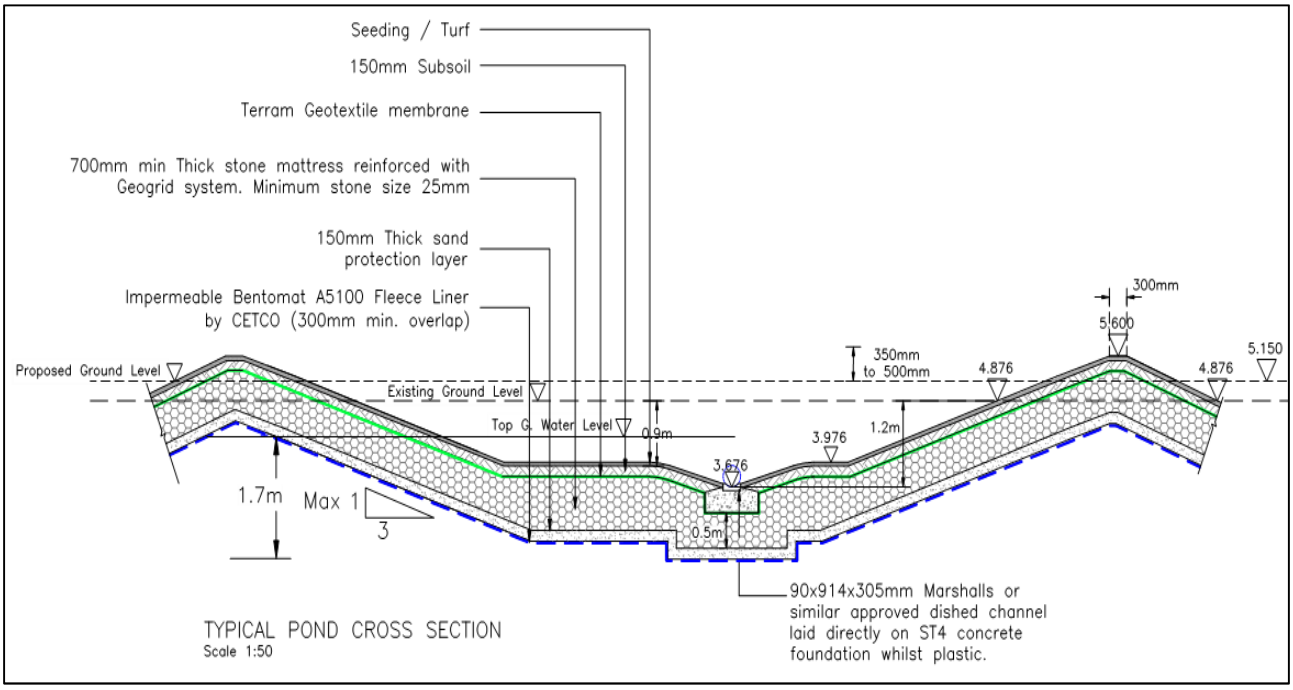
Uplift Calculations (New Barn Lane, North Bersted 99 Unit Scheme)



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

Uplift = Pond depth – Ground water level + Pond construction depth;

Therefore, Uplift = 1.2m – 0.5m + 1.0m = 1.7m

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

Therefore, characteristic uplift force acting on the pond (per m^2) is:

$Q_{dst;k}$ = 9.81 kN/m^3 x 1.7m = 16.68kN/m^2

Design Uplift Force, $Q_{dst;k}$ x $\gamma Q_{dst;d}$ = 16.68 kN/m^2 x 1.1 = 18.35kN/m^2

Stabilising Actions

* Shear resistance was assumed to be negligible; R_d = 0

Material Densities of pond construction materials;

Loose Rock = 1950 kg/m^3 x 0.50m x (9.81 x 10^{-3}) = 9.56 kN/m^2;

Sand = 1905 kg/m^3 x 0.15m x (9.81 x 10^{-3}) = 2.80 kN/m^2;

Concrete = 2400 kg/m^3 x 0.35m x (9.81 x 10^{-3}) = 8.24 kN/m^2;

Bentomat = 4.1 kg/m^2 x (9.81 x 10^{-3}) = 0.04 kN/m^2;

Σ = 20.64 kN/m^2

$G_{stb;d}$; pond construction materials = 20.64kN/m^2

Design Permanent Stabilising Force

$G_{stb;d}$; pond construction materials x $\gamma G_{dst;d}$

$G_{stb;d}$ = 20.64kN/m^2 x 0.9

$G_{stb;d}$ = 18.58kN/m^2

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

18.35kN ≤ 18.58kN; OK

*Further Assumptions
1- Ground water level of 0.5m as instructed by Arun District Council due to lack of data provided for borehole WS103.
2- No standing storm water was considered to be in the pond.

DOCUMENT CONTROL RECORD

Document Issue:

Rev	Date	Issue Status	Prepared by	Checked by
-	21 November 2018	First Issue	J Valadas	RF
A	24 November 2018	Calculations revised	J Valadas	KTG
B	18 December 2018	Calculations revised	J Valadas	KTG
C	25 January 2019	Calculations revised	J Valadas	KTG
D	28 January 2019	Calculations revised	J Valadas	KTG/RF
E	19 February 2019	Title of calculation sheet amended	J Valadas	KTG/RF

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