Culverts

General

Culverts are pipe conduits constructed of steel, iron, concrete, aluminum, or other suitable material installed for the purpose of transporting surface runoff for short distances. The most common installation location is where roads cross natural drainage ways. Another use is at locations where the natural stream is placed in an underground pipe to permit use of an area for buildings, parking lots, etc.

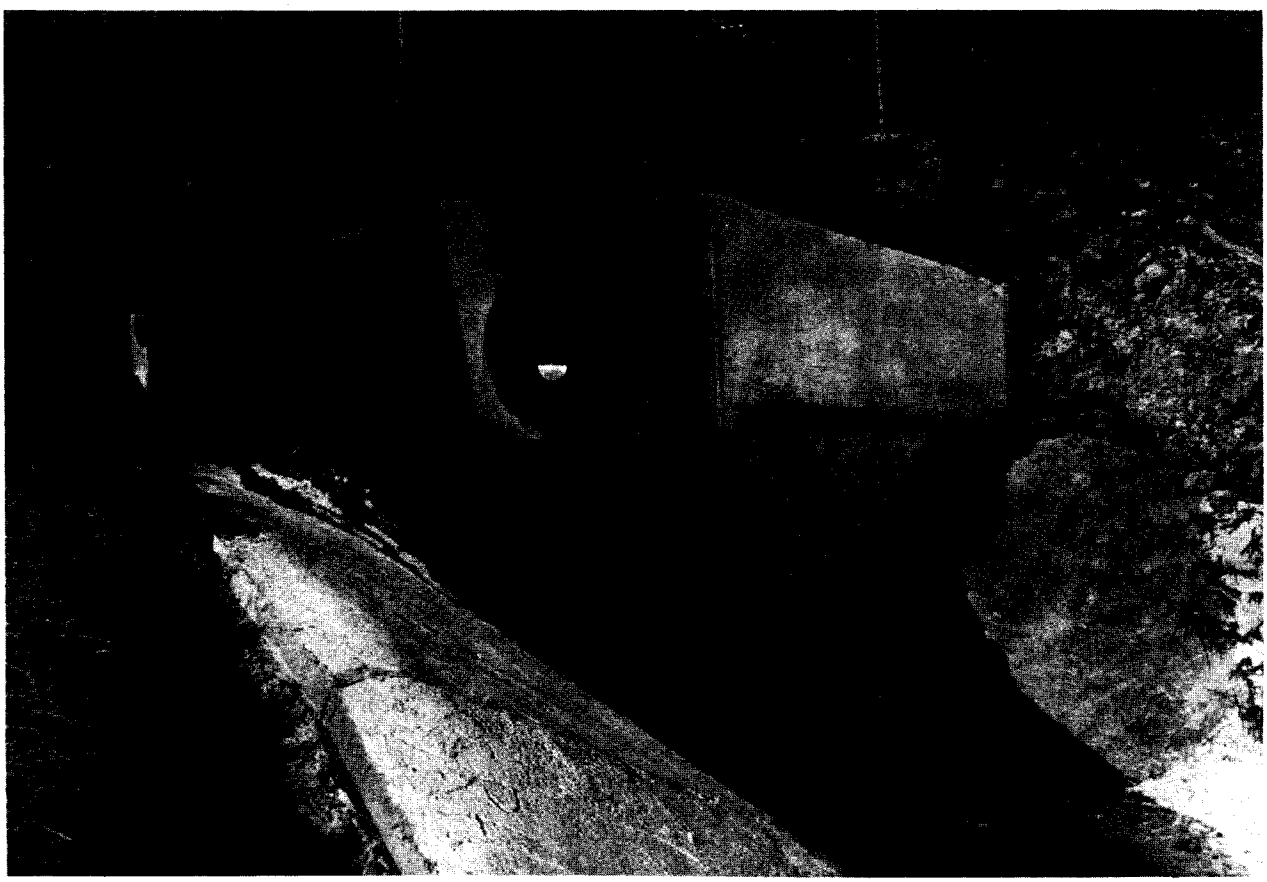
The storm frequency used for culvert design depends on the project and its location to other improvements. For example, a road culvert being installed in a mostly wooded area on a low traveled road may only require a 10-year storm frequency design. A culvert installed on a highly traveled road in an urban area may be designed on a 50- to 100-year storm frequency. The frequency of design should be selected based upon the hazard involved to life and property.

The following table provides suggested minimum frequency for the locations noted. It does not relieve the designer of making on-site evaluations and in-turn storm frequency determinations.

Table 11 — Culvert Design Storm Frequencies (Minimum)

Location	Design	Frequency
1 lane road (urban area)	10 year	24 hour
2 lane road (urban area)	25 year	24 hour
Parking lots	10 year	24 hour
Building sites	50 year	24 hour

Runoff can be determined by using procedures outlined in Appendix B. Figures 28 through 32 may be used for sizing corrugated metal and concrete culverts.



This well designed culvert conveys water underneath a new highway to help reduce erosion.

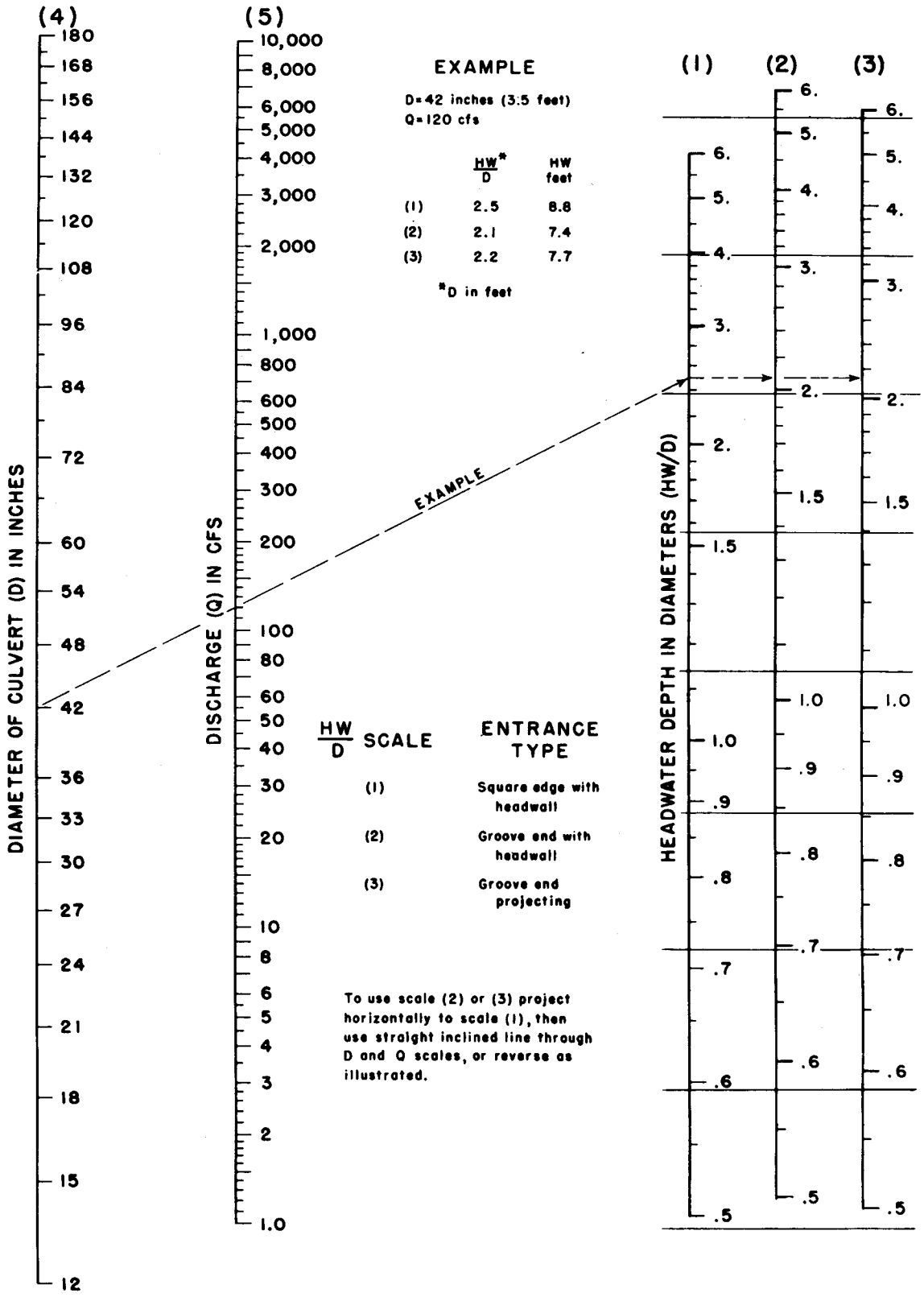


Figure 28 — Headwater Depth for Concrete Pipe Culverts with inlet Control (Ref. Hyd. Eng. Cir. No. 5, USBPR, 1965)

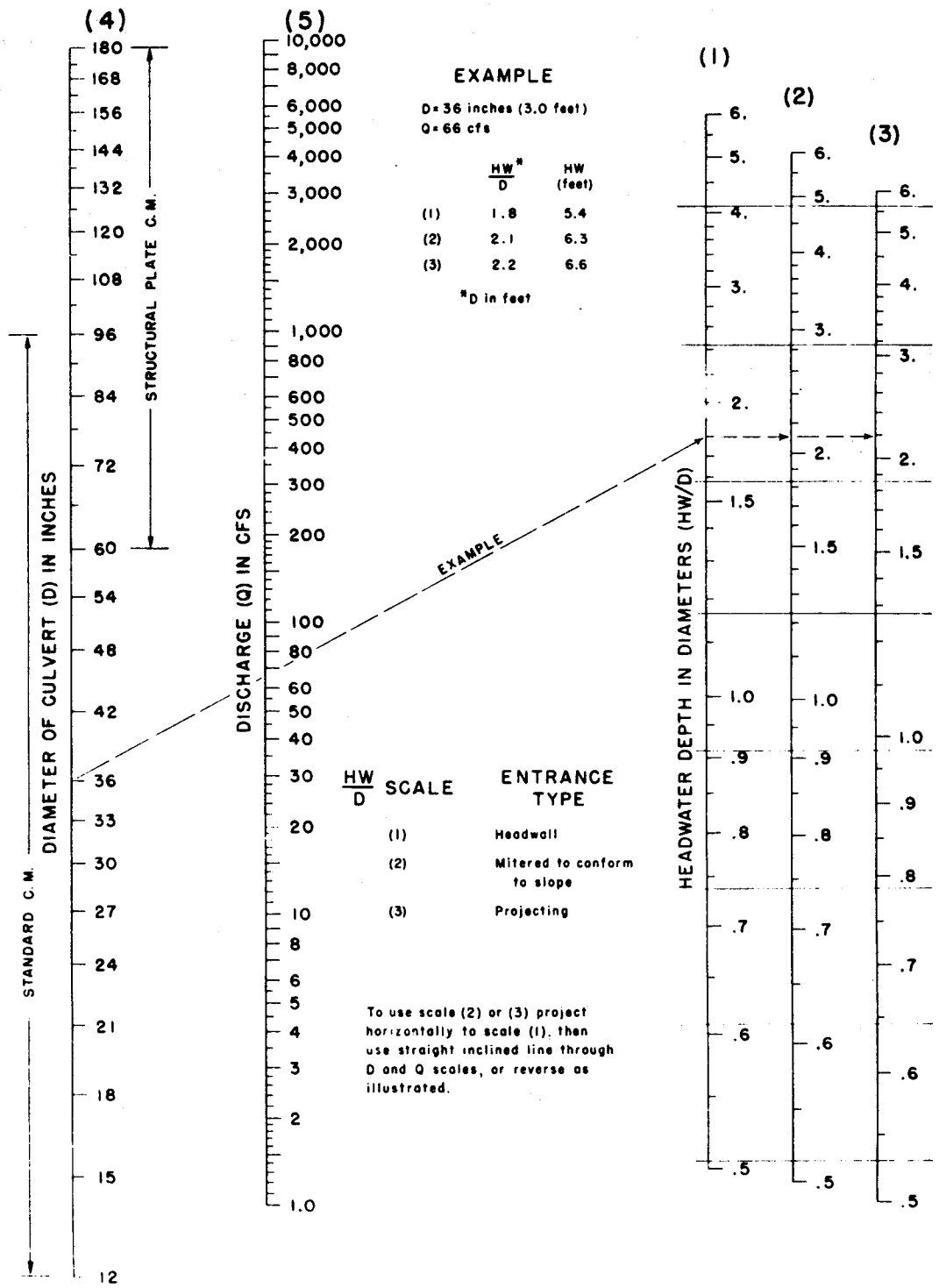


Figure 29 — Headwater Depth for CM Pipe Culverts with inlet Control (Ref. Hyd. Eng. Cir. No. 5, USBPR, 1965)

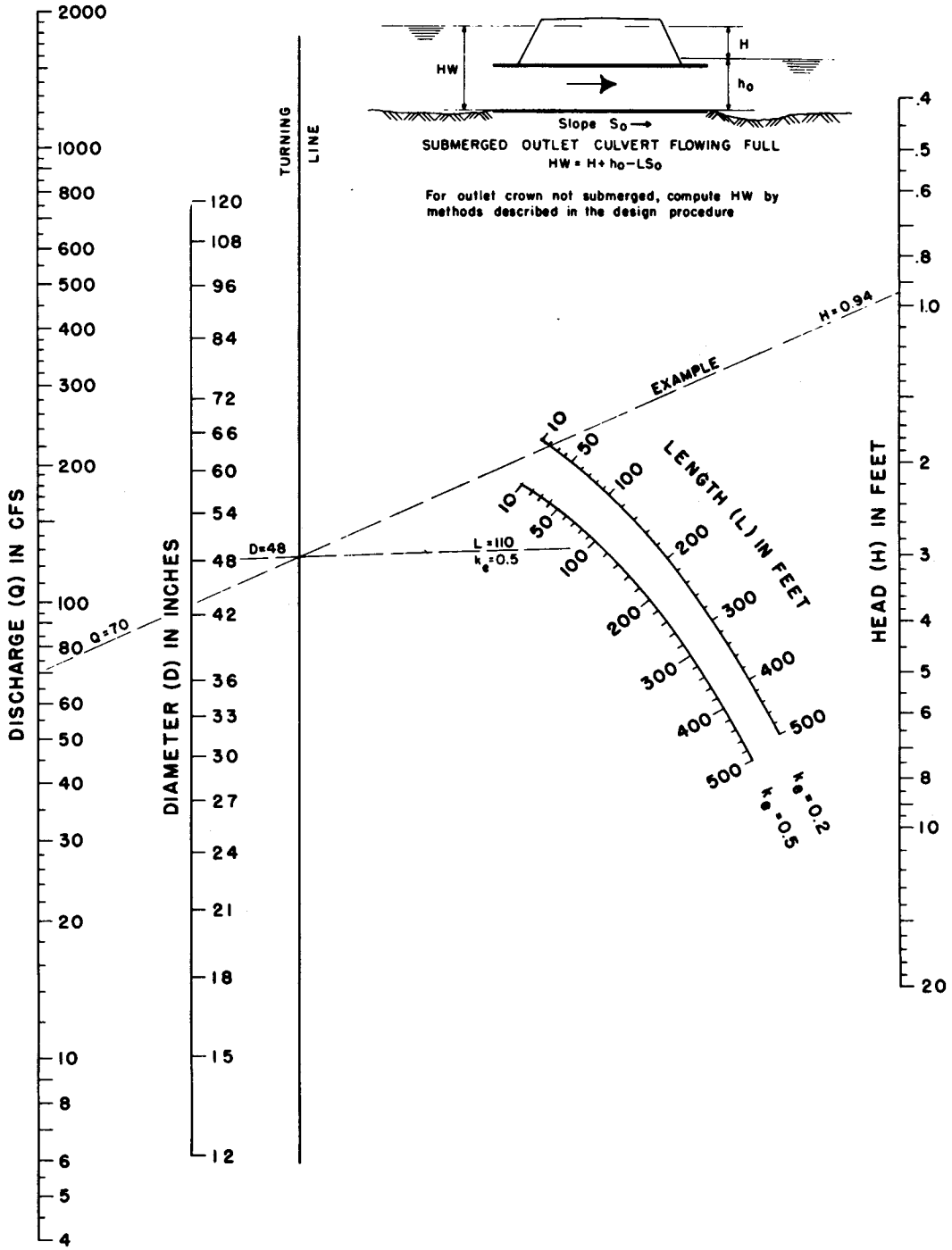


Figure 30 — Head for Concrete Pipe Culverts Flowing Full with Outlet Control n = 0.012 (Ref. Hyd. Eng. Cir. No. 5, USBPR, 1965)

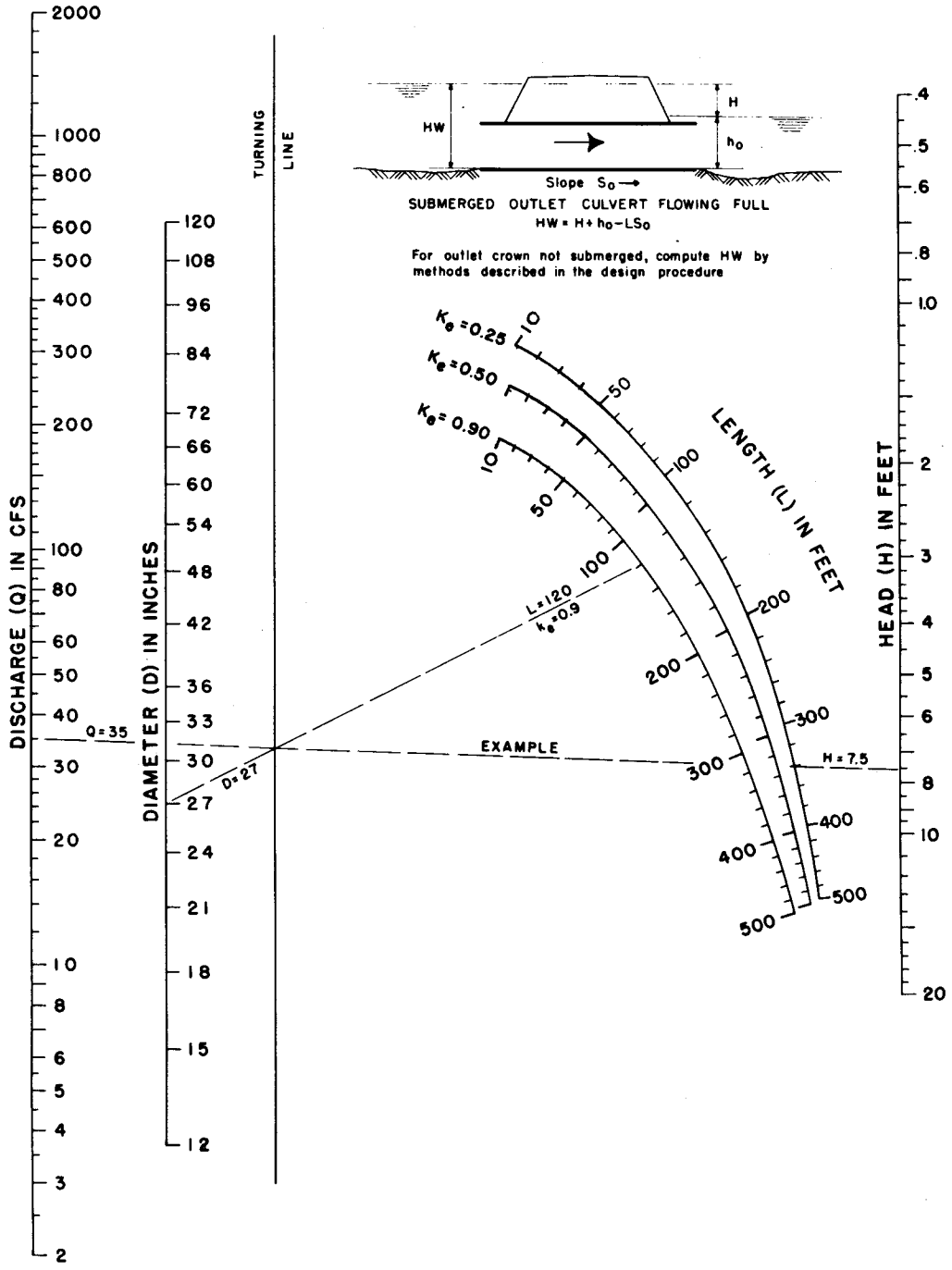


Figure 31 — Head for CM Pipe Culverts Flowing Full with Outlet Control n = 0.024 (Ref. Hyd. Eng. Cir. No. 5, USBPR, 1965)

Figure 32 — Culvert Capacity

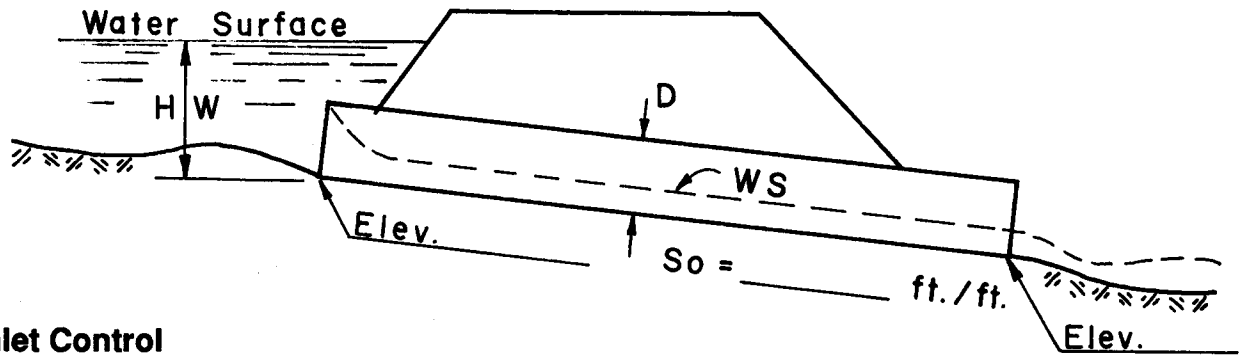
Project _____ By _____ Date _____

Location _____ Checked By _____ Date _____

Q Required = _____ cfs (Appendix B) Culvert Type _____

Concrete n = 0.012 CMP n = 0.024

Compute Q for both inlet and outlet control, and use the lower value.



Inlet Control

Type of inlet: Head Wall _____; Mitered to Conform to Slope _____; Projecting _____

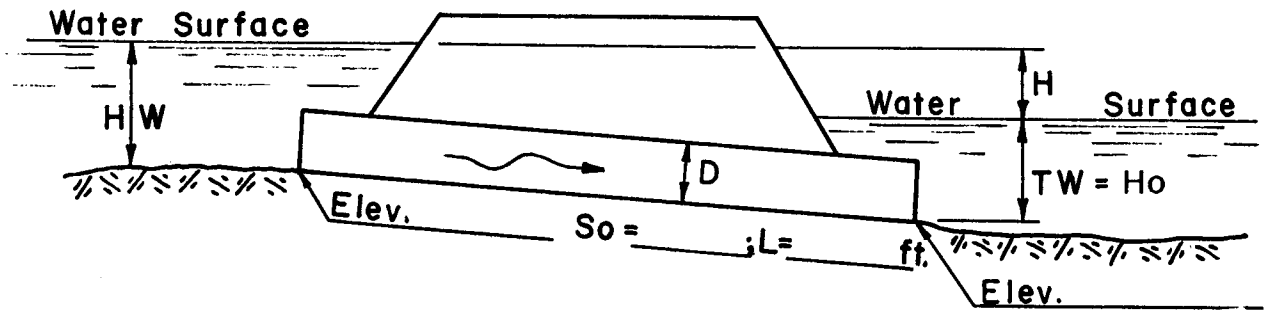
D = _____ ft.

HW = _____ ft.

HW/D = _____ = _____

n = _____

Q = _____ cfs (Figure 28 or 29)



Outlet Control

D = _____ ft.

HW = _____ ft.

Ho = _____ ft.

H = HW - Ho + SoL = _____ - _____ + _____ = _____ ft,

(For Free Outlet Ho = 3/4D)

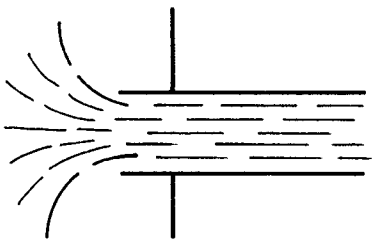
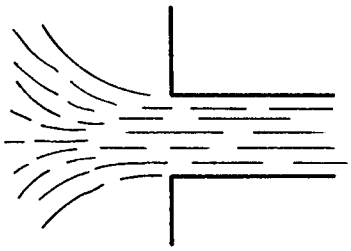
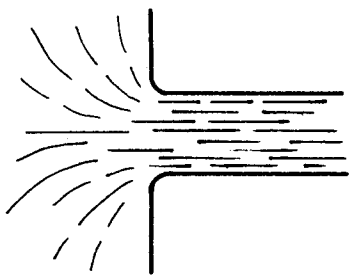
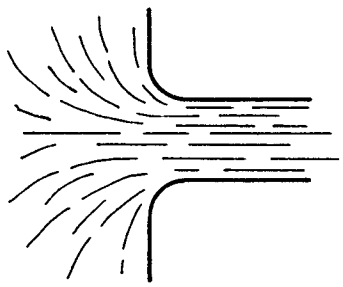
n = _____

Ke = _____ (See Figure 33)

Q = _____ cfs (Figure 30 or 31)

Materials for culvert construction should meet the applicable ASTM standard for the kind of material used. Construction methods should be in accordance with standard procedures of pipe conduits.

Figure 33

PIPE ENTRANCES			
INWARD PROJECTING PIPE	K_e	SHARP - CORNERED	K_e
	0.78		0.50
HOODED INLET	1.00		
SLIGHTLY ROUNDED	K_e	BELL MOUTH	K_e
	0.23		0.20