## EXAMPLE PROBLEM 1.

**Given:**

| | |
|---|---|
| Design Flow | Q = 120 cfs. |
| Length of Sewer | $\ell$ = 450 ft. |
| Available Drop | $d$ = 3.5 ft. |
| *Manning's Roughness Coefficient* | |
| Concrete Pipe | $n$ = 0.011 |
| CMP 2-2/3"x1/2" Corr. | $n$ = 0.024 |
| CMP 3" x 1" Corr. | $n$ = 0.027 |
| CMP 6" x 2" Corr. | $n$ = 0.033 |

**Find:**

(1) Selection of pipe sizes
(2) Drop required for full flow
(3) Parts full if all available (3.5 ft.) drop is used
(4) Velocity of flow

**Solution:**

1. Set length of sewer 450 ft. ($\ell$ scale) at the design flow 120 cfs. (Q scale). Opposite the available drop 3.5 ft. ($d$ scale), read a value of $C$ (1360) discharge coefficient. Move slide to right so the desired Manning's $n$ is at the computed $C$ (1360) value.

The circular pipe size is shown in the window; elliptical and arch pipe sizes and areas are in windows on the reverse side. Read the size at or to left of hairline in window.

The following types and sizes will carry the design flow:

| Type of Pipe | Pipe Size (Inches) |
|---|---|
| Circular Concrete Pipe | 48 |
| Circular CMP 2-2/3"x 1/2" | 60 |
| Circular CMP 3"x 1" | 66 |
| Circular CMP 6"x 2" | 72 |
| Horizontal Elliptical Concrete Pipe | 38 x 60 |
| Concrete Arch Pipe | 36 x 58½ |

Choosing the 48" circular concrete pipe —

2. Move slide so pipe size chosen (48" dia.) is at hairline. At $n$ used (0.011), read a new value for $C$ (1700). Reset $\ell$ (450 ft.) at Q (120 cfs). Opposite the new $C$ (1700) value, read the drop required $d$ = 2.3 ft., if the sewer (48" dia.) is to flow full.

3. Move slide so the available drop (3.5 ft.) is at the new $C$ (1700) value. Opposite $\ell$ (450 ft.) read potential full flow Q = 150 cfs. available through 48" dia. pipe size, at this drop. Move slide so 1.0 on parts full scale is at the actual full flow Q (150 cfs). Opposite the design flow Q (120 cfs.), read parts full = 0.67.

4. Set the pipe area (12.6 sq.ft.), referenced by the pipe diameter 48" on D scale, at the potential full flow Q (150 cfs). Opposite the arrow, read the full flow velocity V = 12 fps. For the partial flow velocity set 1.0 on the circular pipe parts full scale at the full flow velocity V (12 fps). Opposite the parts full computed in step 3 (0.67), read the partial flow V = 13.3 fps.

## EXAMPLE PROBLEM 2.

**Given:**

A 48" x 76" horizontal elliptical concrete pipe storm sewer, $n$=0.012 and flowing three-tenths full.

**Find:**

Slope required to maintain a minimum velocity of 3 feet per second.

**Solution:**

Start with V scale on reverse side of calculator. Set 0.3 on horizontal elliptical parts full scale at the minimum velocity 3 fps. At 1.0 read full flow velocity V = 4.1 fps.

Move arrow to full flow velocity V (4.1), at the area A sq.ft. for a 48" x 76" HE pipe (20.5 sq.ft.) read full flow Q = 83 cfs.

Set 48" x 76" at hairline in elliptical pipe size window. On front side of calculator, then read at $n$ = 0.012 a value for $C$ = 2910.

At full flow Q (83 cfs) set $\ell$ = 100 ft., at $C$ (2910) read the drop $d$ = 0.08 ft.; or the slope equals 0.08 ft. per 100 ft. or 0.08% slope.