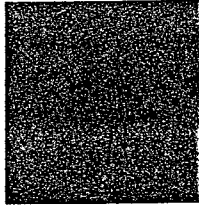


PROFESSIONAL
ENGINEERING
CONSULTANTS
PROFESSIONAL ASSOCIATION



November 17, 1992

Mr. David C. Spears, P.E.
Director, Sedgwick County
Bureau of Public Services
1250 S. Seneca
Wichita, KS 67213-4498

Attention: Harlan Foraker, P.E.

Reference: 29th St. Substation Addition
PEC File No. 36-92549-1-3040

Dear Mr. Spears:

Transmitted herewith are two (2) copies of the Drainage Plan and supporting computations for the referenced project. We would like to ask you to review and approve this Drainage Plan on or before the November 23, closing date for scheduling of a hearing before the Subdivision Committee of the Metropolitan Area Planning Commission.

If there are any questions, please advise.

Very truly yours,

PROFESSIONAL ENGINEERING CONSULTANTS, P.A.

Michael W. Berry

Michael W. Berry, P.E.
Manager
Land Development Division

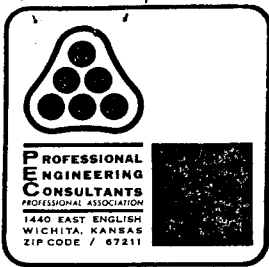
MWB:ama

Encl: As noted

cc: KG & E w/Attachments

DIRECTORS: D.E. MAHRE, P.E. W.B. KLEBE, P.E. R.D. FLEETCHER, P.E. M.J. SCHOMAKER, P.E. G.D. SCHNEF, P.E.
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303 S. TOPEKA
WICHITA, KANSAS 67202
(316) 262-2691
FAX (316) 262-3003



Date 11/14/92 MNB Page _____ of _____

Project KG+E 29th St Sub Plat 36-92549-1-

Item Ditch & Pipe Computations

Drainage Area

Plot = 1.4 Ac. Lies approx on ridge line. However, surveyor reported approx 200 L.F. of north road ditch flows toward existing culvert.

Use DA = 2.0 Ac to be conservative

Land use — pasture &/or gravel substation

Use C = 0.3

DA, small

Use $T_c = 15$ min.

Intensities

$$i_2 = 3.83 \text{ in/hr}$$

$$i_{10} = 5.22 \text{ in/hr}$$

$$i_{100} = 7.37 \text{ in/hr}$$

Compute discharge by Rational Formula

$$Q_2 = 2.3 \text{ CFS}$$

$$Q_{10} = 3.1 \text{ CFS}$$

$$Q_{100} = 4.4 \text{ CFS}$$

Road ditch grade = 1.5%

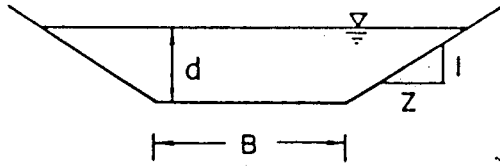
Assume 4' ditch, 4:1 slopes, $n = 0.050$

Find depth d $d_2 =$ $d_{10} =$ $d_{100} =$

Try 24" x 40' CMP Entrance Pipe

1004E
 29th St Substation Plat
 MWS 1/14/92 36-92549-1

$n = 0.050$
 $Qn_2 = 0.050 \times 2.3 = 0.115$
 $Qn_{10} = 0.050 \times 3.1 = 0.155$
 $Qn_{100} = 0.050 \times 4.4 = 0.22$



NOTE: Project horizontally from Z=0 scale to obtain values for Z=1 to 6

$d/B_2 = 0.07 \quad d = 0.28'$
 $d/B_{10} = 0.08 \quad d = 0.32'$
 $d/B_{100} = 0.09 \quad d = 0.36'$

DITCH DEPTHS
 8/11 $\frac{d}{B}$

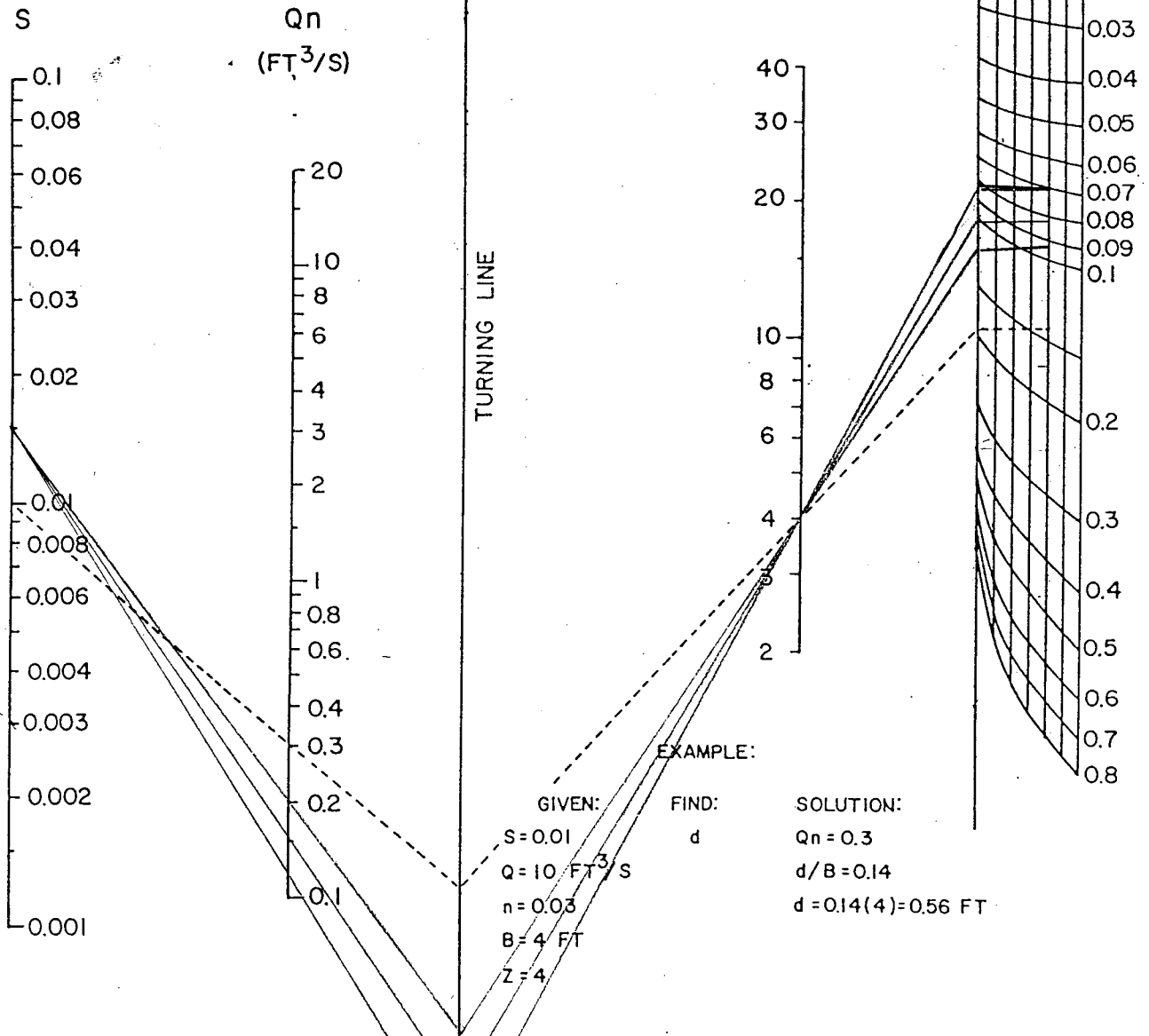


CHART 16. Solution of Manning's equation for channels of various side slopes.

PROJECT: K&T E 29th St Sub Plat

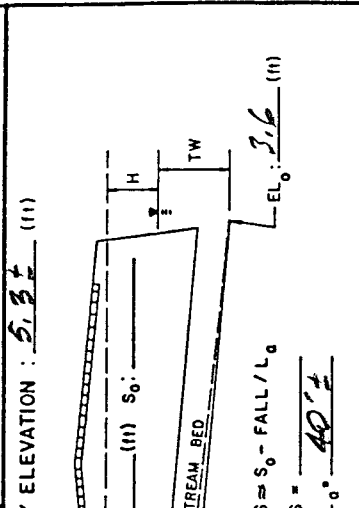
STATION: _____ OF _____

SHEET 1 OF 1

CULVERT DESIGN FORM

DESIGNER/DATE: MBS 11/14/92

REVIEWER/DATE: _____



HYDROLOGICAL DATA

METHOD: RATIONAL

DRAINAGE AREA: 2.0 STREAM SLOPE: 0.015

CHANNEL SHAPE: 4' FLAT BPT 4:1

ROUTING: _____ OTHER: _____

DESIGN FLOWS/TAIWATER

R.I. (YEARS) 10 FLOW (cfs) 3.1 TW (ft) 4.4

100 3.1 4

4.4

CULVERT DESCRIPTION:

MATERIAL - SHAPE - SIZE - ENTRANCE

TOTAL FLOW PER BARREL	INLET CONTROL		OUTLET CONTROL				COMMENTS						
	HW _i /D (2)	HW _i (3)	FALL (3)	EL _{hi} (4)	TW (5)	d _c		d _c +D/2 (6)	h _o (6)	k _e (7)	H (7)	EL _{ho} (8)	
3.1	0.4	0.8		5.0		0.5	1.3	1.3	0.5	n _i /1	4.9	5.0	OK
4.4	0.5	1.0		5.2		0.5	1.3	1.3	0.5	n _i /1	4.9	5.2	OK
3.1	0.45	0.7		4.9		0.5	1.0	1.0	0.5	n _i /1	4.6	4.9	OK
4.4	0.55	0.8		5.0		0.5	1.0	1.0	0.5	n _i /1	4.6	5.0	OK

TECHNICAL FOOTNOTES:

(1) USE Q/NB FOR BOX CULVERTS

(2) HW_i/D = HW / D OR HW_i/D FROM DESIGN CHARTS

(3) FALL = HW_i - (EL_{hd} - EL_o) ; FALL IS ZERO FOR CULVERTS ON GRADE

(4) EL_{hi} = HW_i + EL_i (INVERT OF INLET CONTROL SECTION)

(5) TW BASED ON DOWN STREAM CONTROL OR FLOW DEPTH IN CHANNEL

(6) h_o = TW or (d_c + D/2) (WHICHEVER IS GREATER)

(7) H = [+ k_e + (29 n_i² L) / R^{1.33}] V² / 2g

(8) EL_{ho} = EL_o + H + h_o

SUBSCRIPT DEFINITIONS:

Q - APPROXIMATE

f - CULVERT FACE

hd - DESIGN HEADWATER

ri - HEADWATER IN INLET CONTROL

ho - HEADWATER IN OUTLET CONTROL

i - INLET CONTROL SECTION

o - OUTLET

ni - STREAMBED AT CULVERT FACE

tw - TAILWATER

COMMENTS / DISCUSSION:

CULVERT BARREL SELECTED:

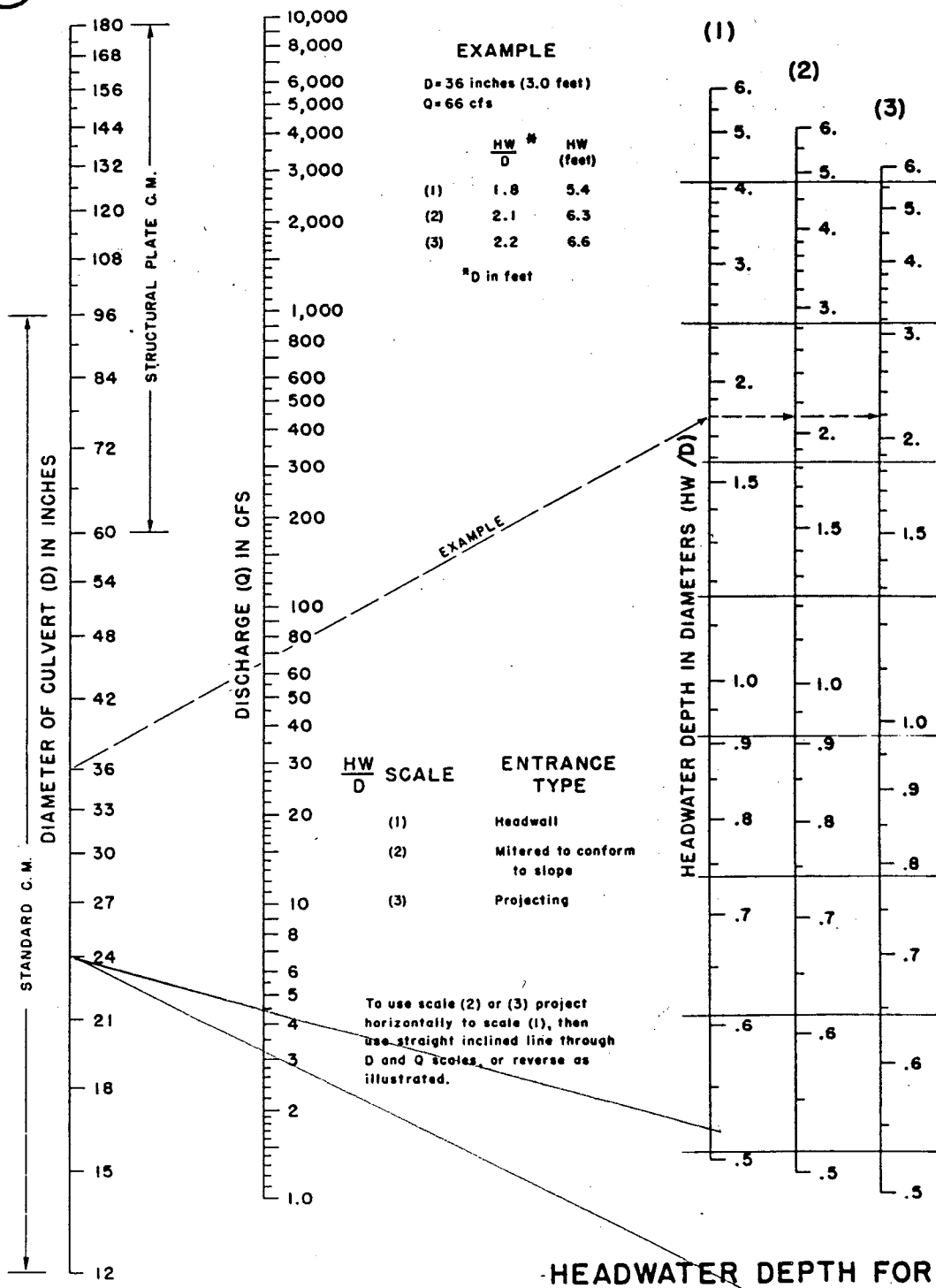
SIZE: _____

SHAPE: _____

MATERIAL: _____

ENTRANCE: _____

CHART 2

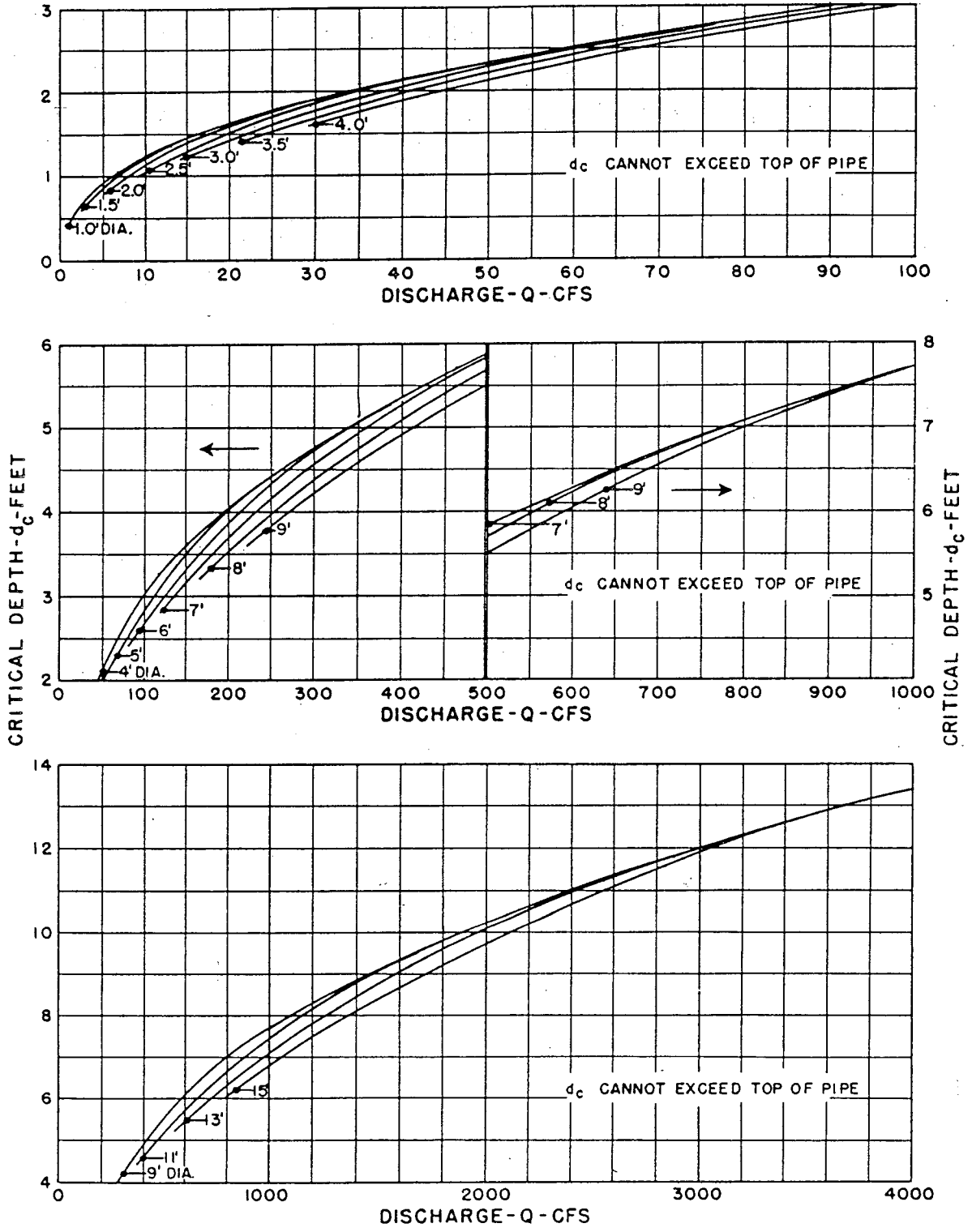


BUREAU OF PUBLIC ROADS JAN. 1963

**HEADWATER DEPTH FOR
 C. M. PIPE CULVERTS
 WITH INLET CONTROL**



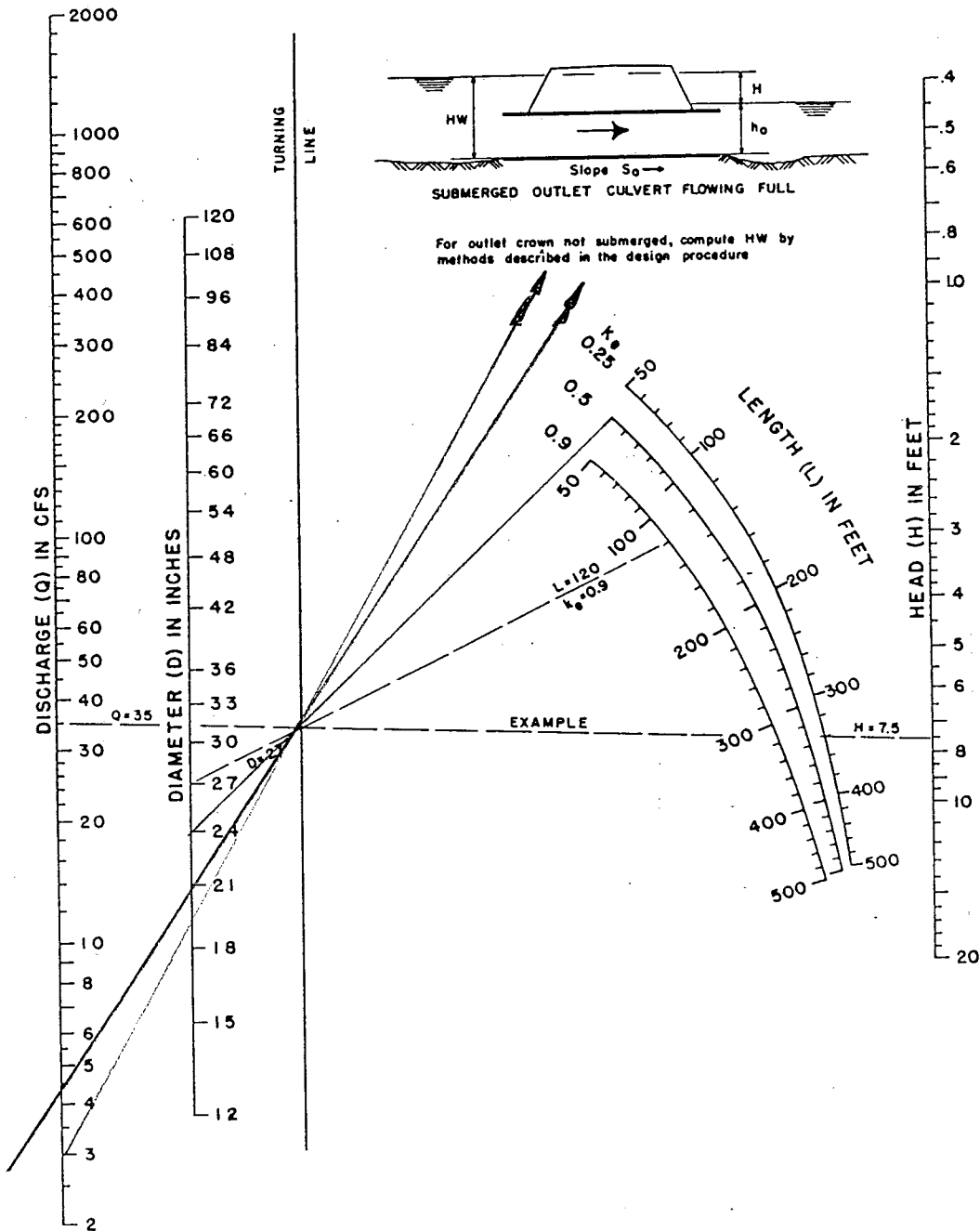
CHART 4



BUREAU OF PUBLIC ROADS
JAN. 1964

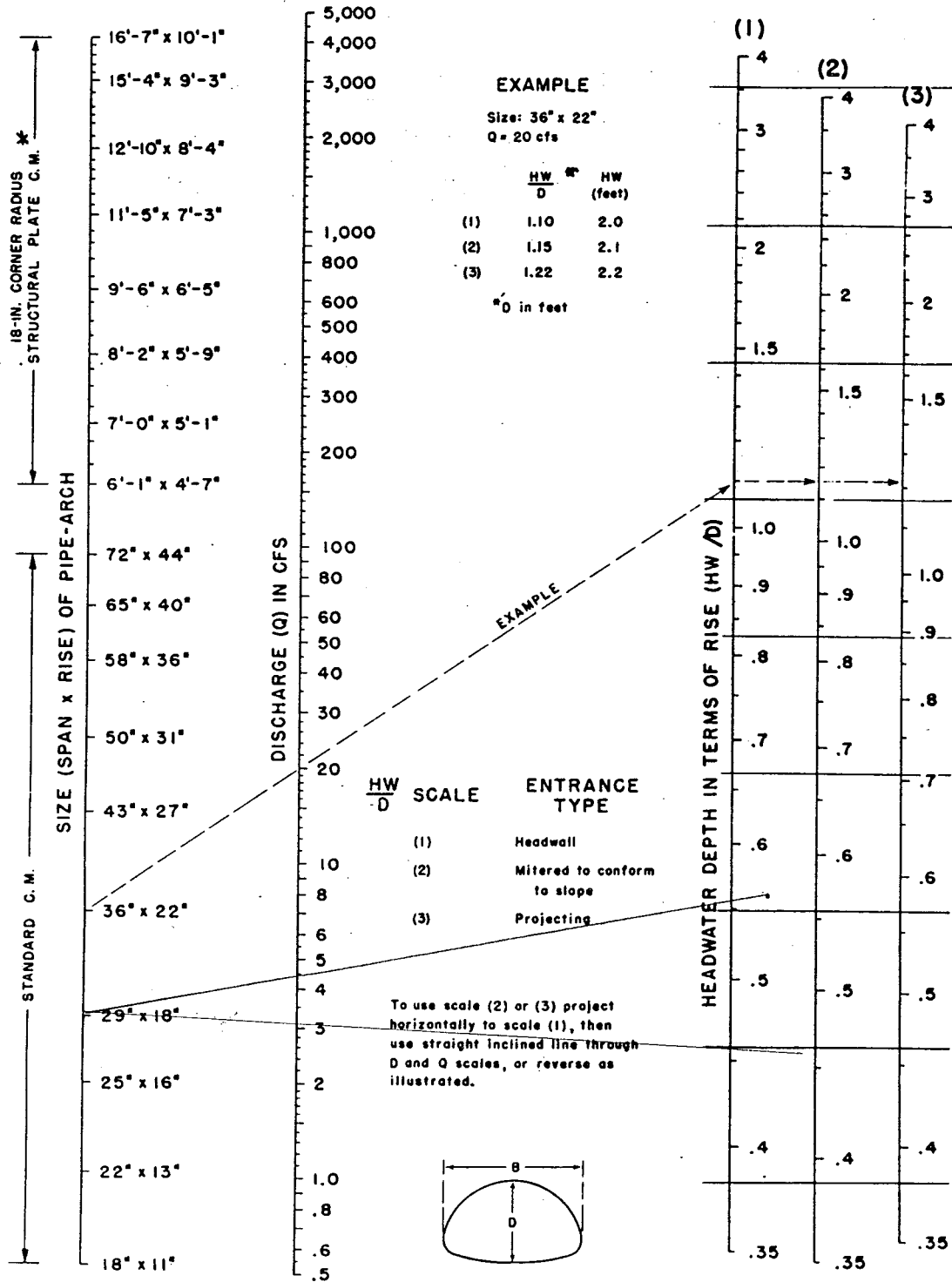
CRITICAL DEPTH CIRCULAR PIPE

CHART 6



HEAD FOR
STANDARD
C. M. PIPE CULVERTS
FLOWING FULL
 $n = 0.024$

CHART 34

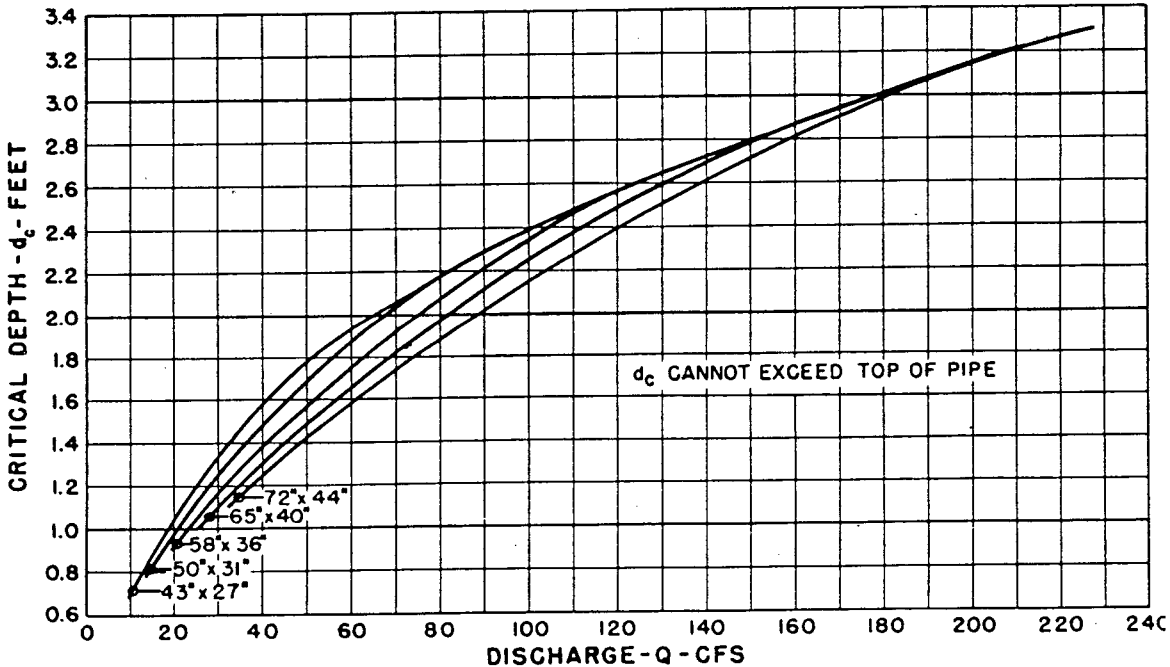
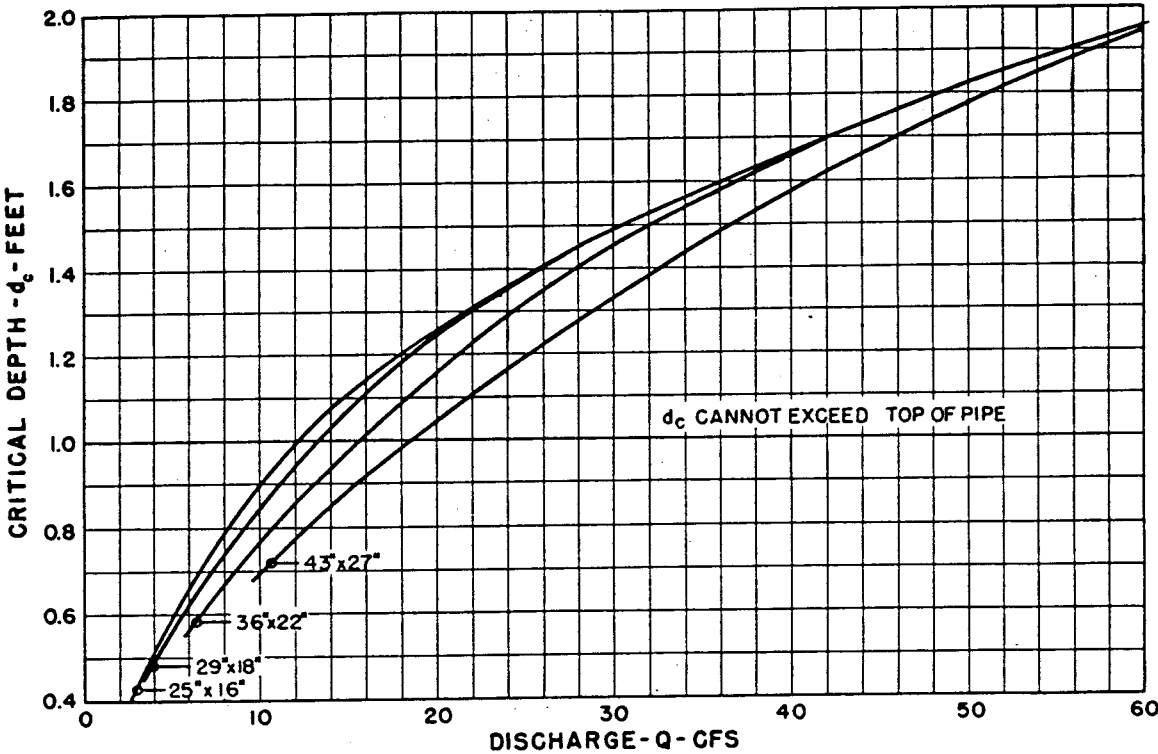


*ADDITIONAL SIZES NOT DIMENSIONED ARE LISTED IN FABRICATOR'S CATALOG

BUREAU OF PUBLIC ROADS JAN. 1963

HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

CHART 37

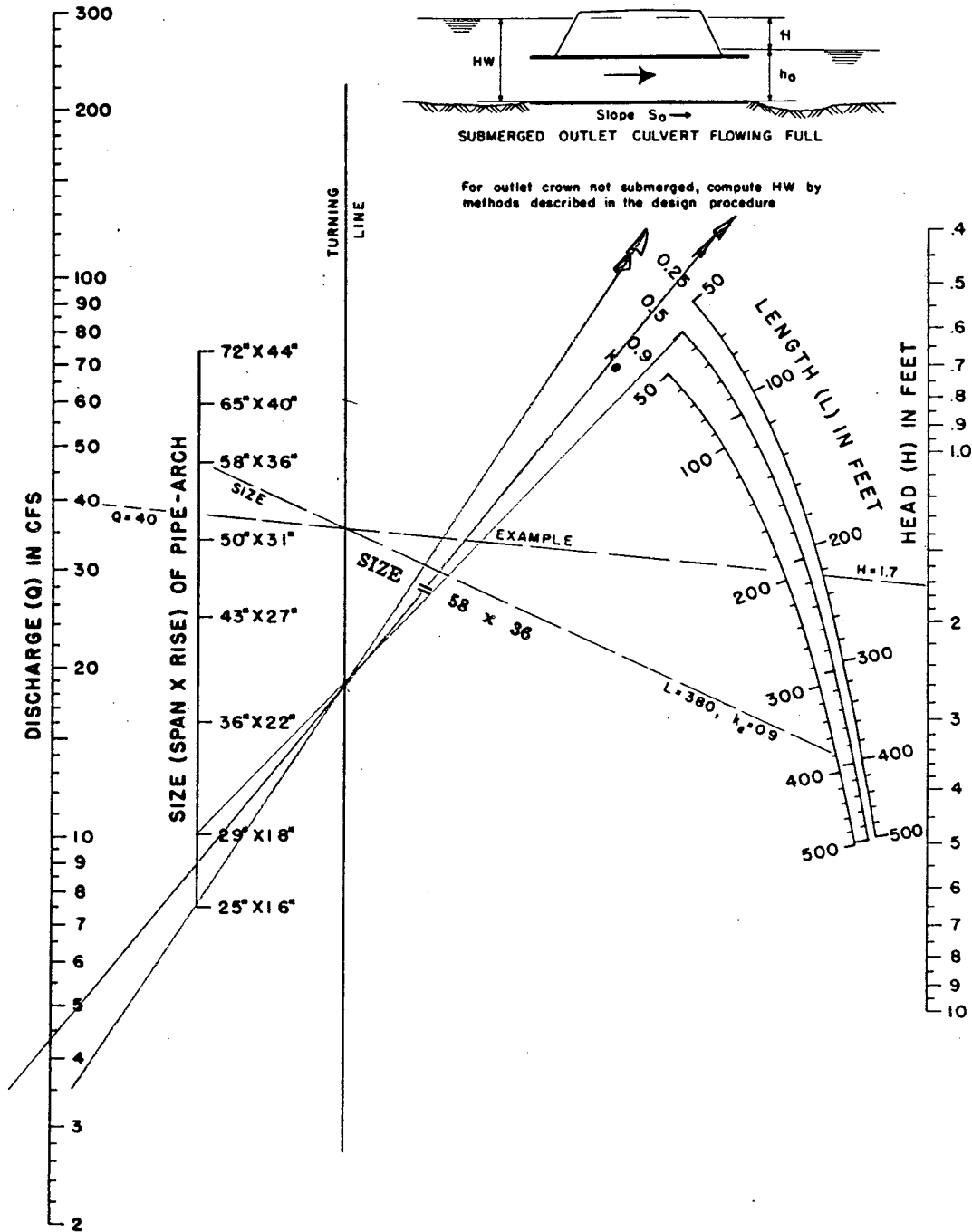


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 JAN. 1964

CRITICAL DEPTH STANDARD C.M. PIPE-ARCH



CHART 39



**HEAD FOR
STANDARD G. M. PIPE-ARCH CULVERTS
FLOWING FULL
 $n=0.024$**

BUREAU OF PUBLIC ROADS JAN. 1963