

Lagoons may be provided as a means of temporary flood storage. They shall be water-tight and designed to hold the volume derived in accordance with Section 4.1.2. The outflow may be by gravity return or pumping back to the storm water network Lagoons shall start to empty automatically immediately after the storm event.

The key features of lagoon design are shown in Volume 3: Standard Drawings.

***Safety Note – Minimum Safety Requirements for Lagoons***

*Particular attention shall be given to the safety of ponds and lagoons in areas where the public have access.*

*The following safety provisions shall be included:*

- ✓ Protection in the form of fencing or railings
- ✓ Steps or ladders located at intervals not exceeding 100m to facilitate escape from the pond/lagoon, with at least one escape point per pond/lagoon.
- ✓ Life-saving devices (such as a lifebuoy) shall be positioned at intervals not exceeding 100m, with at least one device per pond/lagoon
- ✓ Appropriate Warning signs at intervals not exceeding 50m, with at least two signs per pond/lagoon

### **4.3. Design Parameters for Gravity Pipelines**

The required system design parameters are given below. Deviation from these is not permitted without the agreement of DMAT.

For Projects in Al Ain Region, connection details with the main pipeline and gullies details provided in Al Ain Municipality standard drawings and specification to be followed.

#### **4.3.1. Pipe Hydraulic Formulae**

The recommended hydraulic design formula for pipes is the 'Colebrook-White' formula, as this gives the greatest accuracy.

The Colebrook-White equation for full bore flow in circular pipes is given by:

$$V = -2\sqrt{2gdS} \log\left(\frac{k}{3.7d} + \frac{2.51\nu}{d\sqrt{2gdS}}\right)$$

Where:

V = velocity (m/s)

g = gravitational acceleration = 9.81 m/s<sup>2</sup>

D = pipe bore (m)

S = hydraulic gradient (water surface slope where free surface) (m/m)

K<sub>S</sub> = effective roughness (m)

ν = kinematic viscosity of fluid. Water = 0.727 x 10<sup>-6</sup> m<sup>2</sup> s<sup>-1</sup> (at 35 °C)

Where pipes are flowing part-full the following factors apply: