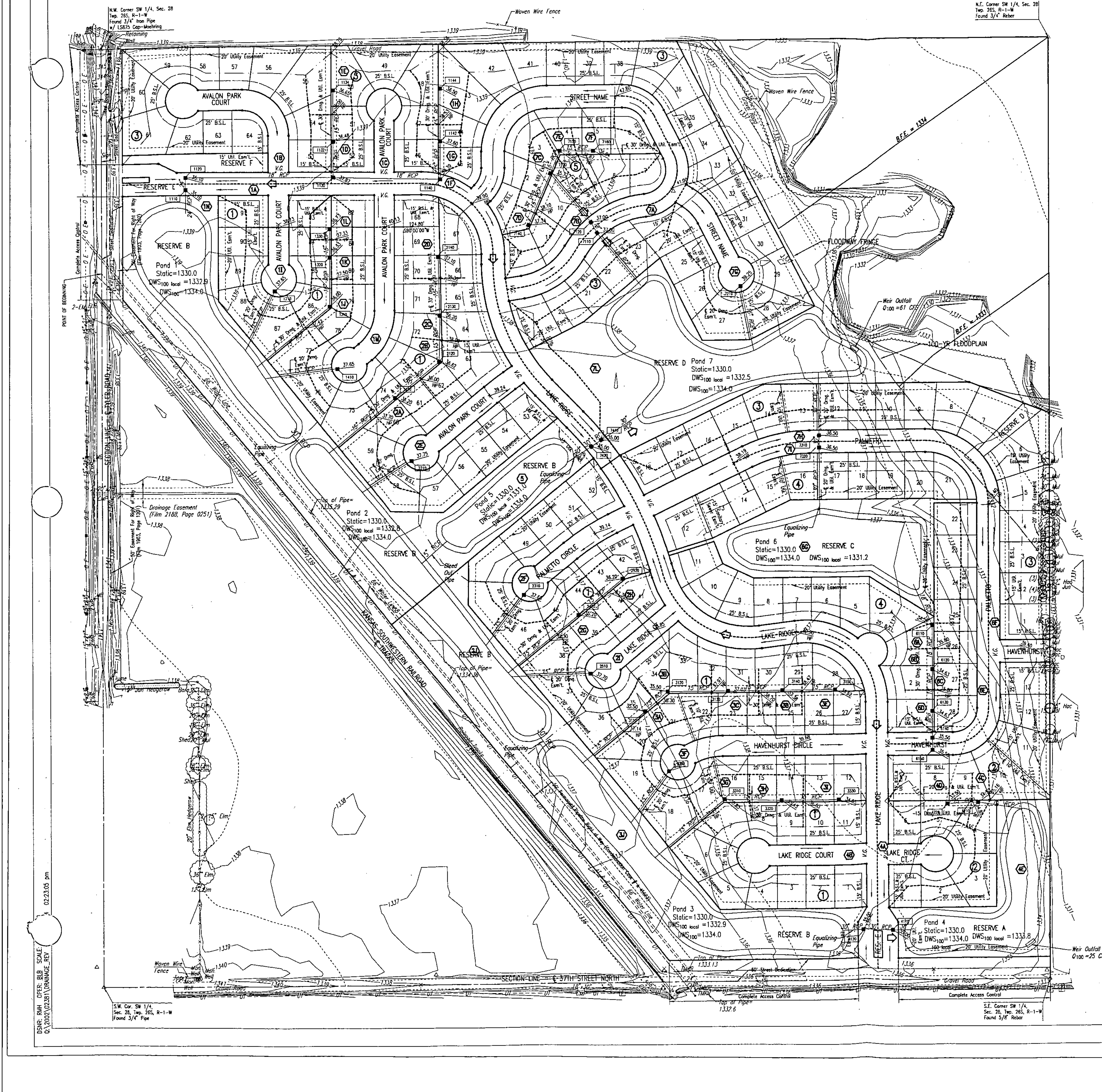
SEDGWICK COUNTY, KANSAS — SHEET NUMBER 25



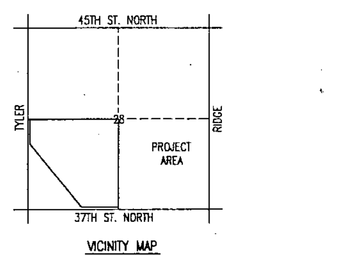
DRAINAGE PLAN FOR

AVALON PARK

AN ADDITION TO WICHITA
SEDGWICK COUNTY, KANSAS



SCALE: 1" = 100'
ADD 1300 TO SPOT ELEVATIONS FOR N.G.V.D. ELEVATION
• = 3/4" IRON PIPE W/PEC CAP UNLESS OTHERWISE NOTED



VICINITY MAP

LEGEND

- SOIL GROUP BOUNDARY
- BASIN IDENTIFIER
- MINOR BASIN BOUNDARY
- MAJOR BASIN BOUNDARY
- MAJOR STORM WATER OVERFLOW (Q100)
- MINOR STORM WATER FLOW (Q2)
- NODE IDENTIFIER
- STORM SEWER AND INLET
- PRIVATE STORM SEWER AND INLET (BY OWNER)
- STORM SEWER AND MANHOLE
- SPOT ELEVATION
- HIGH POINT ELEVATION
- MATCH EXISTING ELEVATION

BM #50 – "T" Post, 1/2 mile E. of Tyler Rd., 14' N. of N. edge 37th St. N.
Elev.=1333.15 N.G.V.D.
Elev.=145.75 CITY DATUM

BM #51 – "T" Post, 3/8 mile E. of Tyler Rd., 14' N. of N. edge 37th St. N., E. of R.R. tracks 186'±
Elev.=1335.55 N.G.V.D.
Elev.=148.15 CITY DATUM

BM #52 – "T" Post, 1/4 mile E. of Tyler Rd., 12' N. of N. edge 37th St. N., W. of R.R. tracks
Elev.=1336.68 N.G.V.D.
Elev.=149.28 CITY DATUM

BM #53 – Found bridge spike in SW face Power Pole at SW corner 37th St. N. and Tyler Rd.
Elev.=1343.38 N.G.V.D.
Elev.=155.98 CITY DATUM

BM #54 – R.R. Spike in E. face of 2nd Power Pole N. of 37th St. N., W. side Tyler Rd. at House #3803
Elev.=1342.89 N.G.V.D.
Elev.=155.49 CITY DATUM

BM #55 – R.R. Spike in E. face Power Pole W. side Tyler Rd. at House #3915
Elev.=1340.28 N.G.V.D.
Elev.=152.88 CITY DATUM

BM #56 – R.R. Spike in E. face Power Pole W. side Tyler Rd. 2nd Pole S. of R.R. Tracks
Elev.=1339.98 N.G.V.D.
Elev.=152.58 CITY DATUM

BM #57 – Chiseled "o" on S. end RCP at entrance to "the edge" Paintball Adventures, E. side Tyler Rd. between R.R. Tracks and K96 Highway.
Elev.=1340.74 N.G.V.D.
Elev.=153.34 CITY DATUM

BM #58 – Chiseled "o" on S. end concrete headwall, E. end RCB under Tyler Rd. at 1/2 mile line, S. of K96 Highway.
Elev.=1342.03 N.G.V.D.
Elev.=154.63 CITY DATUM

BASIN 1 SHALL BE GRADED TO DRAIN TO PROPOSED POND #1 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 2 SHALL BE GRADED TO DRAIN TO PROPOSED POND #2 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 3 SHALL BE GRADED TO DRAIN TO PROPOSED POND #3 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 4 SHALL BE GRADED TO DRAIN TO PROPOSED POND #4 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 5 SHALL BE GRADED TO DRAIN TO PROPOSED POND #5 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 6 SHALL BE GRADED TO DRAIN TO PROPOSED POND #6 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

BASIN 7 SHALL BE GRADED TO DRAIN TO PROPOSED POND #7 VIA APPROVED DRAINAGE CONVEYANCE METHODS.

MINIMUM OPENINGS	ELEVATION (N.G.V.D.)	CITY DATUM
BLOCK 1		
LOTS 1–6, 18–19	1336.0	148.6
LOTS 36–37, 46–58	1337.0	149.6
LOTS 59, 75–77, 87–91	1338.0	150.6
LOTS 7–17, 20–22, 33–35	1338.2	150.8
LOTS 38–45	1338.3	150.9
LOTS 78–86	1338.5	151.1
LOTS 23, 31–32, 62–65, 71–72	1339.0	151.6
LOTS 66–70	1339.3	151.9
LOTS 24–30	1339.7	152.3
BLOCK 2		
LOTS 1–4, 10–13	1336.0	148.6
LOTS 5–9	1336.2	148.8
BLOCK 3		
LOTS 1–6	1336.0	148.6
LOTS 7–18	1337.0	149.6
LOTS 19–36, 62–64	1338.0	150.6
LOTS 50–55	1339.2	151.8
LOTS 43–49	1340.0	152.6
LOTS 37–42	1340.5	153.1
LOTS 56–61	1341.0	153.6
BLOCK 4		
LOTS 4–9, 22–25	1336.0	148.6
LOTS 1–3, 26–28	1336.8	149.4
LOTS 10–21	1337.0	149.6
BLOCK 5		
LOTS 1,11,12	1339.1	151.7
LOTS 2,3,9,10	1338.3	150.9
LOTS 4–8	1338.9	151.5

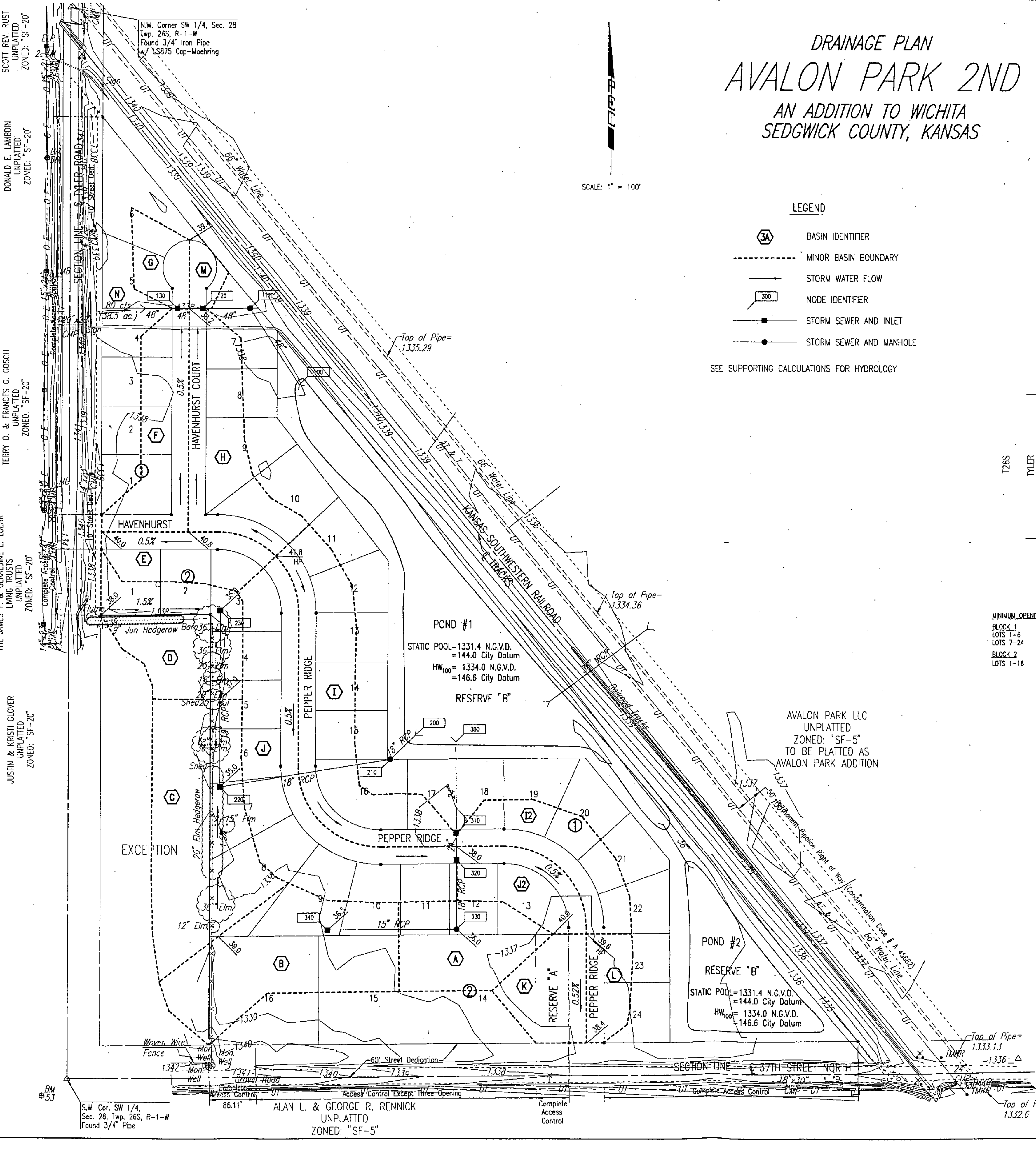
THIS REVISED DRAINAGE PLAN, REVISED ON 02/14/03, REPLACES ALL PAST DRAINAGE PLANS FOR AVALON PARK.

DRAINAGE PLAN

AVALON PARK 2ND

AN ADDITION TO WICHITA
SEDGWICK COUNTY, KANSAS

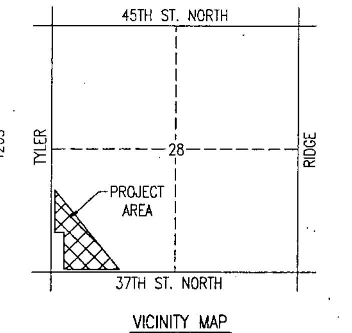
SCALE: 1" = 100'



LEGEND

- BASIN IDENTIFIER
- MINOR BASIN BOUNDARY
- STORM WATER FLOW
- NODE IDENTIFIER
- STORM SEWER AND INLET
- STORM SEWER AND MANHOLE

SEE SUPPORTING CALCULATIONS FOR HYDROLOGY



VICINITY MAP

MINIMUM OPENINGS	ELEVATION (N.G.V.D.)	CITY DATUM
BLOCK 1		
LOTS 1-6	1339.0	151.6
LOTS 7-24	1337.9	150.5
BLOCK 2		
LOTS 1-16	1338.5	151.1

REVISED 7/12/04

Professional Engineering Consultants, P.A.
303 S. TOPEKA - WICHITA, KANSAS 67202
316-262-2691 - FAX 316-262-3003