HYDRAULIC AND OTHER TABLES, FOR PURPOSES OF SEWERAGE AND WATER-SUPPLY

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BY

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1884.

PREFACE.

It has been found that the Engineering Pocket Books in most general use give comparatively little information relating to Sewerage and Water Supply. And even the large and valuable works of the late Mr. Beardmore and others contain somewhat abridged Tables applicable to the calculations most frequently required in designing and carrying out works of moderate size.

The Tables in this book have been calculated from time to time by the author to meet his own requirements. Thinking it probable that other engineers will have experienced the same want as himself, he has now been induced to make them public. The greater part have been used in manuscript for some years; but a few additional Tables have been recently added in order to make the work more complete.

Every precaution has been taken, as far as possible, to guard against errors both in the calculations and printing. If however, notwithstanding, any mistakes should be discovered, the author will be greatly obliged by having them pointed out to him.

6, Delahay Street, Westminster,
November 1883.

CONTENTS.

DESCRIPTION AND REMARKS ON THE USE OF THE TABLES.

TABLES I. and II. show the quantities of water in gallons per foot contained in pipes, wells, tanks, &c., of given dimensions, and require no explanation.

Tables III. and IV. give the discharge in gallons per minute of water passing through sluices and over weirs under ordinary conditions. Correction is required in case of bell-mouthed or specially formed orifices, and also where there is any considerable velocity of current in approaching the outlets, but the notes at the head of the Tables, to which attention should be directed, will enable this to be made with sufficient accuracy for most practical purposes.

Table V. shows the velocity and discharge under varying conditions of flow in circular sewers and conduits, from 9 inches to 6 feet in diameter.

In designing and carrying out sewerage works, it is important to know not only the maximum carrying capacity of the sewers, but also the effect produced by the much smaller quantity which will be generally flowing through them. This is essential in order to ascertain whether flushing will be required, and if so, what quantity of water will be needed for the purpose. The Table consequently shows, not only the maximum discharge and velocity of each kind of sewer under the most favourable circumstances, but also the discharge and velocity of the same sewers when full to one-half, one quarter, and one-eighth only of their heights respectively. If a sewer should at any time run quite full, its discharge will be somewhat less than that indicated in the fourth column, the velocity of current being in that case considerably diminished by friction against the top. With any circular conduit the velocity when full is exactly the same, and the discharge just double that when half-full; the precise figures for a sewer running full may therefore be ascertained, if required, from the third column of Table by doubling the discharge.

A velocity of 150 feet per minute, or $2\frac{1}{2}$ feet per second, is generally considered sufficient to remove all obstacles of the ordinary character found in sewers. The quantity of water required to produce this velocity in each case is given in the last column of the same Table, and will be found especially useful in designing flushing arrangements.

Table VI. gives precisely similar information for egg-shaped sewers, as Table V. for circular sewers.

Table VII. gives the discharge of pipes from $\frac{3}{8}$-inch to 8 feet diameter, when running full at various inclinations or pressures. It should be remembered that the velocity of water passing through a line of pipes of any considerable length depends not on the inclination of any particular section, but on the hydraulic gradient throughout, or ratio of head of water to length of pipe; the "head" being the difference of level between the surface at or above the upper end of the pipe, and that of the cistern or pond into which it delivers, or if it has a free outlet, the lower end of the pipe itself. This velocity, except for slightly increased friction at bends, is entirely independent of the course of the pipes, whether laid at a uniform inclination or otherwise, also whether commencing at or below the upper surface and discharging, if not freely, at or below the lower surface.

The formula which has been used in the calculations