MUNICIPAL ENGINEERS
Civil Engineers & Land Surveyors

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February 25, 1991

Vicki Huang, P.E.
City Engineer's Office
City Hall - 7th Floor
455 North Main Street
Wichita, Kansas 67202

Re: Smithmoor Third Addition
Drainage Plan
90-02

Dear Ms. Huang:

Attached please find a copy of drainage plan for the referenced plat. Preliminary plat for this addition was submitted earlier and contained 41 lots. The final plat has been downsized to have just 18 lot.

Please review this and feel free to call me if you have any questions or need additional information.

Sincerely,
MUNICIPAL ENGINEERS

Babar M. Khan, P.E.

BK:st:encl.

# DRAINAGE PLAN

# SMITHMOOR THIRD ADDITION

# WICHITA, SEDGWICK COUNTY, KANSAS

FEBRUARY, 1991

## 1.0 INTRODUCTION:

The proposed smithmoor Third Addition is located along the southerly line of Smithmoor First Addition. Preliminary plat submitted for this Third Addition contained 41 lots. Final plat as submitted has been reduced to 18 lots. A sketch of proposed development was also prepared and submitted to MAPD along with preliminary plat of this Third Addition. This sketch plan showed various phases of development.

There is a ridge that runs northeasterly along approximate middle of the development. This ridge divides the development into two drainage areas. One drains to north and the other drains to south and east.

This drainage plan addresses area north on the ridge. The existing flow patterns are maintained. This area drains to a drainage channel along the west side of Smithmoor First Addition.

# SMITHMOOR 3RD ADDITION :

## 2.0. HYDROLOGY :

USE RATIONAL METHOD

SOIL TYPE = $I_a$

HYDRO GROUP = D

LAND USE = SINGLE FAMILY
MIN. LOT SIZE 6,600 S.F. ±

RUNOFF COEFFICIENTS:

PRORATE BETWEEN $\frac{1}{8}$ AC. LOTS & $\frac{1}{4}$ AC. LOTS

$C_2 = 0.55$

$C_{100} = 0.78$

$T_C = 15$ MIN.

$i_2 = 3.83$ IN.

$i_{100} = 7.37$ IN.

| NODE | DRAINAGE AREA | CFS $Q_2$ | CFS $Q_{100}$ |
|---|---|---|---|
| 100 | 6.4 Ac. | 13.5 | 36.8 |
| 101 | 2.7 | 5.7 | 15.5 |
| 102 | 1.4 | 2.9 | 8.0 |
| 103 | 10.2 | 21.5 | 58.6 |
| 104 | 4.0 | 8.4 | 23.0 |

(3 pages)

ATTACHMENT D

DRAINAGE CRITERIA

CITY OF WICHITA, KANSAS

RECOMMENDED RUNOFF COEFFICIENTS FOR RATIONAL METHOD
AND PERCENT IMPERVIOUS FOR UNIT HYDROGRAPH METHOD

| Land Use or Surface Characteristics | Percent Impervious | Frequency 2 | 5 | 10 | 100 |
|---|---|---|---|---|---|
| 1. Business: | | | | | |
| Downtown Areas | 95 | 0.84 | 0.85 | 0.87 | 0.91 |
| Neighborhood Areas | 70 | 0.68 | 0.69 | 0.73 | 0.80 |
| 2. Residential: | | | | | |
| Single Family (Soil Group D) | | | | | |
| 1/8 Acre (6600 S.F) | 50 → 0.55 | [0.57 | 0.61 | 0.66 → 0.78 | 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 |

April 15, 1986

ATTACHMENT A
DRAINAGE CRITERIA MANUAL

CITY OF WICHITA, KANSAS

RAINFALL INTENSITY TABLE FOR SEDGWICK COUNTY, KANSAS

The following tabulation contains rainfall intensity in inches per hour as derived from ESSA Weather Bureau Technical Paper 40 Modified to NWS Hydro-35, 1977 During First Hour

| DURATION IN MINUTES | RETURN PERIODS OF 1-YR | 2-YR | 5-YR | 10-YR | 25-YR | 50-YR | 100-YR |
|---|---|---|---|---|---|---|---|
| 5 | 4.18 | 5.57 | 6.53 | 7.41 | 8.52 | 9.48 | 10.32 |
| 6 | 3.99 | 5.32 | 6.25 | 7.09 | 8.16 | 9.09 | 9.89 |
| 7 | 3.81 | 5.09 | 5.99 | 6.81 | 7.84 | 8.74 | 9.50 |
| 8 | 3.66 | 4.89 | 5.75 | 6.55 | 7.55 | 8.42 | 9.15 |
| 9 | 3.52 | 4.70 | 5.54 | 6.31 | 7.28 | 8.13 | 8.83 |
| 10 | 3.39 | 4.52 | 5.34 | 6.09 | 7.04 | 7.86 | 8.54 |
| 11 | 3.27 | 4.36 | 5.16 | 5.89 | 6.81 | 7.61 | 8.27 |
| 12 | 3.18 | 4.21 | 4.99 | 5.71 | 6.60 | 7.38 | 8.02 |
| 13 | 3.05 | 4.08 | 4.84 | 5.53 | 6.41 | 7.17 | 7.79 |
| 14 | 2.96 | 3.95 | 4.69 | 5.37 | 6.23 | 6.97 | 7.57 |
| 15 | 2.87 | 3.83 | 4.56 | 5.22 | 6.06 | 6.78 | 7.37 |
| 16 | 2.78 | 3.72 | 4.43 | 5.08 | 5.90 | 6.60 | 7.18 |
| 17 | 2.71 | 3.61 | 4.31 | 4.95 | 5.75 | 6.44 | 7.00 |
| 18 | 2.63 | 3.51 | 4.20 | 4.83 | 5.61 | 6.29 | 6.84 |
| 19 | 2.56 | 3.42 | 4.10 | 4.71 | 5.47 | 6.14 | 6.68 |
| 20 | 2.50 | 3.33 | 4.00 | 4.60 | 5.35 | 6.00 | 6.53 |
| 21 | 2.44 | 3.25 | 3.90 | 4.50 | 5.23 | 5.87 | 6.39 |
| 22 | 2.38 | 3.17 | 3.81 | 4.40 | 5.12 | 5.75 | 6.26 |
| 23 | 2.32 | 3.10 | 3.73 | 4.31 | 5.01 | 5.63 | 6.13 |
| 24 | 2.27 | 3.03 | 3.65 | 4.22 | 4.91 | 5.52 | 6.01 |
| 25 | 2.22 | 2.96 | 3.57 | 4.13 | 4.81 | 5.41 | 5.90 |
| 26 | 2.20 | 2.90 | 3.50 | 4.05 | 4.72 | 5.31 | 5.79 |
| 27 | 2.16 | 2.84 | 3.43 | 3.98 | 4.63 | 5.21 | 5.69 |
| 28 | 2.14 | 2.78 | 3.37 | 3.90 | 4.55 | 5.12 | 5.59 |
| 29 | 2.11 | 2.72 | 3.30 | 3.83 | 4.47 | 5.03 | 5.49 |
| 30 | 2.08 | 2.67 | 3.24 | 3.76 | 4.39 | 4.94 | 5.40 |
| 31 | 2.05 | 2.62 | 3.19 | 3.70 | 4.32 | 4.86 | 5.32 |
| 32 | 2.02 | 2.57 | 3.10 | 3.63 | 4.25 | 4.79 | 5.22 |
| 33 | 1.99 | 2.52 | 3.05 | 3.57 | 4.18 | 4.71 | 5.14 |
| 34 | 1.96 | 2.48 | 3.01 | 3.51 | 4.11 | 4.63 | 5.07 |
| 35 | 1.93 | 2.44 | 2.98 | 3.46 | 4.05 | 4.56 | 5.00 |
| 36 | 1.91 | 2.39 | 2.93 | 3.41 | 3.99 | 4.50 | 4.93 |
| 37 | 1.89 | 2.35 | 2.88 | 3.36 | 3.93 | 4.43 | 4.86 |
| 38 | 1.87 | 2.32 | 2.84 | 3.31 | 3.87 | 4.37 | 4.79 |
| 39 | 1.85 | 2.28 | 2.80 | 3.26 | 3.82 | 4.31 | 4.73 |
| 40 | 1.83 | 2.24 | 2.76 | 3.22 | 3.76 | 4.25 | 4.66 |
| 41 | 1.81 | 2.21 | 2.72 | 3.17 | 3.71 | 4.19 | 4.60 |
| 42 | 1.79 | 2.18 | 2.68 | 3.13 | 3.66 | 4.13 | 4.54 |
| 43 | 1.77 | 2.14 | 2.64 | 3.09 | 3.61 | 4.08 | 4.49 |
| 44 | 1.75 | 2.11 | 2.61 | 3.05 | 3.57 | 4.03 | 4.43 |
| 45 | 1.73 | 2.08 | 2.57 | 3.01 | 3.52 | 3.98 | 4.38 |

## 3.0 INLET SIZING

| NODE | $Q_2$ CFS | INLET COND. | L | $Q_{max}$ CFS | |
|---|---|---|---|---|---|
| 100 | 13.5 | SUMP | 10' | 22 | O.K |
| 101 | 5.7 | SUMP | 5' | 11 | O.K. |
| 102 | 2.9 | SUMP | 5' | 11 | O.K |
| 103 | 21.5 | SUMP | 10' | 22 | O.K. |
| 104 | 8.4 | SUMP | 5' | 11 | O.K. |

## 4.0 PIPE SIZING:

| NODE FROM | NODE TO | $Q_2$ CFS | $\Sigma Q_2$ CFS | PIPE SIZE |
|---|---|---|---|---|
| 100 | 101 | 13.5 | 13.5 | 21" @ 0.7 % |
| 102 | 101 | 2.9 | 2.9 | 12" @ 0.7 % |
| 103 | 101 | 5.7 | 22.1 | 27" @ 0.5 % |
| 104 | 103 | 21.5 | 43.6 | 36" @ 0.4 % |
| 104 | OUTFALL | 8.4 | 52.0 | 42" @ 0.25 % |

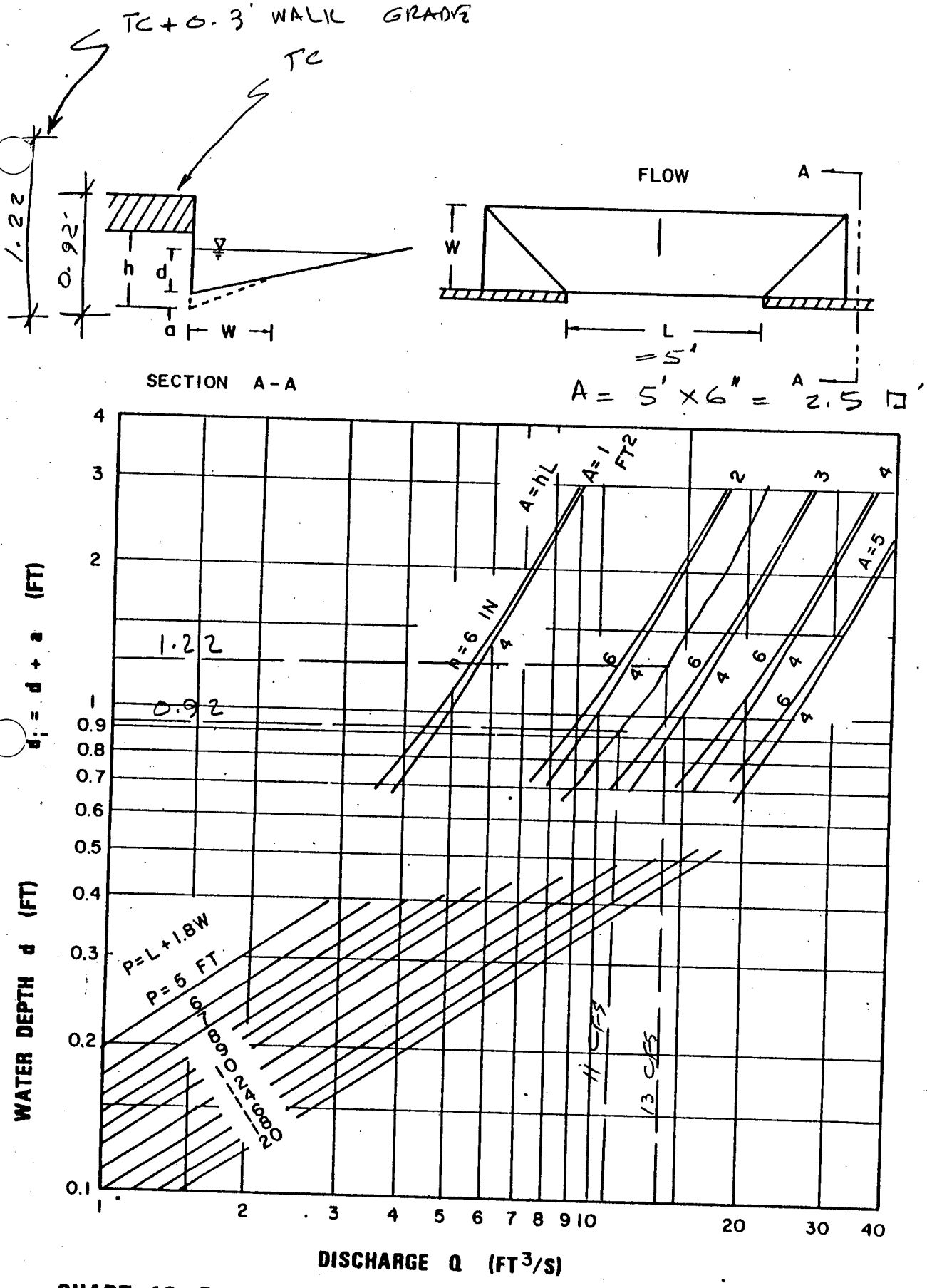



**CHART 12. Depressed curb–opening inlet capacity in sump locations.**

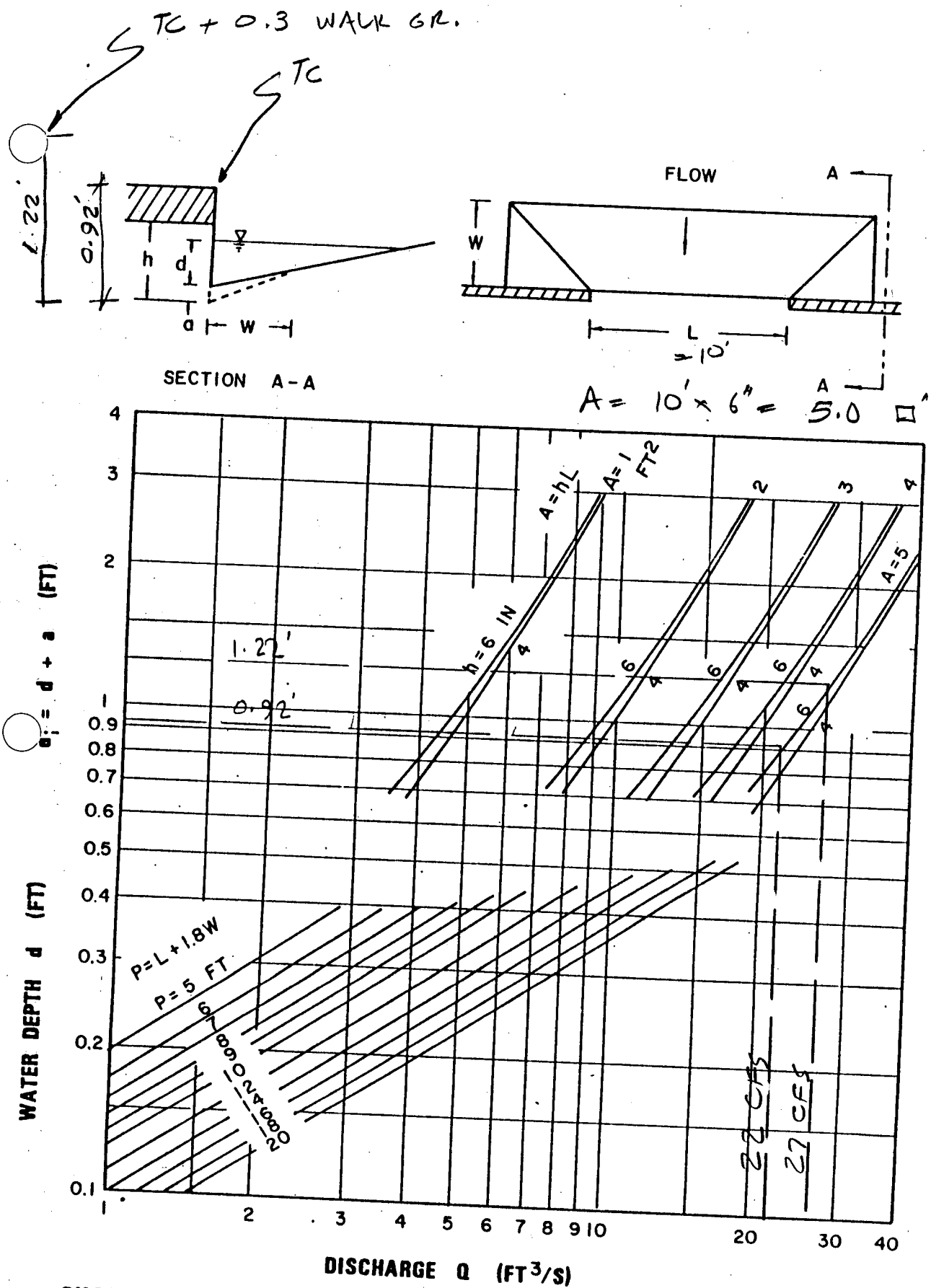



**CHART 12. Depressed curb-opening inlet capacity in sump locations.**

## 5.0 STREET FLOWS (2 YEAR):

BLUESTEM / HONEYTREE WILL HAVE COMB. C&G.

$X\text{-SLOPE} = \frac{3/8''}{1} = 0.03125$

$Z = \frac{1}{0.03125} = 32$

$n\ (\text{ASPH.}) = 0.016$

$Z/n = \frac{32}{0.016} = 2{,}000$

$S = 0.0032$

$d = 0.55'$

$Q_{CAP.} = 14\ \text{CFS} \leftarrow (\text{HALF STREET})$

$Q_2$ @ NODES 100, 101, 102 & 104 $< Q_{CAP}$

$Q_2$ @ NODE 103 $= 21.5\ \text{CFS}$

$Q_2\ (\text{FROM SOUTH}) = \frac{D.A.(S)}{D.A.} \times 21.5$

$= \frac{3.5}{10.2} \times 21.5 = 7.4\ \text{CFS}$ ← O.K

$Q_2\ (\text{FROM NE}) = 21.5 - 7.4 = 14.1\ \text{CFS}$

↑ O.K.

## NOMOGRAPH FOR FLOW IN TRIANGULAR CHANNELS

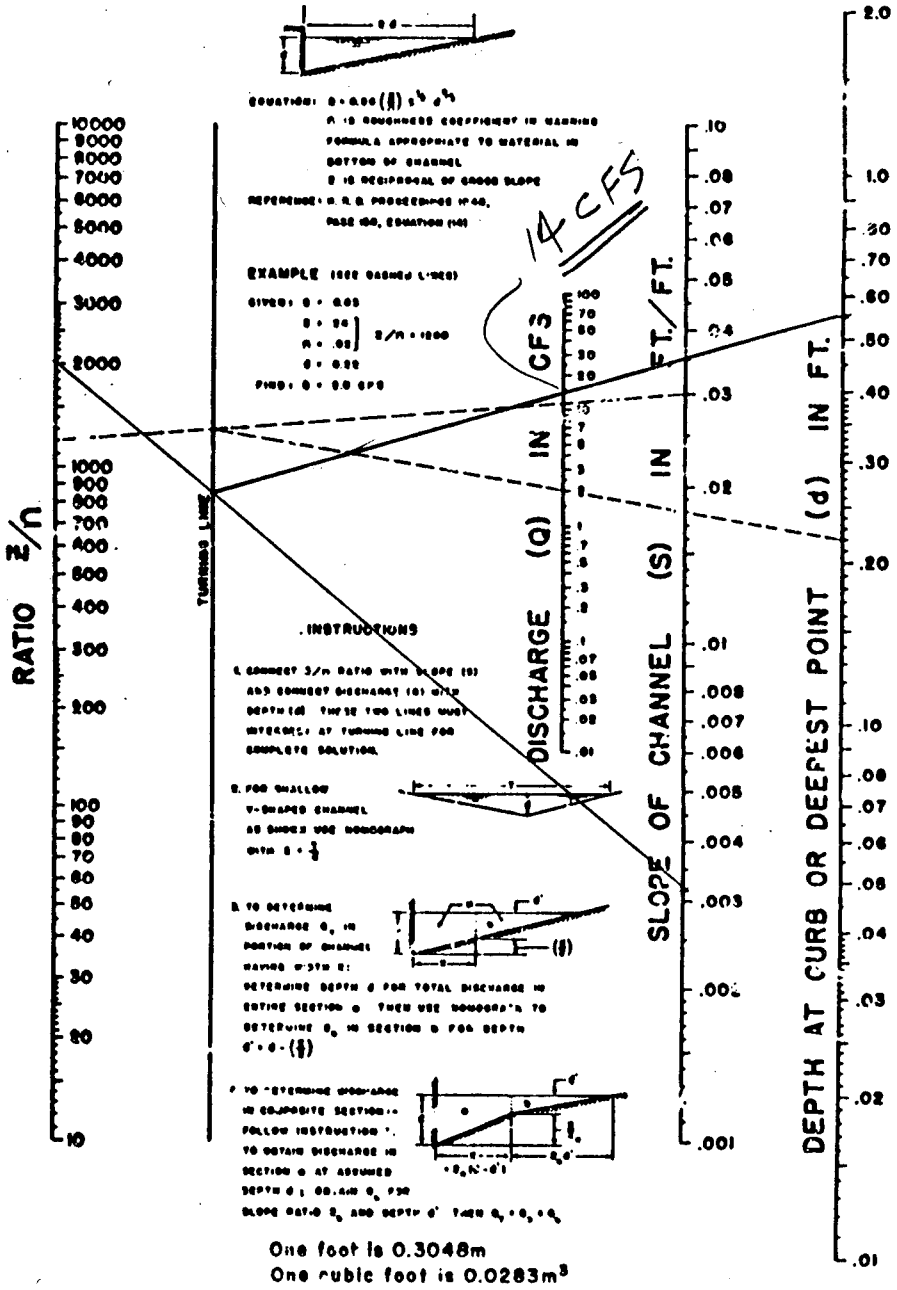
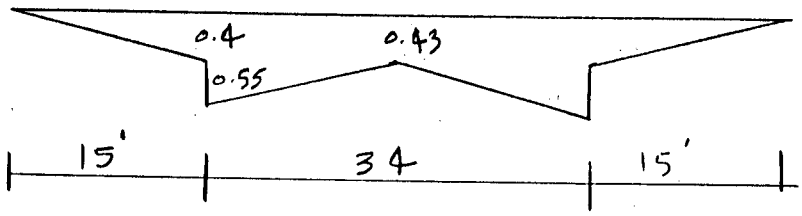



FIG. 5-1 *(After FHWA)*

# 6.0 STREET FLOW (100 YEAR)

WALK GRADE = + 0.4'




n (PARKING) = 0.03

n (GUTTER) = 0.013

n (ASPHALT) = 0.016

$$n(\text{COMP.}) = \frac{(2\times 14.5\times 0.03)+(2\times 3.05\times 0.013)+30\times 0.016}{65.1}$$

n (COMP.) = 0.022

$$A = \frac{2\times 0.4\times 15}{2} + \frac{2\times 0.52\times 17}{2} + 0.43\times 34$$

= 29.5 S.F.

P = 65.1

$$R = A/P = \frac{29.5}{65.1} = 0.45$$

S = 0.0032

$$Q_{CAP} = 29.5 \times \frac{1.486}{0.022} \times 0.45^{2/3} \times 0.0032^{1/2}$$

$Q_{CAP}$ = 66.0 CFS

$Q_{CAP}$ (HALF STREET) $= 66/2 = 33.0$ CFS.

$Q_{100}$ @ NODE 101, 102 & 103 $< Q_{CAP}$

O.K.

$Q_{100}$ @ NODE 100 $= 36.8$ CFS

$Q_{100}$ @ NODE 100 (FROM SOUTH) $= \frac{D.A.(SOUTH)}{D.A} \times 36.8$

$= \frac{1.9}{6.4} \times 36.8$

$= 10.9$ CFS ← O.K

$Q_{100}$ @ NODE 100 (FROM NE) $= 36.8 - 10.9$

$= 25.9$ CFS. ← O.K

$Q_{100}$ @ NODE 103 $= 58.6$ CFS

$Q_{100}$ @ NODE 103 (FROM SOUTH) $= \frac{D.A.(SOUTH)}{D.A.} \times 58.6$

$= \frac{3.5}{10.2} \times 58.6$

$= 20.1$ CFS ← O.K

$Q_{100}$ @ NODE 103 (FROM NE) $= 58.6 - 20.1$

$= 38.5$ C.F.S ←

$= 33.0$ CFS.

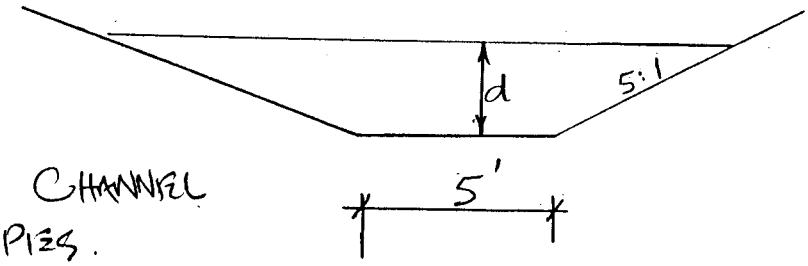
O.K

## 7.0 OVERFLOW CHANNEL

TOTAL $Q_{100}$ = 141.9 CFS

TOTAL $Q_2$ = 52.0 CFS

89.9 CFS




TRY 5' BOTTOM CHANNEL WITH 5:1 SLOPES.

$S = 0.005$

$d = 1.75'$

$A = 5 \times 1.75 + 2 \times 1.75 \times 5 \times 1.75/2$

$= 24.1$ SF.

$P = 5 + 2\sqrt{(1.75^2 + (5 \times 1.75)^2)}$

$= 22.8$

$R = 24.1 / 22.8 = 1.057$

$$Q_{CAP} = 24.1 \times \frac{1.486}{0.03} \times 1.057^{2/3} \times 0.005^{1/2}$$

$= 87.6$ CFS $\simeq$ 89.9 CFS

O.K. ←

MIN. DRAINAGE DEDICATION = $2 \times 1.75 \times 5 + 5$

$= 22.5' \simeq 25'$