

## 20079 – Basin Floatation Calculations - Rev A (04.10.2021)

### General Assumptions

- Destabilising Forces Factor Applied = 1.10
- Resisting Forces Factor Applied = 0.90
- Assumed Ground Water Density = 1000 kg/m<sup>3</sup>
- Assumed Topsoil Density = 1600 kg/m<sup>3</sup>
- Assumed London Clay Density = 1800 kg/m<sup>3</sup>

### Area A

(124.8m<sup>2</sup>)

### Buoyancy Calculation (Based on 1550mm Formation depth)

273.1m<sup>3</sup> (Volume removed from ground within water table)

273.1m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 273,100

273,100 x 1.10 = **300,410 (Total Upward Force)**

### Design Counter Action Calculation (Using 300mm Topsoil / 1250mm Sub-Soil)

#### Topsoil

0.30m x 124.8m<sup>2</sup> = 37.44m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

37.44m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 59,904

59,904 x 0.90 = **53,914 (Total Downward Force)**

#### Sub-Soil

1.25m x 124.8m<sup>2</sup> = 156.00m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

156.00m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 280,800

280,800 x 0.90 = **252,720 (Total Downward Force)**

### Final Calculation

**300,410 – 53,914 – 252,720 = -6,224 kg/m<sup>3</sup>**

**Area B**

(170.1m<sup>2</sup>)

**Buoyancy Calculation (Based on 2100mm Formation depth)**

507.9m<sup>3</sup> (Volume removed from ground within water table)

507.9m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 507,900

507,900 x 1.10 = **558,690 (Total Upward Force)**

**Design Counter Action Calculation (Using 300mm Topsoil / 1800mm Sub-Soil)**

**Topsoil**

0.30m x 170.1m<sup>2</sup> = 51.03m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

51.03m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 81,648

81,648 x 0.90 = **73,483 (Total Downward Force)**

**Sub-Soil**

1.80m x 170.1m<sup>2</sup> = 306.18m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

306.18m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 551,124

551,124 x 0.90 = **496,011 (Total Downward Force)**

**Final Calculation**

**558,690 – 73,483 – 496,011 = -10,804 kg/m<sup>3</sup>**

**Area C**

(172.2m<sup>2</sup>)

**Buoyancy Calculation (Based on 2700mm Formation depth)**

642.2m<sup>3</sup> (Volume removed from ground within water table)

642.2m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 642,200

642,200 x 1.10 = **706,420 (Total Upward Force)**

**Design Counter Action Calculation (Using 300mm Topsoil / 2400mm Sub-Soil)**

**Topsoil**

0.30m x 172.2m<sup>2</sup> = 51.66m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

51.66m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 82,656

82,656 x 0.90 = **74,390 (Total Downward Force)**

**Sub-Soil**

2.40m x 172.2m<sup>2</sup> = 413.28m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

413.28m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 743,904

743,904 x 0.90 = **669,514 (Total Downward Force)**

**Final Calculation**

**706,420 – 74,390 – 669,514 = -37,484 kg/m<sup>3</sup>**

**Area D**

(397.1m<sup>2</sup>)

**Buoyancy Calculation (Based on 3300mm Formation depth)**

1876.6m<sup>3</sup> (Volume removed from ground within water table)

1876.6m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 1,876,600

1,876,600 x 1.10 = **2,064,260 (Total Upward Force)**

**Design Counter Action Calculation (Using 300mm Topsoil / 3000mm Sub-Soil)**

**Topsoil**

0.30m x 397.1m<sup>2</sup> = 119.13m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

119.13m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 190,608

190,608 x 0.90 = **171,547 (Total Downward Force)**

**Sub-Soil**

3.00m x 397.1m<sup>2</sup> = 1,191.30m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

1,191.30m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 2,144,340

2,144,340 x 0.90 = **1,929,906 (Total Downward Force)**

**Final Calculation**

**2,064,260 – 171,547 – 1,929,906 = -37,193 kg/m<sup>3</sup>**

**Area E**

(194.9m<sup>2</sup>)

**Buoyancy Calculation (Based on 4500mm Formation depth)**

1278.8m<sup>3</sup> (Volume removed from ground within water table)

1278.8m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 1,278,800

1,278,800 x 1.10 = **1,406,680 (Total Upward Force)**

**Design Counter Action Calculation (Using 300mm Topsoil / 4200mm Sub-Soil)**

**Topsoil**

0.30m x 194.9m<sup>2</sup> = 58.47m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

58.47m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 93,552

93,552 x 0.90 = **84,197 (Total Downward Force)**

**Sub-Soil**

4.20m x 194.9m<sup>2</sup> = 818.58m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

818.58m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 1,473,444

1,473,444 x 0.90 = **1,326,100 (Total Downward Force)**

**Final Calculation**

**1,406,680 – 84,197 – 1,326,100 = -3,617 kg/m<sup>3</sup>**

**Area F**

(65.0m<sup>2</sup>)

**Buoyancy Calculation (Based on 3900mm Formation depth)**

368.4m<sup>3</sup> (Volume removed from ground within water table)

368.4m<sup>3</sup> x 1000 kg/m<sup>3</sup> = 368,400

368,400 x 1.10 = **405,240 (Total Upward Force)**

**Design Counter Action Calculation (Using 300mm Topsoil / 3600mm Sub-Soil)**

**Topsoil**

0.30m x 65.0m<sup>2</sup> = 19.5m<sup>3</sup> (Volume of Topsoil laid on top of Liner – within water table)

19.5m<sup>3</sup> x 1600 kg/m<sup>3</sup> = 31,200

31,200 x 0.90 = **28,080 (Total Downward Force)**

**Sub-Soil**

3.60m x 65.0m<sup>2</sup> = 234.0m<sup>3</sup> (Volume of Sub-Soil laid on top of Liner – within water table)

234.0m<sup>3</sup> x 1800 kg/m<sup>3</sup> = 421,200

421,200 x 0.90 = **379,080 (Total Downward Force)**

**Final Calculation**

405,240 – 28,080 – 379,080 = **-1,920 kg/m<sup>3</sup>**