APPENDIX B

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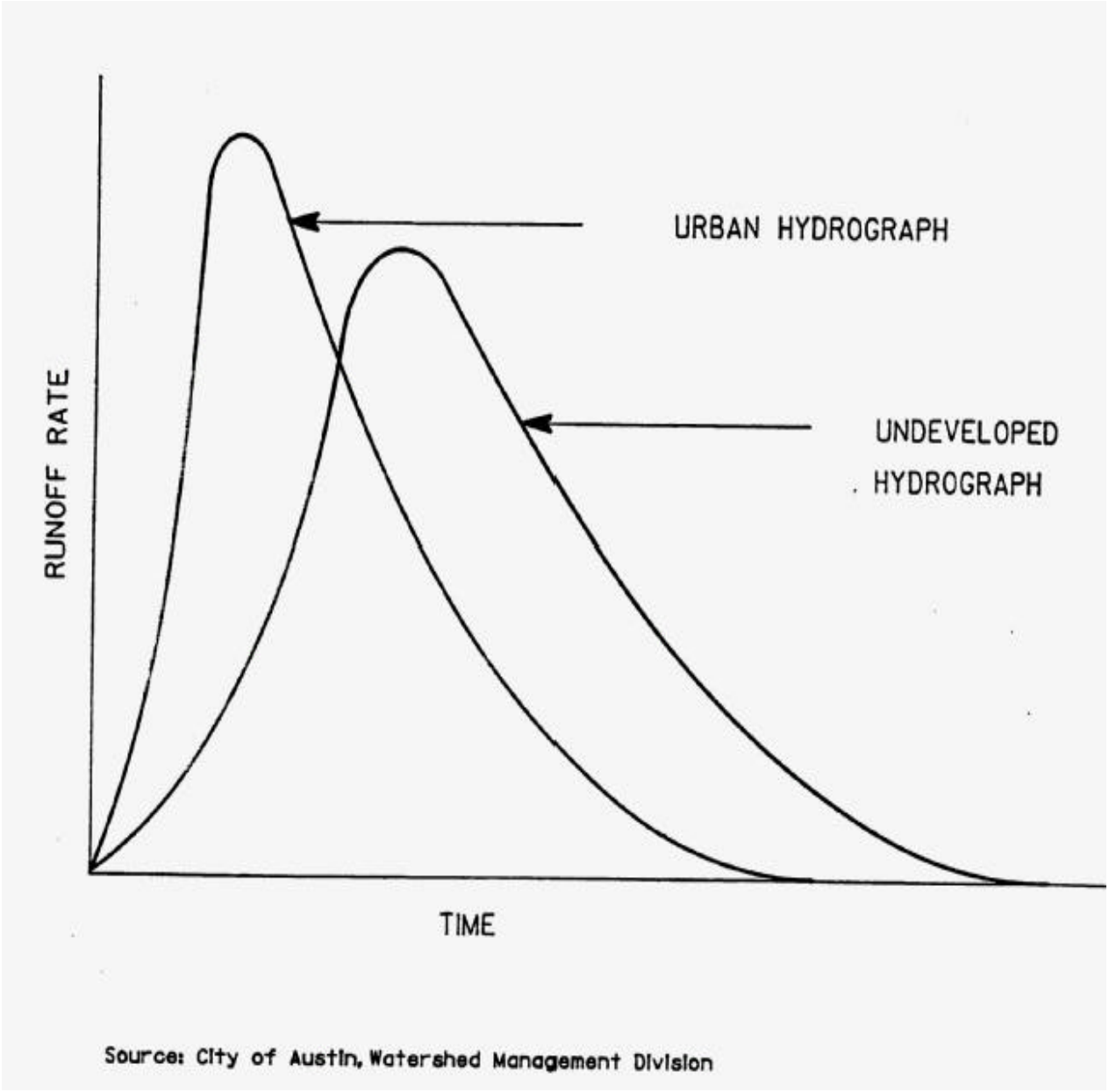
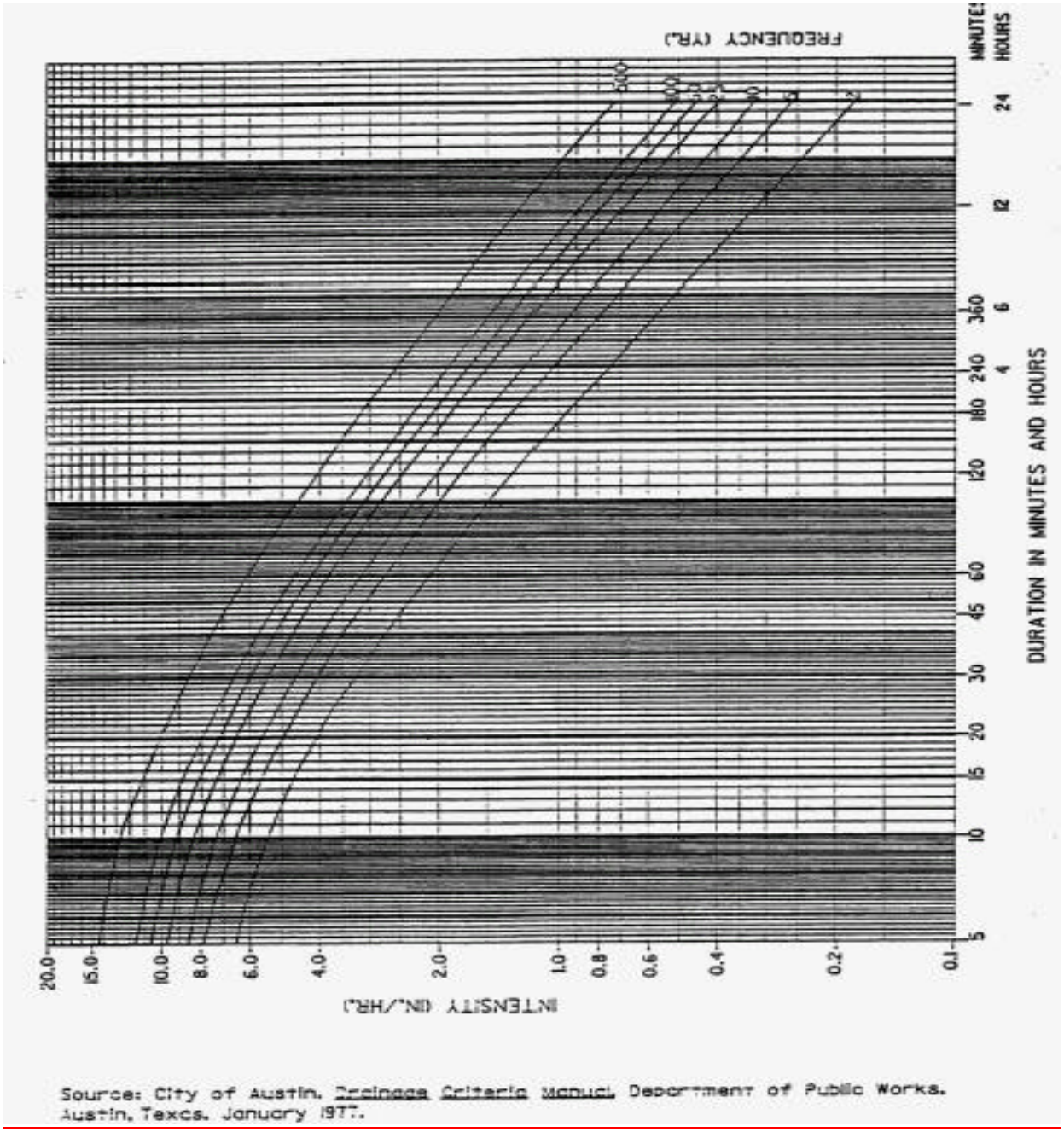
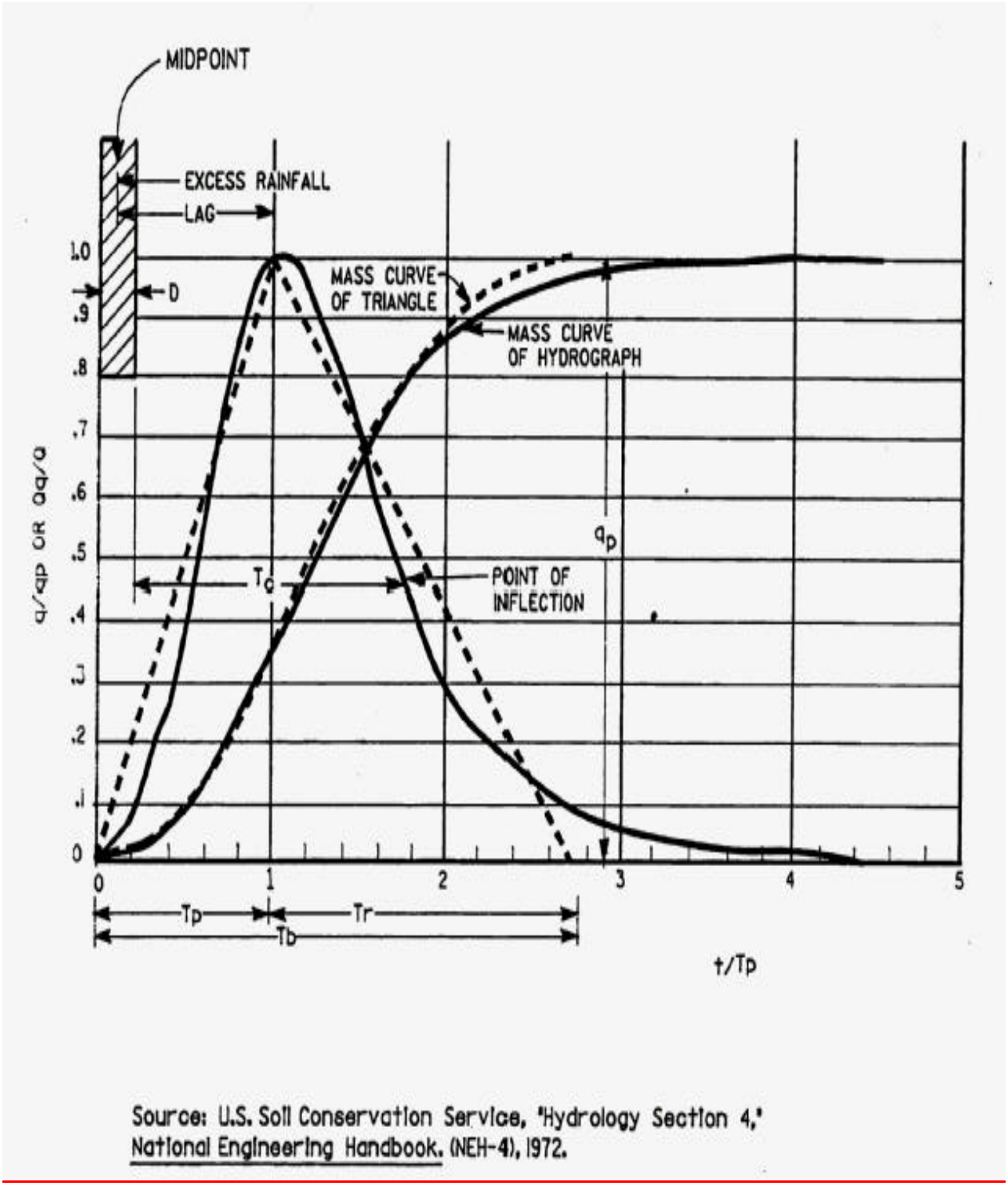


Figure 2-2 Austin Intensity-Duration-Frequency Curves



Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 2-3 Dimensionless Curvilinear Unit Hydrograph and Equivalent Triangular Hydrograph



Source: U.S. Soil Conservation Service, "Hydrology Section 4," National Engineering Handbook. (NEH-4), 1972.

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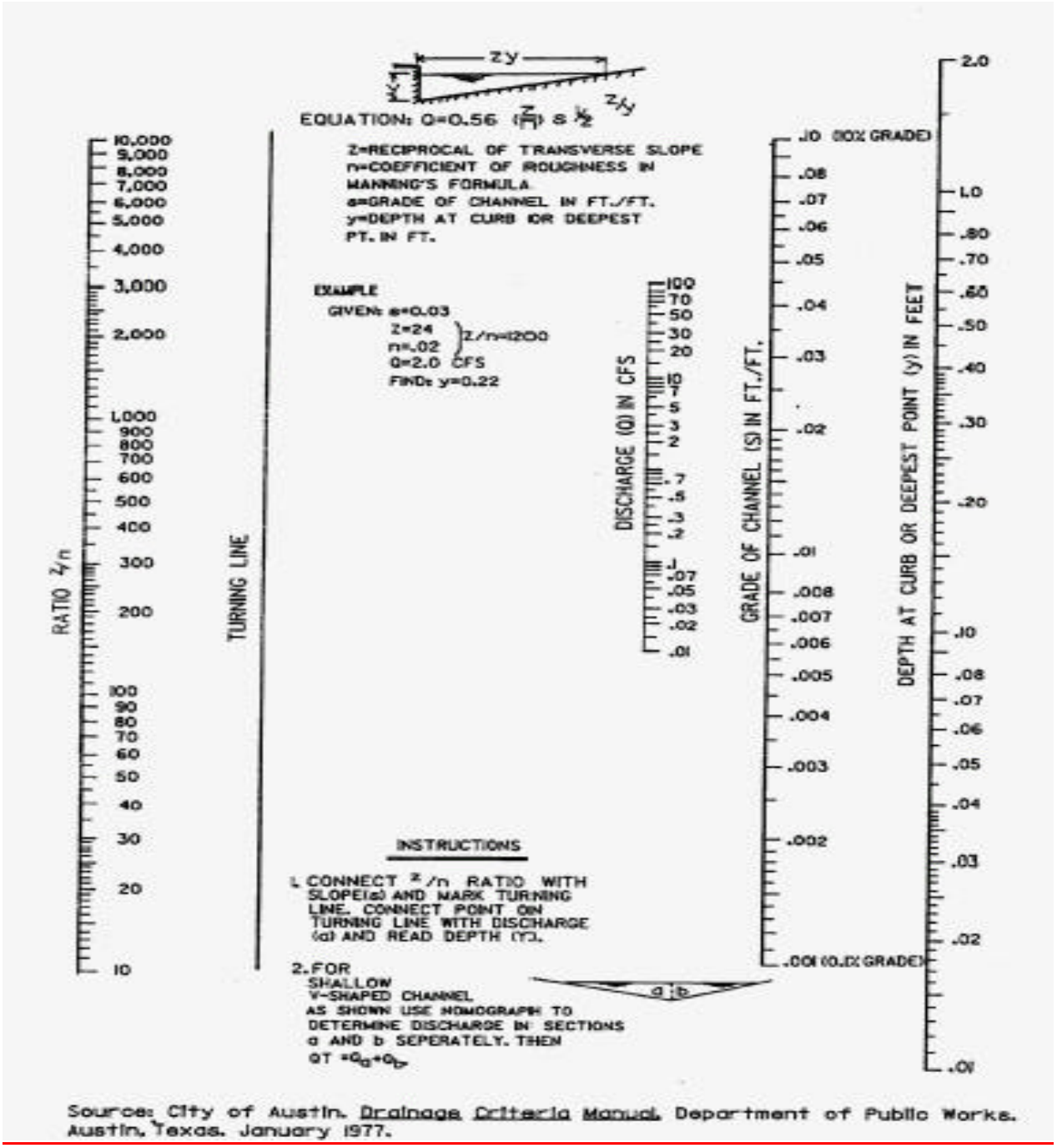
Figure 3-1 Nomograph for Flow in Gutters



Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

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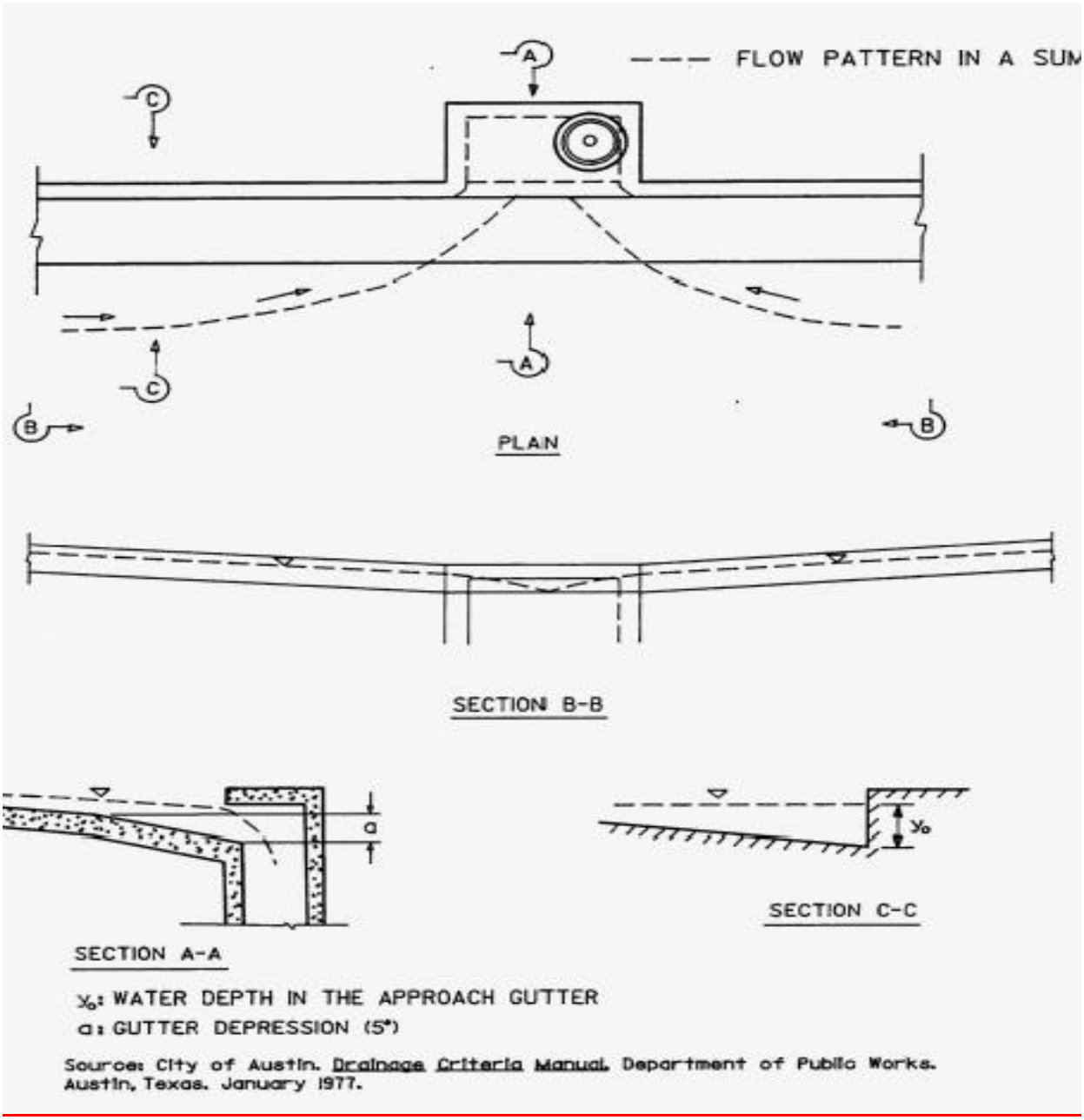
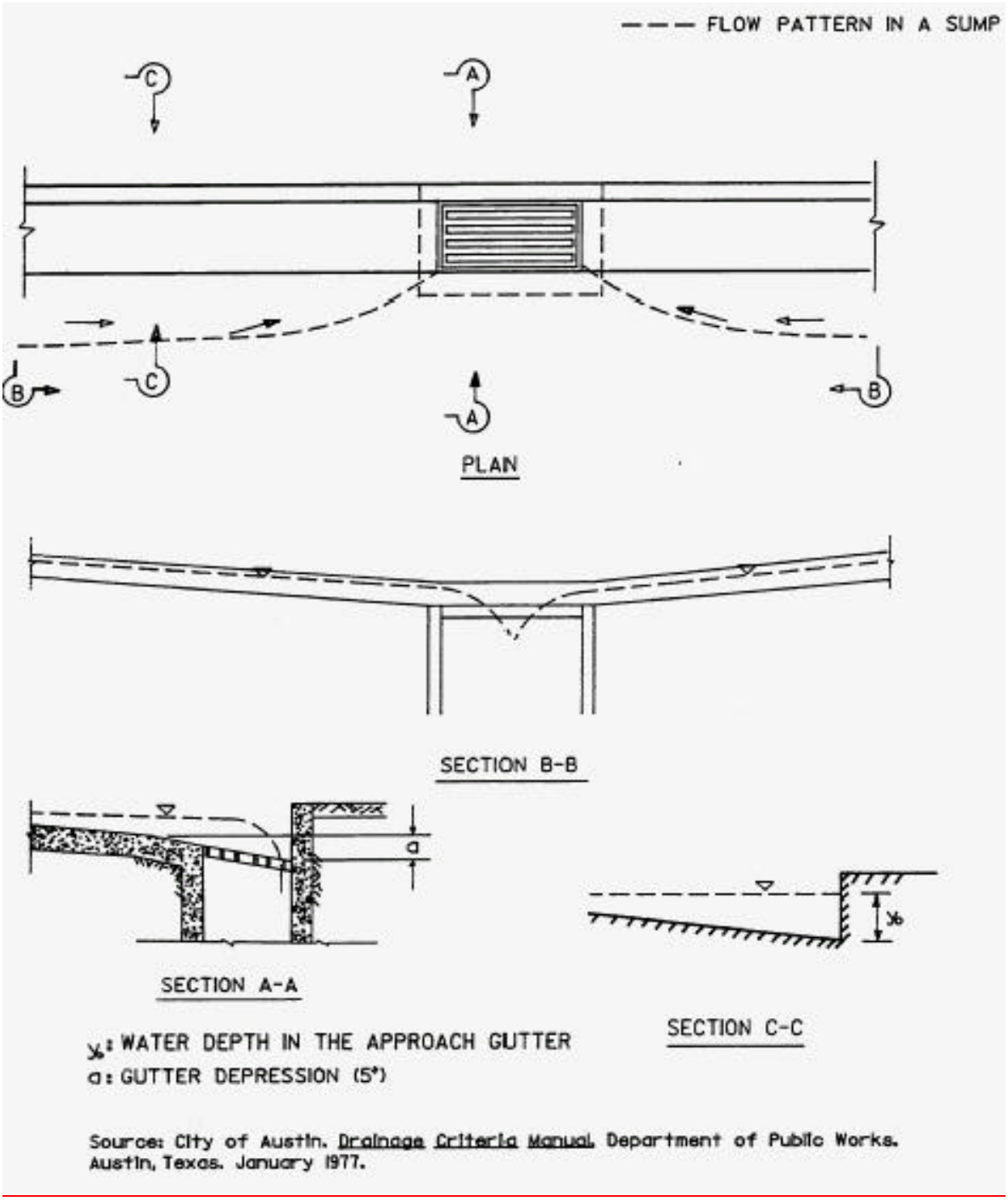
Figure 4-1 Curb Opening Inlet in a Sump (Type S-1)



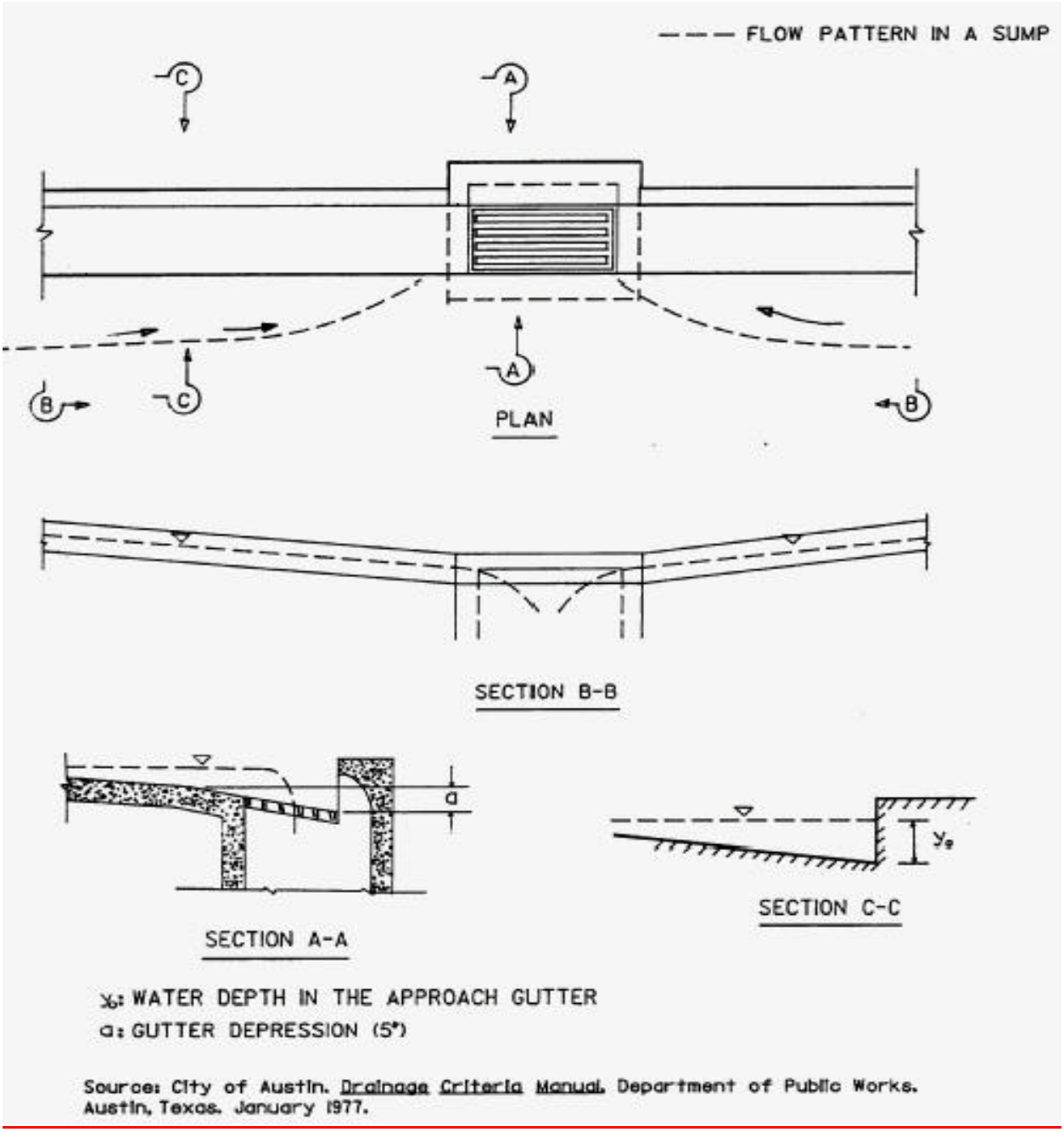
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-2 Grate Inlet in a Sump (Type S-2)



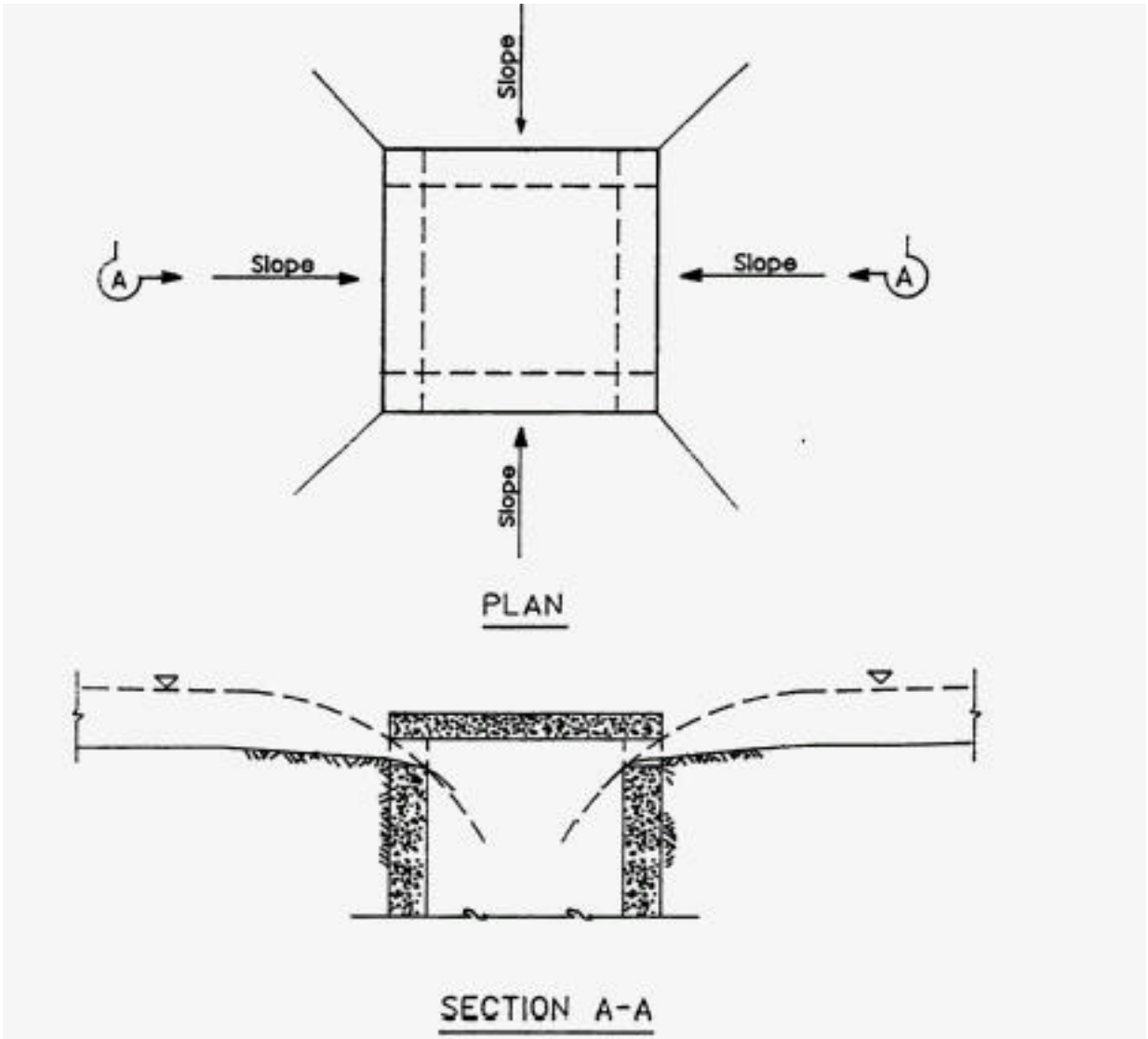
Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 4-3 Combination Inlet in a Sump (Type S-3)



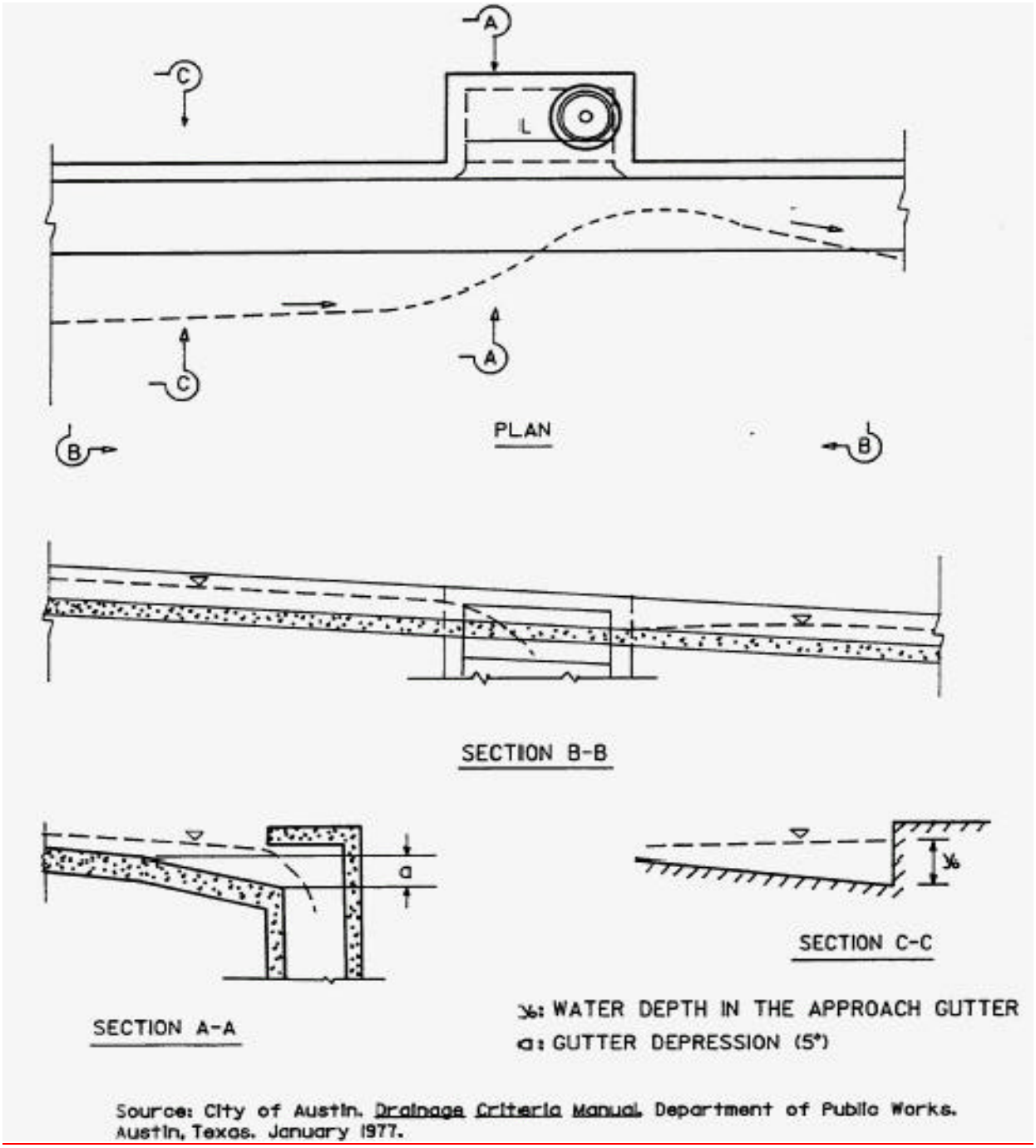
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-4 Area Inlet Without Grate (Type S-4)



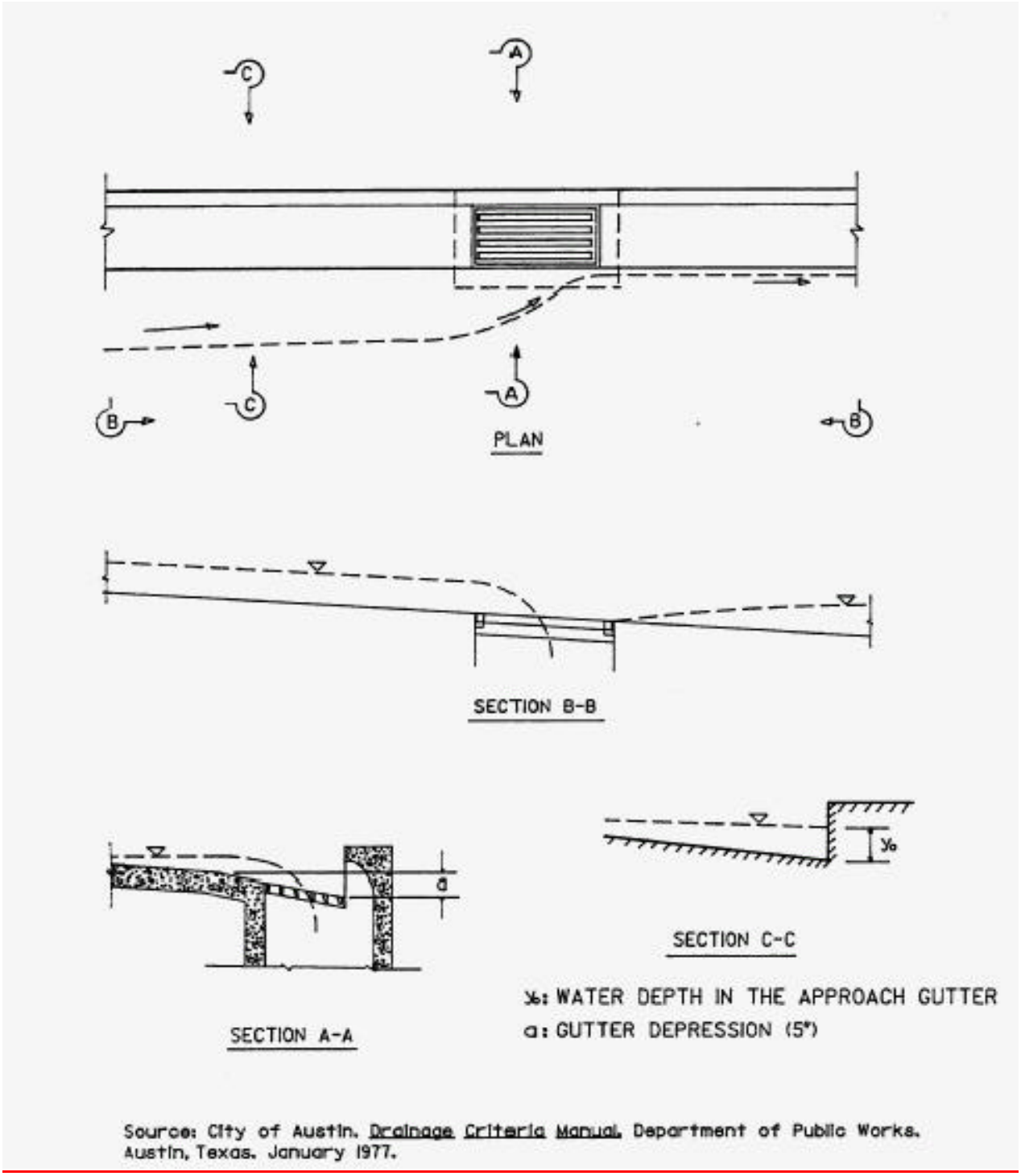
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-5 Curb Opening, Inlet on Grade (Type G-1)



Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-6 Grate, Inlet on Grade (Type G-2)



Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 4-7 Combination Inlet on Grade (Type G-3)

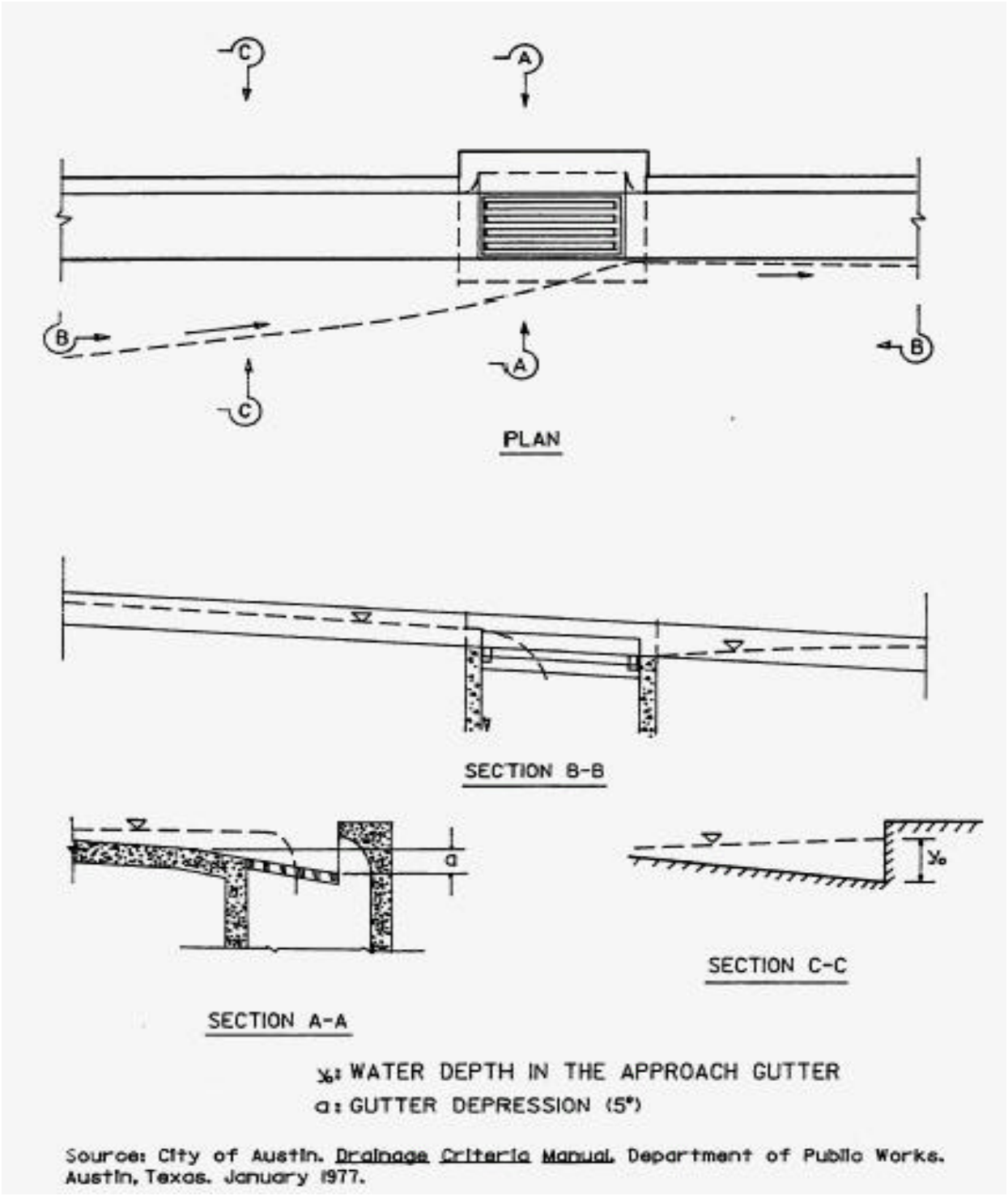
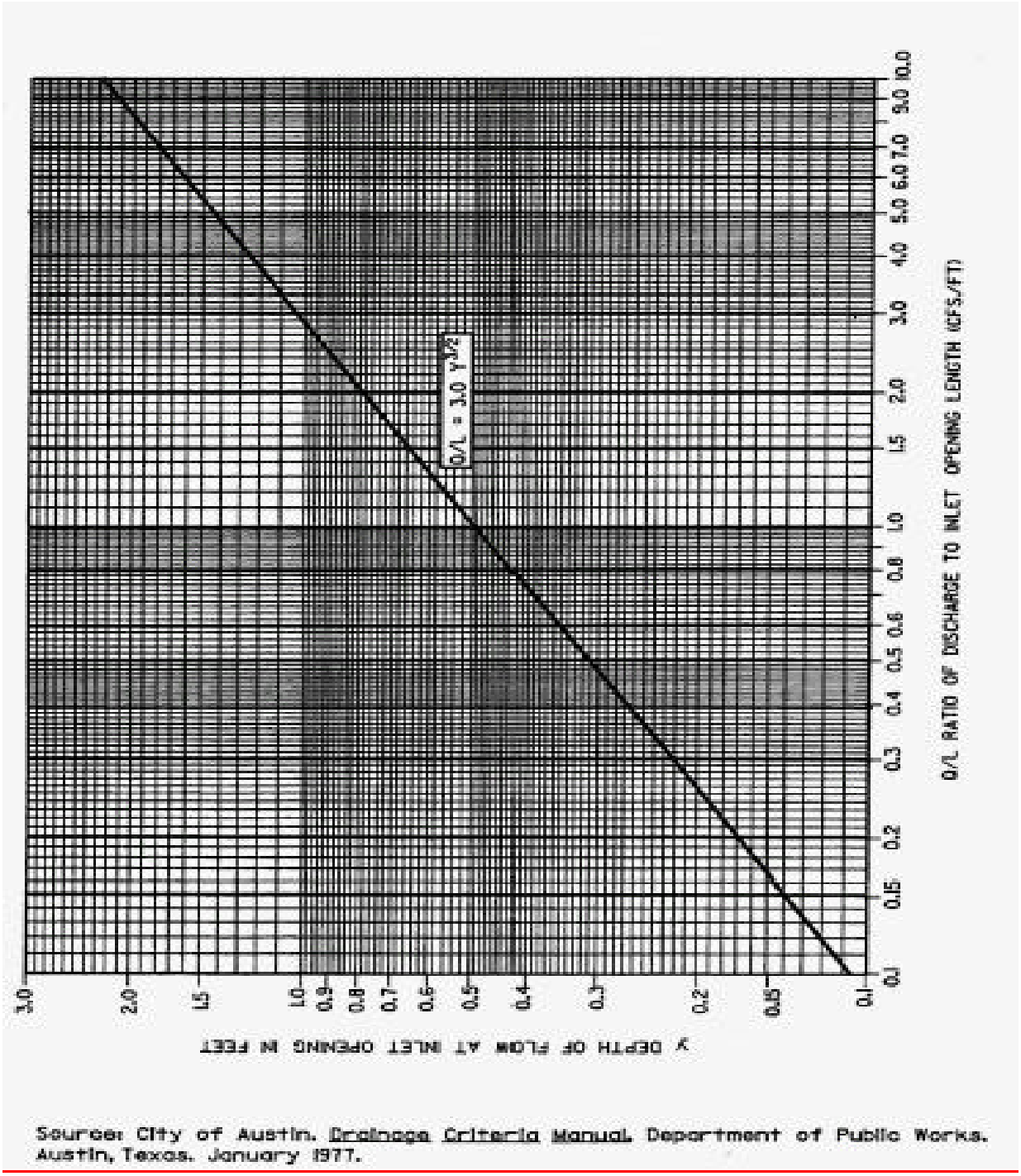
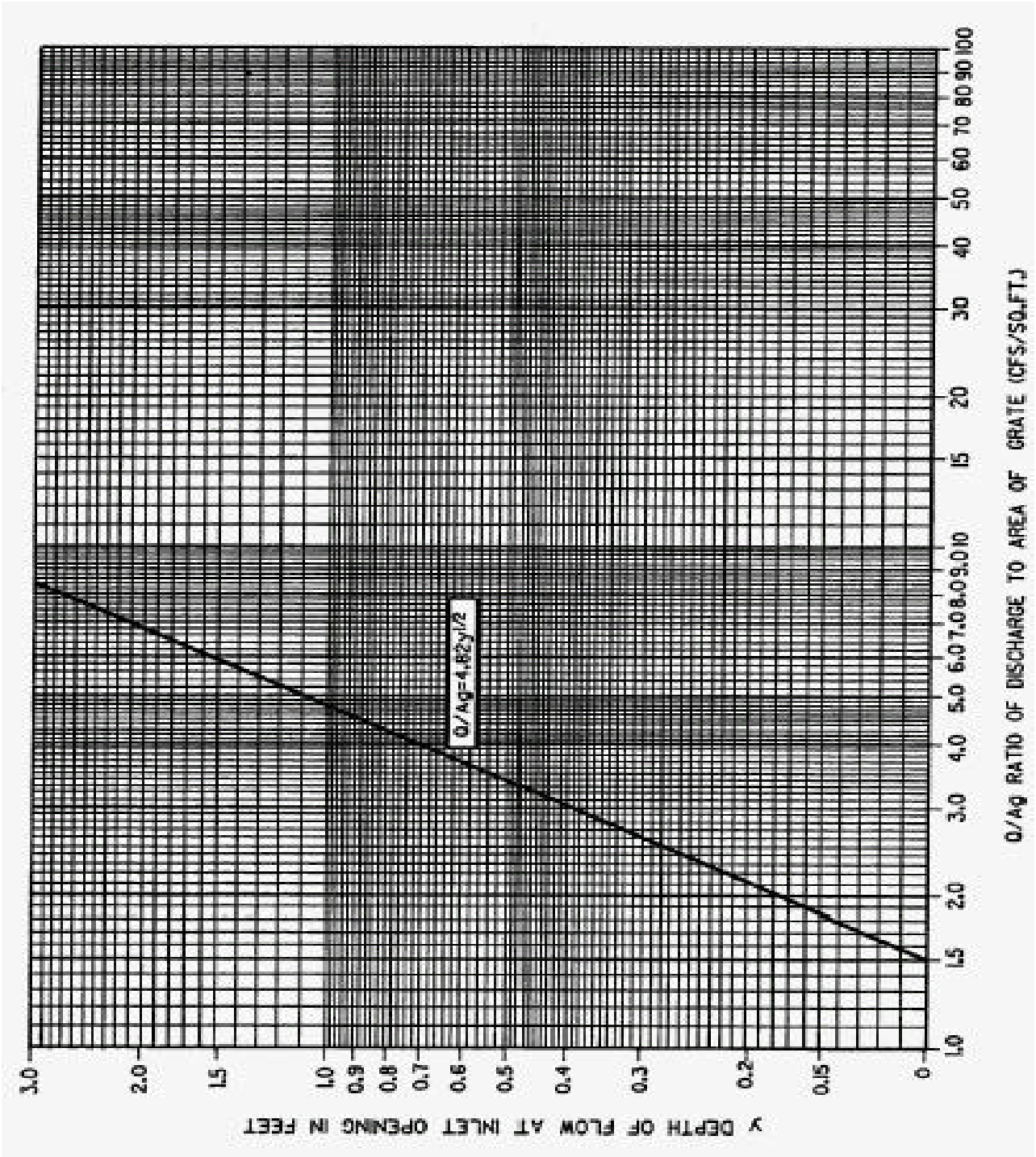


Figure 4-8 Inlet Capacity for Type S-1 and S-3



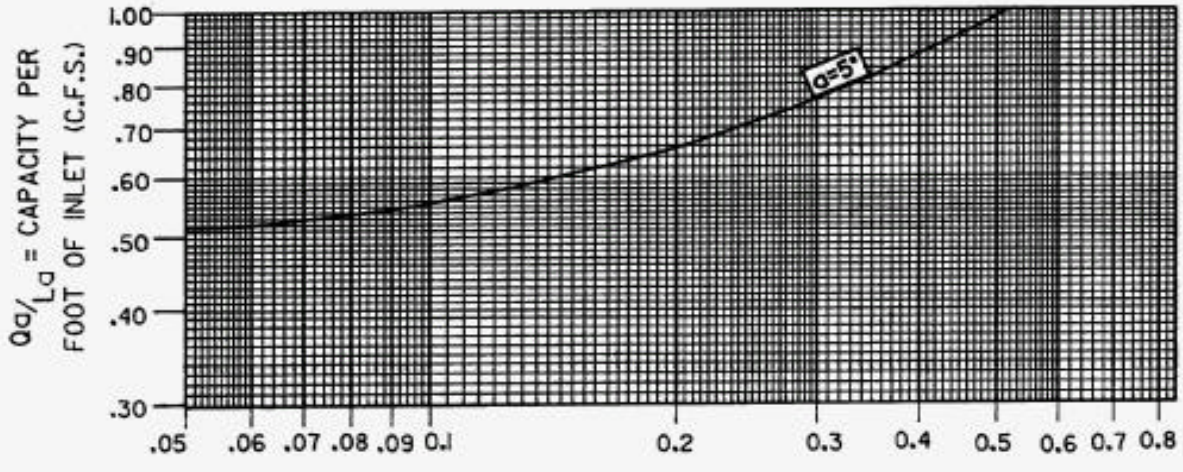
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-9 Inlet Capacity for Type S-2



Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-10 Capacity for Inlets on Grade



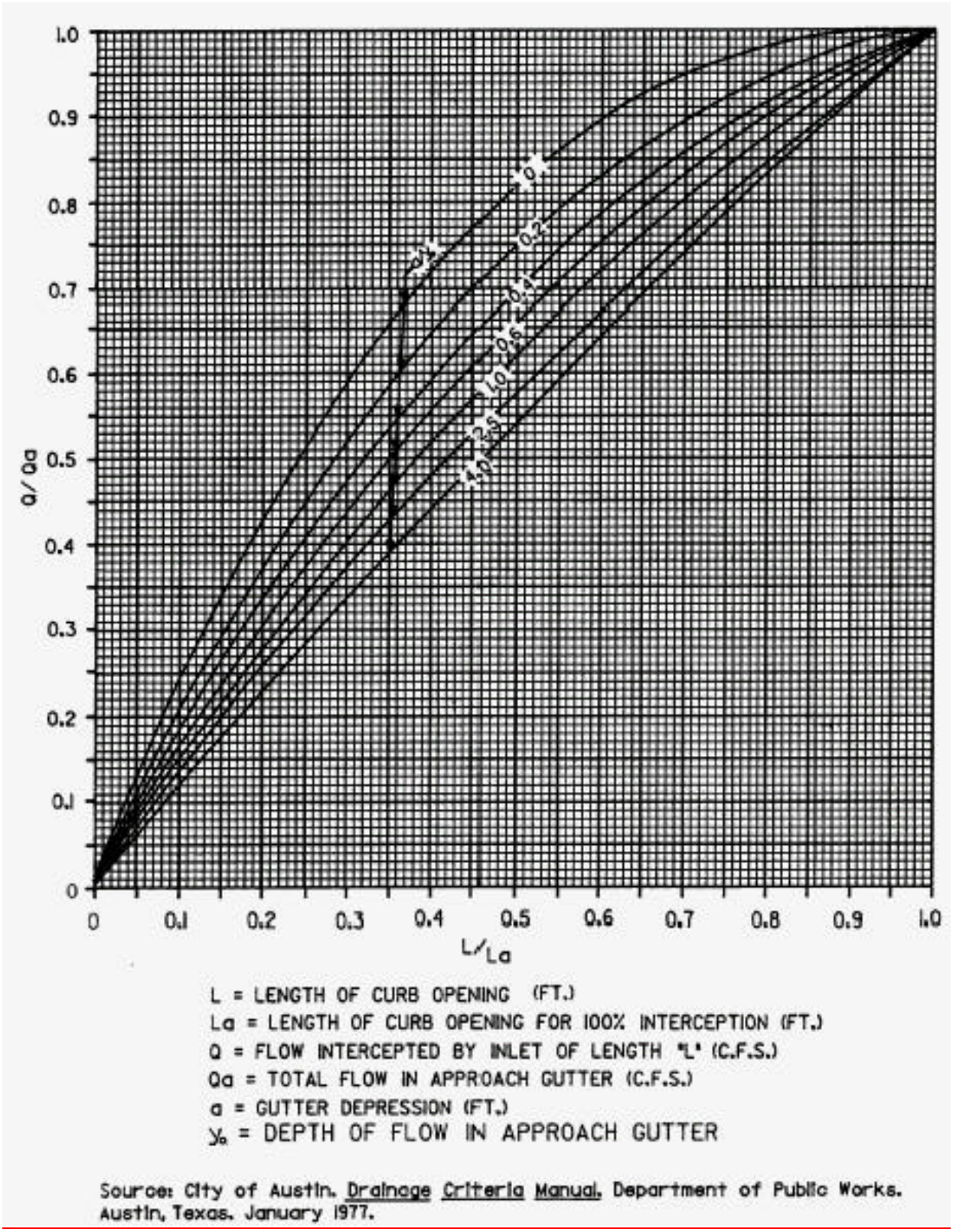
$$Qa/La = 0.7\left[\frac{1}{H_1 - H_2}\right]\left[(H_1)^{5/2} - (H_2)^{5/2}\right]$$

$H_1 = a + y_o$

$H_2 = a$=GUTTER DEPRESSION

Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 4-11 Ratio of Intercepted to Total Flow for Inlets on Grade

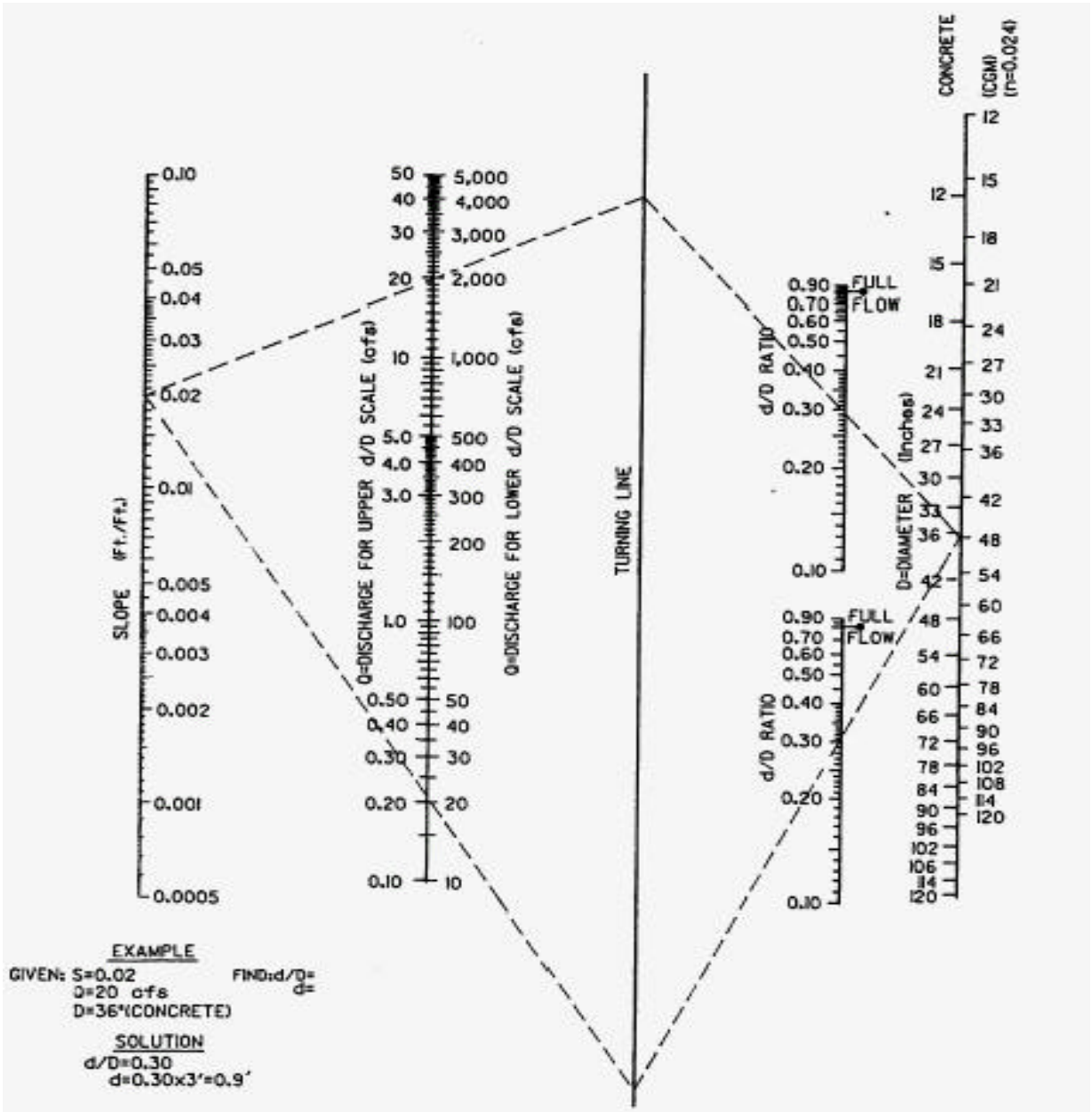


L = LENGTH OF CURB OPENING (FT.)
La = LENGTH OF CURB OPENING FOR 100% INTERCEPTION (FT.)
Q = FLOW INTERCEPTED BY INLET OF LENGTH "L" (C.F.S.)
Qa = TOTAL FLOW IN APPROACH GUTTER (C.F.S.)
a = GUTTER DEPRESSION (FT.)
y_o = DEPTH OF FLOW IN APPROACH GUTTER

Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

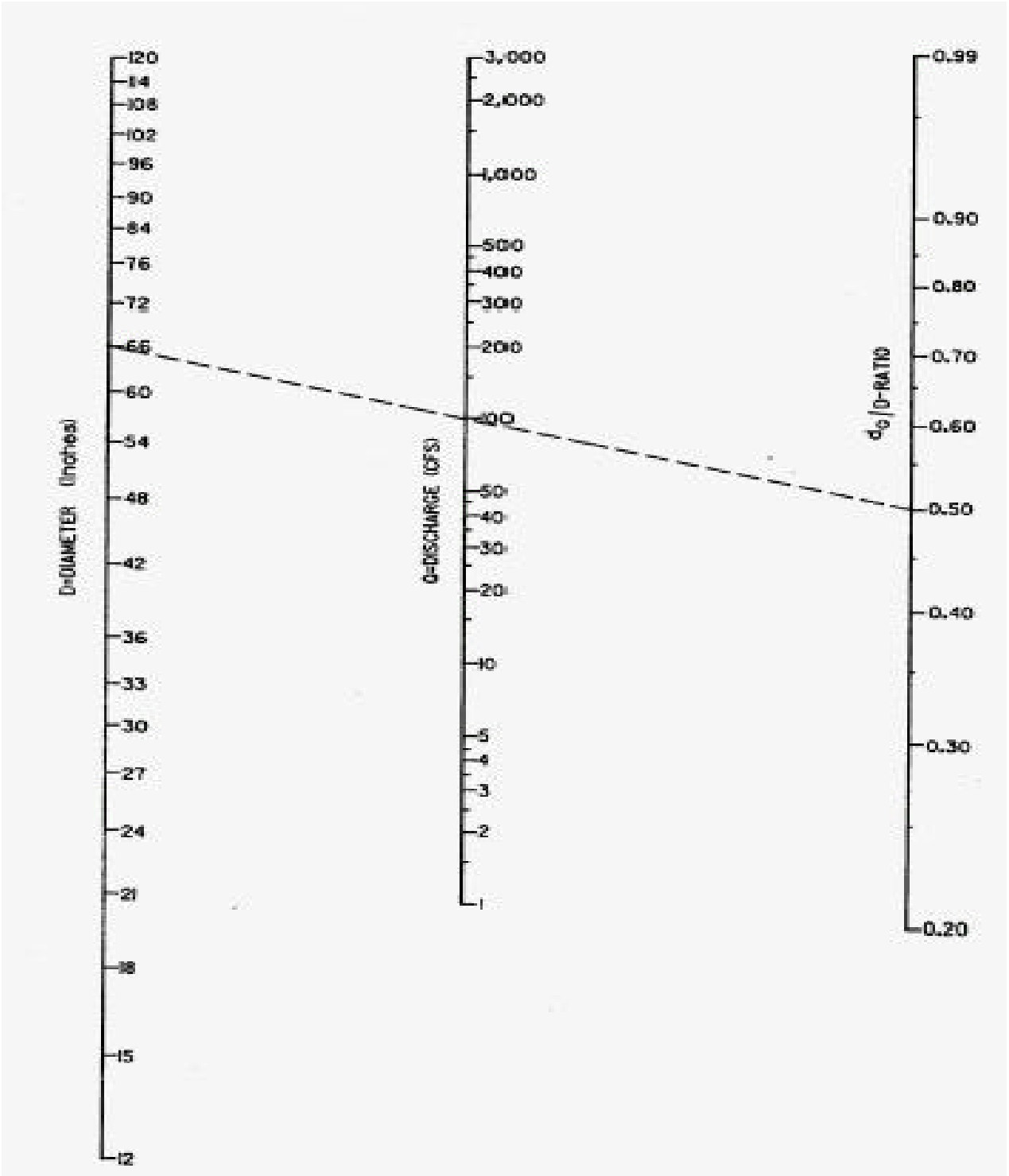
FIGURES FROM SECTION 5

Figure 5-1 Uniform Flow For Pipe Culverts



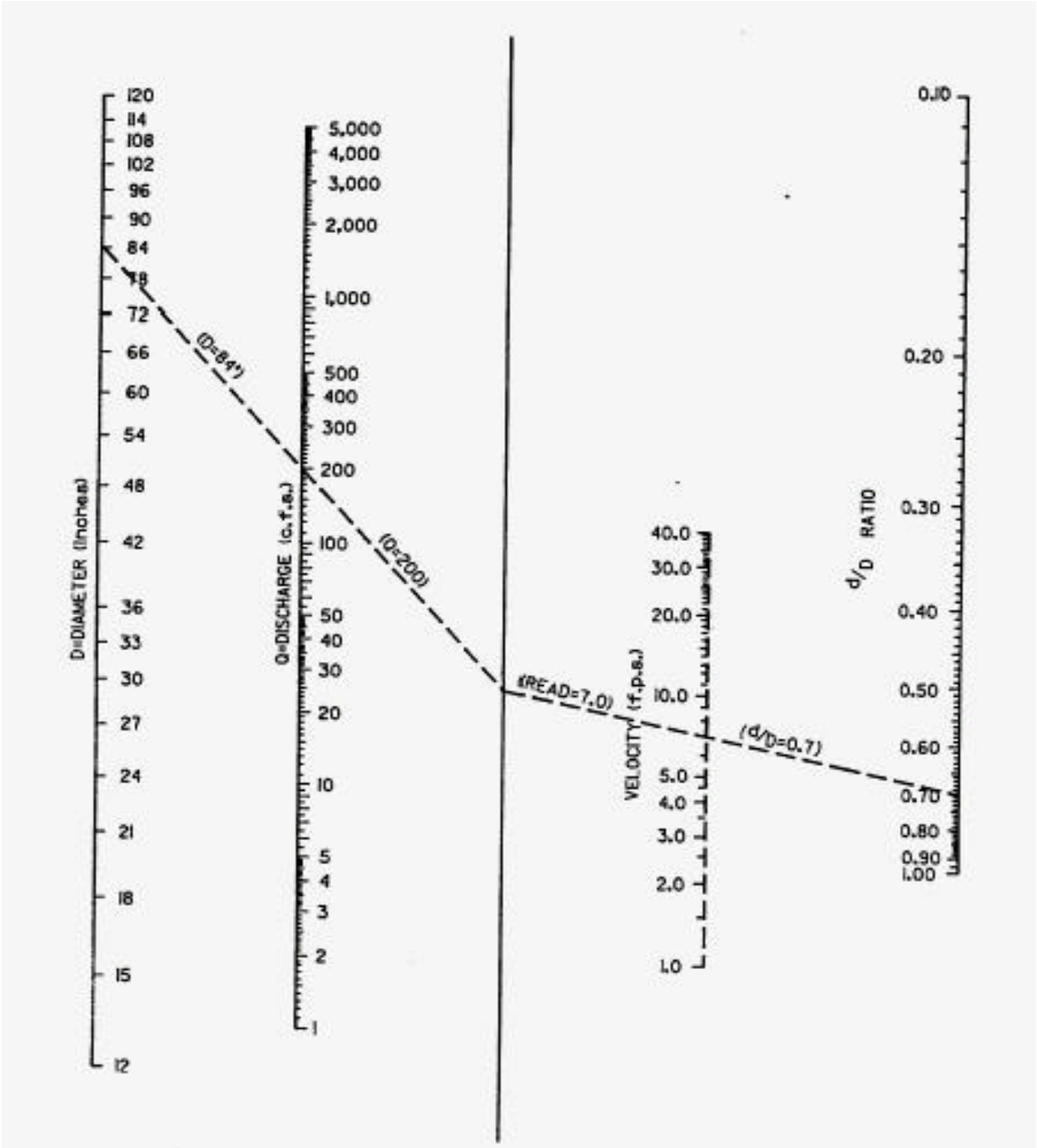
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-2 Critical Depth of Flow For Circular Conduits



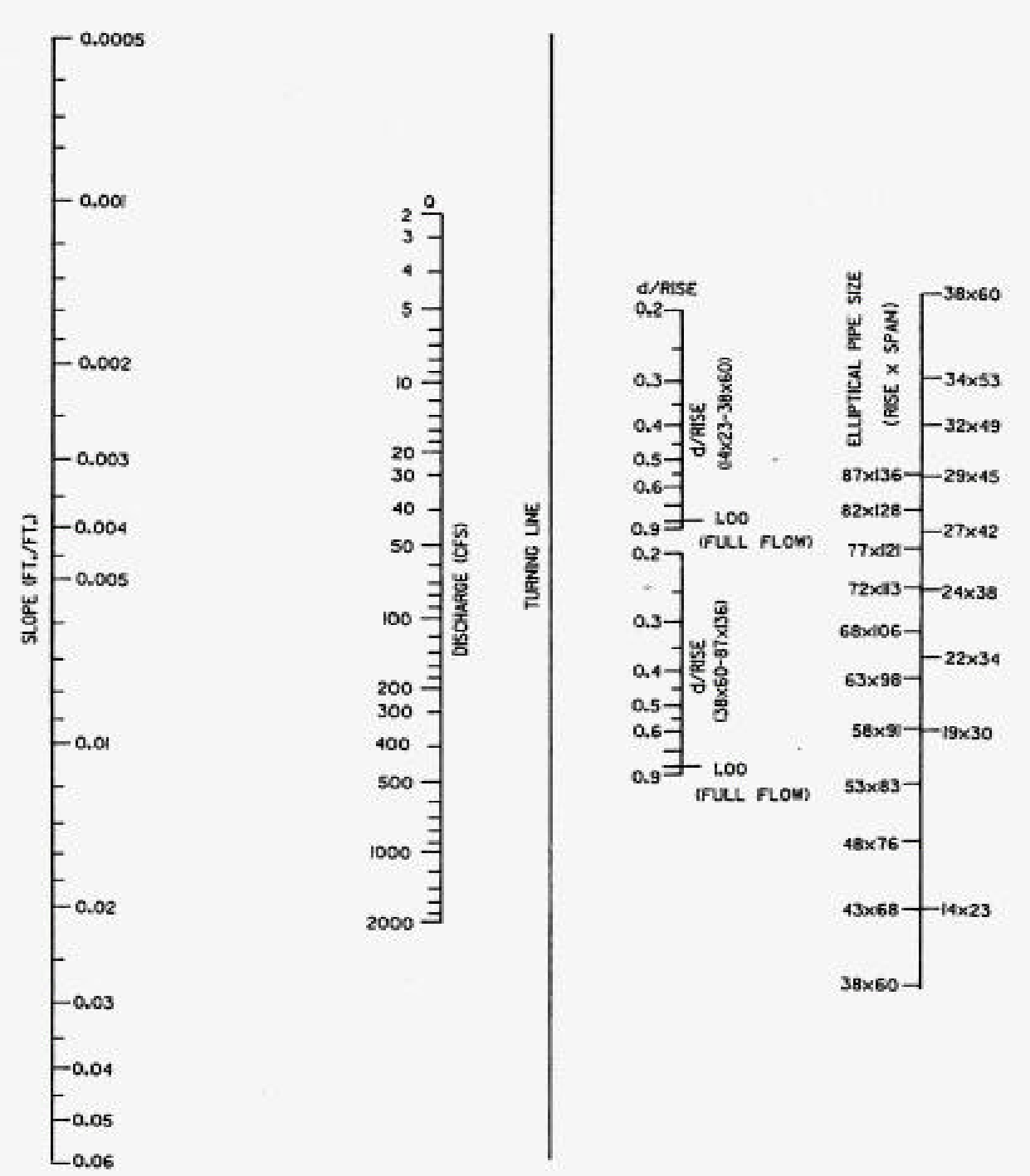
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-3 Velocity in Pipe Conduits



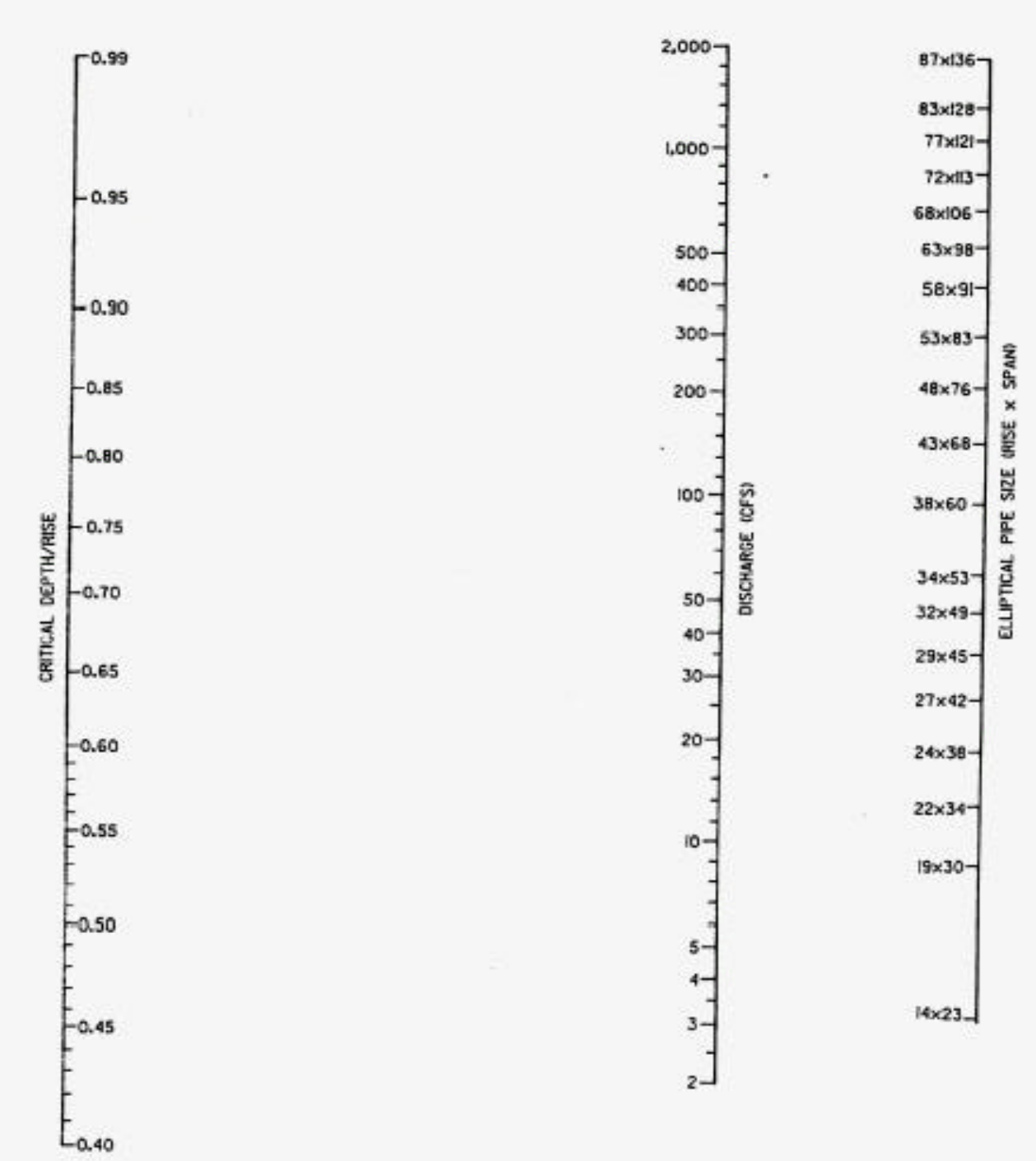
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-4 Uniform Flow For Concrete Elliptical Pipe



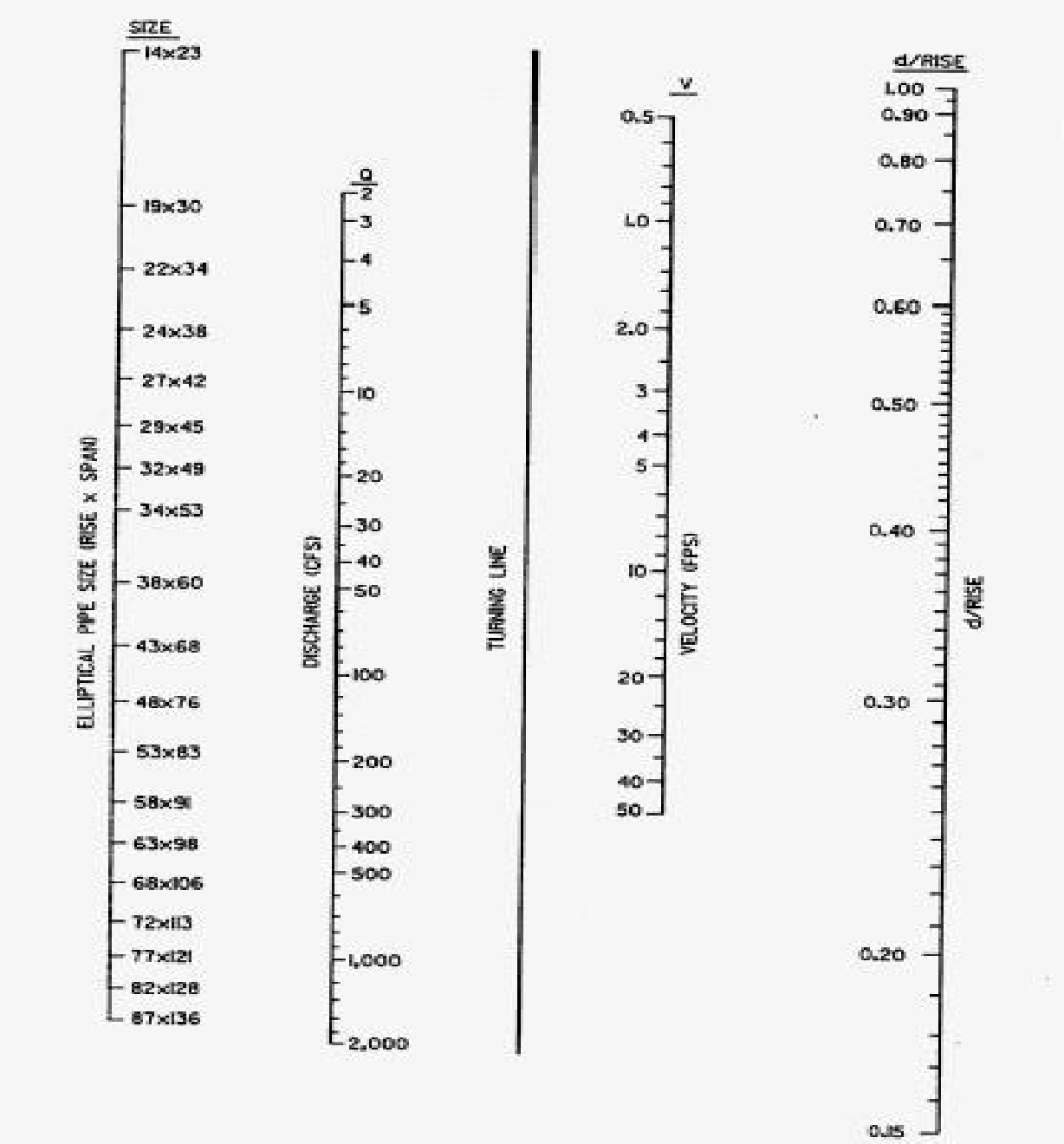
Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 5-5 Critical Depth For Elliptical Pipe



Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-6 Velocity in Elliptical Pipe



Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 5-7 Uniform Flow For Pipe Arch

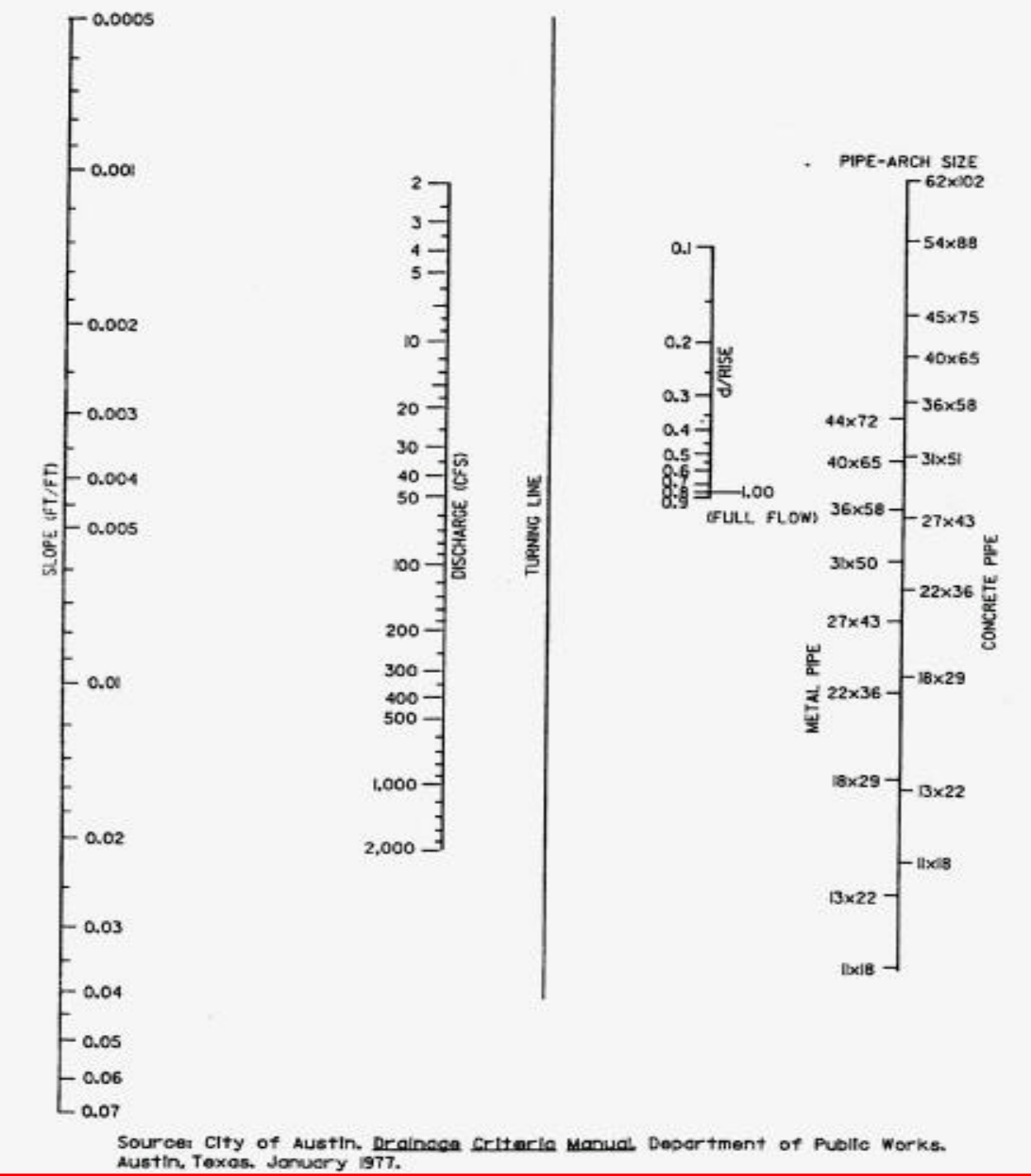
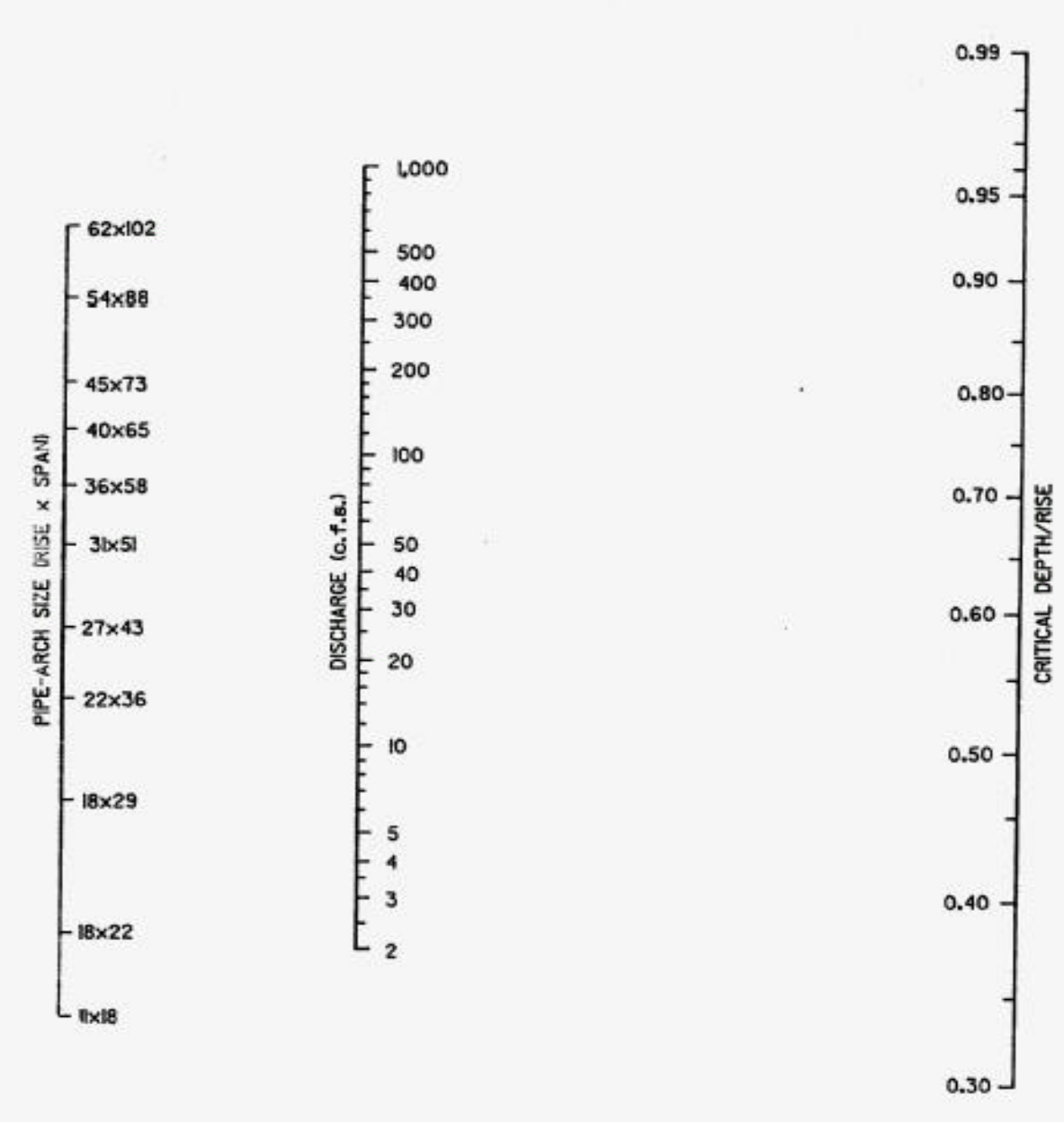
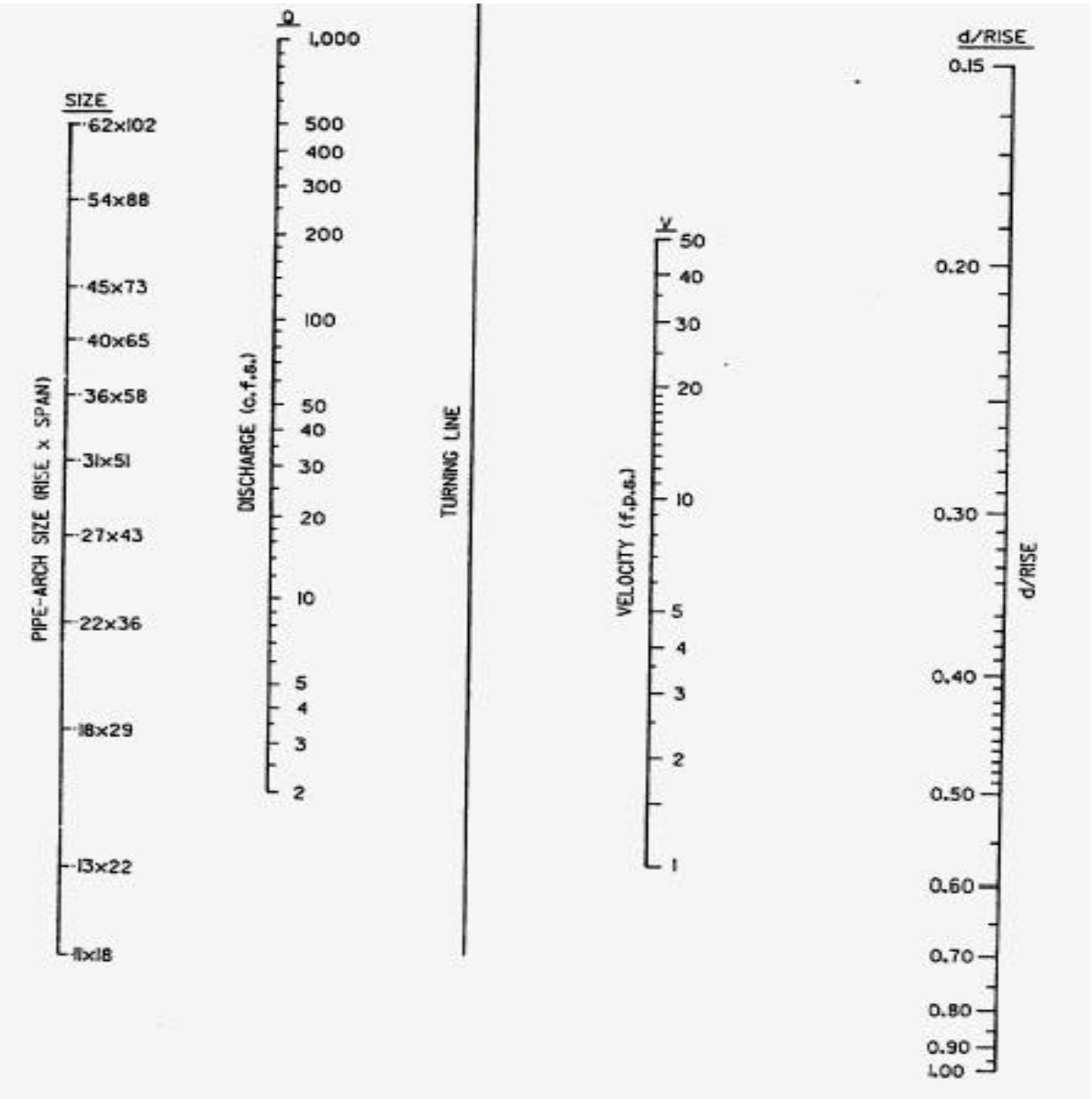


Figure 5-8 Critical Depth of Flow For Pipe-Arch



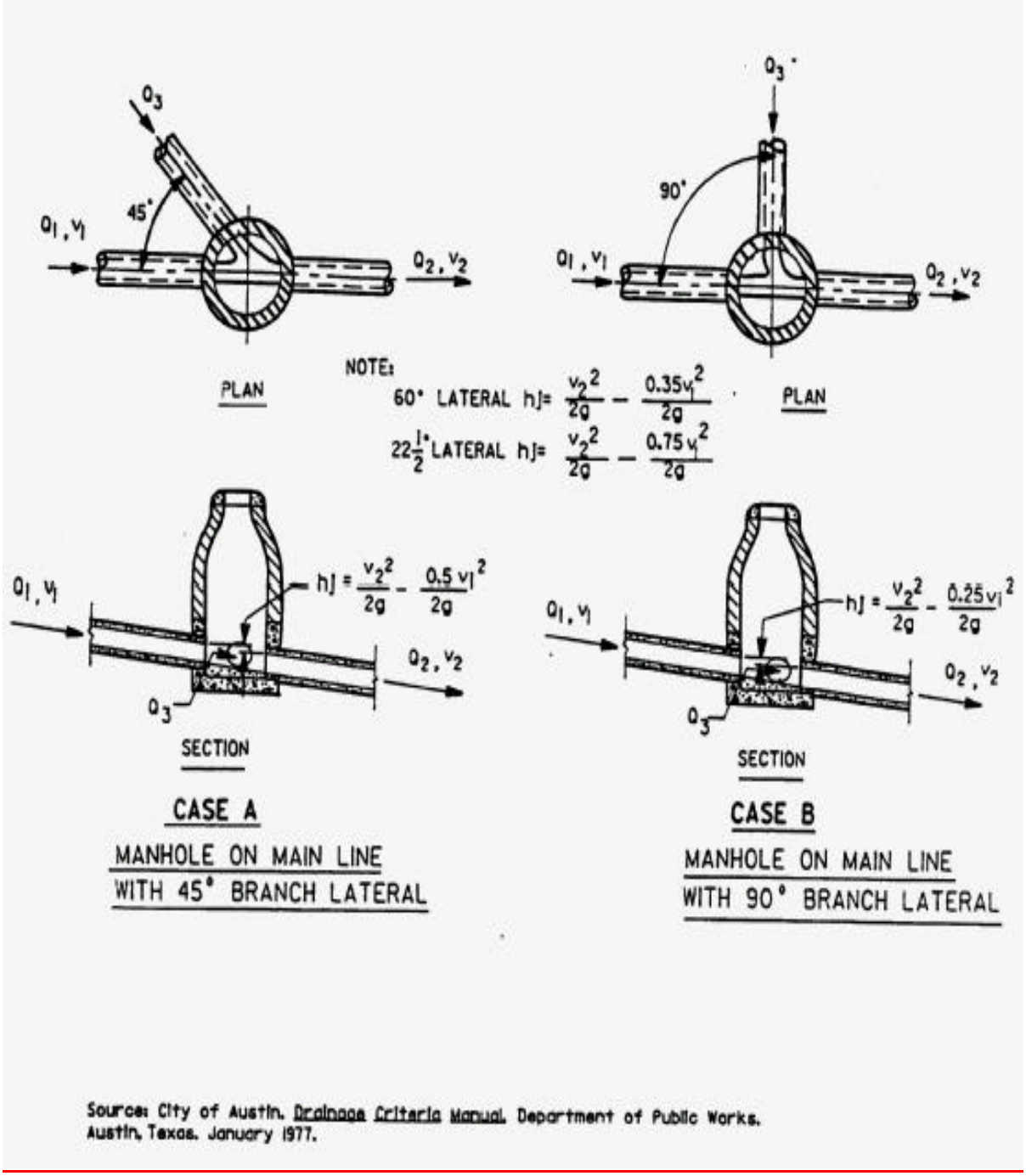
Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-9 Velocity in Pipe-Arch



Source: City of Austin. Drainage Criteria Manual. Department of Public Works. Austin, Texas. January 1977.

Figure 5-10 Minor Head Losses Due to Turbulence at Structures



Source: City of Austin, Drainage Criteria Manual, Department of Public Works, Austin, Texas, January 1977.

Figure 5-11 Minor Head Losses Due to Turbulence at Structures

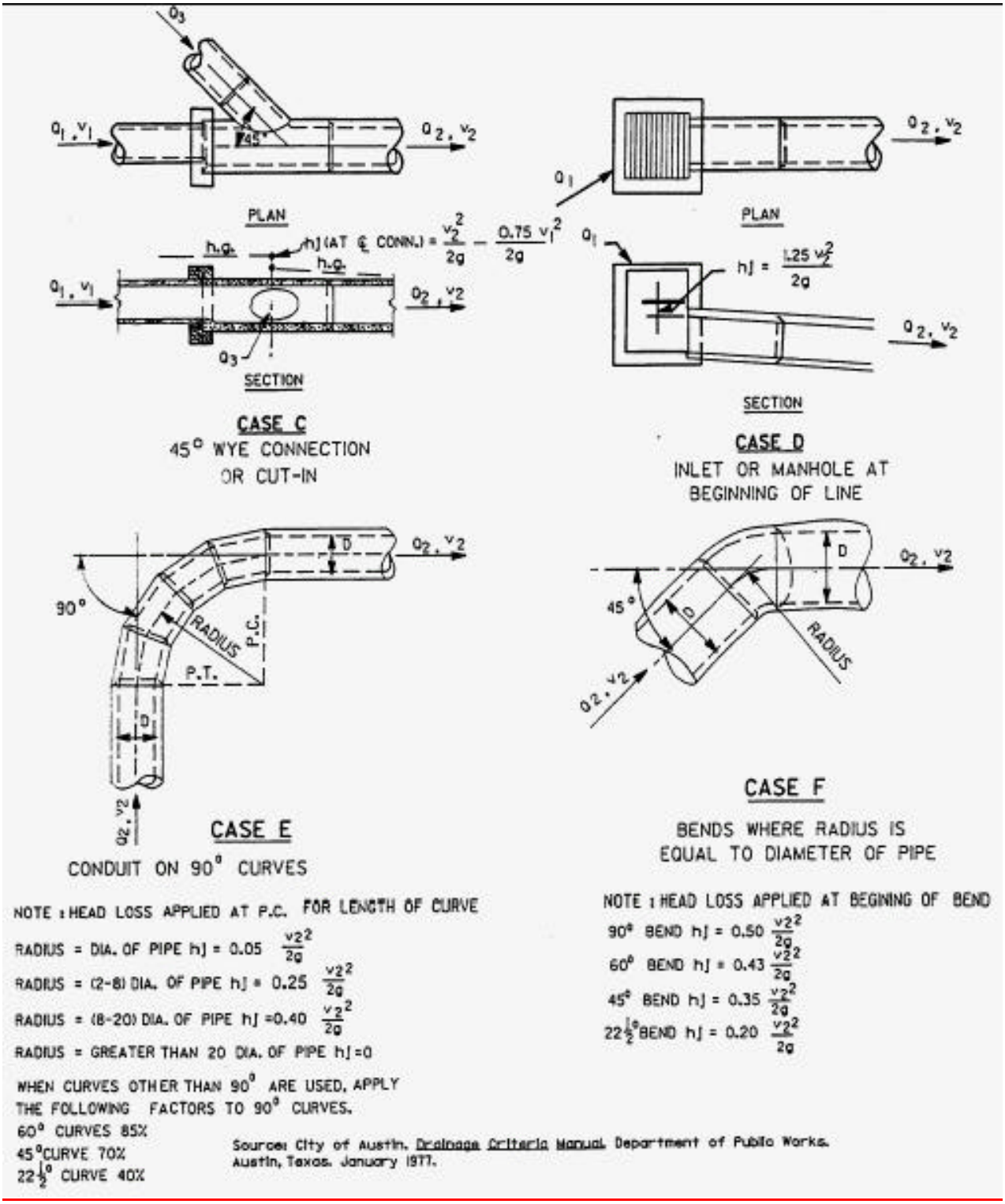
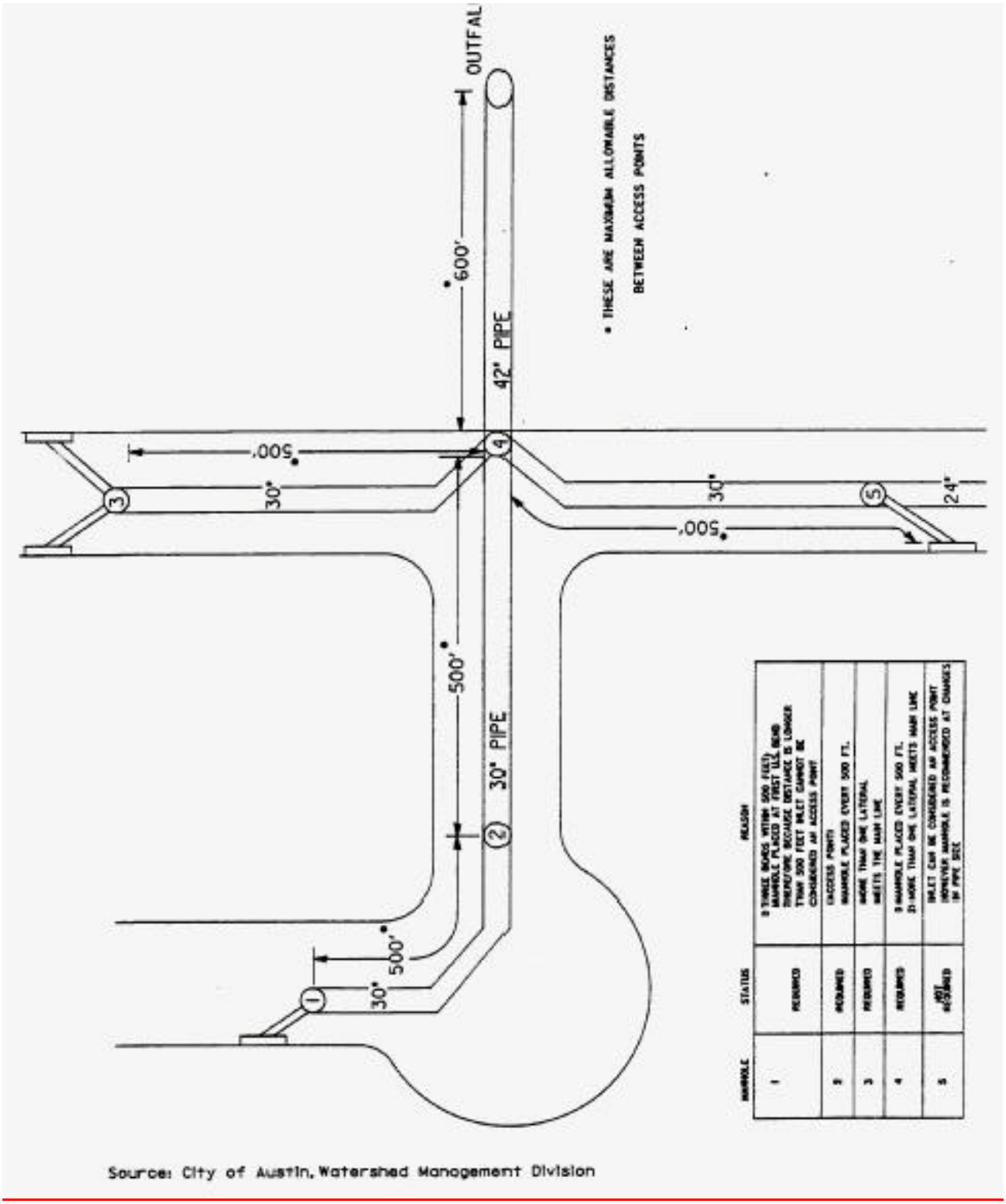


Figure 5-12 Sample Stormsewer Layout



Source: City of Austin, Watershed Management Division

Figure 5-13 Flow For Circular Pipe Flowing Full (n=0.010)

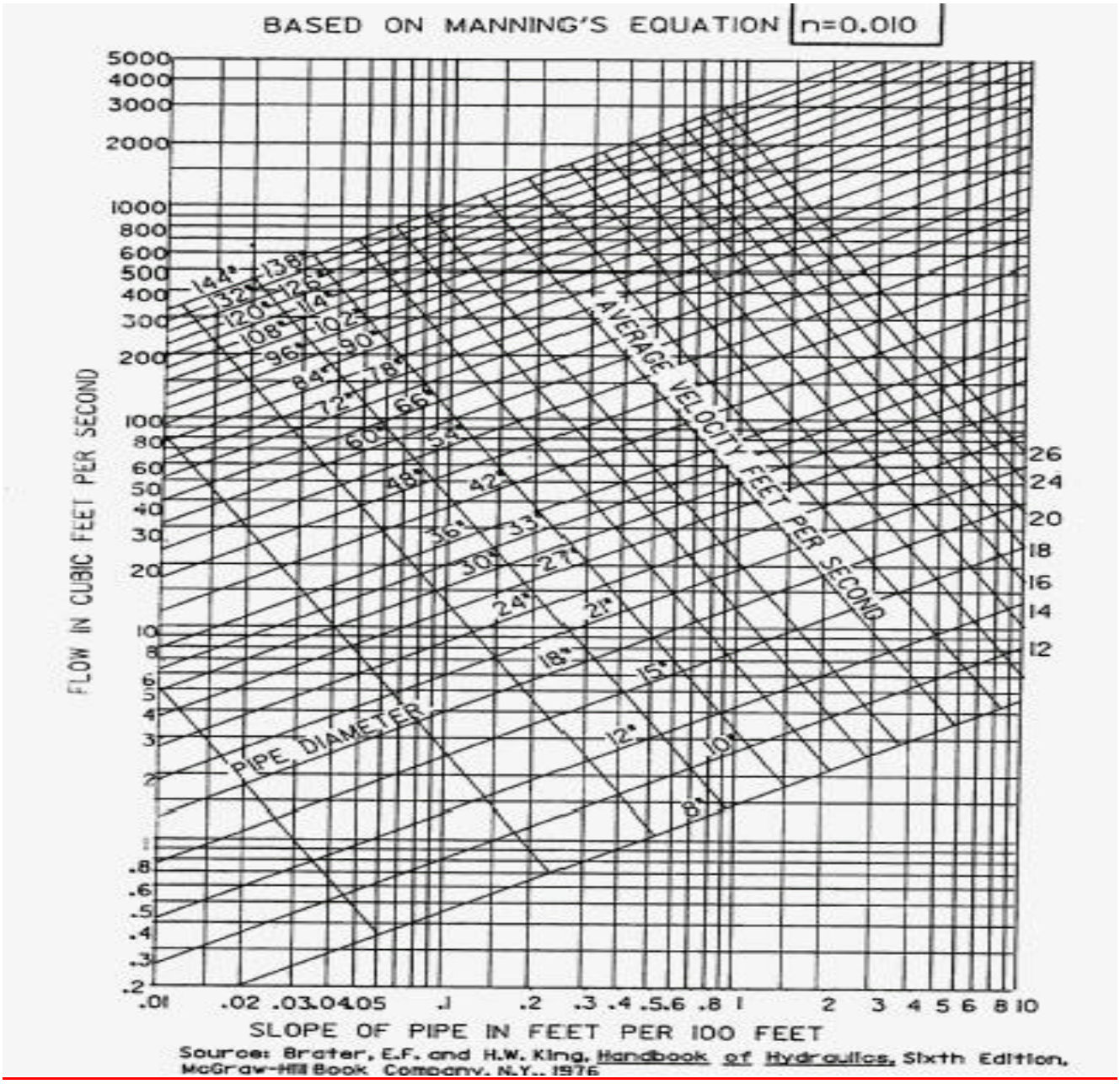


Figure 5-14 Flow For Circular Pipe Flowing Full (n=0.011)

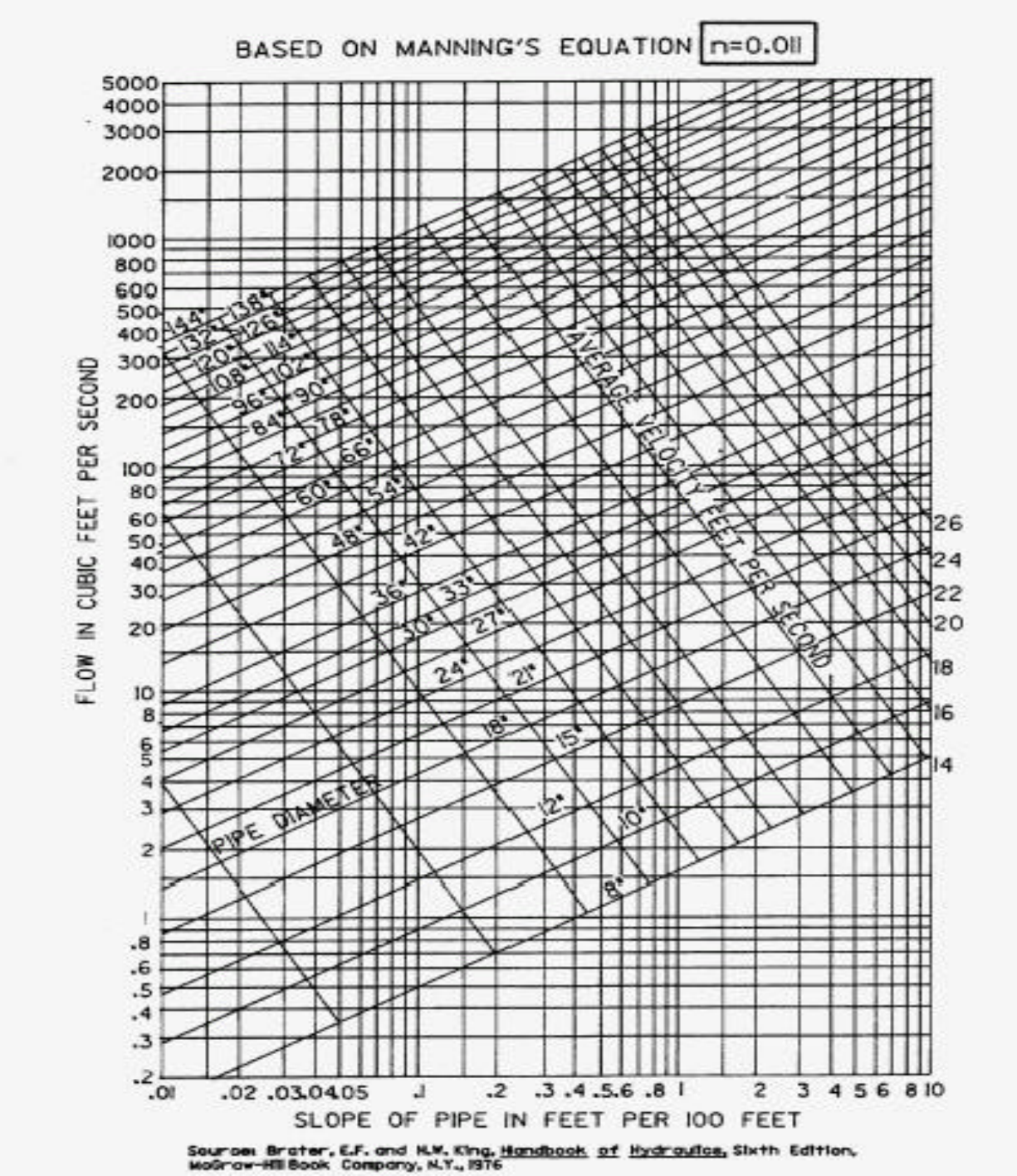


Figure 5-15 Flow For Circular Pipe Flowing Full (n=0.012)

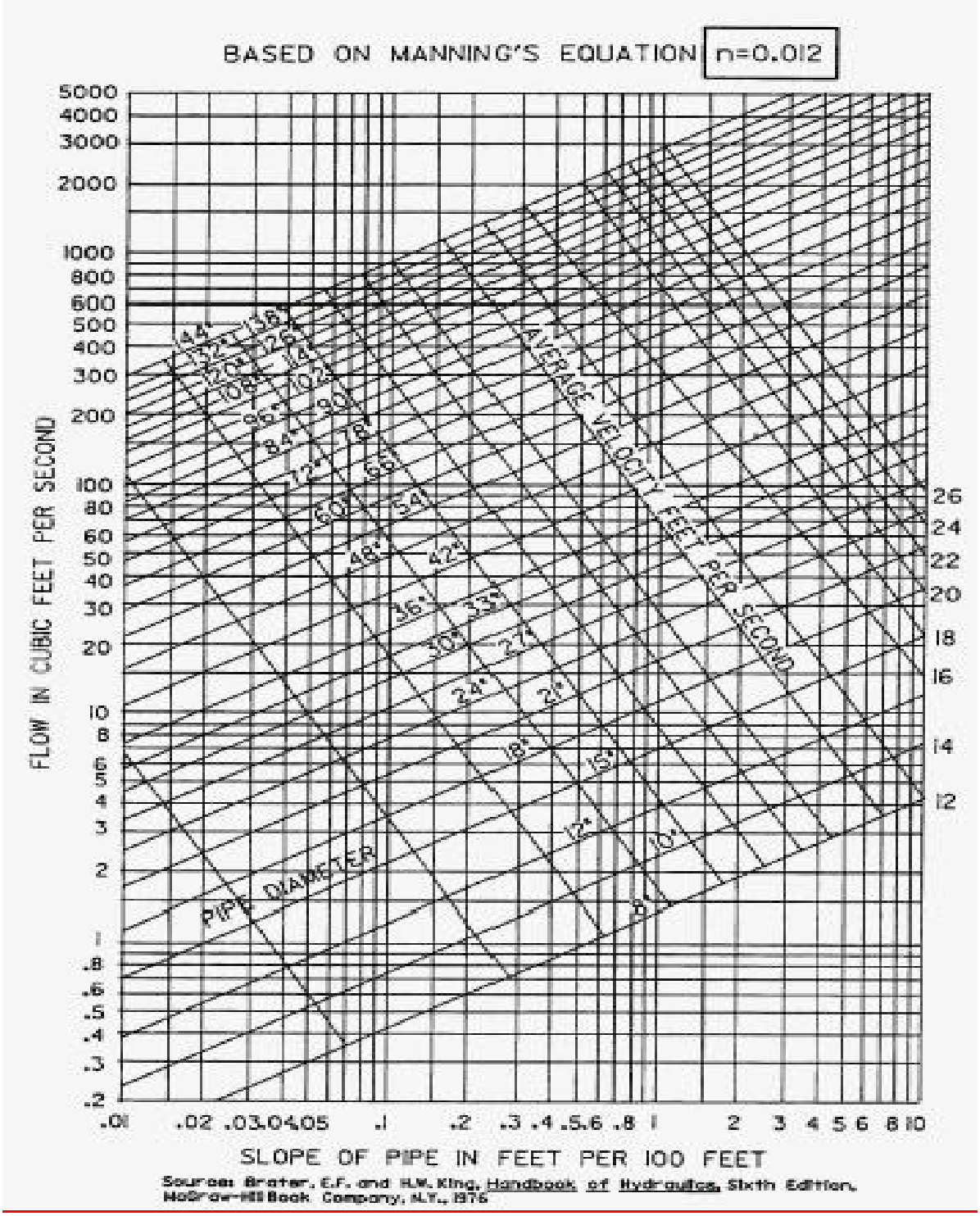
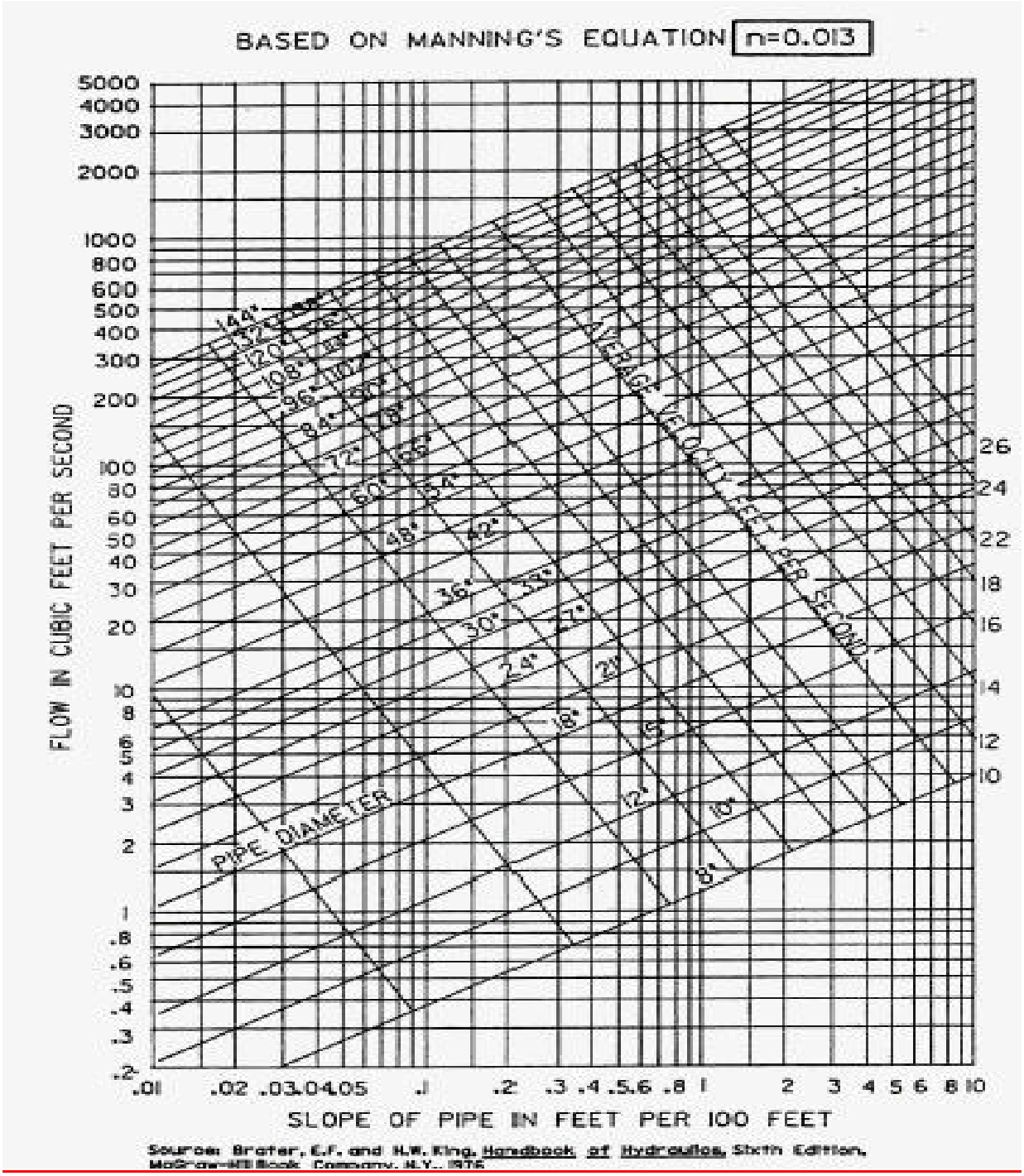


Figure 5-16 Flow For Circular Pipe Flowing Full (n=0.013)



Source: Brater, E.F. and H.W. King, Handbook of Hydraulics, Sixth Edition, McGraw-Hill Book Company, N.Y., 1976

FIGURES FROM SECTION 6

Figure 6-1 Uniform Flow For Trapezoidal Channels

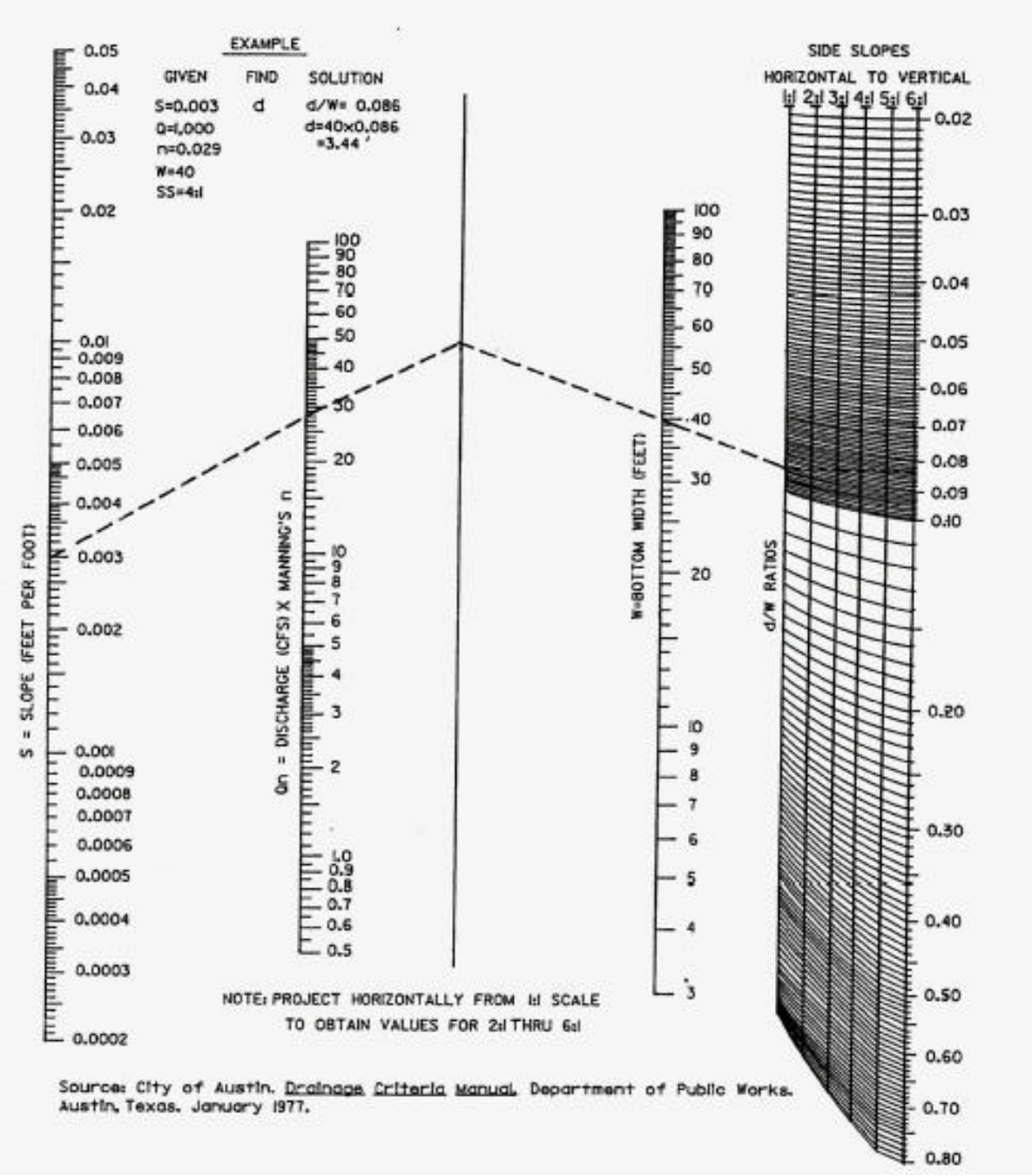
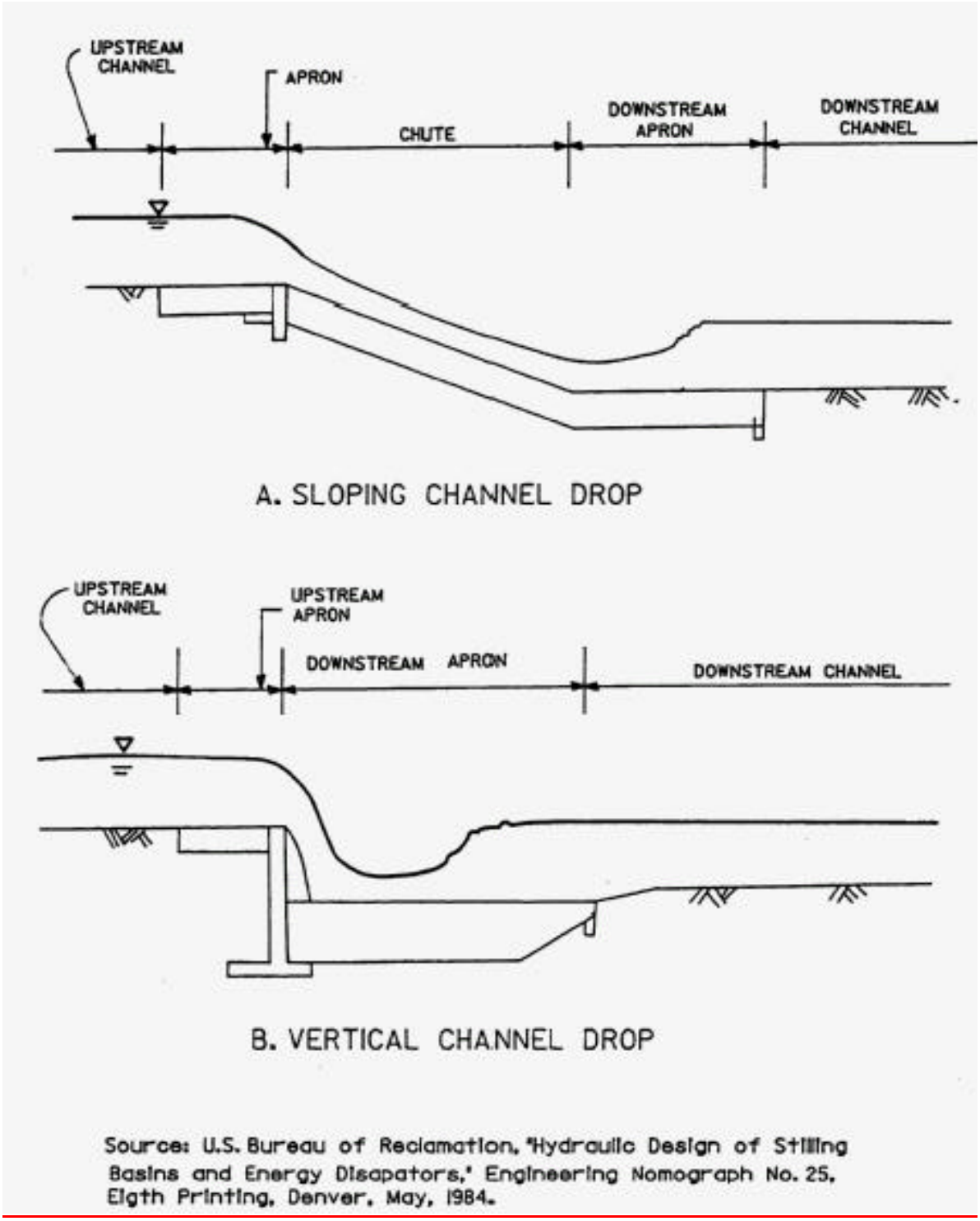
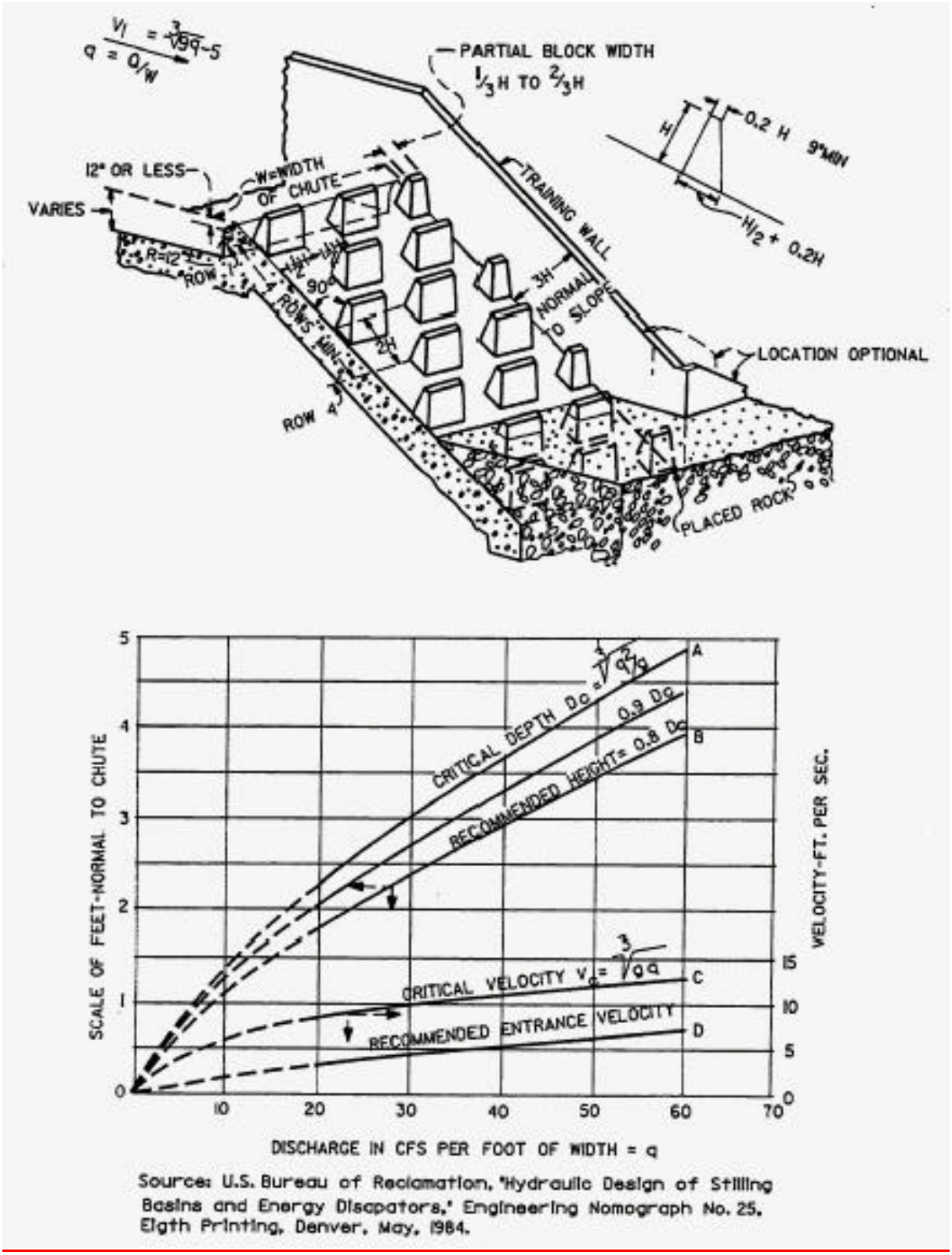


Figure 6-2 Sloping and Vertical Channel Drops



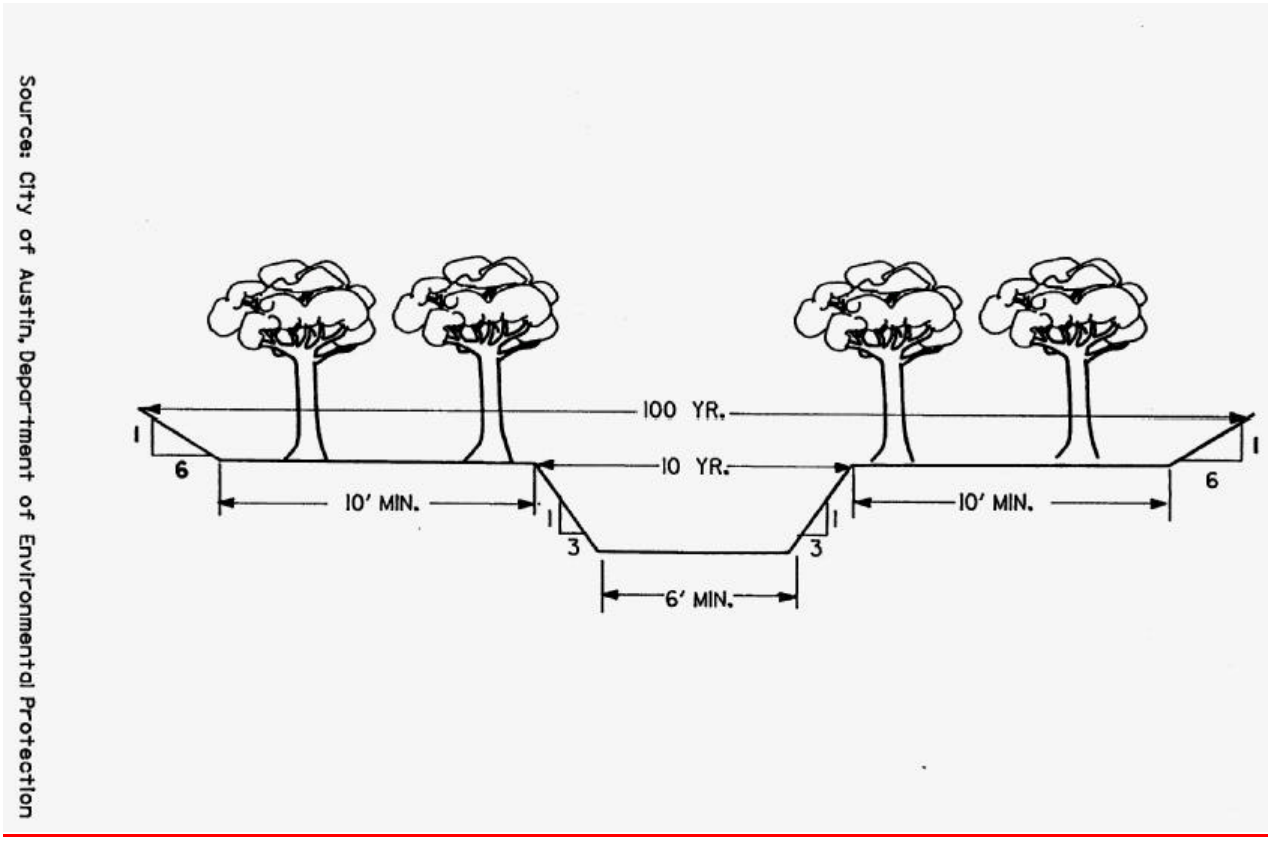
Source: U.S. Bureau of Reclamation, "Hydraulic Design of Stilling Basins and Energy Dissipators," Engineering Nomograph No. 25, Eigth Printing, Denver, May, 1984.

Figure 6-3 Baffled Apron and Its Design Curve



Source: U.S. Bureau of Reclamation, "Hydraulic Design of Stilling Basins and Energy Dissipators," Engineering Nomograph No. 25. Eigth Printing, Denver, May, 1984.

Figure 6-4 Conceptual Design of Alternative Channel



Source: City of Austin, Department of Environmental Protection

FIGURES FROM SECTION 7

Figure 7-1 Headwall Entrance Type

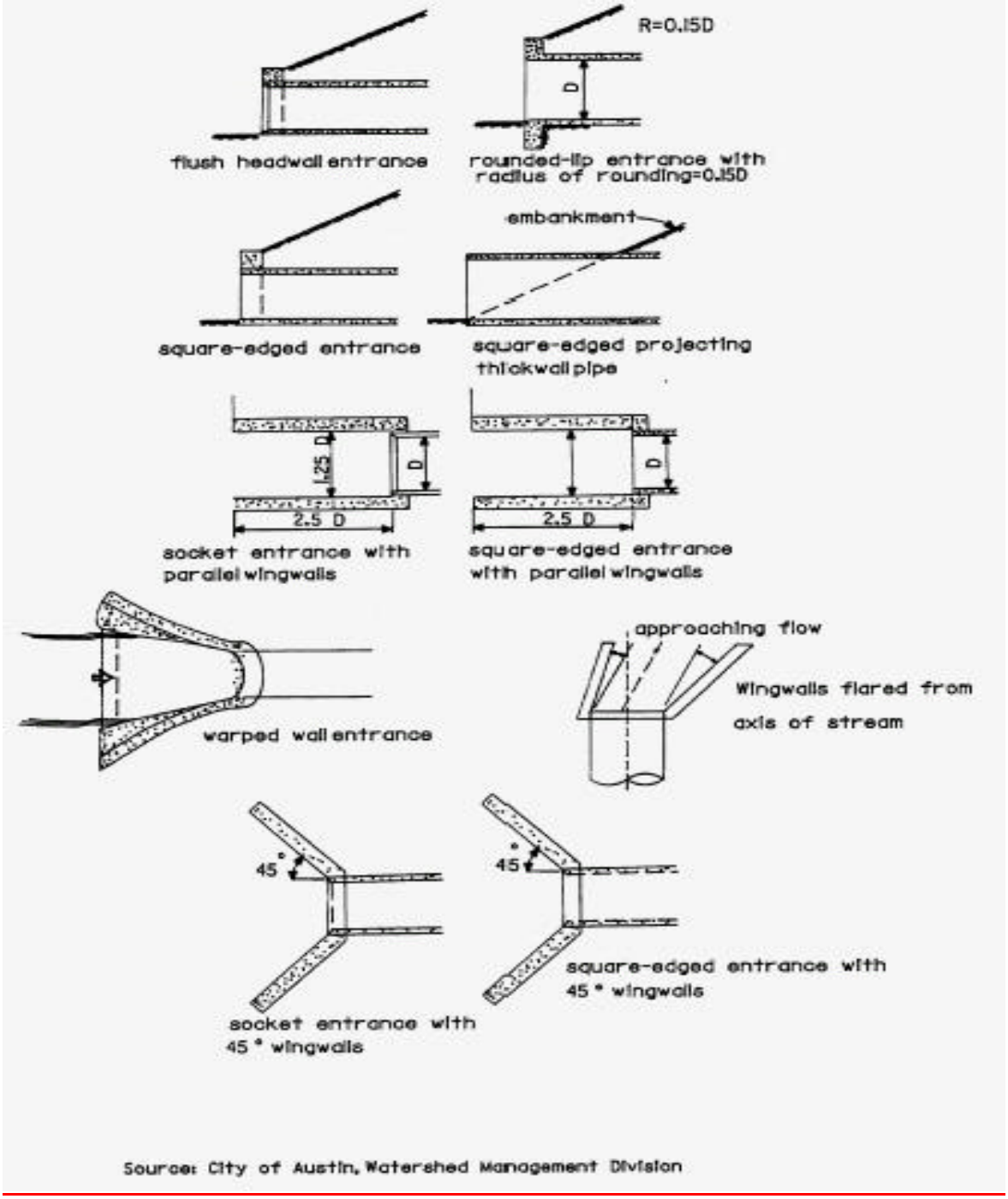
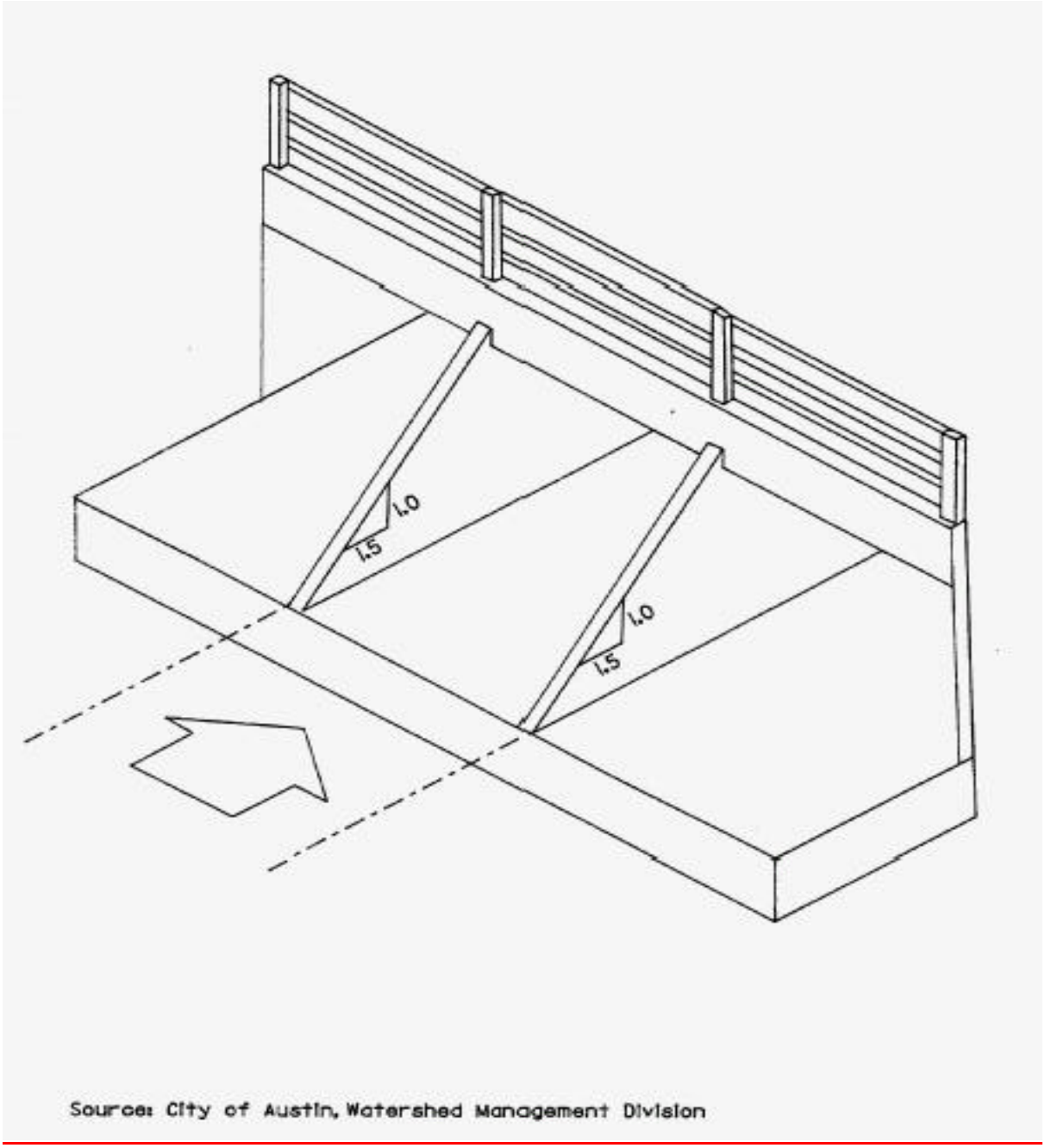


Figure 7-2 Conceptual Design of Debris Fins



Source: City of Austin, Watershed Management Division

Figure 7-3 Inlet and Outlet Conditions For Culverts

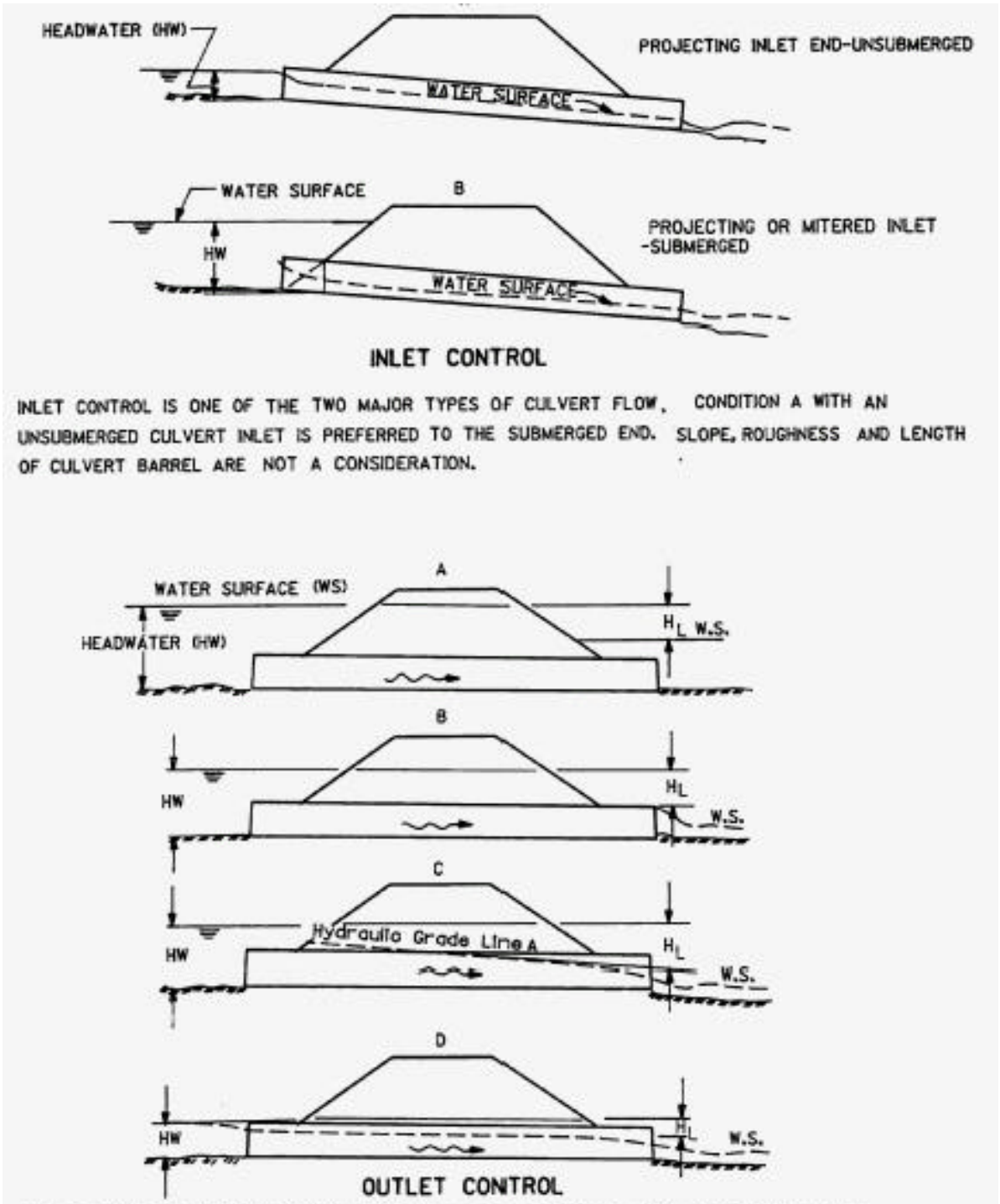
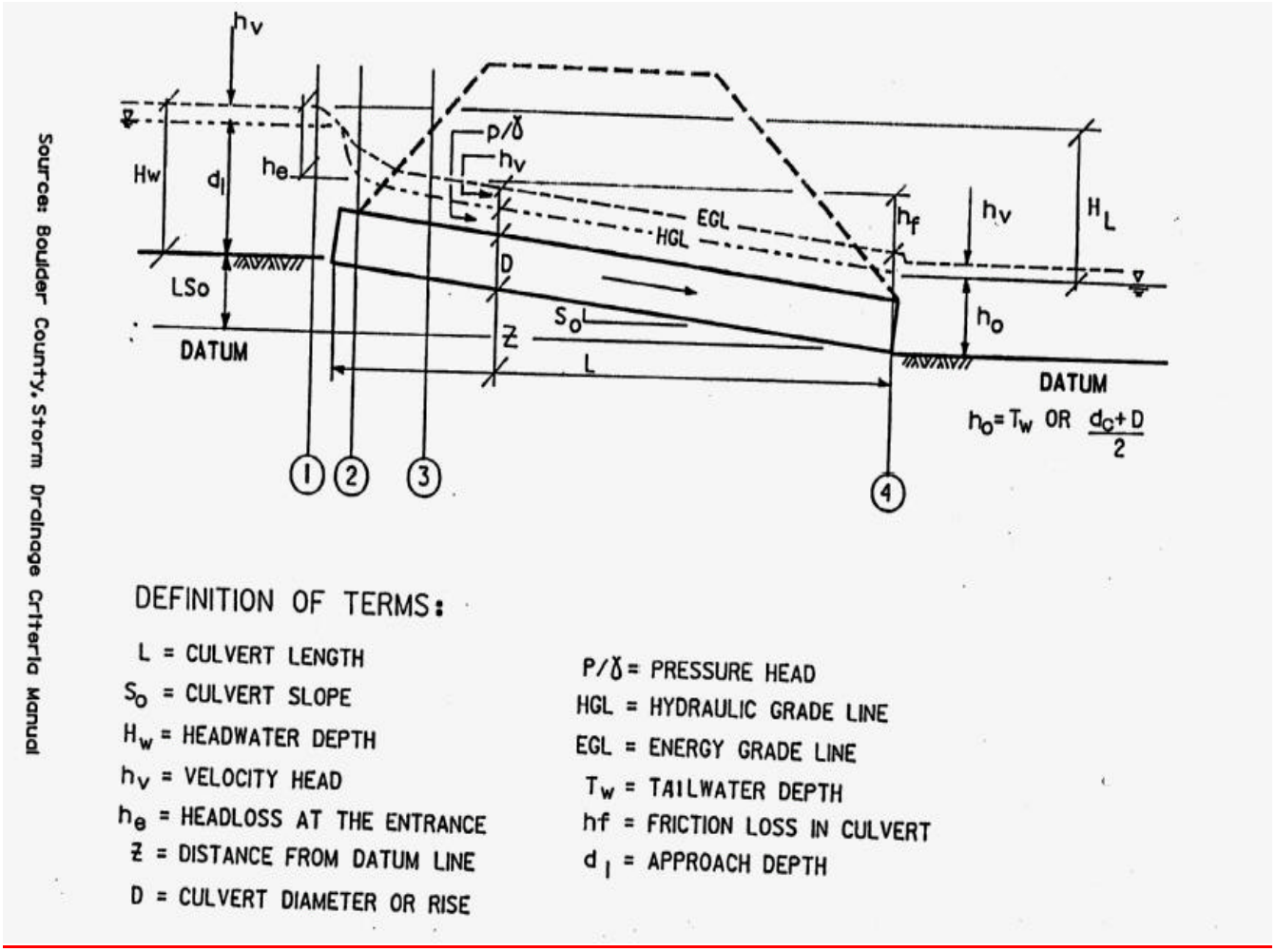


Figure 7-4 Hydraulics of a Culvert Under Outlet Control Condition



Source: Boulder County, Storm Drainage Criteria Manual

Figure 7-5 Inlet Control Nomograph, Circular Pipe

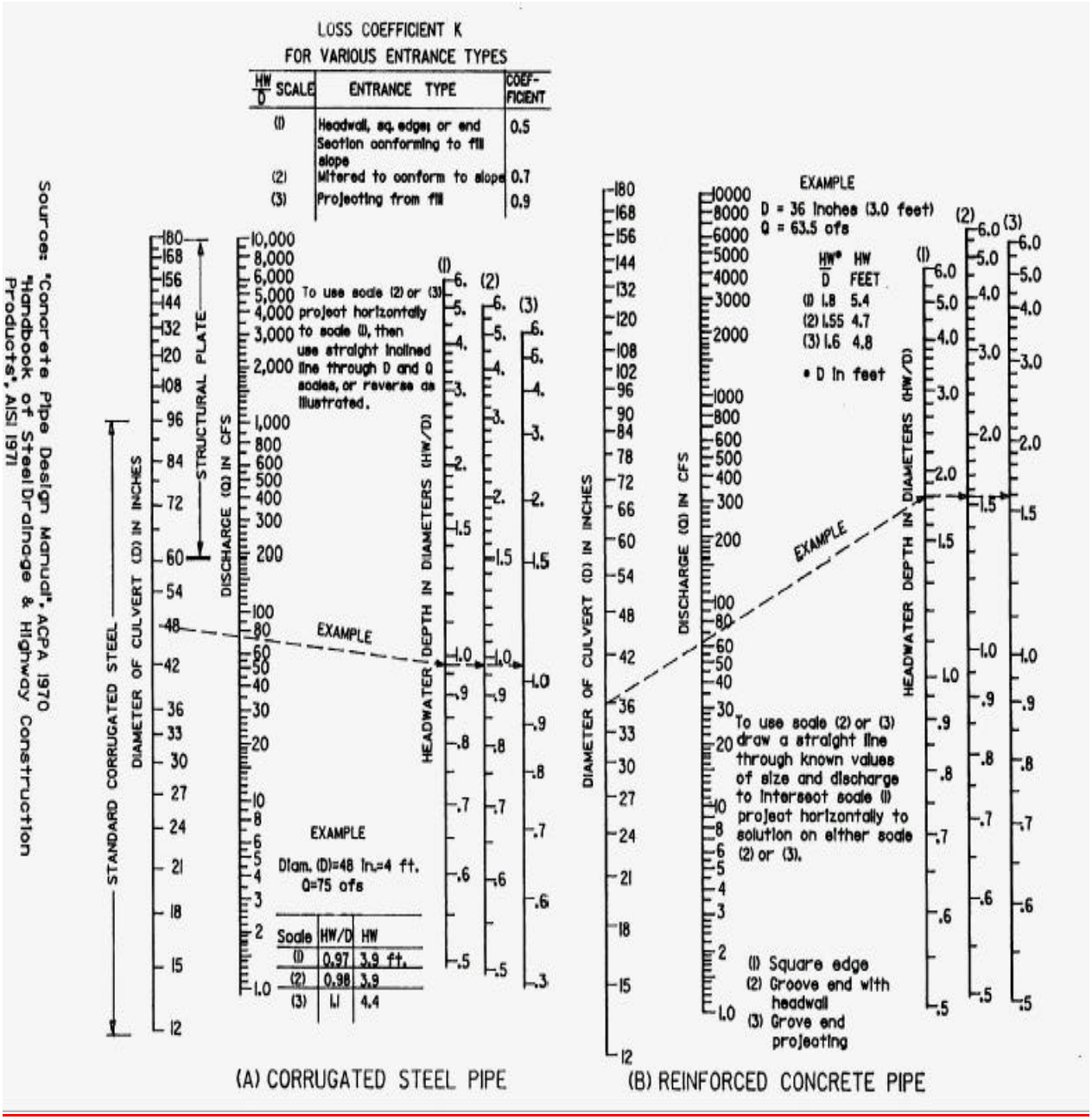
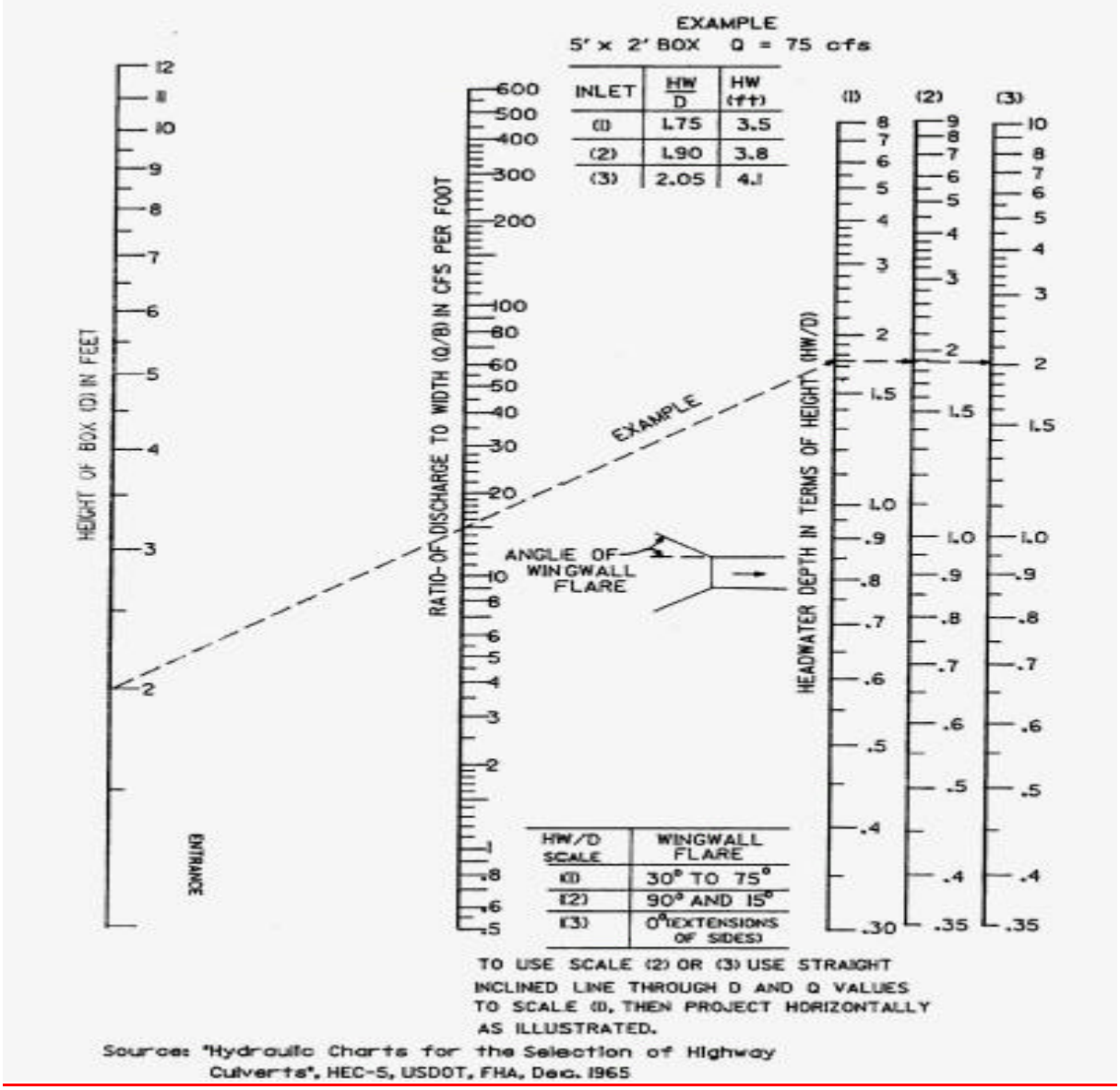
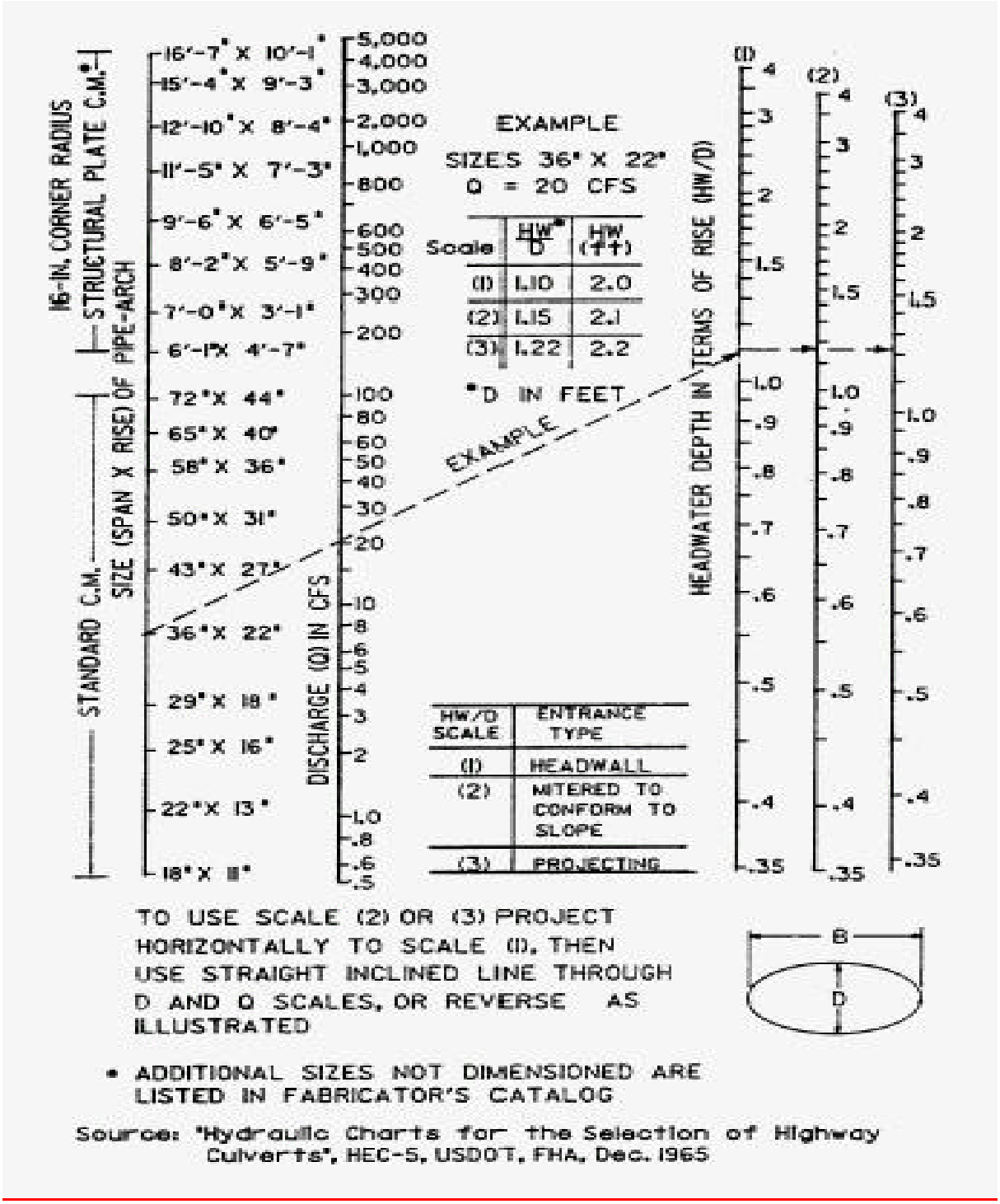


Figure 7-6 Inlet Control Nomograph, Box Culverts



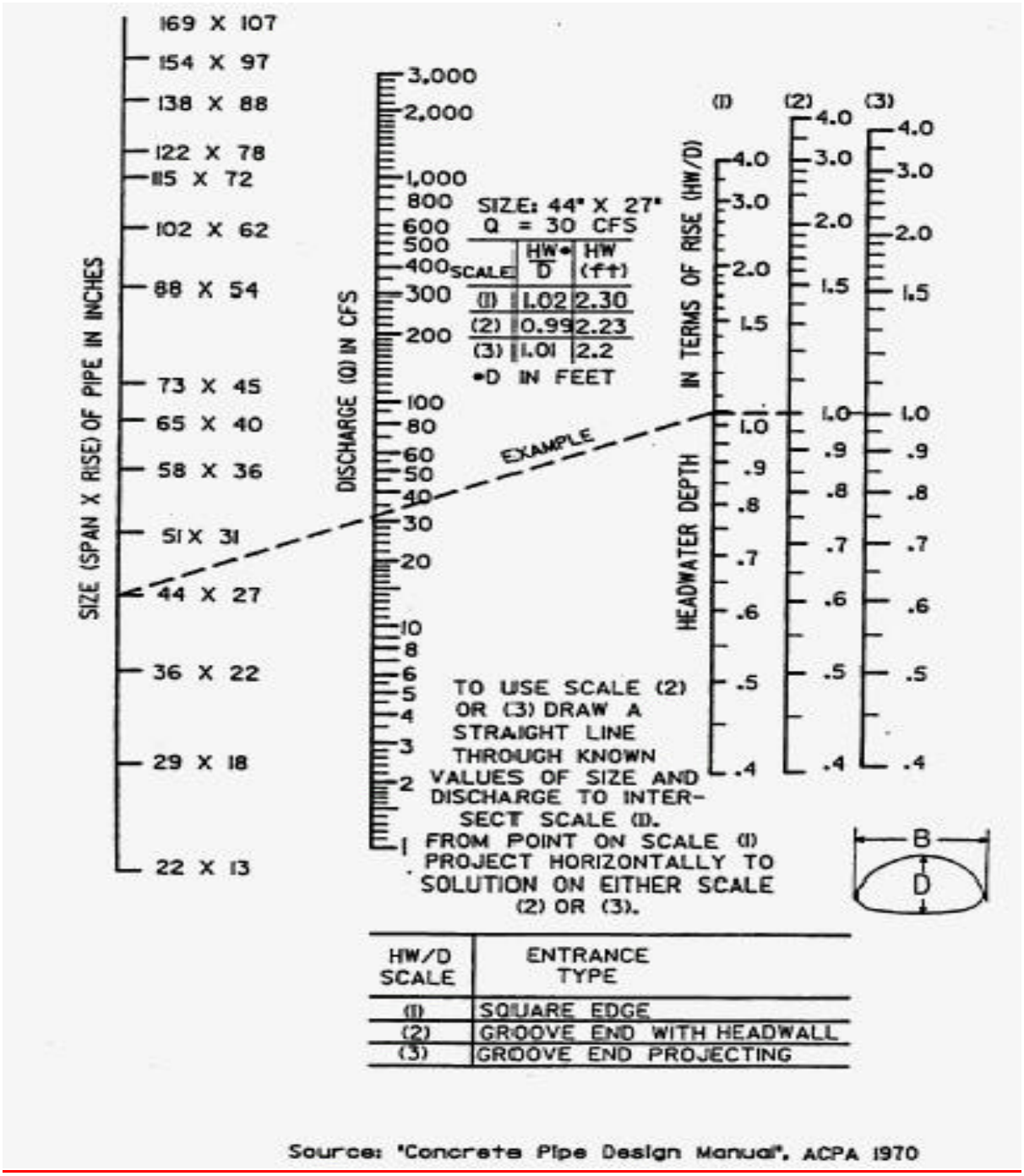
Source: "Hydraulic Charts for the Selection of Highway Culverts", HEC-5, USDOT, FHA, Dec. 1965

Figure 7-7 Inlet Control Nomograph, CSP Arch



Source: "Hydraulic Charts for the Selection of Highway Culverts", HEC-5, USDOT, FHA, Dec. 1965

Figure 7-8 Inlet Control Nomograph, RCP Arch



HW/D SCALE	ENTRANCE TYPE
(1)	SQUARE EDGE
(2)	GROOVE END WITH HEADWALL
(3)	GROOVE END PROJECTING

Source: "Concrete Pipe Design Manual", ACPA 1970

Figure 7-9 Inlet Control Nomograph, SSP Arch

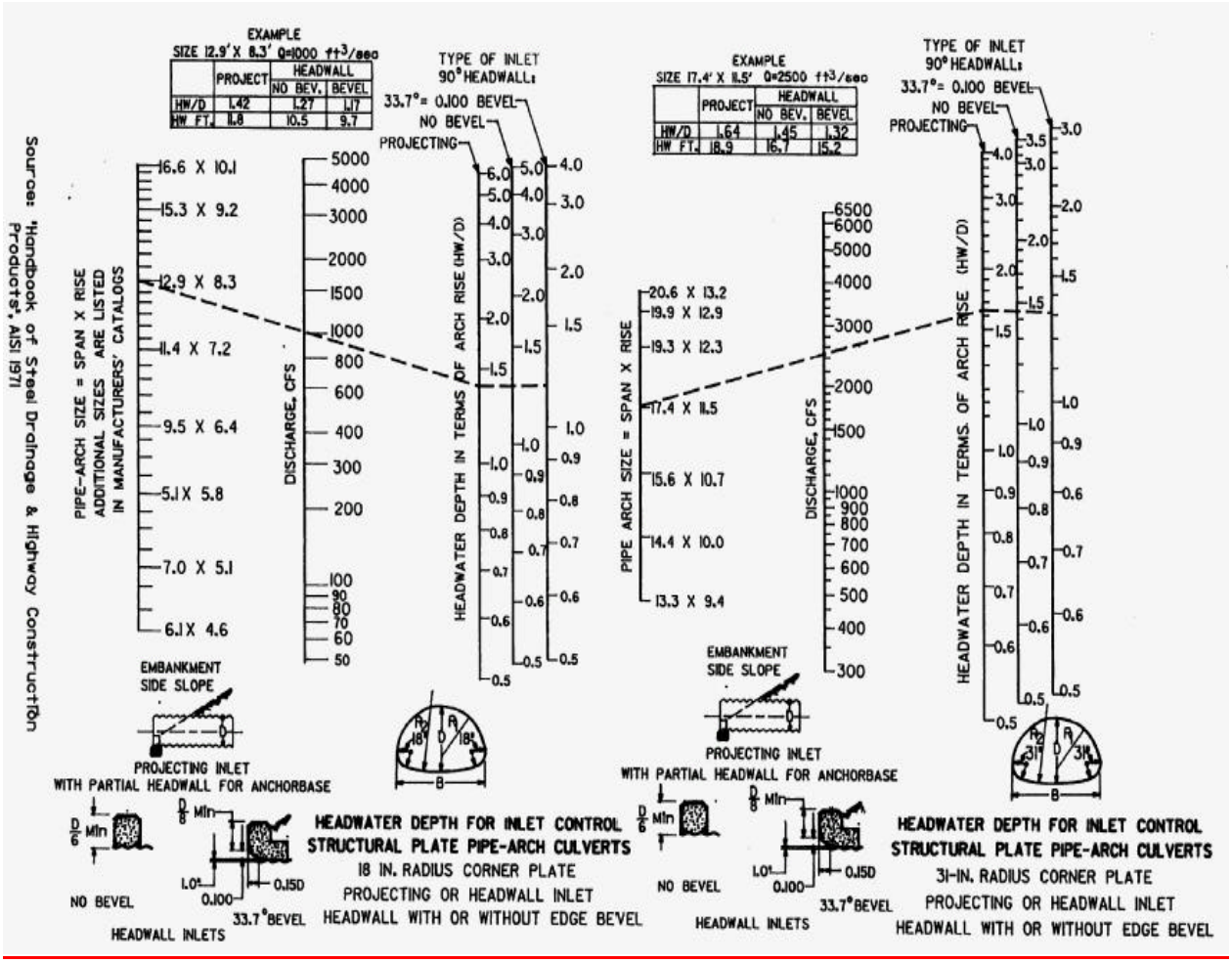
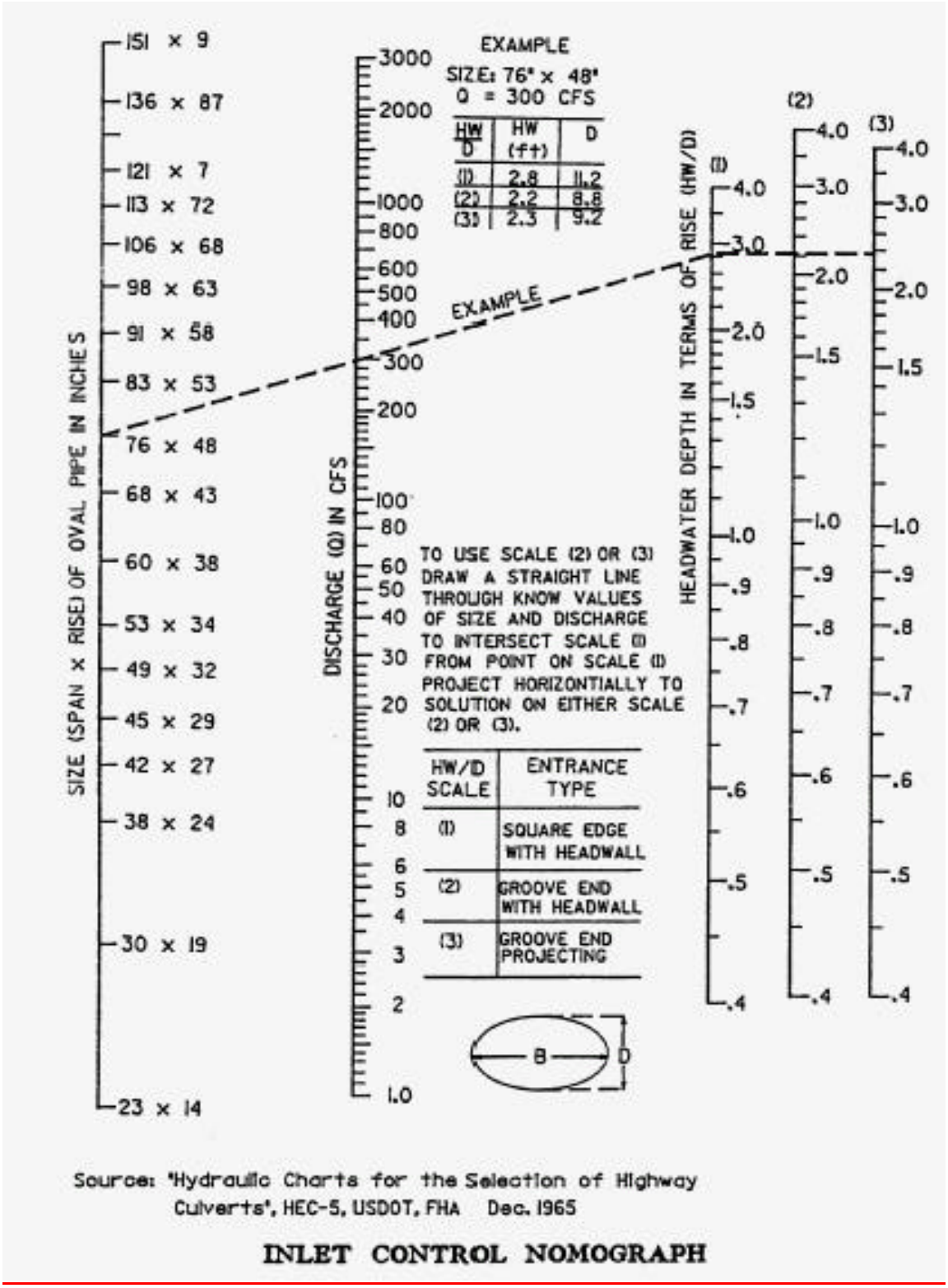


Figure 7-10 Inlet Control Nomograph, RCP Ellipse



Source: 'Hydraulic Charts for the Selection of Highway Culverts', HEC-5, USDOT, FHA Dec. 1965

INLET CONTROL NOMOGRAPH

Figure 7-11 Outlet Control Nomograph, Circular CSP

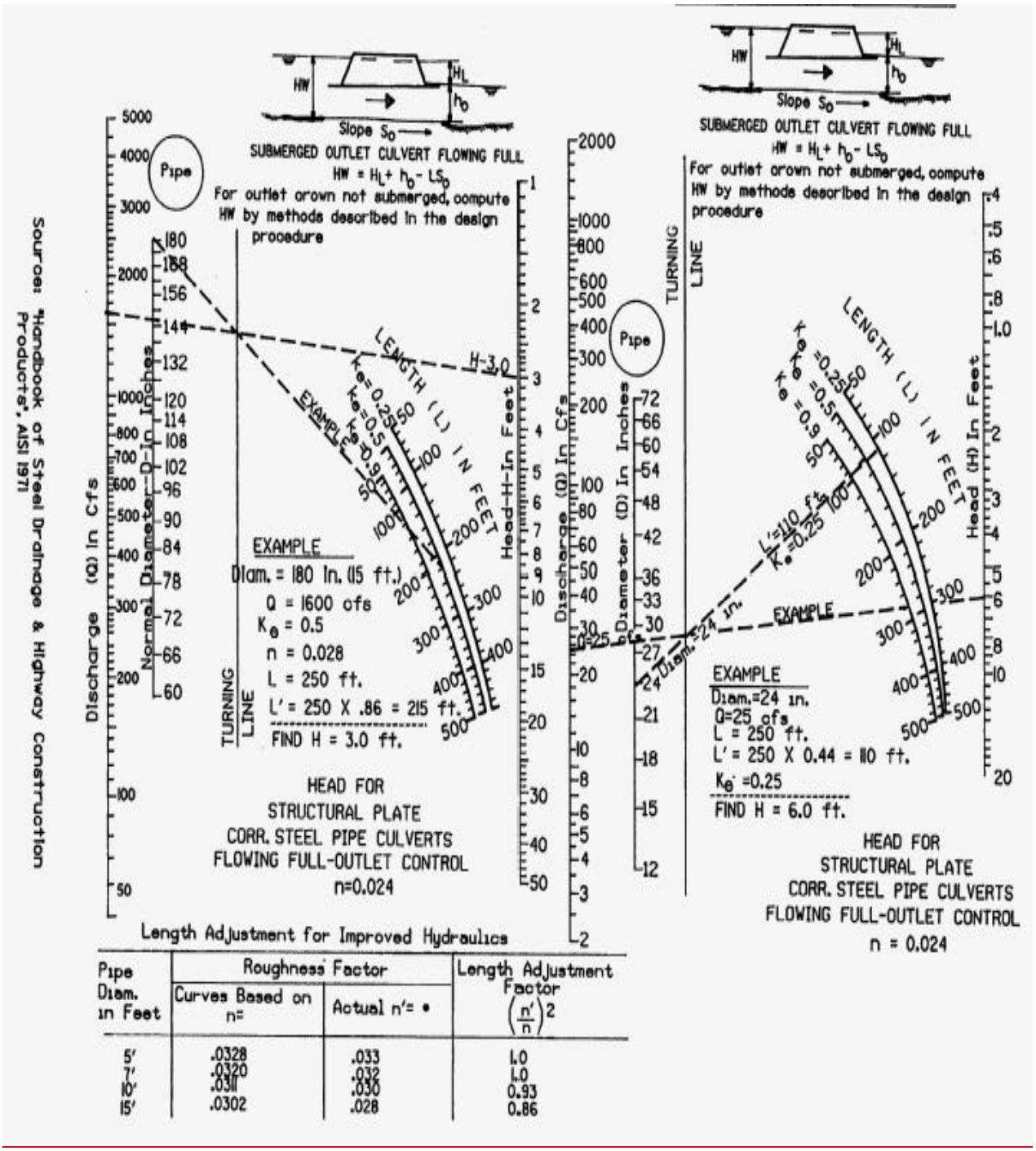
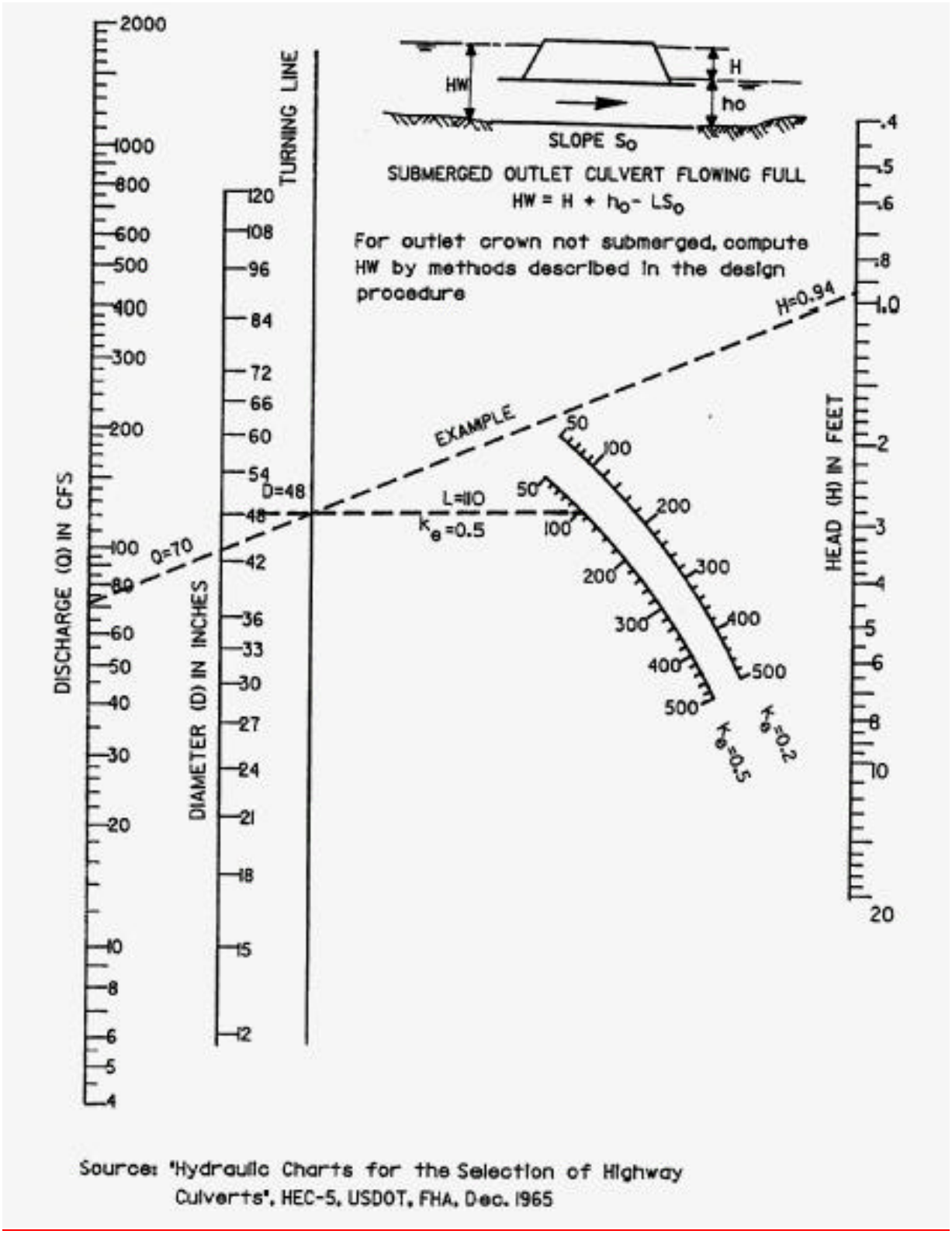


Figure 7-12 Outlet Control Nomograph, Circular RCP



Source: "Hydraulic Charts for the Selection of Highway Culverts", HEC-5, USDOT, FHA, Dec. 1965

Figure 7-13 Outlet Control Nomograph, Box Culverts

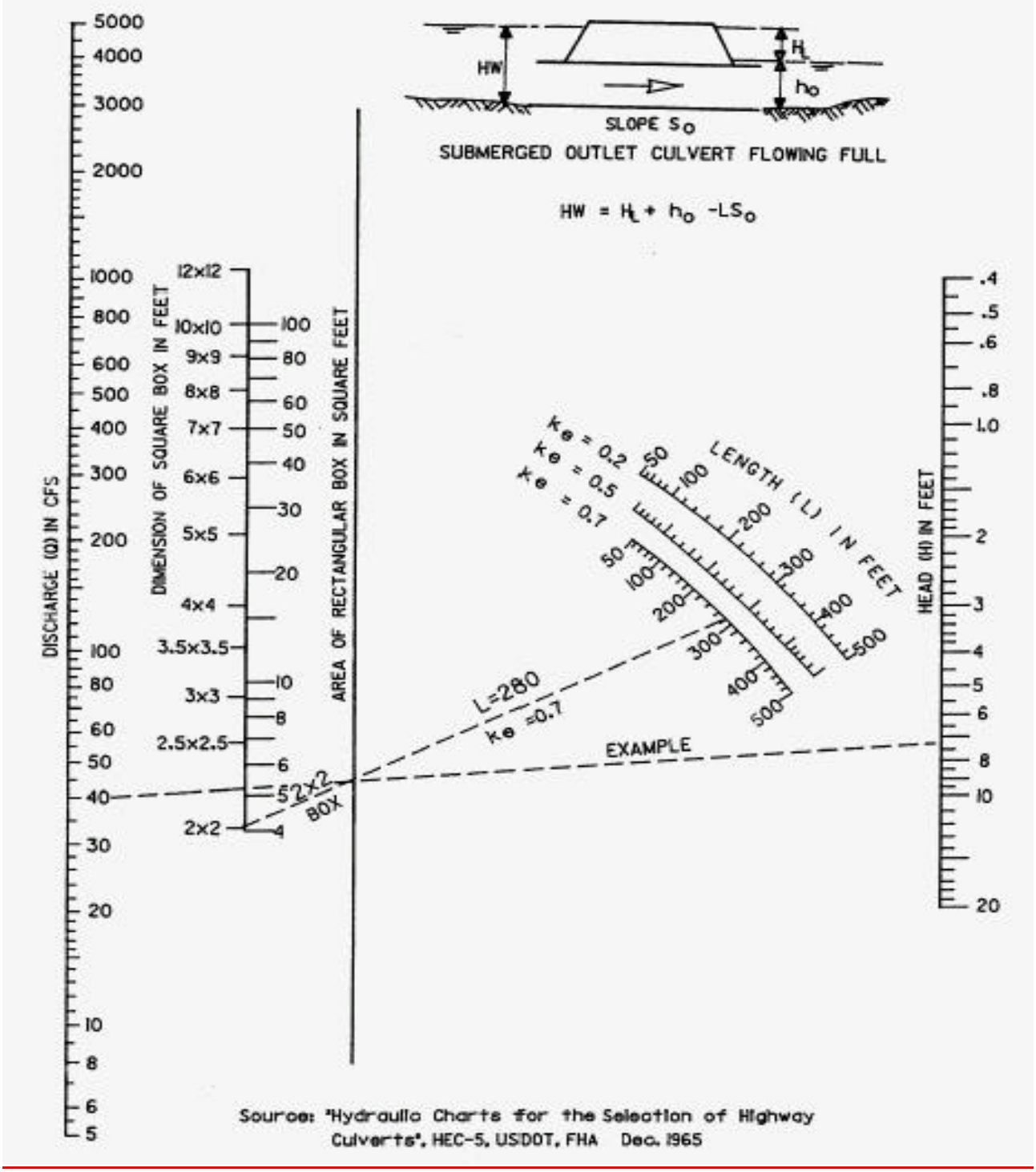
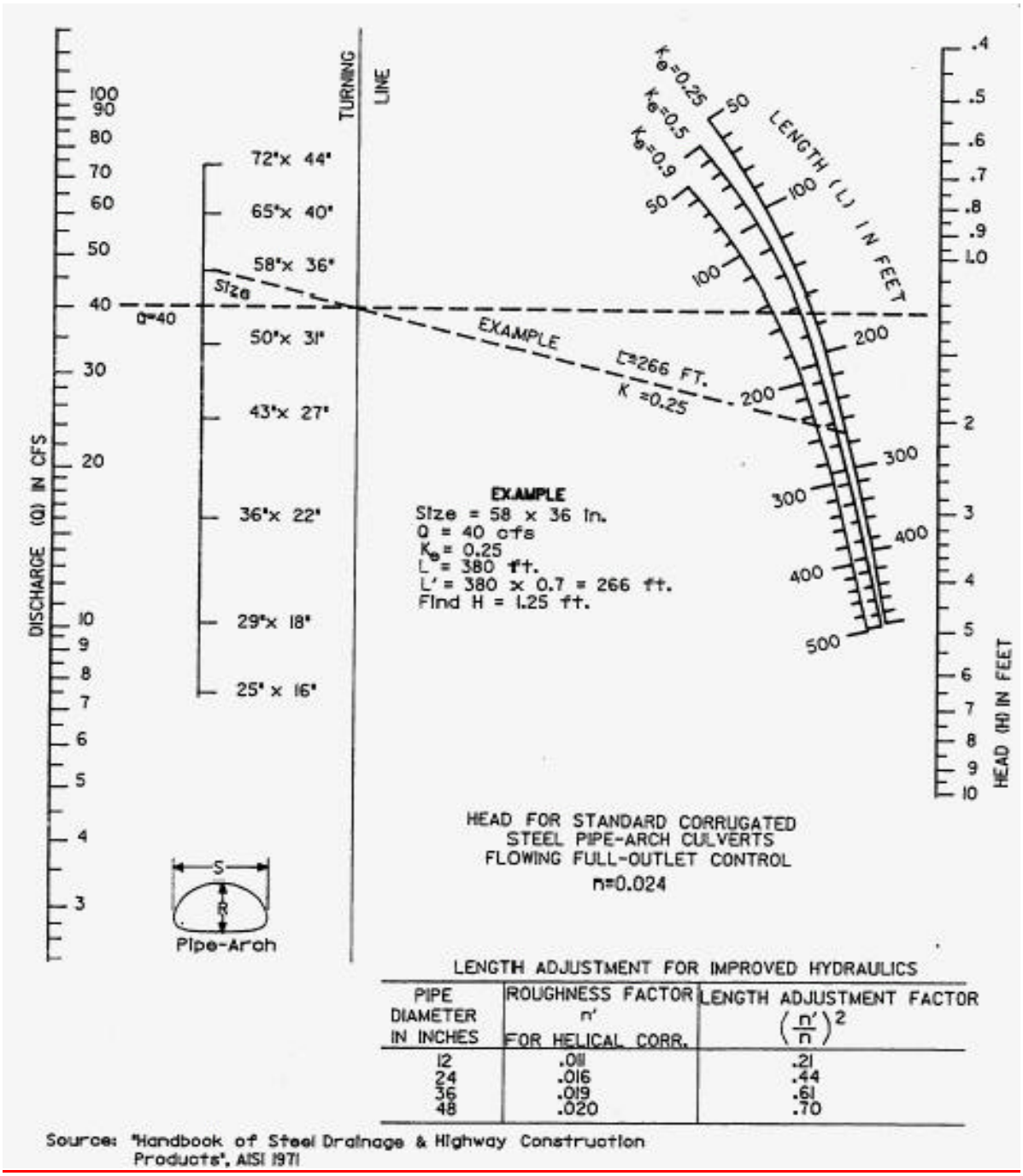


Figure 7-14 Outlet Control Nomograph, CSP Arch

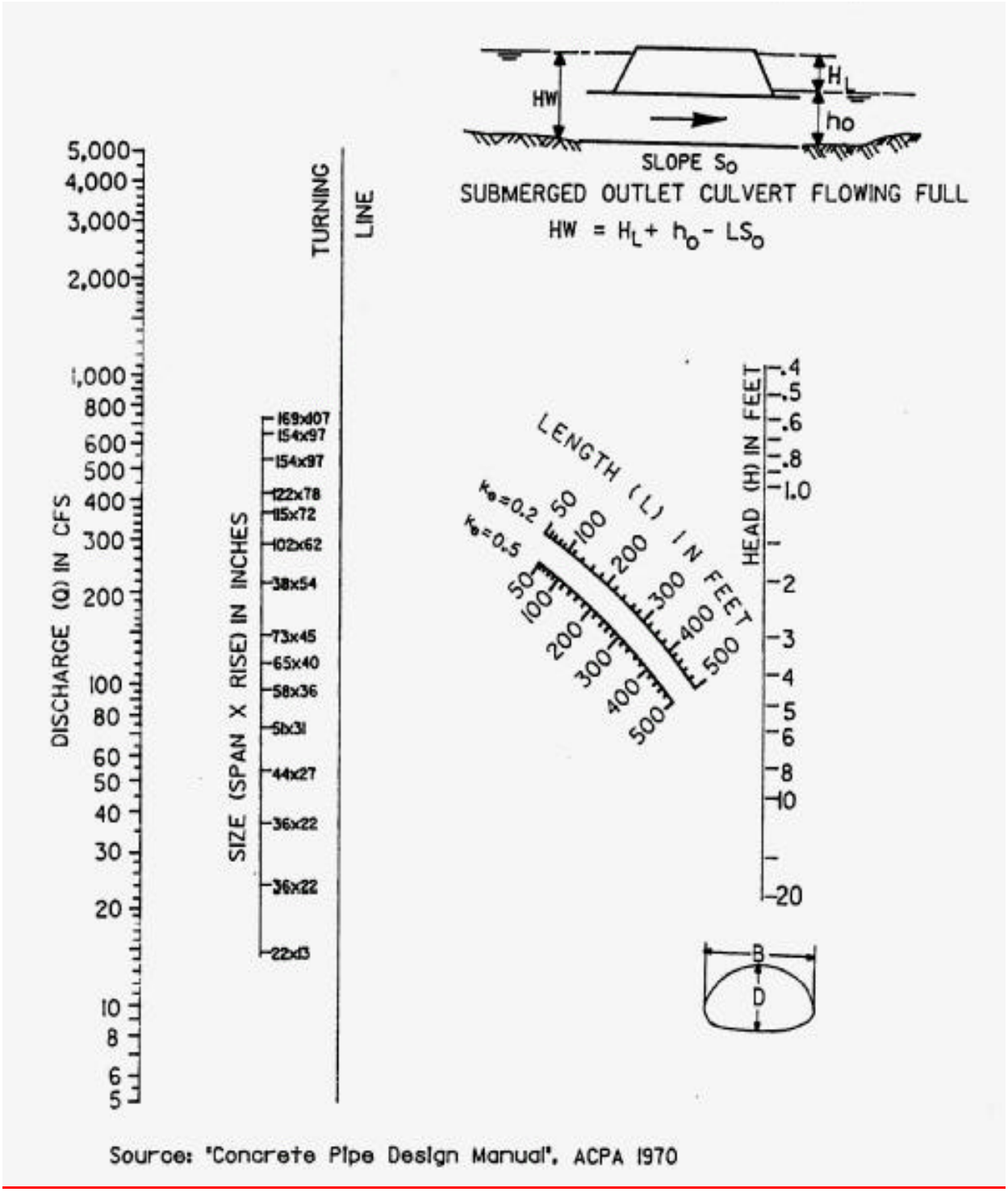


LENGTH ADJUSTMENT FOR IMPROVED HYDRAULICS

PIPE DIAMETER IN INCHES	ROUGHNESS FACTOR n' FOR HELICAL CORR.	LENGTH ADJUSTMENT FACTOR $\left(\frac{n'}{n}\right)^2$
12	.011	.21
24	.016	.44
36	.019	.61
48	.020	.70

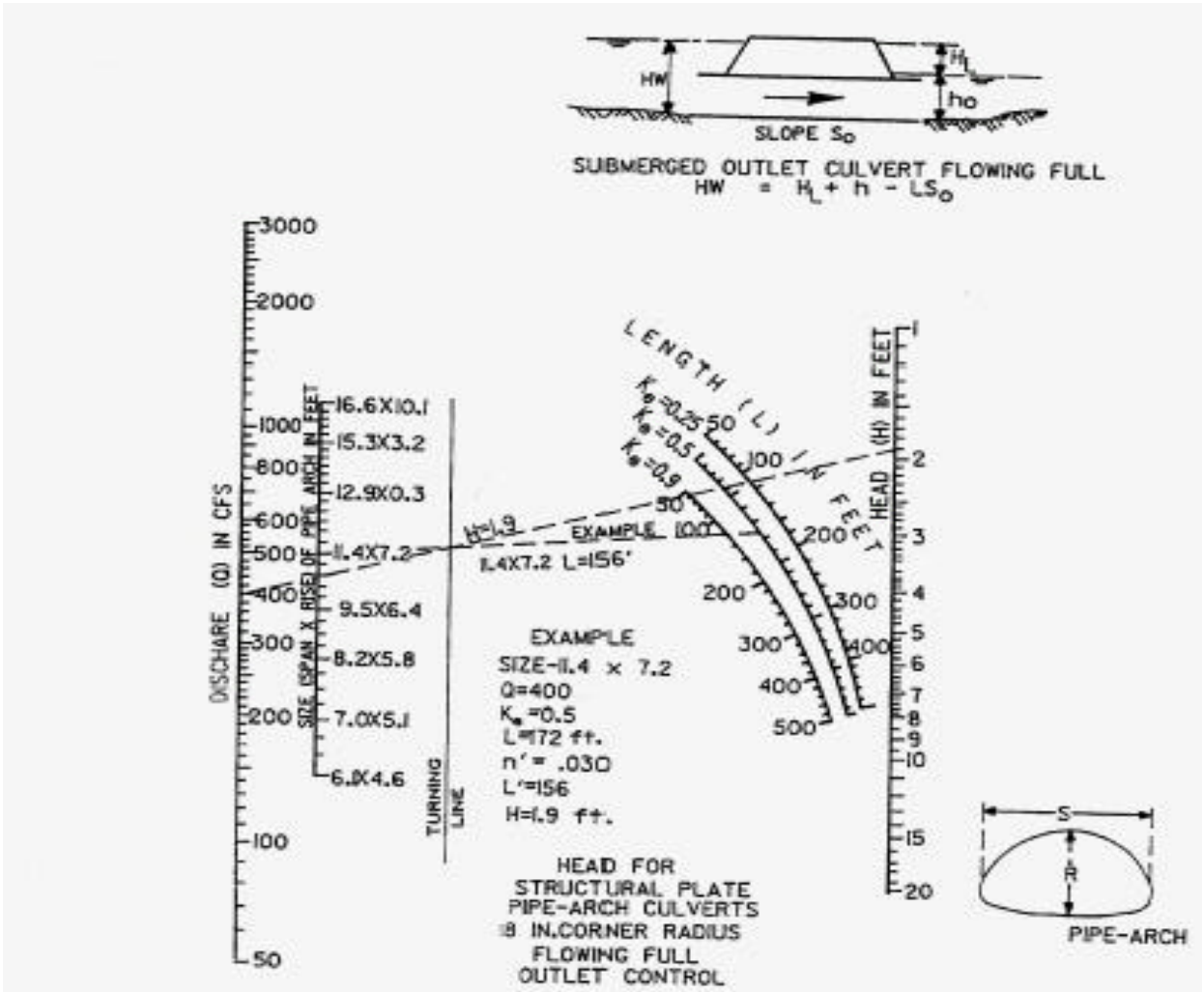
Source: "Handbook of Steel Drainage & Highway Construction Products", AISI 1971

Figure 7-15 Outlet Control Nomograph, RCP Arch



Source: "Concrete Pipe Design Manual", ACPA 1970

Figure 7-16 Outlet Control Nomograph, SPP Arch



OUTLET CONTROL. Head for structural plate pipe-arch culvert with 18 in corner radius with submerged outlet and flowing full. For 31 in. corner radius, use structure sizes with equivalent areas on the 18-in. corner radius scale.

Length Adjustment for Improved Hydraulics

Pipe-Arch Size in Feet	Roughness Factor		Length Adjustment Factor $\left(\frac{n'}{n}\right)^2$
	Curves based on n	Actual n'	
6.1 x 4.6	.0327	.0327	1.0
8.1 x 5.8	.0321	.032	1.0
11.4 x 7.2	.0315	.030	0.907
16.6 x 10.1	.0306	.028	0.837

Source: "Handbook of Steel Drainage & Highway Construction Products", AISI 1971

Figure 7-17 Outlet Control Nomograph, RCP Ellipse

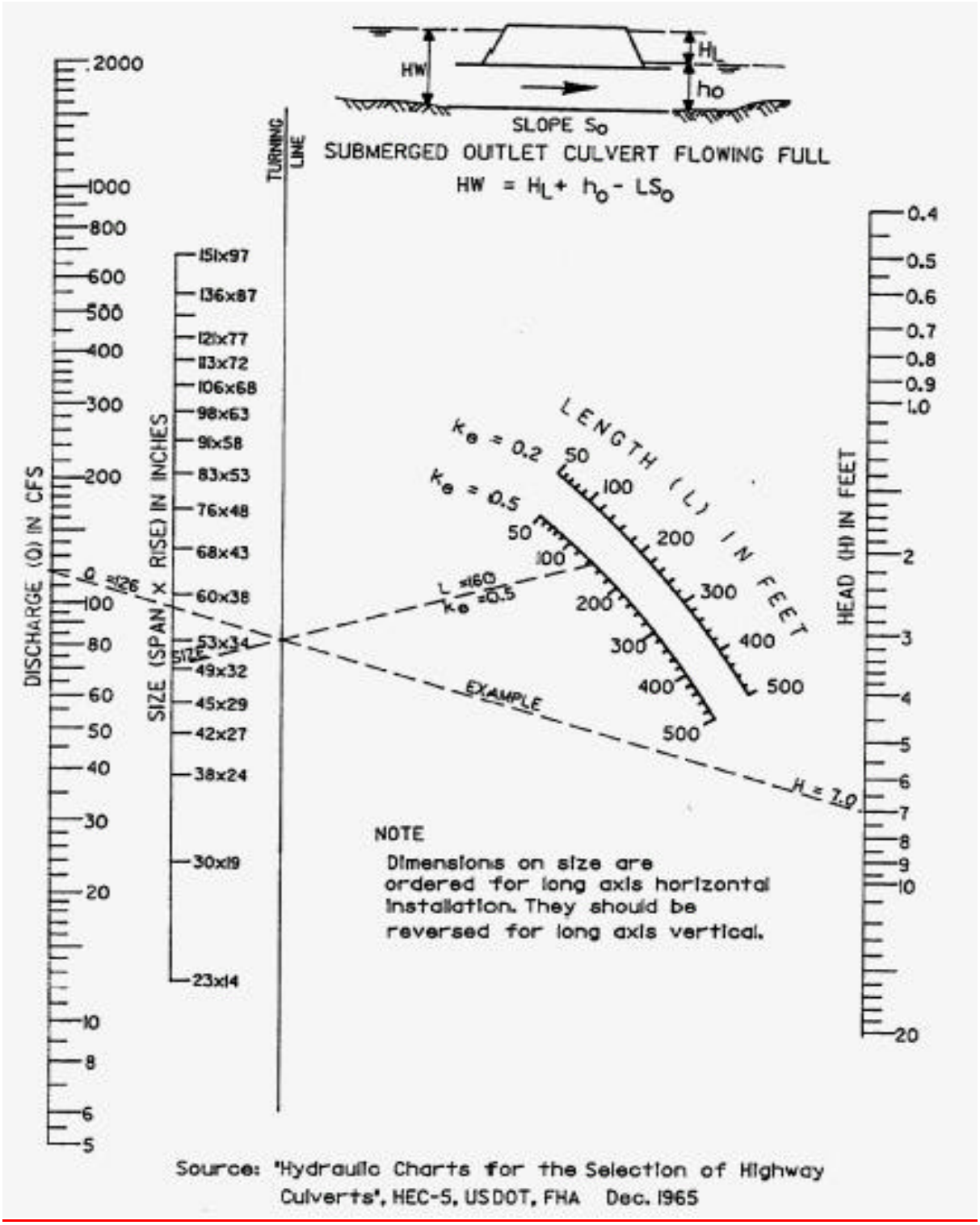
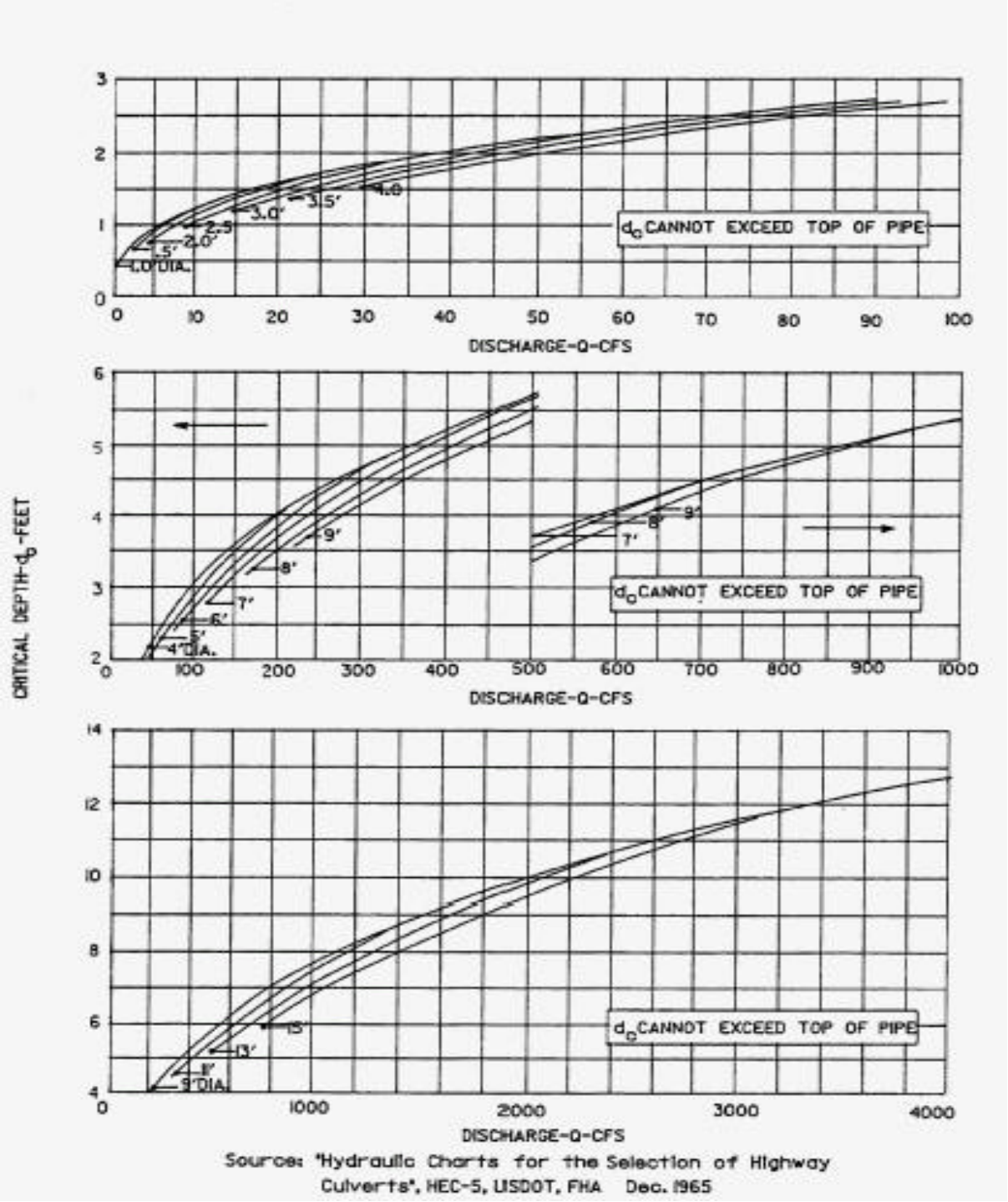
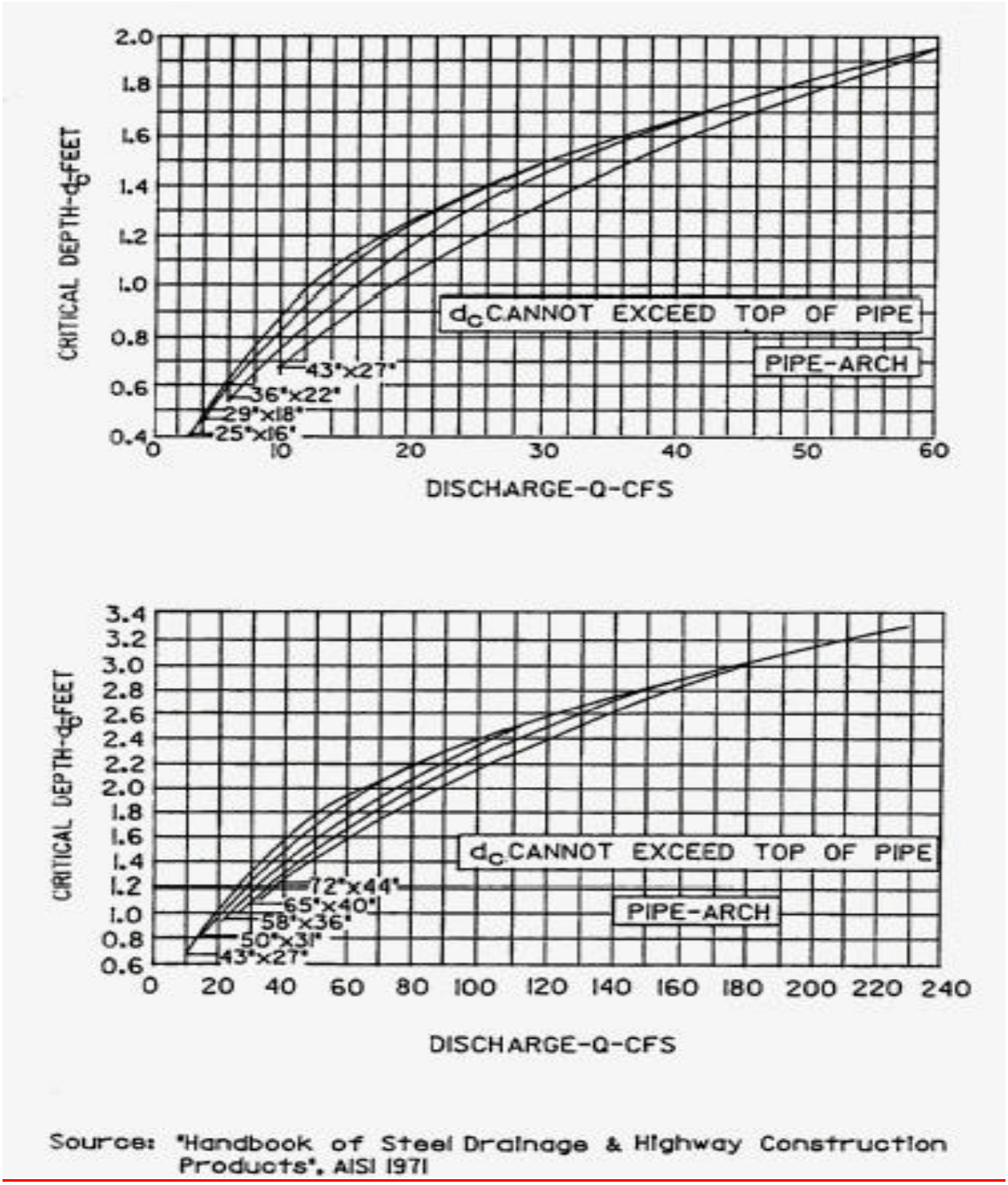


Figure 7-18 Critical Depth Curves, Circular Pipe



Source: "Hydraulic Charts for the Selection of Highway Culverts", HEC-5, USDOT, FHA Dec. 1965

Figure 7-19 Critical Depth Curves, CSP Arch



Source: "Handbook of Steel Drainage & Highway Construction Products", AISI 1971

Figure 7-20 Critical Depth Curves, RCP Arch

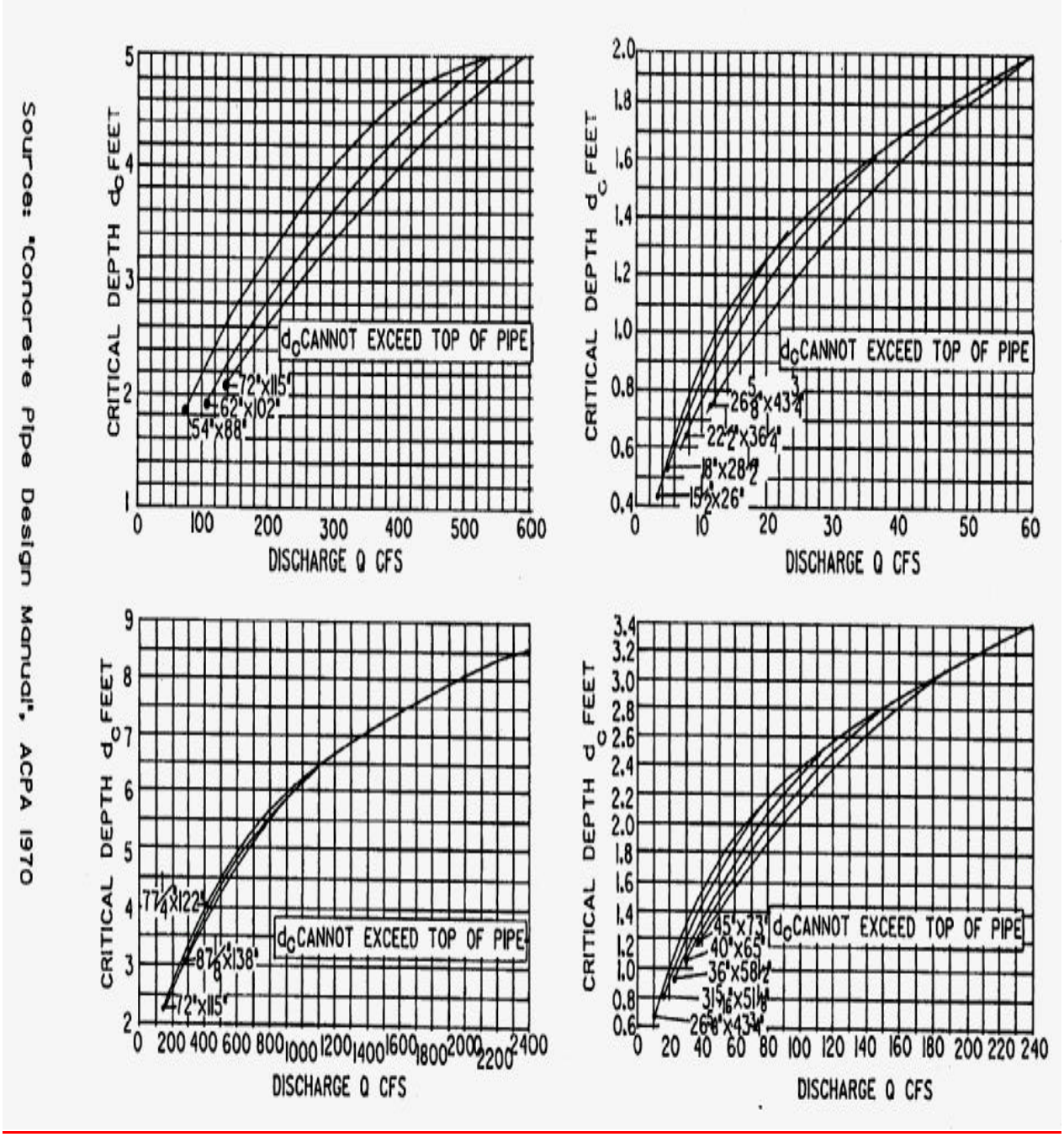
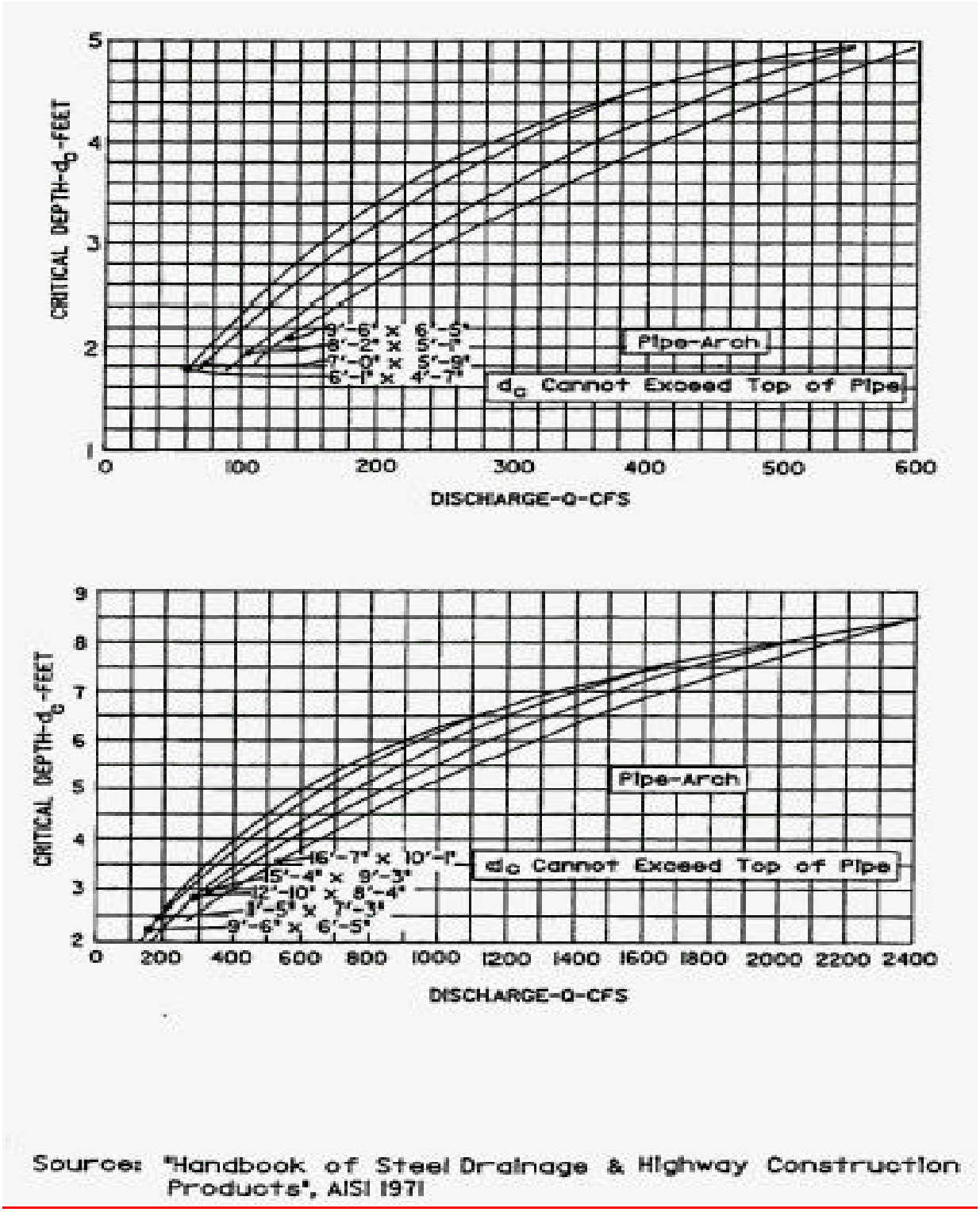
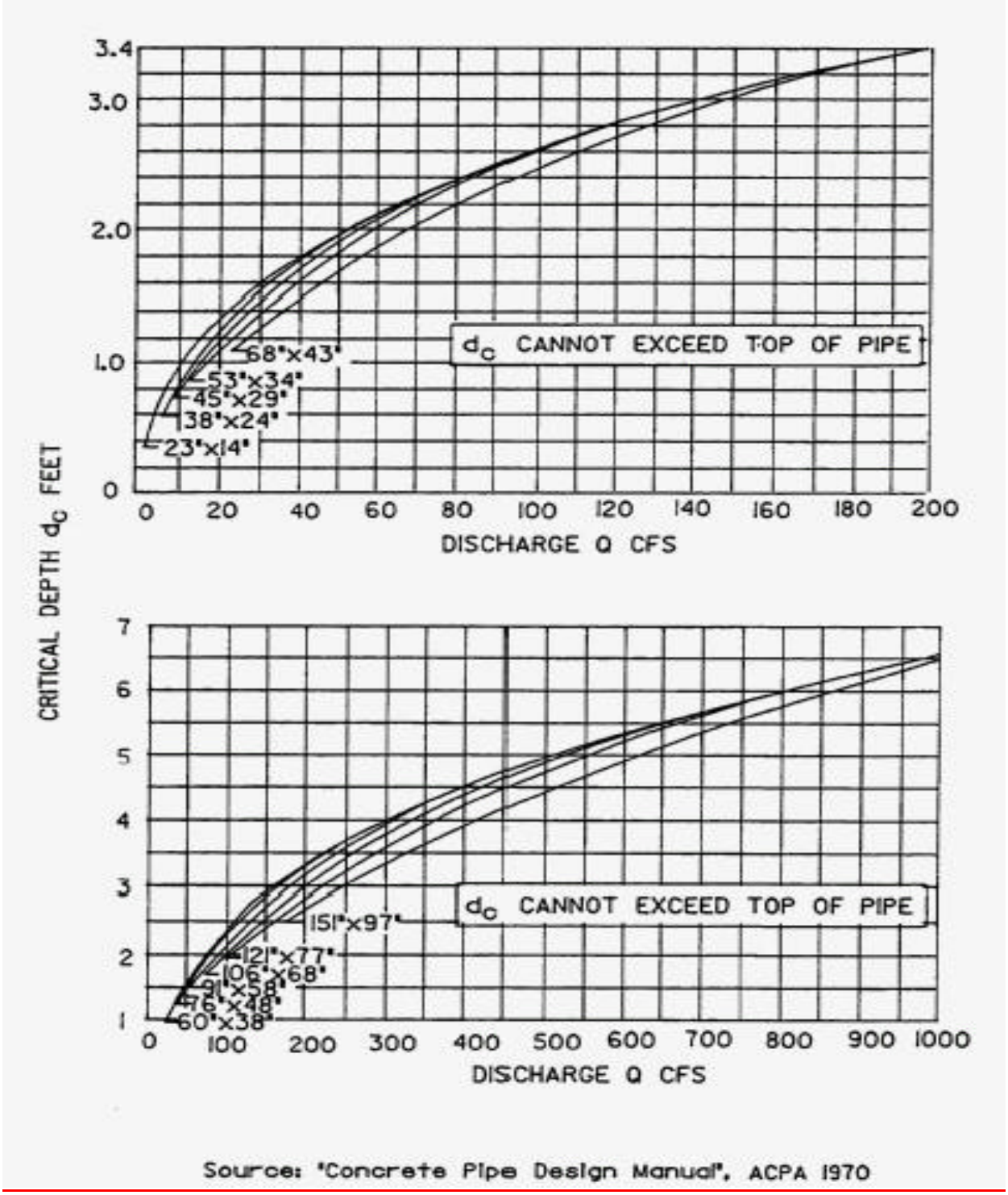


Figure 7-21 Critical Depth Curves, SSP Arch



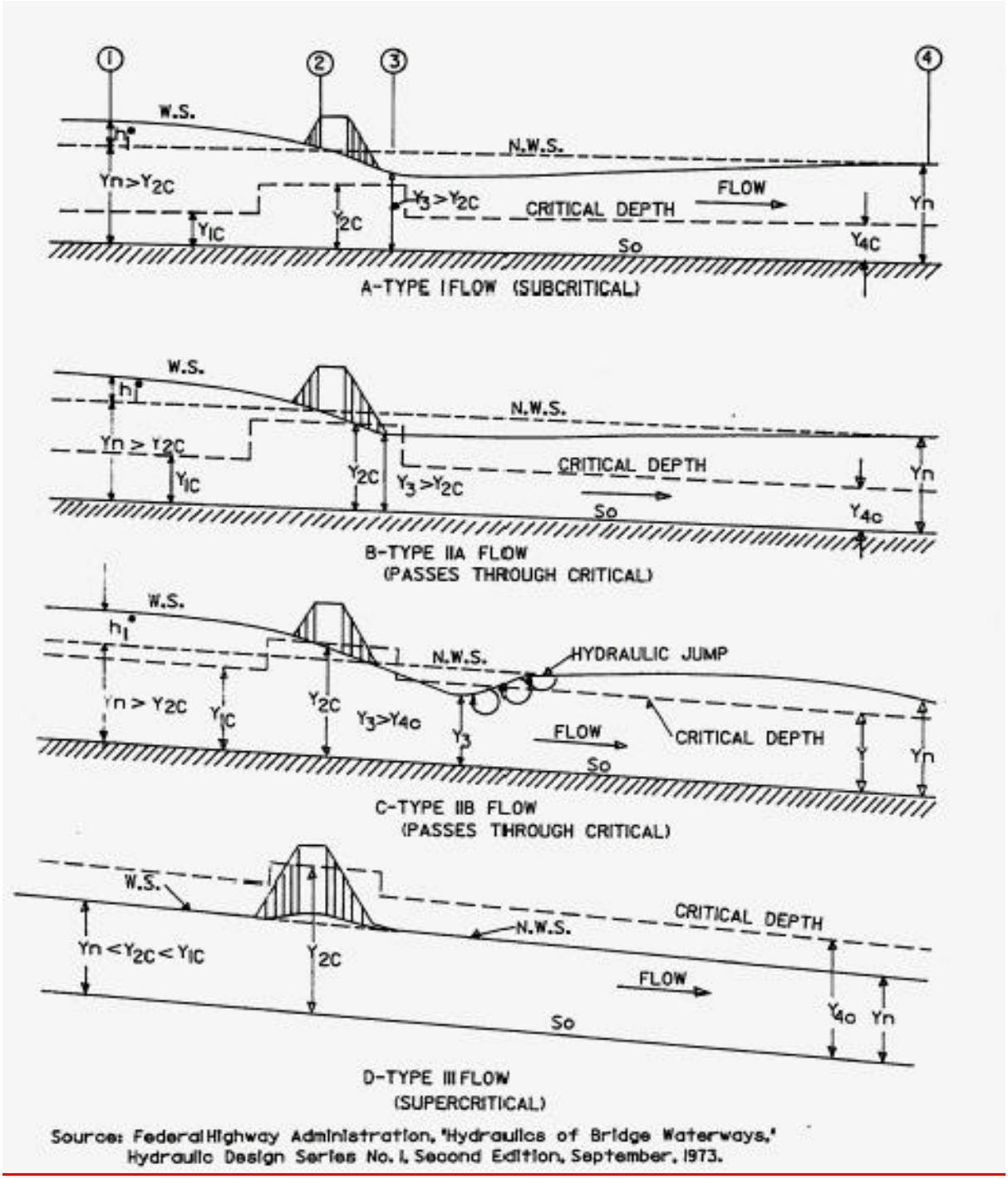
Source: "Handbook of Steel Drainage & Highway Construction Products", AISI 1971

Figure 7-22 Critical Depth Curves, RCP Ellipse



Source: "Concrete Pipe Design Manual", ACPA 1970

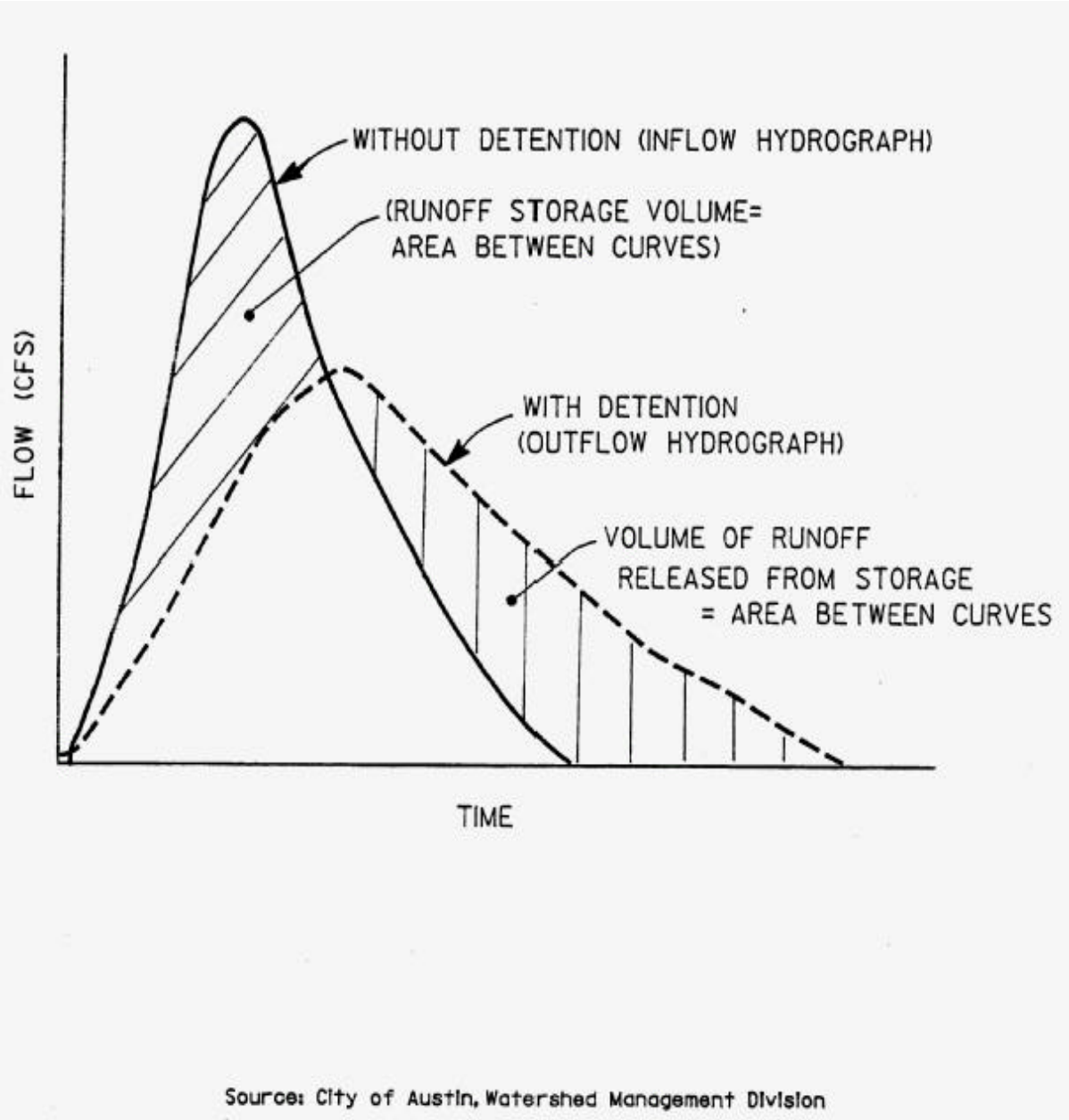
Figure 7-23 Types of Flow For Bridge Design



Source: Federal Highway Administration, 'Hydraulics of Bridge Waterways,' Hydraulic Design Series No. 1, Second Edition, September, 1973.

FIGURES FROM SECTION 8

Figure 8-1 Concept of Detention Pond



Source: City of Austin, Watershed Management Division

Figure 8-2 Weir and Orifice Flows