Where twin mains are found to be required, which may not necessarily be the same diameter; it is advisable to use both mains as duty rather than one as duty and the other as standby from an economical and operational point of view.

7.3.2. Friction Head Losses

Friction head loss is the loss of pressure caused by water flowing through the pipe in a system. Flow in pipes are usually turbulent and the roughness of the inside walls of pipes have a direct effect on the amount of friction loss. Turbulence increases and consequently friction loss increases with the degree of roughness. Friction losses are dependent on the flow rate, the pipeline diameter, roughness, and length. The commonly used formulas for computation of head loss due to friction losses are:

- Hazen-Williams formula
- Darcy-Weisbach formula

Hazen-Williams and Darcy-Weisbach are most commonly used and result in a good degree of accuracy. In metric terms, Hazen Williams' formula is given below:

$$h_f = 10.67 \text{ x } L \text{ x } \frac{Q^{1.85}}{C^{1.85} \cdot D^{4.87}}$$

Where:

hf = Friction head losses of the pipe in m

L = Length of the pipe in m

Q = flow through the pipe in m^3/s

D = Inside diameter of the pipe in m

C = Coefficient depending on the pipe diameter, dimensionless as shown in Table 7-2 below.

Pipe diameters	Hazen Williams "C" Coefficient
Pipe diameters > 500mm	140
Pipe diameters < 500mm	135

Table 7-2 – Hazen Williams C Coefficients for Types of Pipe

In metric terms, the Darcy-Weisbach formula is:

$$h_f = \frac{8\, f\, L\, Q^2}{g\, \pi^2 D^5}$$

Where:

hf: Friction head losses of the pipe in m

f = Friction factor, dimensionless

L = Length of the pipe in m

Q = flow through the pipe in m^3/s

G = gravity acceleration = 9.81 m/s^2

D = Inside diameter of the pipe in m

The friction factor, in its more general expression, is calculated from the Colebrook-White equation:

$$\frac{1}{\sqrt{f}} = -2\log_{10}\left(\frac{K_s}{3.7D_h} + \frac{2.51}{R_e\sqrt{f}}\right)$$

Where: