

**DRAINAGE
CALCULATIONS**

FOR

**GRAVE GOLDEN TON ADDITION
WICHITA, KANSAS**

MARCH 1992

**THE
WICHITA COUNTY**

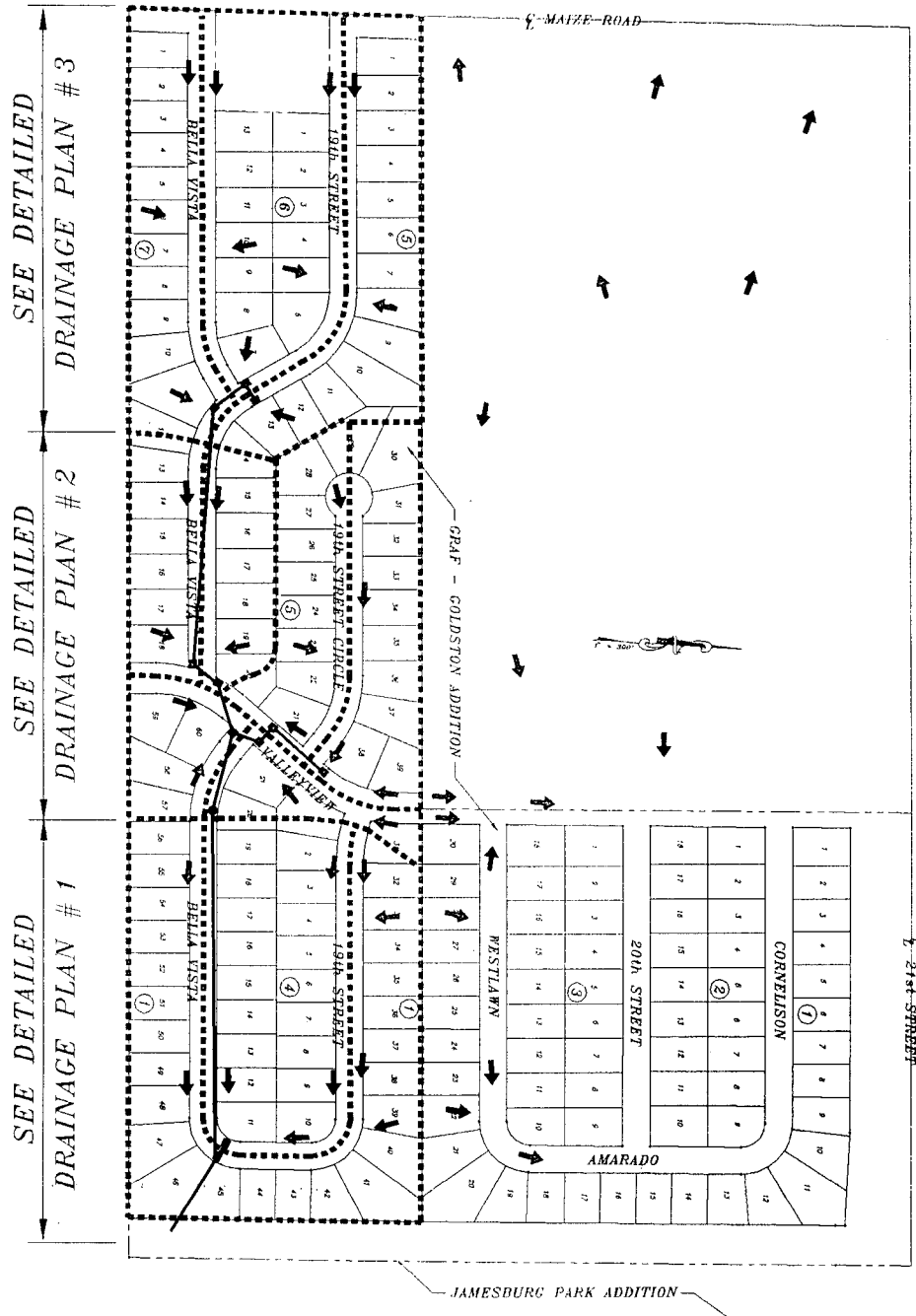
ENGINEERING & SURVEYING

WICHITA, KANSAS

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254 N. Cleveland - P.O. Box 244

Wichita, Mo. 67201 - (316) 268-6620



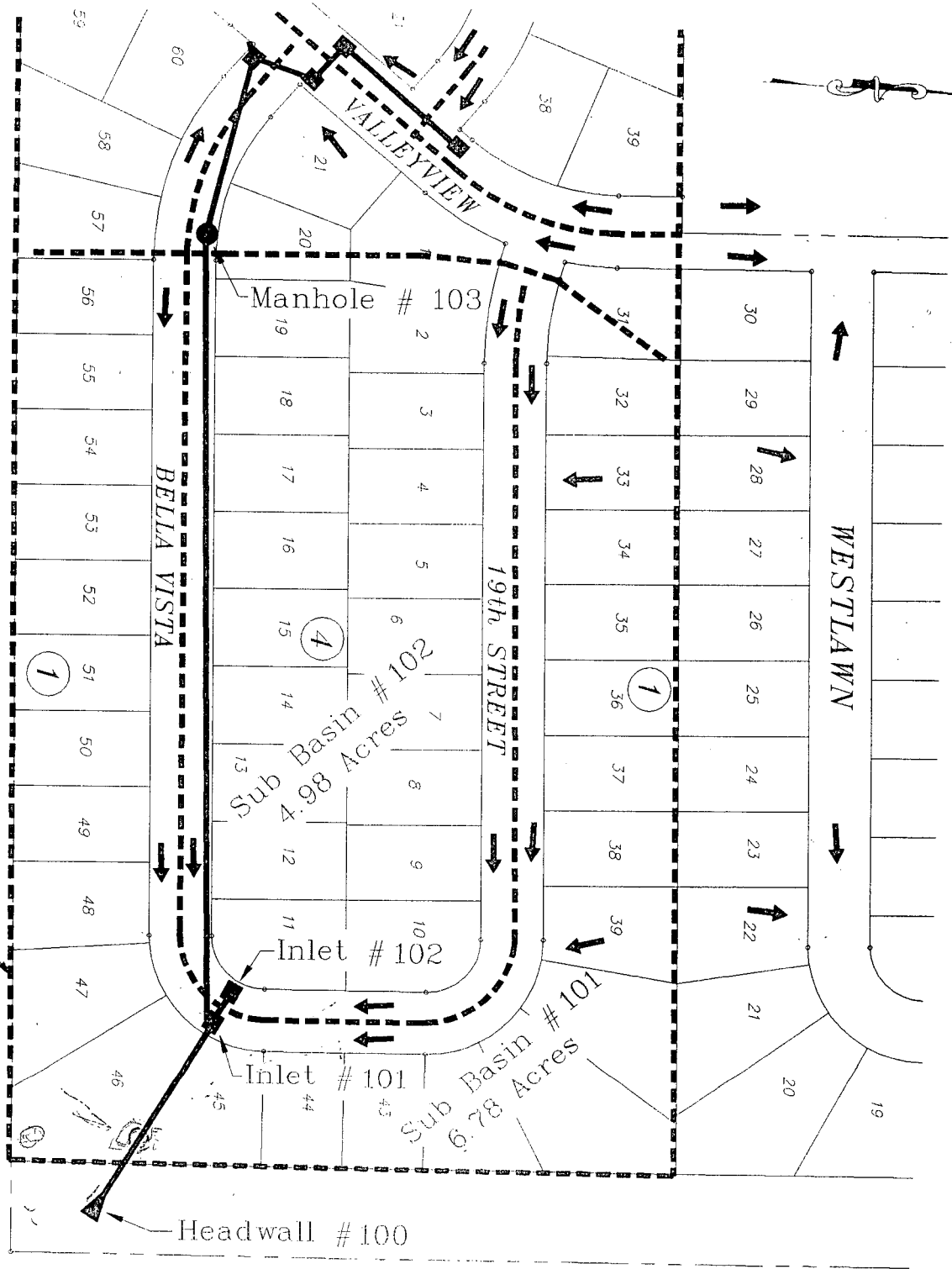
OVERALL DRAINAGE PLAN
 1"=400'

GRAF-GOLDSTON ADDITION
 WICHITA, KANSAS



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 DATE: March 13, 1992

STONEGATE ESTATES ADDITION



DETAILED DRAINAGE AREA #1

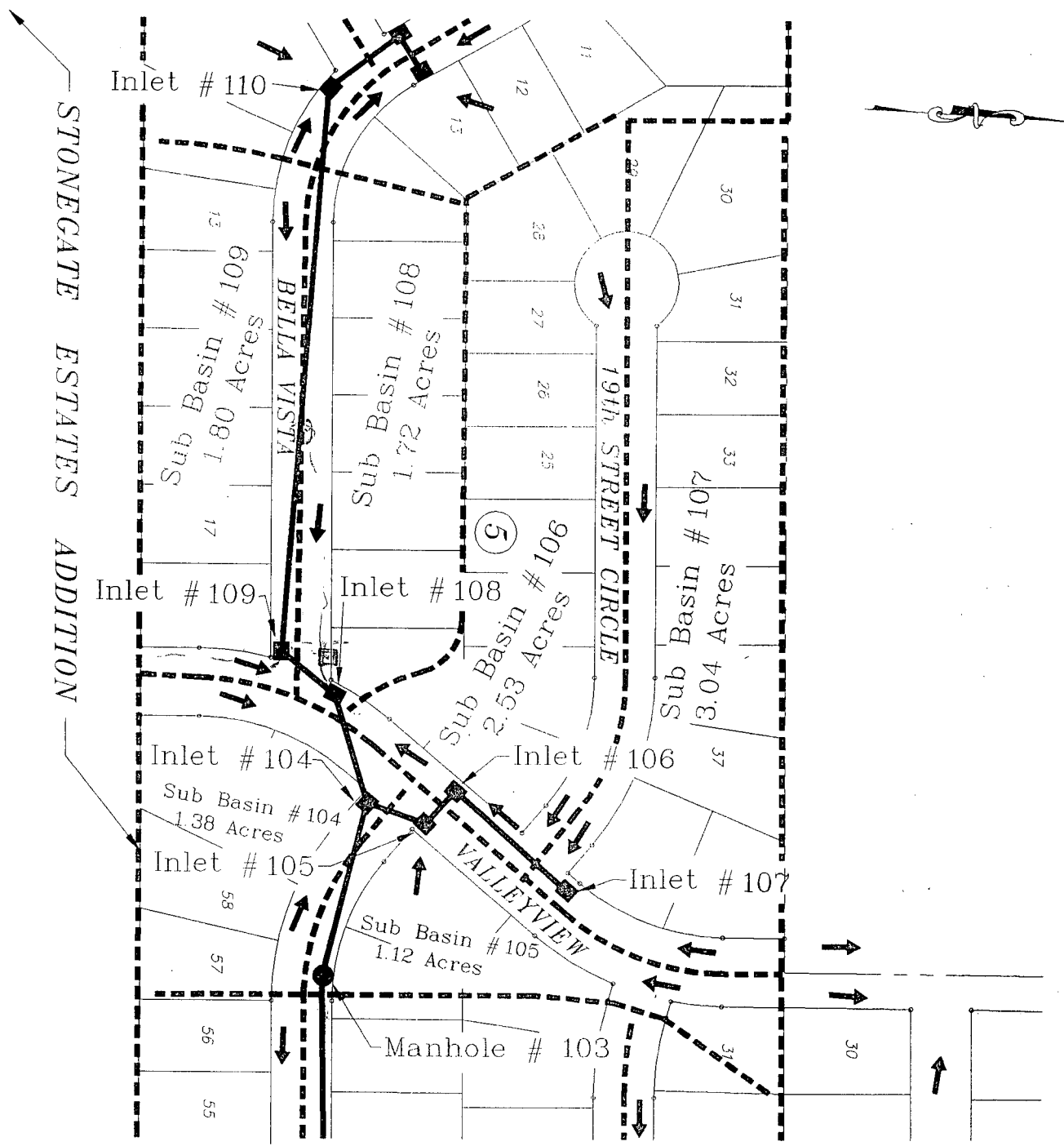
1"=150'

GRAF - GOLDSTON ADDITION
WICHITA, KANSAS



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DATE: March 13, 1992

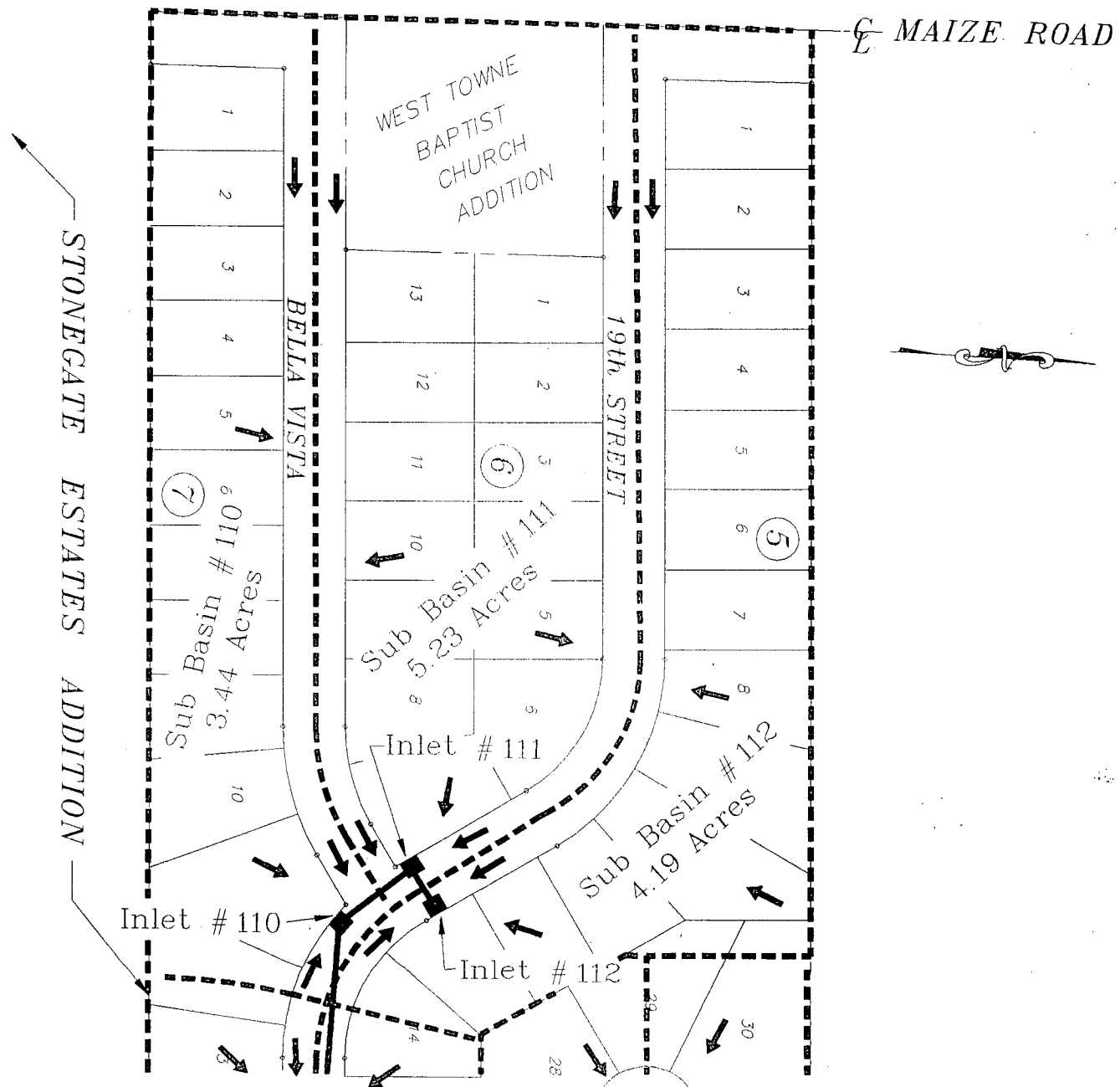


DETAILED DRAINAGE AREA #2
 1"=150'

GRAF - GOLDSTON ADDITION
 WICHITA, KANSAS



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 DATE: March 13, 1992



DETAILED DRAINAGE AREA #3
 1"=150'

GRAF - GOLDSTON ADDITION
 WICHITA, KANSAS



ENGINEERING • SURVEYING
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 Wichita, KS. 67201 - (316) 263-6620

DATE: March 13, 1992

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

<u>DURATION IN MINUTES</u>	<u>RETURN PERIODS OF</u>						
	<u>1-YR</u>	<u>2-YR</u>	<u>5-YR</u>	<u>10-YR</u>	<u>25-YR</u>	<u>50-YR</u>	<u>100-YR</u>
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

City of Wichita
Rainfall Intensity

(7. YEAR)

Minutes	Intensity	Minutes	Intensity
15.0	3.83	19.0	3.42
15.1	3.82	19.1	3.41
15.2	3.81	19.2	3.40
15.3	3.80	19.3	3.39
15.4	3.79	19.4	3.38
15.5	3.77	19.5	3.38
15.6	3.76	19.6	3.37
15.7	3.75	19.7	3.36
15.8	3.74	19.8	3.35
15.9	3.73	19.9	3.34
16.0	3.72	20.0	3.33
16.1	3.71	20.1	3.32
16.2	3.70	20.2	3.31
16.3	3.69	20.3	3.31
16.4	3.68	20.4	3.30
16.5	3.66	20.5	3.29
16.6	3.65	20.6	3.28
16.7	3.64	20.7	3.27
16.8	3.63	20.8	3.27
16.9	3.62	20.9	3.26
17.0	3.61	21.0	3.25
17.1	3.60	21.1	3.24
17.2	3.59	21.2	3.23
17.3	3.58	21.3	3.23
17.4	3.57	21.4	3.22
17.5	3.56	21.5	3.21
17.6	3.55	21.6	3.20
17.7	3.54	21.7	3.19
17.8	3.53	21.8	3.19
17.9	3.52	21.9	3.18
18.0	3.51	22.0	3.17
18.1	3.50	22.1	3.16
18.2	3.49	22.2	3.16
18.3	3.48	22.3	3.15
18.4	3.47	22.4	3.14
18.5	3.47	22.5	3.13
18.6	3.46	22.6	3.13
18.7	3.45	22.7	3.12
18.8	3.44	22.8	3.11
18.9	3.43	22.9	3.11
19.0	3.42	23.0	3.1

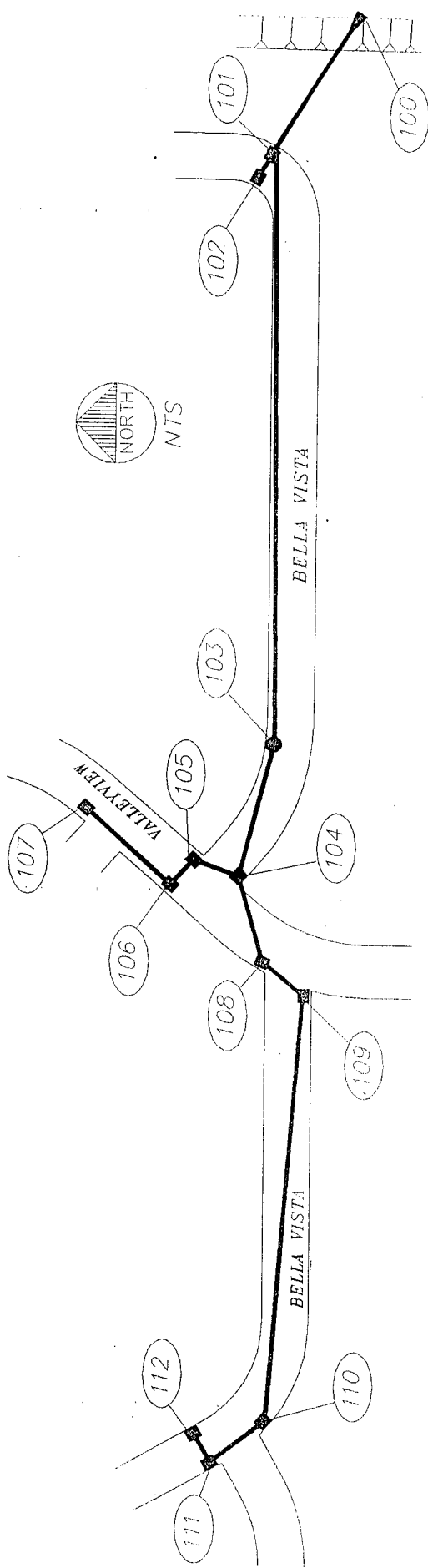


HYDROLOGY DATA SHEET

PAGE 1 OF 4
 PROJECT NO. 347
 DATE: 3-13-92

ENGINEERING SURVEYING PROJECT: GRAF - GOLDSTON ADDITION
 234 N. Cleveland - P.O. Box 244 ITEM: PHASE II STORM SEWER (SYSTEM 100)
 Wichita, KS. 67201 - (316) 263-6620 RETURN PERIOD: 2 COMPUTATIONS BY: RDF REVISIONS BY: _____

SCHEMATIC DIAGRAM:



HYDROLOGY DATA SHEET																	
TRIBUTARY AREA					HYDROLOGY SUMMATION					CONDUIT DATA							
SUB BASIN (1)	C (2)	AREA (acres) (3)	SLOPE (%) (4)	LENGTH (feet) (5)	T _{c0} (minutes) (6)	I ₀ in./hr. (7)	O ₀ (cfs) (8)	T _c (minutes) (9)	I in./hr. (10)	Q (cfs) (11)	ΣQ (cfs) (12)	PIPE (inches) (13)	SLOPE (%) (14)	VELOCITY (ft./sec.) (15)	LENGTH (feet) (16)	T ₁ (minutes) (17)	T _{c+T₁} (minutes) (18)
112	0.5	4.19	-	-	15	3.83	8.0	15	3.83	8.0	8.0	15	1.3	6.5	36	0.1	15.1
111	0.5	5.23	-	-	15	3.83	10.0	15.1	3.82	10.0	18.0	24	0.5	5.7	82	0.2	15.3
110	0.5	3.44	-	-	15	3.83	6.6	15.3	3.80	6.5	24.5	30	0.3	5.0	540	1.5	16.8
109	0.5	1.80	-	-	15	3.83	3.4	16.8	3.63	3.3	27.8	30	0.4	5.7	81	0.2	17.0
108	0.5	1.72	-	-	15	3.83	3.3	17.0	3.61	3.1	30.9	30	0.5	6.3	115	0.3	17.3
104	0.5	1.72	-	-	15	3.83	3.3	17.0	3.61	3.1	30.9	30	0.5	6.3	115	0.3	17.3

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 112-111

Solve For Full Flow Slope

Given Input Data:

Diameter.....	1.25 ft
Manning's n.....	0.012
Discharge.....	8.00 cfs

Computed Results:

Full Flow Channel Slope	0.0131 ft/ft
Full Flow Depth.....	1.25 ft
Velocity.....	6.52 fps
Flow Area.....	1.23 sf
Critical Depth....	1.12 ft
Critical Slope....	0.0116 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	8.00 cfs
QMAX @.94D.....	8.61 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 111-110

Solve For Full Flow Slope

Given Input Data:

Diameter.....	2.00 ft
Manning's n.....	0.012
Discharge.....	18.00 cfs

Computed Results:

Full Flow Channel Slope	0.0054 ft/ft
Full Flow Depth.....	2.00 ft
Velocity.....	5.73 fps
Flow Area.....	3.14 sf
Critical Depth....	1.53 ft
Critical Slope....	0.0062 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	18.00 cfs
QMAX @.94D.....	19.36 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 110-109

Solve For Full Flow Slope

Given Input Data:

Diameter.....	2.50 ft
Manning's n.....	0.012
Discharge.....	24.50 cfs

Computed Results:

Full Flow Channel Slope	0.0030 ft/ft
Full Flow Depth.....	2.50 ft
Velocity.....	4.99 fps
Flow Area.....	4.91 sf
Critical Depth....	1.69 ft
Critical Slope....	0.0048 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	24.50 cfs
QMAX @.94D.....	26.35 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 109-108

Solve For Full Flow Slope

Given Input Data:

Diameter.....	2.50 ft
Manning's n.....	0.012
Discharge.....	27.80 cfs

Computed Results:

Full Flow Channel Slope	0.0039 ft/ft
Full Flow Depth.....	2.50 ft
Velocity.....	5.66 fps
Flow Area.....	4.91 sf
Critical Depth....	1.80 ft
Critical Slope....	0.0052 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	27.80 cfs
QMAX @.94D.....	29.90 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 108-104

Solve For Full Flow Slope

Given Input Data:

Diameter.....	2.50 ft
Manning's n.....	0.012
Discharge.....	30.90 cfs

Computed Results:

Full Flow Channel Slope	0.0048 ft/ft
Full Flow Depth.....	2.50 ft
Velocity.....	6.29 fps
Flow Area.....	4.91 sf
Critical Depth....	1.89 ft
Critical Slope....	0.0057 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	30.90 cfs
QMAX @.94D.....	33.24 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 107-106

Solve For Full Flow Slope

Given Input Data:

Diameter.....	1.25 ft
Manning's n.....	0.012
Discharge.....	5.80 cfs

Computed Results:

Full Flow Channel Slope	0.0069 ft/ft
Full Flow Depth.....	1.25 ft
Velocity.....	4.73 fps
Flow Area.....	1.23 sf
Critical Depth....	0.98 ft
Critical Slope....	0.0076 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	5.80 cfs
QMAX @.94D.....	6.24 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 106-105

Solve For Full Flow Slope

Given Input Data:

Diameter.....	1.50 ft
Manning's n.....	0.012
Discharge.....	10.60 cfs

Computed Results:

Full Flow Channel Slope	0.0087 ft/ft
Full Flow Depth.....	1.50 ft
Velocity.....	6.00 fps
Flow Area.....	1.77 sf
Critical Depth....	1.25 ft
Critical Slope....	0.0084 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	10.60 cfs
QMAX @.94D.....	11.40 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 105-104

Solve For Full Flow Slope

Given Input Data:

Diameter.....	1.75 ft
Manning's n.....	0.012
Discharge.....	12.70 cfs

Computed Results:

Full Flow Channel Slope	0.0055 ft/ft
Full Flow Depth.....	1.75 ft
Velocity.....	5.28 fps
Flow Area.....	2.41 sf
Critical Depth....	1.33 ft
Critical Slope....	0.0064 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	12.70 cfs
QMAX @.94D.....	13.66 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 104-103

Solve For Full Flow Slope

Given Input Data:

Diameter.....	3.00 ft
Manning's n.....	0.012
Discharge.....	46.10 cfs

Computed Results:

Full Flow Channel Slope	0.0041 ft/ft
Full Flow Depth.....	3.00 ft
Velocity.....	6.52 fps
Flow Area.....	7.07 sf
Critical Depth....	2.21 ft
Critical Slope....	0.0051 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	46.10 cfs
QMAX @.94D.....	49.59 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 103-101

Solve For Full Flow Slope

Given Input Data:

Diameter.....	3.00 ft
Manning's n.....	0.012
Discharge.....	46.10 cfs

Computed Results:

Full Flow Channel Slope	0.0041 ft/ft
Full Flow Depth.....	3.00 ft
Velocity.....	6.52 fps
Flow Area.....	7.07 sf
Critical Depth....	2.21 ft
Critical Slope....	0.0051 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	46.10 cfs
QMAX @.94D.....	49.59 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 102-101

Solve For Full Flow Slope

Given Input Data:

Diameter.....	1.50 ft
Manning's n.....	0.012
Discharge.....	9.50 cfs

Computed Results:

Full Flow Channel Slope	0.0070 ft/ft
Full Flow Depth.....	1.50 ft
Velocity.....	5.38 fps
Flow Area.....	1.77 sf
Critical Depth....	1.19 ft
Critical Slope....	0.0074 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	9.50 cfs
QMAX @.94D.....	10.22 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 101-100 (2 year storm)

Solve For Full Flow Slope

Given Input Data:

Diameter.....	5.00 ft
Manning's n.....	0.012
Discharge.....	66.80 cfs

Computed Results:

Full Flow Channel Slope	0.0006 ft/ft
Full Flow Depth.....	5.00 ft
Velocity.....	3.40 fps
Flow Area.....	19.63 sf
Critical Depth....	2.31 ft
Critical Slope....	0.0030 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	66.80 cfs
QMAX @.94D.....	71.86 cfs
Froude Number.....	FULL

Circular Channel Analysis & Design
Solved with Manning's Equation

Open Channel - Uniform flow

Worksheet Name: Graf-Goldston SWS

Comment: 101-100 (100 year storm flow)

Solve For Full Flow Slope

Given Input Data:

Diameter.....	5.00 ft
Manning's n.....	0.012
Discharge.....	115.70 cfs

Computed Results:

Full Flow Channel Slope	0.0017 ft/ft
Full Flow Depth.....	5.00 ft
Velocity.....	5.89 fps
Flow Area.....	19.63 sf
Critical Depth....	3.07 ft
Critical Slope....	0.0035 ft/ft
Percent Full.....	100.00 %
Full Capacity.....	115.70 cfs
QMAX @.94D.....	124.46 cfs
Froude Number.....	FULL

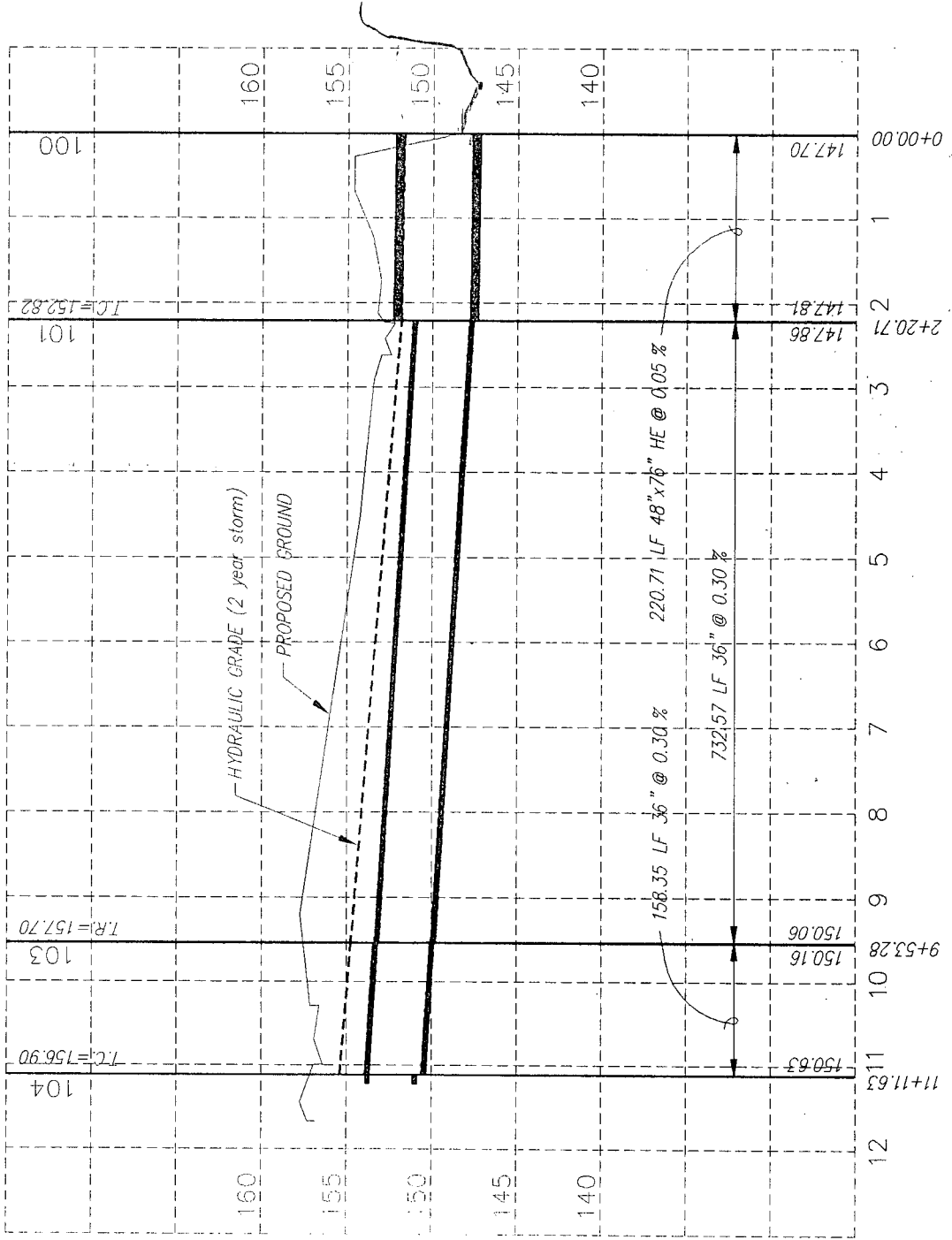


HYDROLOGY DATA SHEET

PAGE 1 OF 3
PROJECT NO. 347
DATE: 3-16-92
REVISIONS BY:

ENGINEERING • SURVEYING PROJECT: GRAF-GOLDSTON ADDITION
234 N. Cleveland - P.O. Box 244 ITEM: Storm Sewer Profiles
Wichita, KS. 67201 - (316) 263-6620 RETURN PERIOD: 2 yr. COMPUTATIONS BY: RDF

SCHEMATIC PROFILE





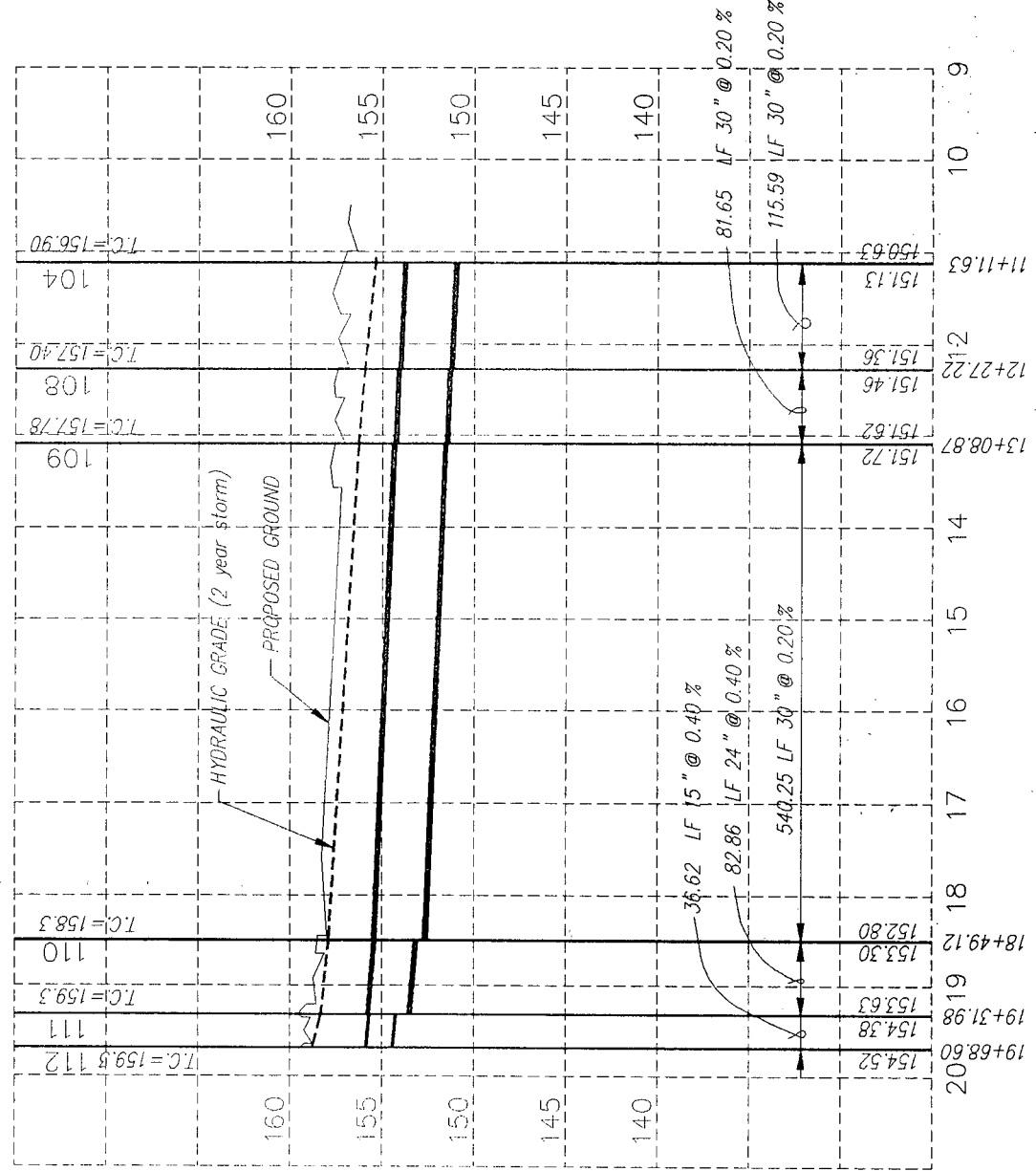
HYDROLOGY DATA SHEET

PAGE 2 OF 3
 PROJECT NO. 347
 DATE: 3-16-92
 REVISIONS BY: _____

ENGINEERING SURVEYING PROJECT: GRAF-GOLDSTON ADDITION
 ITEM: Storm Sewer Profiles
 RETURN PERIOD: 2 yr. COMPUTATIONS BY: RDF

234 N. Cleveland - P.O. Box 244
 Wichita, KS. 67201 - (316) 263-6620

SCHEMATIC PROFILE



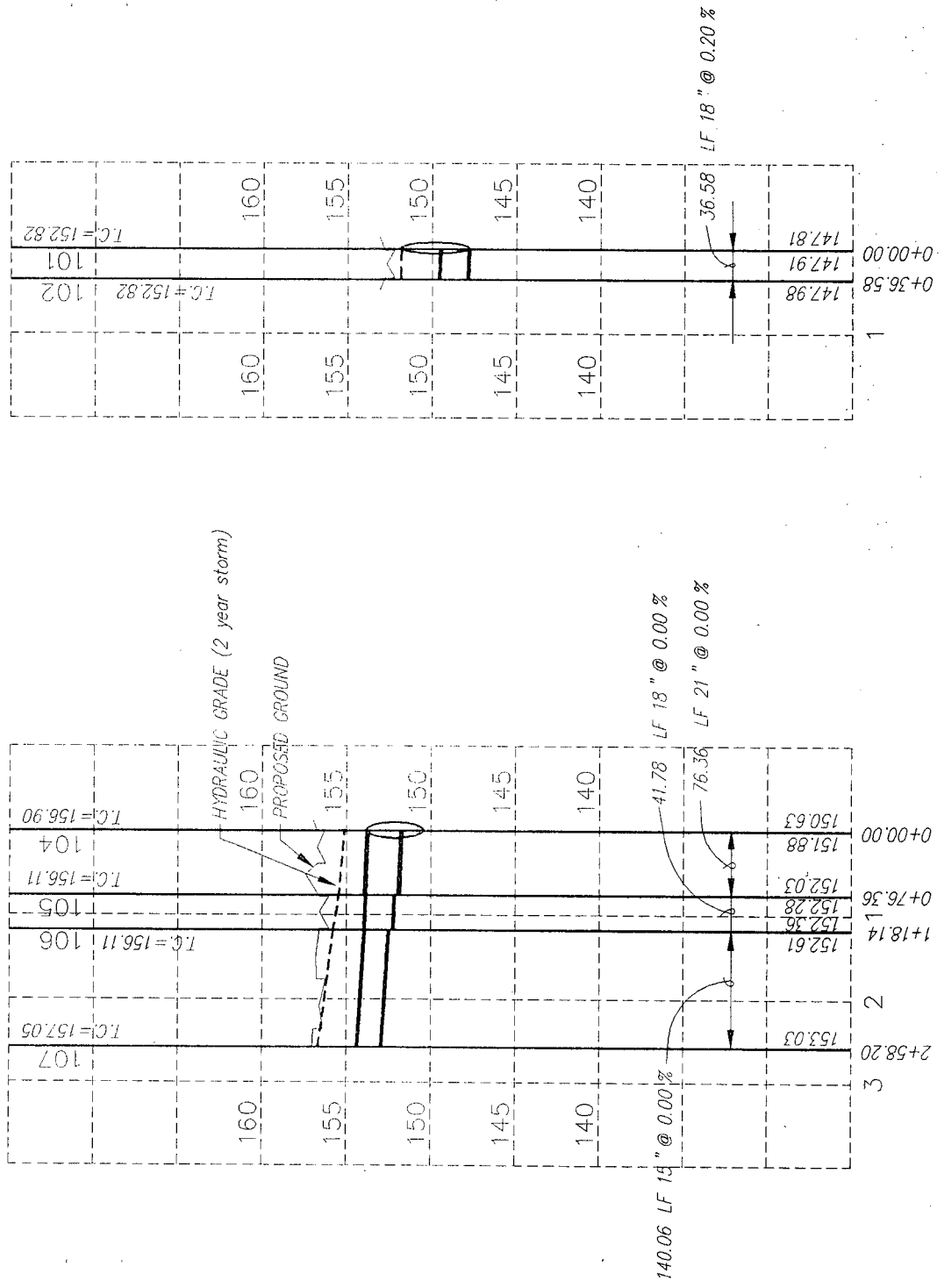


HYDROLOGY DATA SHEET

PAGE 3 OF 3
 PROJECT NO. 347
 DATE: 3-16-92
 REVISIONS BY: _____

ENGINEERING • SURVEYING PROJECT: GRAF-GOLDSTON ADDITION
 234 N. Cleveland - P.O. Box 244 ITEM: Storm Sewer Profiles
 Wichita, KS. 67201 - (316) 263-6620 RETURN PERIOD: 2 yr. COMPUTATIONS BY: RDF

SCHEMATIC PROFILE





CALCULATION SHEET

PAGE 1 OF 1
 PROJECT NO. 347
 DATE: 3-14-92
 REV. DATE: _____

ENGINEERING • SURVEYING PROJECT: GRAF - GOLDSTON ADD
 234 N. Cleveland - P.O. Box 244 ITEM: STREET FLOW
 Wichita, KS. 67201 - (316) 263-6620 COMPUTATIONS BY: RPE REVISIONS BY: _____

STREET FLOW
2 YR STORM

C = 0.5
TC = 15 min
I₂ = 3.83

INLET NO.	FLOW FROM	STREET SLOPE %	AREA (acres)	FLOW (cfs)	FLOW DEPTH
101	19th(N)	0.32	3.81	7.3	0.47
	Bella Vista(W)	0.55	2.97	5.7	0.39
102	19th(N)	0.32	2.60	5.0	0.41
	Bella Vista(W)	0.55	2.38	4.5	0.36
103	Manhole				
104	Valleyview	0.44	1.38	2.6	0.30
105	Valleyview	0.44	1.12	2.1	0.28
106	Valleyview	0.32	2.53	4.8	0.40
107	Valleyview	0.50	3.04	5.8	0.40
108	Valleyview	0.44	1.72	3.3	0.33
109	Bella Vista	0.44	1.80	3.4	0.34
110	Bella Vista	0.50	3.44	6.6	0.42
111	Bella Vista(SW)	0.50	2.76	5.3	0.39
	19th(NW)	0.53	2.47	4.7	0.37
112	19th(NW)	0.53	3.67	7.0	0.42
	19th(SE)	0.32	0.52	1.0	0.22

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 101 - flow from 19th (N)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0032 ft/ft
Discharge.....	7.30 cfs

Computed Results:

Depth.....	0.47 ft
Velocity.....	1.97 fps
Flow Area.....	3.70 sf
Flow Top Width...	15.64 ft
Wetted Perimeter.	16.11 ft
Critical Depth...	0.41 ft
Critical Slope...	0.0066 ft/ft
Froude Number....	0.71 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 101 - flow from Bella Vista (W)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0055 ft/ft
Discharge.....	5.70 cfs

Computed Results:

Depth.....	0.39 ft
Velocity.....	2.27 fps
Flow Area.....	2.51 sf
Flow Top Width...	12.87 ft
Wetted Perimeter.	13.27 ft
Critical Depth...	0.37 ft
Critical Slope...	0.0068 ft/ft
Froude Number....	0.91 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 102 - flow from 19th (N)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0032 ft/ft
Discharge.....	5.00 cfs

Computed Results:

Depth.....	0.41 ft
Velocity.....	1.79 fps
Flow Area.....	2.79 sf
Flow Top Width...	13.57 ft
Wetted Perimeter.	13.98 ft
Critical Depth...	0.36 ft
Critical Slope...	0.0069 ft/ft
Froude Number....	0.70 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 102 - flow from Bella Vista (W)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0055 ft/ft
Discharge.....	4.50 cfs

Computed Results:

Depth.....	0.36 ft
Velocity.....	2.14 fps
Flow Area.....	2.10 sf
Flow Top Width...	11.78 ft
Wetted Perimeter.	12.14 ft
Critical Depth...	0.34 ft
Critical Slope...	0.0070 ft/ft
Froude Number....	0.89 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 104 - flow from Bella Vista & Valley View

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0044 ft/ft
Discharge.....	2.60 cfs

Computed Results:

Depth.....	0.30 ft
Velocity.....	1.72 fps
Flow Area.....	1.52 sf
Flow Top Width...	10.00 ft
Wetted Perimeter.	10.31 ft
Critical Depth...	0.27 ft
Critical Slope...	0.0075 ft/ft
Froude Number....	0.78 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 105 - flow from Valley View

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0044 ft/ft
Discharge.....	2.10 cfs

Computed Results:

Depth.....	0.28 ft
Velocity.....	1.63 fps
Flow Area.....	1.29 sf
Flow Top Width...	9.23 ft
Wetted Perimeter.	9.51 ft
Critical Depth...	0.25 ft
Critical Slope...	0.0078 ft/ft
Froude Number....	0.77 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 106 - flow from Valley View

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0032 ft/ft
Discharge.....	4.80 cfs

Computed Results:

Depth.....	0.40 ft
Velocity.....	1.78 fps
Flow Area.....	2.70 sf
Flow Top Width...	13.36 ft
Wetted Perimeter.	13.77 ft
Critical Depth...	0.35 ft
Critical Slope...	0.0069 ft/ft
Froude Number....	0.70 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 107 - flow from Valley View

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0050 ft/ft
Discharge.....	5.80 cfs

Computed Results:

Depth.....	0.40 ft
Velocity.....	2.20 fps
Flow Area.....	2.64 sf
Flow Top Width...	13.19 ft
Wetted Perimeter.	13.59 ft
Critical Depth...	0.38 ft
Critical Slope...	0.0068 ft/ft
Froude Number....	0.87 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 108 - flow from Valley View

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0044 ft/ft
Discharge.....	3.30 cfs

Computed Results:

Depth.....	0.33 ft
Velocity.....	1.82 fps
Flow Area.....	1.81 sf
Flow Top Width...	10.94 ft
Wetted Perimeter.	11.27 ft
Critical Depth...	0.30 ft
Critical Slope...	0.0073 ft/ft
Froude Number....	0.79 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 109 - flow from Bella Vista

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0044 ft/ft
Discharge.....	3.40 cfs

Computed Results:

Depth.....	0.34 ft
Velocity.....	1.84 fps
Flow Area.....	1.85 sf
Flow Top Width...	11.06 ft
Wetted Perimeter.	11.40 ft
Critical Depth...	0.30 ft
Critical Slope...	0.0073 ft/ft
Froude Number....	0.79 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 110 - flow from Bella Vista

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0050 ft/ft
Discharge.....	6.60 cfs

Computed Results:

Depth.....	0.42 ft
Velocity.....	2.27 fps
Flow Area.....	2.90 sf
Flow Top Width...	13.85 ft
Wetted Perimeter.	14.27 ft
Critical Depth...	0.40 ft
Critical Slope...	0.0067 ft/ft
Froude Number....	0.87 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 111 - flow from Bella Vista (SW)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0050 ft/ft
Discharge.....	5.30 cfs

Computed Results:

Depth.....	0.39 ft
Velocity.....	2.15 fps
Flow Area.....	2.46 sf
Flow Top Width...	12.75 ft
Wetted Perimeter.	13.14 ft
Critical Depth...	0.36 ft
Critical Slope...	0.0069 ft/ft
Froude Number....	0.86 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 111 - flow from 19th (NW)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0053 ft/ft
Discharge.....	4.70 cfs

Computed Results:

Depth.....	0.37 ft
Velocity.....	2.13 fps
Flow Area.....	2.20 sf
Flow Top Width...	12.06 ft
Wetted Perimeter.	12.43 ft
Critical Depth...	0.35 ft
Critical Slope...	0.0070 ft/ft
Froude Number....	0.88 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 112 - flow from 19th (NW)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0053 ft/ft
Discharge.....	7.00 cfs

Computed Results:

Depth.....	0.42 ft
Velocity.....	2.36 fps
Flow Area.....	2.97 sf
Flow Top Width...	14.00 ft
Wetted Perimeter.	14.43 ft
Critical Depth...	0.41 ft
Critical Slope...	0.0066 ft/ft
Froude Number....	0.90 (flow is Subcritical)

Triangular Channel Analysis & Design
Open Channel - Uniform flow

Worksheet Name: GRAF STREETS

Comment: Inlet 112 - flow from 19th (SE)

Solve For Depth

Given Input Data:

Left Side Slope..	0.01:1 (H:V)
Right Side Slope.	33.00:1 (H:V)
Manning's n.....	0.016
Channel Slope....	0.0032 ft/ft
Discharge.....	1.00 cfs

Computed Results:

Depth.....	0.22 ft
Velocity.....	1.20 fps
Flow Area.....	0.83 sf
Flow Top Width...	7.42 ft
Wetted Perimeter.	7.65 ft
Critical Depth...	0.19 ft
Critical Slope...	0.0086 ft/ft
Froude Number....	0.63 (flow is Subcritical)



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CALCULATION SHEET

PAGE 1 OF 1
 PROJECT NO. 347
 DATE: 3-14-92
 REV. DATE:

PROJECT: GRAF-GOLDSTON ADDITION
 ITEM:
 COMPUTATIONS BY: RDE REVISIONS BY:

STREET FLOW
 (100 year storm)

Check flow on Bella Vista (west of Inlet 101 & 102)
 D.A. = 36.21 acres
 C = 0.5
 T.C. = 21 minutes
 I(100) = 6.39 in/hr
 Q(100) = 36.21x0.5x6.39 = 115.7 cfs
 Q(2) (flow in storm sewer) = -66.8 cfs

 Street Flow = 48.9 cfs

STREET FLOW CAPACITY

Street Width = 28 Feet
 X-sec Area = 9.52 Sq. Ft.
 Street Grade = 0.55 %
 Walk Grade = 0.30 Feet
 Right-of-Way = 58 Feet
 X-sec. ROW = 22.42 Sq. Ft.

Capacity of street (cb-cb)
 n = 0.016
 A = 9.52 Sq. Ft.
 P = 29.10
 R = 0.3271
 R 2/3 = 0.4748
 S 1/2 = 0.0742
 Q = 31.1 CFS

Capacity of street (row-row)
 n = 0.021
 A = 22.42 Sq. Ft.
 P = 59.10
 R = 0.3794
 R 2/3 = 0.5240
 S 1/2 = 0.0742
 Q = 62.7 CFS



CALCULATION SHEET

PAGE _____ OF _____
PROJECT NO. _____
DATE: _____
REV. DATE: _____

ENGINEERING • SURVEYING PROJECT: _____
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REQUIRED INLETS (2 year storm)

For inlets in sump condition Refer to Chart # 1073.03 (Copy attached) $Q_{Allow} = 10 cfs$

For inlets on grade, Assume 50% is intercepted & 50% bypassed to next inlet

<u>INLET</u>	<u>Q₂</u>	<u>INLET CONDITION</u>	<u>REQUIRED COW - Type IA</u>
101	13.0	SUMP	2
102	9.5	SUMP	1
103	Manhole	—	—
104	2.6	SUMP	1
105	2.1	SUMP	1
106	$4.8 + 1.7 = 6.5$	SUMP	1
107	5.8	SUMP	1
108	3.3	ON-GRADE	1
109	3.4	SUMP	1
110	6.6	SUMP	1
111	10.0	SUMP	1
112	8.0	SUMP	1

CALCULATION SHEET

PROJECT: _____

ITEM: _____

COMPUTATIONS BY: _____

REVISIONS BY: _____

INLETS 101 & 102
(100 Yr. Storm)

$$DA = 36.21 \text{ Acres}$$

$$C = 0.5$$

$$t_c = 21 \text{ min}$$

$$I_{100} = 6.39 \text{ in/hr}$$

$$Q_{100} = 36.21 \times 0.5 \times 6.39 = 115.7 \text{ cfs}$$

$$Q_2 = (\text{pipe } 103-101) = \underline{-46.1 \text{ cfs}}$$

$$\text{Street Flow} = 69.6 \text{ cfs.}$$

INLETS

$$H = 10'' + 0.3' = 1.133'$$

$$h = 6'' = 0.500'$$

$$H/h = 2.266$$

$$Q/L = 2.7 \text{ cfs/L.F.}$$

$$\text{Flow} = 69.6 / 2.7 = 25.8 \text{ LF}$$

USE 5 - 5 LF Type I A inlets
OR EQUIVALENT

SUMP CONDITION ONLY

1073.03

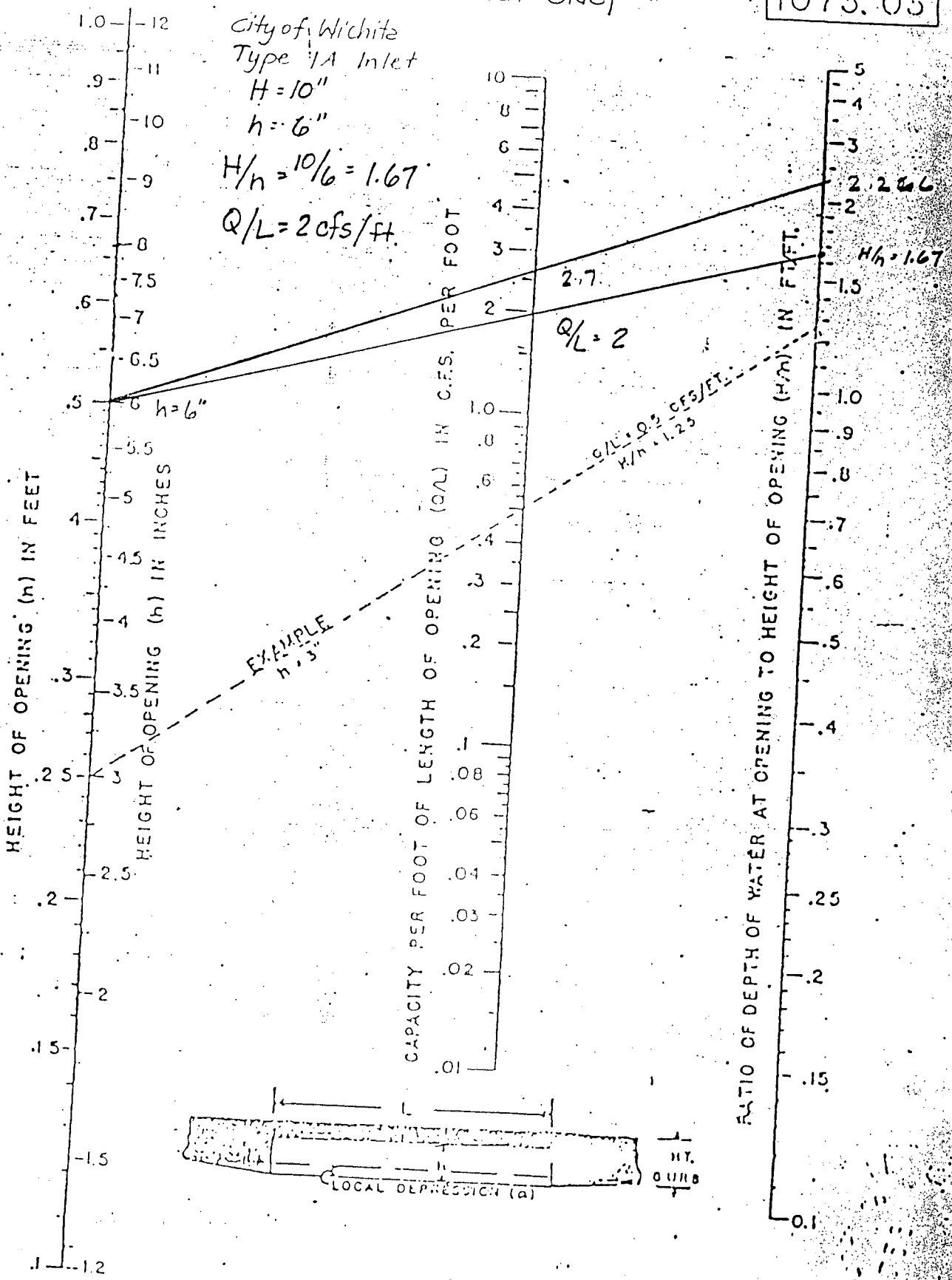
City of Wichita
Type 1A Inlet

H = 10"

h = 6"

$H/h = 10/6 = 1.67$

$Q/L = 2 \text{ cfs/ft.}$



EXAMPLE
h = 3"

$Q/L = 2$

$Q/L = 2.266$
 $H/h = 1.67$

2.7

JAN. 1951