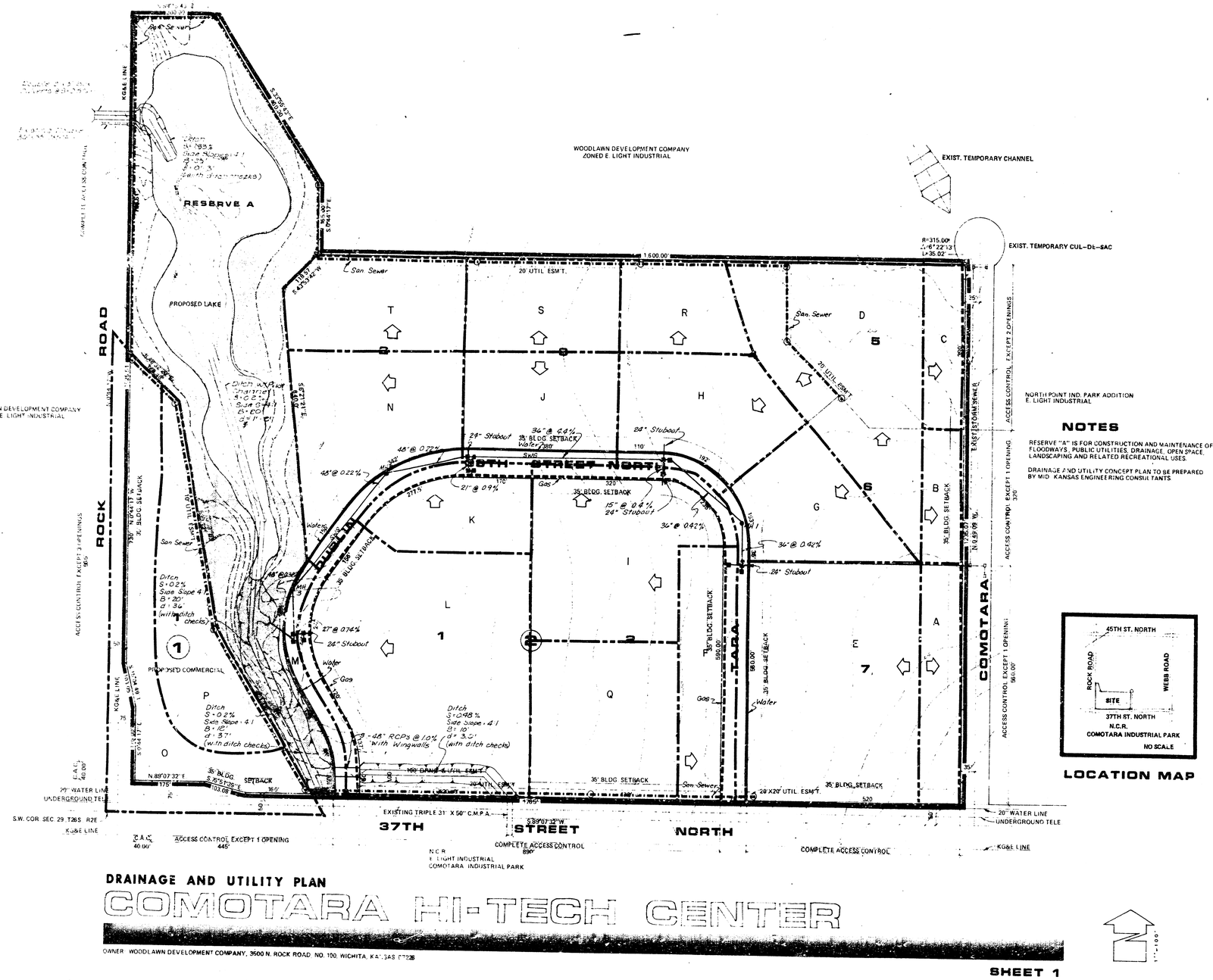


NOTES

RESERVE "A" IS FOR CONSTRUCTION AND MAINTENANCE OF FLOODWAYS, PUBLIC UTILITIES, DRAINAGE, OPEN SPACE, LANDSCAPING AND RELATED RECREATIONAL USES.

DRAINAGE AND UTILITY CONCEPT PLAN TO BE PREPARED BY MID-KANSAS ENGINEERING CONSULTANTS

LOCATION MAP

DRAINAGE AND UTILITY PLAN

COMOTARA HI-TECH CENTER

OWNER WOODLAWN DEVELOPMENT COMPANY, 3500 N. ROCK ROAD, NO. 100, WICHITA, KANSAS 67226

SHEET 1

BILL G. YUNG DESIGN
8225 E. 38TH ST. NORTH, WICHITA, KS. 37235 316 682-5561

date NOVEMBER 19, 1984
rev. NOV 26, 1984

sheet title
PRELIMINARY PLAT

project
COMOTARA HI-TECH CENTER

sheet 2

	AREA (ACRES)	AREA ACCUM.	C	T (MIN)	I (IN/HR)	Q (CFS)	Q100 (CFS)	PIPE SLOPE	PIPE SIZE	REMARKS
A	1.16		0.70	10	5.21	8.98	9.9			
		15.76	0.70	19	4.75	52.5	90.4			
B	0.72		0.70	15	5.21	8.98	9.9			Exist. Retaining
		16.48	0.70	19	4.76	54.9	94.5			Exist. Retaining
C	0.89		0.70	15	5.21	8.96	9.9			
		17.37	0.70	19	4.76	57.3	98.6			Exist. Retaining
D	1.82		0.70	20	4.58	8.33	15.7			
E	5.01		0.70	16	5.09	8.74	21.4			
F	1.86		0.70	15	5.21	8.68	11.3	12.1%	18"	
		7.37	0.70	16	5.09	8.74	48.3	3.22%	24"	
G	2.18		0.70	15	5.21	8.48	11.7			
		10.15	0.70	18	4.85	8.67	58.7			
H	2.53		0.70	15	5.21	8.96	9.4	5.3		
		12.68	0.70	19	4.76	8.19	60.2	1.7	24"	
I	3.90		0.70	15	5.21	7.08	14.2	25.1		
		16.58	0.70	20	4.66	8.11	75.1	30.1		
J	3.23		0.70	15	5.21	8.48	9.1	14.3		
		19.81	0.70	21	4.57	7.48	90.2	19.9	30"	
K	1.73		0.70	15	5.21	8.48	9.1	15.1		
		20.16	0.70	22	4.48	7.40	92.1	19.4	30"	
L	7.22		0.70	16	5.09	8.24	25.7	44.2		
		27.78	0.70	25	4.27	7.26	83.3	44.6		
M	0.48		0.95	15	5.21	8.48	7.4	9.1		
		28.26	0.71	26	4.21	7.22	94.1	45.3	30"	
N	3.37		0.70	15	5.21	8.46	12.3	29.5		Not Calc'd
O	4.50		0.70	15	5.21	8.48	16.4	28.1		Not Calc'd
P	1.58		0.70	15	5.21	8.48	15.7	28.8		Not Calc'd
Q	3.20		0.70	15	5.21	8.48	11.7	20.1		Not Calc'd
R	1.32		0.70	15	5.21	8.48	9.5	9.6		Not Calc'd
S	1.98		0.70	15	5.21	8.98	11.2	15.4		Not Calc'd
T	2.32		0.70	15	5.21	8.98	8.5	14.8		Not Calc'd
Reserve A	42.87		0.70	15	5.21	8.98	46.2	78.9		Not Calc'd
Ditch in Reserve A	24.00 will vary.		45 denotes to control erosion.							
Initial	13.92		0.70	18	4.86	8.27	47.4	81.0		
48 Culvert Under Dublin		81.90	0.70	37	3.33	5.74	190.9	330.2		
Final		110.16	0.70	39	3.29	5.12	254.2	439.4		
Total acreage of Runoff to Lake	145.18		0.70	45	3.06	4.95	290.7	503.0		

Culverts - 1

HI-Tech Center
FRH 11/13/85

Determine max Q through two 4 - 31"x50" CMPA's

Approx. Design Data

L=110'
S=0.004 ft/ft
Allowable HW=4'

CMPA w/ square edge inside
Ke=0.5

Max Head = 3½' = 3.583'

A for Inlet Control

$\frac{HW}{D} = \frac{3.583}{2.583} = 1.55$ from Chart 6 for 1 CMPA, Q = 65 cfs

Total Q = 4 x 65 = 260 cfs

B for Outlet Control

$HW = 4' = H + h_o - LS \Rightarrow H + h_o = HW + LS = 4 + (110)(.003) = 4.44'$

$H = 4.44 - 2.583 = 1.857'$ from Chart 12, Q = 65 cfs

Total Q = 4 x 65 = 260 cfs

Design Ditch based on Q = 260 cfs. Present Ditch is approx 5' deep. ∴ use 1:1, $w = \frac{260}{5 \times 3.2} = 16.25'$ use 16'

Flow Given Area = 3.2(7)(5.18) = 207 cfs

Ditch: use 5:6', d = 4', S = 2.232' // 1 ft 1/4 : Slope 1:1

Initial ℄ Elev of Ditch = 200 - 5 = 195

℄ Elev @ ROW of Dublin = 201 - 0.002(4.5) = 200.17

To get 1 ditch 5' in ground, ℄ Elev @ R.O.W of Dublin must be 202 - 5 = 197.0. Then $L_{min} = \frac{3.83}{.002} = 2135'$

With 2 ditch checks $S = \frac{3.83}{670} = .0057$

Culverts - 2

HI-Tech Center
FRH 11/22/85

Try B=8', d=3', Side slopes 4:1 ; Q = 268.3 cfs N.G.

Try B=10', d=3', " 4:1 Q = 297.8 cfs > 260 cfs OK



Total ℄ Elev of Ditch = 206.9 - 4.0 = 202.90 - 3 ditch checks @ 0.40' each = 1.20' ± 1' CMPA ?

℄ Elev @ R.O.W. of Dublin = 206.9 - 0.01(418) = 197.85

Approx depth reqd Culvert = 205 - 197.85 = 7.15'

Before the culvert under Dublin can be designed, the ℄ of the ditch to the lake must be determine. To determine this ℄, the ex culvert @ ±= 10:53, 37th St N. must be designed. ℄ Elev @ outlet of RCEC will be approx. 196.75. Assuming a slope of 0.6% on the ditch to the lake, the ℄ Elev of the ditch @ the outlet of the ex culvert would be 196.75 + .006(550) = 196.65

Culverts - 3

HI-Tech Center
FRH 11/23/85

A. For Inlet Control

RCP	Try 2 - 36" Chart 2	$\frac{HW}{D} = \frac{4}{3} = 1.33$	Q = 50 cfs x 2 = 100 cfs	N.G.
	Try 3 - 42"	$\frac{HW}{D} = \frac{4.2}{3} = 1.4$	Q = 63 cfs x 3 = 180 cfs	N.G.
	Try 3 - 48"	$\frac{HW}{D} = \frac{4.8}{4} = 1.2$	Q = 80 cfs x 3 = 240 cfs	N.G.
HERCP	Try 3 - 38"x60" Chart 3	$\frac{HW}{D} = 1.26$	Q = 93 cfs x 3 = 279 cfs	OK
CMP	Try 2 - 42" Chart 5	$\frac{HW}{D} = 1.10$	Q = 72 x 3 = 216 cfs	N.G.
CMPA	Try 3 - 36"x98" Chart 6	$\frac{HW}{D} = 1.33$	Q = 70 x 3 = 210 cfs	N.G.

B. For Outlet Control

Try 3 - 48" RCP's Chart 9 Q = 98 cfs H = 1.55'

$d_c = 2.9'$ Chart 9 $TW = 4' - (197.19 - 196.15) = 3.46'$

$\frac{h_o + 2}{D} = \frac{2.46}{4} = 3.95'$ Chart 10 $HW = H + h_o - LS = 1.55 + 3.95 - (66)(.01) = 4.34'$ ✗

Try 3 - 38" x 60" HERCP Chart 10 Q = 99 cfs H = 1.48'

$d_c = 2.46'$ Chart 17 $\frac{d_c + D}{2} = \frac{2.46 + 3.17}{2} = 2.81$ $TW = 3.46'$

$HW = 1.48 + 3.96 - .66(.01) = 4.28'$ ✗

An HW of 4' would put the water surface @ 197.85 + 4 = 201.85. The ℄ of the ditch to the lake must be determined. To determine this ℄, the ex culvert @ ±= 10:53, 37th St N. must be designed. ℄ Elev @ outlet of RCEC will be approx. 196.75. Assuming a slope of 0.6% on the ditch to the lake, the ℄ Elev of the ditch @ the outlet of the ex culvert would be 196.75 + .006(550) = 196.65

Culverts - 4

HI-Tech Center
FRH 11/24/85

A. For Inlet Control

$\frac{HW}{D} = \frac{5.5}{4.75} = 1.16$ Chart 2 Q = 95 cfs x 3 = 285 cfs OK

$\frac{HW}{D} = \frac{5}{4} = 1.25$ Q = 100 cfs x 3 = 330 cfs OK

B. For Outlet Control

3 - 48" RCP Chart 9 Q = 95 cfs H = 1.55' TW = 3.46

$d_c = 2.95'$ Chart 16 $\frac{h_o + D}{2} = \frac{2.90 + 4}{2} = 3.95$ $HW = 1.55 + 3.95 - .26 = 5.24' < 6.65'$ OK

Ditch To Lake

Initial Q = 81.2 cfs Configuration of ditch would initially S = 0.2%, Side Slope 4:1, Total Depth = 207.5 - 197.1 = 7.4' With 4:1 Side Slope, the side slopes of ditch would be 30', with B = 8', d = 2.25' Q = 92.6 cfs

Total width of ditch would be (30)(2) + 8 = 68' < 75' easement.

@ Dublin culvert Q_{100} = 330.2 cfs

S = 0.2% Side Slope = 4:1, B = 12', d = 3.7' Q = 331.2 cfs ≈ 330.2 cfs OK

Comotara Hi-Tech Center
FRH 11/25/85

Culverts - 5

Culvert at Rock Road

Proposed top of curb for Rock Rd @ proposed culvert, Elev = 173.4

Top of Culvert must ∴ be @ 193.18 - 2.0 = 191.18

Per KDE, assume lake is a ditch, rather than detention basin. ∴ Determine Time of Travel, T_c, to culvert from 48" RCP End Sect

Approx S = 0.5%, approx side slopes 1.5:1; approx B = 225'

approx d_c = 2.25' Q = 498 cfs

Area of channel X-section = 136 sq ft, $V = \frac{498}{136} = 3.7$ fps

T_c = 1200 ft ÷ [3.7 fps x 60 sec/min] = 5.9 min

T_c = 6 + 5.9 = 11.9 min Q_{100} = 505 cfs

To minimize the depth of the ℄ @ Rock Rd make culvert height approx. 3' max. ∴ approx. ℄ elev of culvert = 191.18 - 3 - 1 = 187.18

A. For Inlet Control

Try two 8'x3' RCBC's w/ 45° Wingwalls Chart 1

$Q_{per\ box} = \frac{505}{2} = 252.5$ cfs $\frac{D}{B} = \frac{3.5}{8} = 31.5$ Chart 1

$\frac{HW}{D} = 2.05$ $HW = 2.05(3) = 5.05'$ 187.18 + 5.05 = 193.23 < 193.8 N.

Culverts - 6

Comotara Hi-Tech Center
FRH 11/26/85

Based on d_c; $HW = H - h_o - LS = .58 - 3.0(.005) = 3.37' < 5'$ OK

Max HW = 5.0' for inlet control ∴ HW must be less than that to keep culvert under inlet control. This makes $TW < HW + h_o - LS = 5 - 1.64 - .58 = 2.78'$

In order for flow to correlate west of Rock Rd a ditch will be required. For map, the nearest 3' contour is approximately 350' or west. The slope of the ditch, $S = \frac{197 - 193.5}{350} = .0057$ use 0.005

Ave. Elev in this area = 190 ∴ depth of ditch = 3'

Try B = 20', d = 3.0' S in Slopes = 4:1 $Q = 479.5 < 505$ cfs ✗

Try B = 25', d = 2.5', " " " = 4:1 $Q = 425$ cfs Close Enough

Try B = 25', d = 2.6', " " " = 4:1 $Q = 455$ cfs OK

Try B = 26', d = 2.8', " " " = 4:1 Q = 5.6 x 82 = 459 cfs

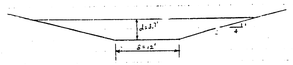
TW = 2.8' < 3.2' OK

Centura HL-Tech Center
FCN 1/28/84

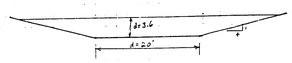
Ditch Cross-Sections - 1

Ditch in Reserve A, N. of 3-48" RCP's

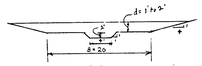
Initial Cross Section



2nd Cross Section



3rd Cross Section



Ditch in Reserve A, South of Double 9'x3' Box Culverts.

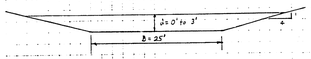
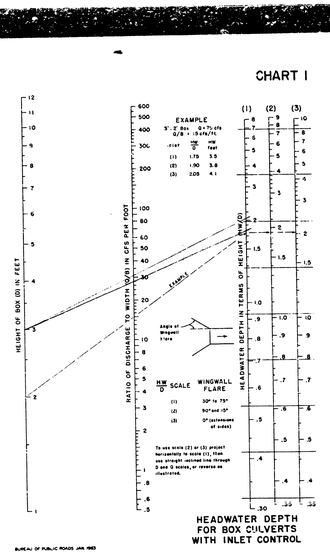


CHART 1

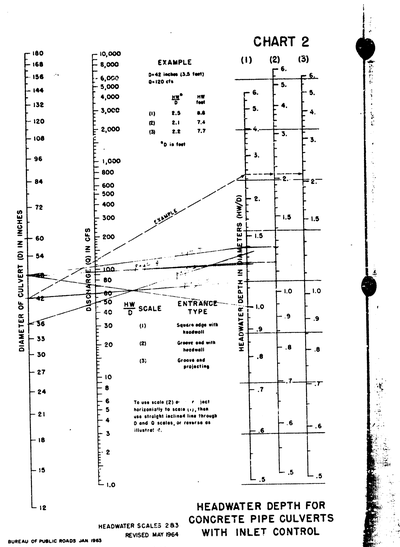


HEADWATER DEPTH FOR BOX CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-21

CHART 2



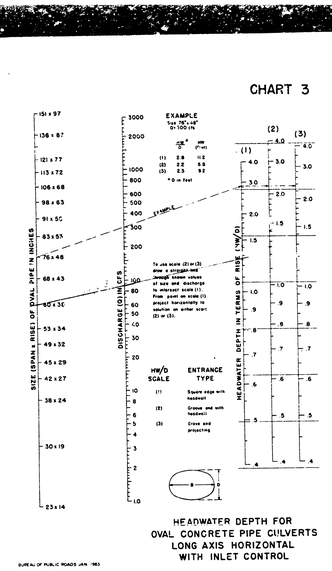
HEADWATER DEPTH FOR CONCRETE PIPE CULVERTS WITH INLET CONTROL

HEADWATER SCALES 2&3 REVISED MAY 1964

BUREAU OF PUBLIC ROADS JAN 1963

5-22

CHART 3

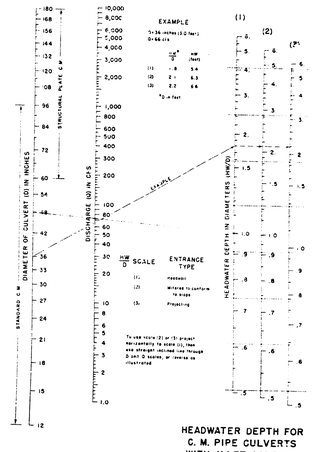


HEADWATER DEPTH FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-23

CHART 5

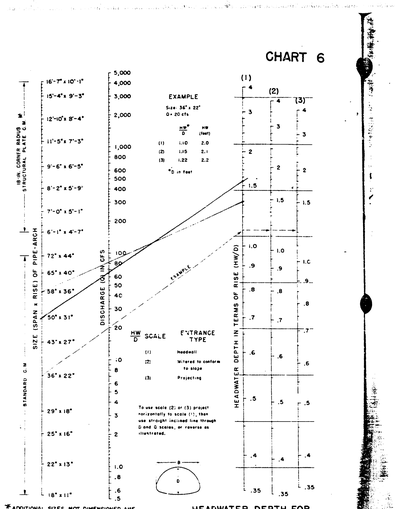


HEADWATER DEPTH FOR C. M. PIPE CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-25

CHART 6

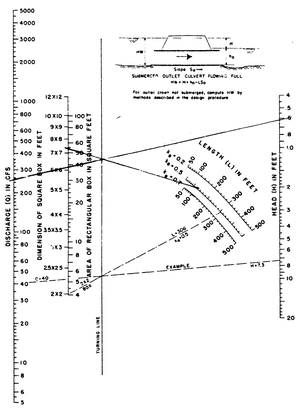


HEADWATER DEPTH FOR C. M. PIPE-ARCH CULVERTS WITH INLET CONTROL

BUREAU OF PUBLIC ROADS JAN 1963

5-26

CHART 8

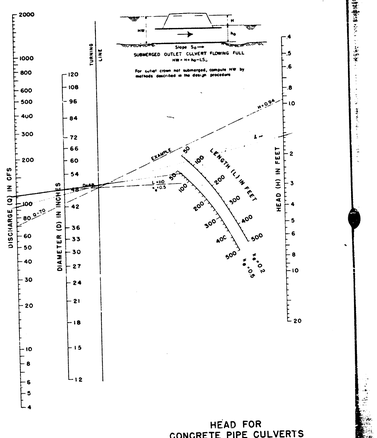


HEAD FOR CONCRETE BOX CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

5-31

CHART 9

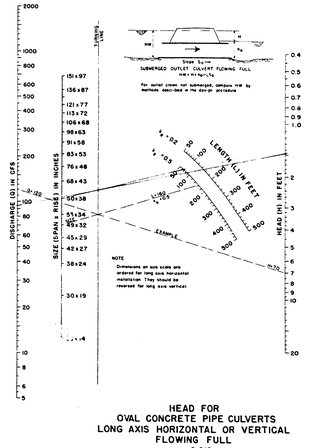


HEAD FOR CONCRETE PIPE CULVERTS FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN 1963

5-32

CHART 10

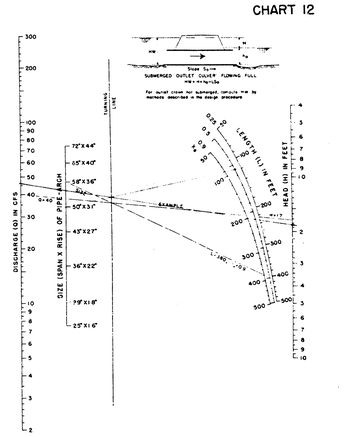


HEAD FOR OVAL CONCRETE PIPE CULVERTS LONG AXIS HORIZONTAL OR VERTICAL FLOWING FULL n = 0.012

BUREAU OF PUBLIC ROADS JAN. 1963

5-33

CHART 12



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

BUREAU OF PUBLIC ROADS JAN. 1963

5-35

Chart 15

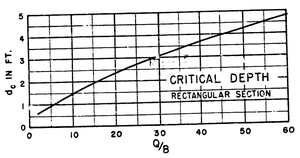


CHART 16

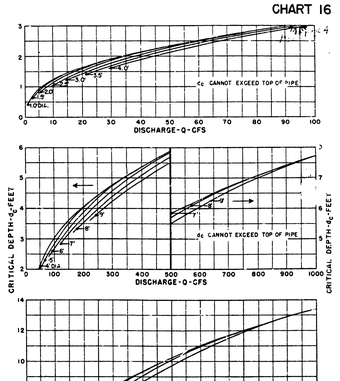


CHART 17