Attenuation Tank 3 (318 m^2) Buoyancy Calculations – 99 Unit Scheme

Buoyancy check – Uplift (UPL) limit state design

$G_{dst;d} + Q_{dst;d} \leq G_{stb;d} + R_d$

Design Destabilising Actions ≤ Design Stabilising Actions

Destabilising Actions

*Assumed water table is above tank through saturated ground conditions

Thus, Volume of water displaced by tank = 1m x 1m x 0.8m deep = 0.8m^3;

Density of water = 1000kg/m^3 x 9.81 x 10^{-3}= 9.81kN/m^3

Therefore, characteristic uplift force acting on the tank is:

$Q_{dst;k}$ = 0.8m^3 x 9.81kN/m^3 = 7.85kN

Design Uplift Force, $Q_{dst;k}$ x $\gamma Q_{dst;d}$ = 7.85kN x 1.1 = 8.64kN

Stabilising Actions

* Shear resistance of tank assumed to be negligible; R_d = 0

Self-weight of the tank

Modular units = Approx. 57 kg/m^3

$G_{stb;d}$; Modular Units = 57 kg/m^3 x 9.81 x 10^{-3} x 1m^2 x 0.8m = 0.44kN

Self-weight of the soil above tank

Density of soil, P_{soil} = 17.6kN/m^3;

Depth of soil over tank = 0.80m

$G_{stb;d}$; soil = 17.6kN/m^3 x 0.80m x 1m^2 = 14.08kN

Design Permanent Stabilising Force

($G_{stb;d}$; Modular Units + $G_{stb;d}$; soil) x $\gamma G_{dst;d}$

$G_{stb;d}$ = (0.44kN + 14.08kN) x 0.9

$G_{stb;d}$ = 13.068

The design inequality for UPL can now be ascertained, thus:

8.64kN ≤ 13.068kN ; OK

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