3.—Poiree's Formula.

$$y = Y - is + \overline{\frac{is}{4\,Y}}\Big)^2$$

$$= 1{\cdot}75 - 1{\cdot}75 + \overline{\frac{1{\cdot}75}{4 + 1{\cdot}75}}\Big)^2$$

$$= 1{\cdot}75 - 1{\cdot}75 + \frac{3{\cdot}0625}{7}$$

$= {\cdot}4375$ feet. Height of backwater at Robey Street junction.

4—Dupuit's Formula.

$\text{Log } y = \log Y - \frac{i\,s}{.77\,P}$; in which P is the mean depth between the points.

$$\text{Log } y = \log 1{\cdot}75 - \frac{{\cdot}000025 \times 70000}{{\cdot}77 \times 23}$$

Reduced to inches gives—

$$\text{Log } 12\,y = \log 21 - \frac{1{\cdot}75}{1{\cdot}77}$$

$$= 1{\cdot}3222193 - 1 = 0{\cdot}3222193$$

$\therefore \quad y = \frac{0{\cdot}3222193}{12} = 0{\cdot}027$ feet. Height of backwater at Robey Street junction.

(1) By Guilhelm's Formula	$y = 0{\cdot}35$ feet.
(2) By Funk's "	$y = 0{\cdot}5$ "
(3) By Poiree's "	$y = 0{\cdot}437$ "
(4) By Dupuit's "	$y = 0{\cdot}027$ "
	4)1·314
Mean height	$y = 0{\cdot}3285$ "

To find the probable errors by the method of least squares, assuming each of the formulas to have equal weights.

No. of Formula.	Depth of Backwater.	Difference from Mean.	Square of Residuals.
1	0·35	—0·021	0·0004
2	0·5	—0·171	0·0292
3	0·437	—0·108	0·0117
4	0·027	+0·301	0·0906
Mean =	0·3285	$[nn_1] =$	0·1319

Probable error :—

$$r = {\cdot}6745\sqrt{\frac{[n\ n_1]}{m-1}} = {\cdot}6745\sqrt{\frac{0{\cdot}1319}{4-1}}$$

$$= 6745\ \sqrt{0{\cdot}044} = {\cdot}6745 \times \pm\ 0{\cdot}21$$

$$= \pm\ 0\ 14 \text{ feet.}$$

Probable error of Arithmetical Mean :—

$$r\ (x) = \frac{{\cdot}6745}{\sqrt{m}}\sqrt{\frac{[n\ n_1]}{m-1}} = \frac{{\cdot}6745}{\sqrt{4}}\sqrt{\frac{0{\cdot}1319}{4-1}}$$

$$= \frac{{\cdot}6745}{2}\sqrt{0{\cdot}044} = {\cdot}3372 \times \pm\ 021$$

$$= \div\ 0{\cdot}071 \text{ feet.}$$

TANK ILLUSTRATIONS.

Suppose a tank 5 feet long, and 2 feet wide, with a depth of water of 10 feet, receives a constant supply of 3 cubic feet per second, what will be the diameter of a round orifice in the bottom capable, with a constant head of 10 feet, to discharge 3 cubic feet per second?

Let D = Discharge in cubic feet per second.
h = Depth of water or constant head.
A = Area of orifice in square feet.
c = Co-efficient of discharge.