

Tank Buoyancy

Archimedes' Principle

Gravitational Acceleration	9.81 m/s ²
Ground Level	94.70 m AOD
Tank Invert Level	92.50 m AOD
Groundwater Level	93.30 m AOD
Tank Internal Diameter	6.500 m
Tank Length (External)	22.00 m
Tank Wall Thickness	50 mm
Tank External Diameter	6.6 m
Concrete Surround	350 mm
Top Level of Concrete Surround	99.4 mAOD
Bottom Level of Concrete Surround	92.1 mAOD

Depth of Water Displaced	0.800 m
Width of Excavation	7.300 m
Length of Excavation	22.700 m

Upthrust

Proportional Volume Centre Angle	1.434 Radians
Crosssectional Area of Water Displaced	2.340 m ²
Volume of Water Displaced	51.49 m ³
Density of Water	1000 kg/m ³
	505.12 kN

Downforce

Tank Mass	2,998 kg
Weight of Tank	29.41 kN

Volume of Excavation	331.42 m ³
Tank Volume (External)	752.66 m ³
Total Volume of Concrete	-421.24 m ³
Density of Concrete	2400 kg/m ³
Weight of Concrete	-9917.74 kN

Depth of Cover	-4.70 m
Density of Soil Type	1440 kg/m ³
Weight of Soil over Excavation	-11002.16 kN

-20890.49 kN

WARNING Structure is Bouyant

Factor of Safety **1.2** (Standard setting 1.2)

WARNING Factor of Saftey not met

Pond Lining Buoyancy
Archimedes' Principle

Gravitational Acceleration	9.81 m/s ²	
Ground level	24.20 m AOD	
Pond Invert Level	22.70 m AOD	
Area of Base of Pond	1.0 m ²	
Groundwater level	23.40 m AOD	Grounwater assumed at
Pond Liner Level / base of Puddled Clay	21.95 m AOD	ground level

Depth of Water Displaced 1.450 m

Upthrust on Base of Pond

Volume of Water Displaced	1.45 m ³
Density of Water	1000 kg/m ³
	15.65 kN

Downforce

Depth of Material over Liner	0.75 m	Permanent Water	0
Volume of Material over Liner	0.75 m ³		0
Density of Material Type	2400 kg/m ³	Compacted Bentonite	1000
Weight of Material over Liner	15.89 kN	Clay	

Lining Non Bouyant

Factor of Safety 1.0 (Standard setting 1.0)
Design OK

Typical Soil Densities

Peat (dry)	0.800 kg/m ³
Peat (wet)	0.960 kg/m ³
Lump chalk	1,200 kg/m ³
Dry Fine Sand	1,280 kg/m ³
Loam	1,280 kg/m ³
Topsoil (some moisture)	1,440 kg/m ³
Dry Course Sand	1,600 kg/m ³
Stiff clay	1,600 kg/m ³
Shingle	1,620 kg/m ³
Ballast	1,760 kg/m ³
Limestone (Solid Rock)	2,739 kg/m ³
MOT Type 1	2,200 kg/m ³
30% voided Sub Base	1,915 kg/m ³
Flint	2,300 kg/m ³
Sandstone	2,320 kg/m ³
Granite	2,720 kg/m ³
Slate	2,800 kg/m ³

Crate Buoyancy - Tank
Archimedes' Principle

Gravitational Acceleration	9.810 m/s ²		
Ground level	4.167 m AOD		
Crate Invert Level	2.040 m AOD		
Groundwater level	3.967 m AOD		
Crate Width	64.000 m	Concrete	64.5
Crate Length	34.000 m		34.5
Crate Height	1.000 m		
Concrete Cover Slab	225.000 mm		

Depth of Water Displaced 2.000 m

Upthrust

Volume of Water Displaced	4352.000 m ³
Density of Water	1000.000 kg/m ³
	42693.120 kN

Downforce

Crate Mass	90720.000 kg
Weight of Crate	889.963 kN

Total Volume of Concrete	500.681 m ³
Density of Concrete	2400.000 kg/m ³
Weight of Concrete	11788.039 kN

Depth of Cover	0.950 m
Density of Soil Type	2200.000 kg/m ³
Weight of Soil over Excavation	44614.310 kN

57292.313 kN
Structure Non Bouyant

Factor of Safety 1.300 (Standard setting 1.3)
Design OK