



Yapton Road
Barnham
Uplift calculations
October 2020



Uplift calculations for an attenuation tank and pond.**Job Information**

Site: Yapton Road, Barnham

Date: 13/10/2020

Significant values:Weight of 6F2 granular fill - 20kN/m³Weight of water - 9.81kN/m³Weight of soil - 20kN/m³
(silty sandy clay from soil
report)Weight of concrete - 24kN/m³Submerged Weight of concrete - 14kN/m³**Attenuation Tank Data:**

Width - 20.8m

Length - 12.8m

Depth - 0.66m

Invert Level - 7.28m

Ground Level - 8.35m

Assumed Water Table Level - 8.25m

Pond Data:

Invert Level - 7.12m

Volume - 188m³

Ground Level - 8.25m

Assumed Water Table Level - 8.25m

Output:

Method of Assessment - BS EN 1997-1-1 Geotechnical Design.

Job. 203434 – Yapton Road, Barnham

Sheet No.	203434
-----------	--------

L01

Section Title		Computer Analysis Used?			
Wind Calculation		No			
Date Of External Issue	Calculation Description	Page No.	Prepared By	Chkd By	Appr' By
13.10.2020	Attenuation tank uplift calculations.	01 – 01	RE	JD	JD
13.10.2020	Pond uplift calculations.	02 – 03	RE	JD	JD

Job: 203434 – Yapton Road, Barnham – Attenuation tank uplift calculation

Prepared By: RE

Checked By: JD

Issued:

Sheet No.

B01827

01

01

Date: 13-10-2020

Approved By: JD

Revised:

Using Eurocode 7 – Geotechnical Design – Part 1.

From table A.15 safety factors are:

Unfavourable permanent action - $\gamma_{G,dst,d} = 1$

Favourable permanent action - $\gamma_{G,stb,d} = 0.9$

Unfavourable variable action - $\gamma_{Q,dst,d} = 1.5$

Clause 10.2 (2) state failure by uplift should be checked against equation 2.8 from clause 2.4.7.4

Equation 2.8:

$$V_{dst,d} \leq G_{stb,d}$$

Where:

$$V_{dst,d} = G_{dst,d} + Q_{dst,d}$$

$$G_{stb,d} = \gamma_{G,stb,d} g_{stb,d}$$

$$G_{dst,d} = \gamma_{G,dst,d} g_{dst,d}$$

$$Q_{dst,d} = \gamma_{Q,dst,d} q_{dst,d}$$

$$\text{Volume of tank per } 1\text{m}^2 = 1 \times 1 \times 0.66 = 0.66\text{m}^3$$

$$\text{Displaced water } q_{dst,d} = 0.66 \times 9.81 = 6.5\text{kN}$$

$$Q_{dst,d} = 1.5 \times 6.5 = 9.75\text{kN}$$

No destabilising permanent load $\therefore g_{dst,d} \& G_{dst,d} = 0$

$$V_{dst,d} = 9.75\text{kN}$$

for equation 2.8 to be satisfied $G_{stb,d} > 9.75\text{kN}$

$$\therefore g_{stb,d} > 9.75 / 0.9 = 10.85\text{kN}$$

$g_{stb,d}$ = volume of soil above tank x soil density

$$\therefore \text{minimum depth of soil above tank} = 10.85 / (20 \times 1 \times 1) = 0.54\text{m}$$

proposed invert level of the tank is 7.28m, tank height is 0.66m, ground level is 8.35m $\therefore$

proposed depth of soil above tank = $8.35 - (7.28 + 0.66) = 0.41\text{m} < 0.54\text{m} \therefore$ depth of soil above tank needs to be increased by 150mm.

Check uplift with ground level at 8.5m

$$G_{stb,d} = (8.5 - (7.28 + 0.66)) \times 20 \times 0.9 = 10.08\text{kN} > 9.75\text{kN} \therefore \text{No uplift occurs with an invert level of 7.28m and ground level of 8.5m}$$

Job: 203434 – Yapton Road, Barnham – Attenuation pond uplift calculation

Prepared By: RE

Checked By: JD

Issued:

Sheet No.

B01827

01

01

Date: 13-10-2020

Approved By: JD

Revised:

Using Eurocode 7 – Geotechnical Design – Part 1.

From table A.15 safety factors are:

Unfavourable permanent action - $\gamma_{G,dst,d} = 1$

Favourable permanent action - $\gamma_{G,stb,d} = 0.9$

Unfavourable variable action - $\gamma_{Q,dst,d} = 1.5$

Clause 10.2 (2) state failure by uplift should be checked against equation 2.8 from clause 2.4.7.4

Equation 2.8:

$$V_{dst,d} \leq G_{stb,d}$$

Where:

$$V_{dst,d} = G_{dst,d} + Q_{dst,d}$$

$$G_{stb,d} = \gamma_{G,stb,d} g_{stb,d}$$

$$G_{dst,d} = \gamma_{G,dst,d} g_{dst,d}$$

$$Q_{dst,d} = \gamma_{Q,dst,d} q_{dst,d}$$

Looking at 1m² of pond:

Try 150mm slab on top of membrane.

$$\text{Volume} = 1 \times 1 \times (1.13 + 0.15 + 0.15) = 1.43 \text{m}^3$$

$$\text{Displaced water } q_{dst,d} = 1.43 \times 9.81 = 14.03 \text{kN}$$

$$Q_{dst,d} = 1.5 \times 14.03 = 21.05 \text{kN}$$

No destabilising permanent load $\therefore g_{dst,d} \& G_{dst,d} = 0$

$$V_{dst,d} = 21.05 \text{kN}$$

for equation 2.8 to be satisfied $G_{stb,d} > 21.05 \text{kN}$

$g_{stb,d}$ = volume of concrete/soil above membrane x concrete/soil density

$$g_{stb,d} = 0.15 \times 24 + 0.15 \times 20 = 6.6 \text{kN}$$

$$G_{stb,d} = 0.9 \times 6.6 = 5.94 \text{kN}$$

$$\text{Net uplift} = 21.05 - 5.94 = 15.11 \text{kN}$$

Use a 150mm anchor slab with 6f2 fill over.

Job: 203434 – Yapton Road, Barnham – Attenuation pond uplift calculation

Prepared By: RE

Checked By: JD

Issued:

Sheet No.

B01827

01

01

Date: 13-10-2020

Approved By: JD

Revised:

Anchor weight = $0.15 \times 14 = 2.1 \text{ kN}$

Net uplift = $15.11 - (0.9 \times 2.1) = 13.01 \text{ kN}$

Depth of fill required = $13.01 / (0.9 \times 20) = 0.73 \text{ m}$

use 750mm of grade 6f2 fill.

Check total weight per m^2 :

$g_{\text{stb,d}} = ((0.15 + 0.75) \times 20) + (0.15 \times 24) + (0.15 \times 14) = 23.7 \text{ kN}$

$G_{\text{tb,d}} = 0.9 \times 23.7 = 21.33 \text{ kN} > 21.05 \text{ kN} \therefore \text{No uplift occurs}$