

GOAT MILL ROAD, DOWLAIS, MERTHYR TYDFIL

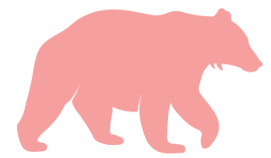
CRIB RETAINING WALL DESIGN

GOAT MILL ROAD, DOWLAIS, MERTHYR TYDFIL

CRIB RETAINING WALL DESIGN

Report No. P0379 - R01
Author B.Evans
Date 08.07.22
Revision -

Rev	Date	Comment
-	08.07.22	First issue for construction

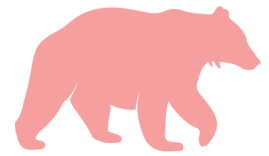


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P0397_01 – PROPOSED BOUNDARY RETAINING WALLS

APPENDIX 1 – RETAINING WALL CALCULATIONS



1. Scope of Works

Scope of work undertaken by Bear Structures Ltd (BSL) is described as below.

Bear Structures Ltd were appointed to provide the structural design for an initial stage 3 design for a 5m high crib wall.

2. Design Reference

2.1 Information Provided

- Architectural drawings
- Topographic Survey

2.2 Standards and Technical Information

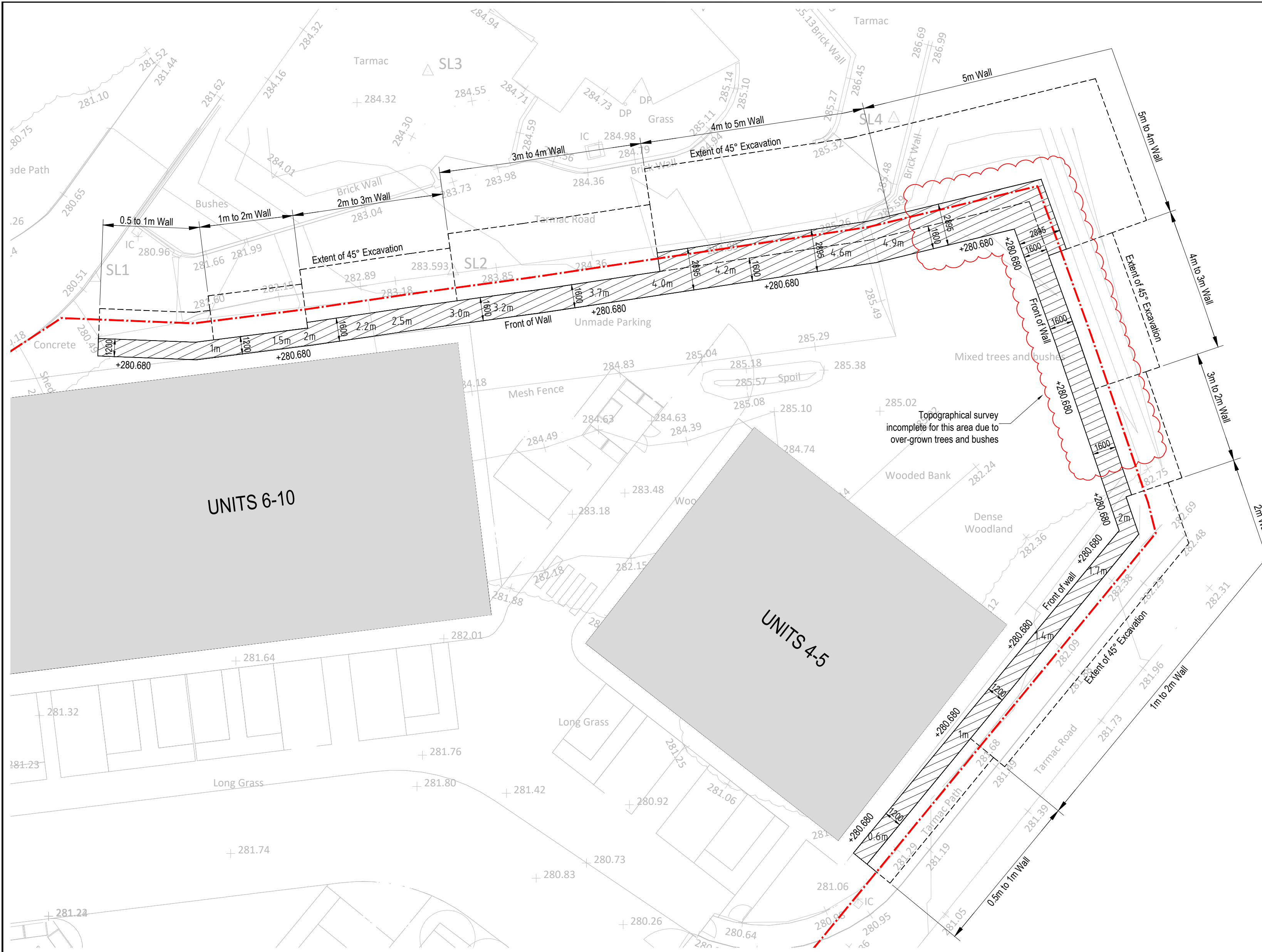
- | | |
|---------------------|-----------------------|
| • BS EN 1991-1:2002 | Actions on Structures |
| • BS EN 1997-1:2004 | Geotechnical Design |

2.3 Software

- Tekla Tedds 2022

3. Design Calculations

Refer to Appendix 1 for Structural Calculations



PLAN ON BOUNDARY RETAINING WALLS (SCALE 1:50)



HAZARD: EXISTING SERVICES MAY BE PRESENT ON SITE. ALL TO BE TRACED AND CARE TO BE TAKEN DURING SITE PREPARATION AND CONSTRUCTION WORKS

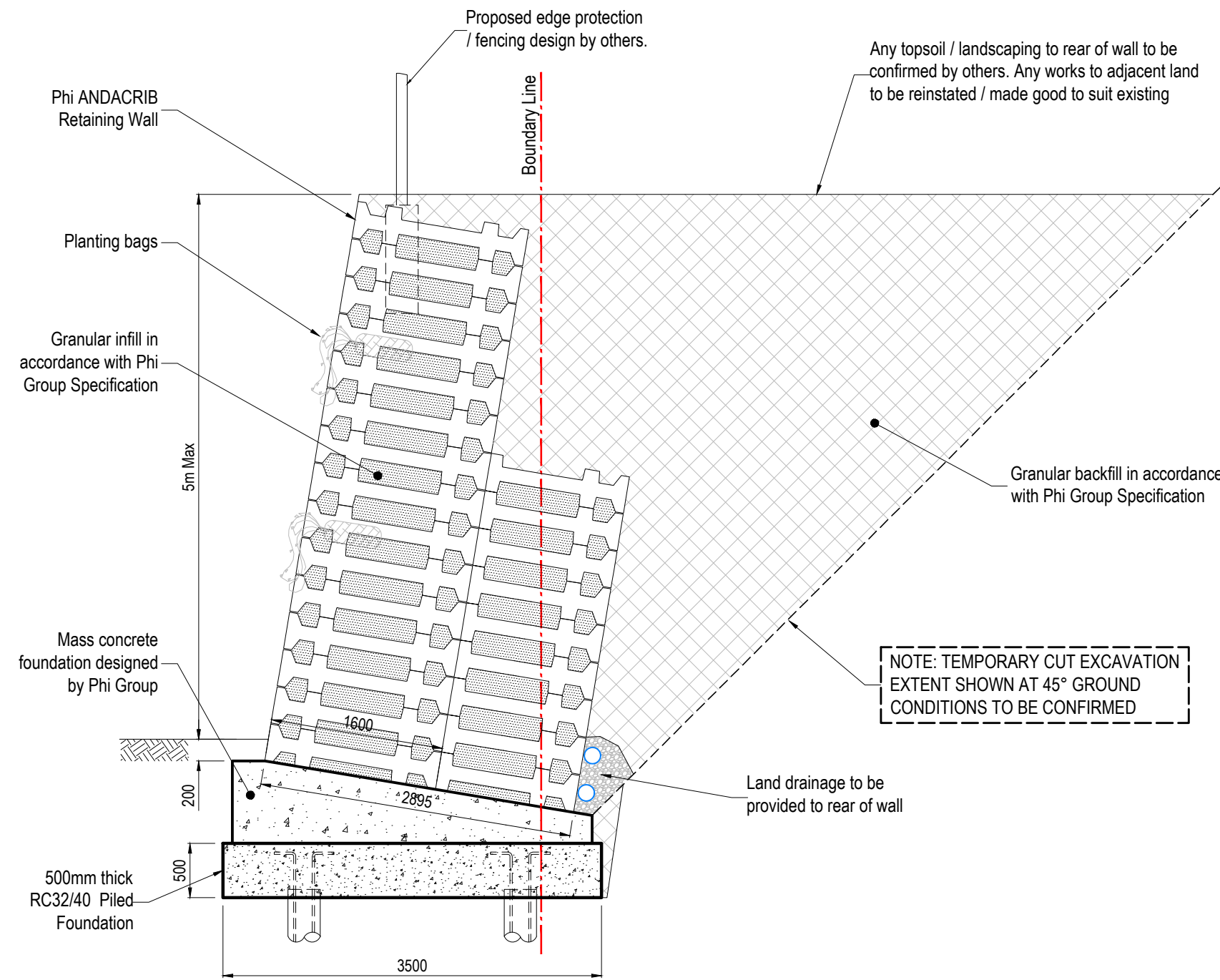
DESIGN NOTES / ASSUMPTIONS:

FOR SETTING OUT OF ALL WALLS REFER TO ARCHITECT'S DETAILS

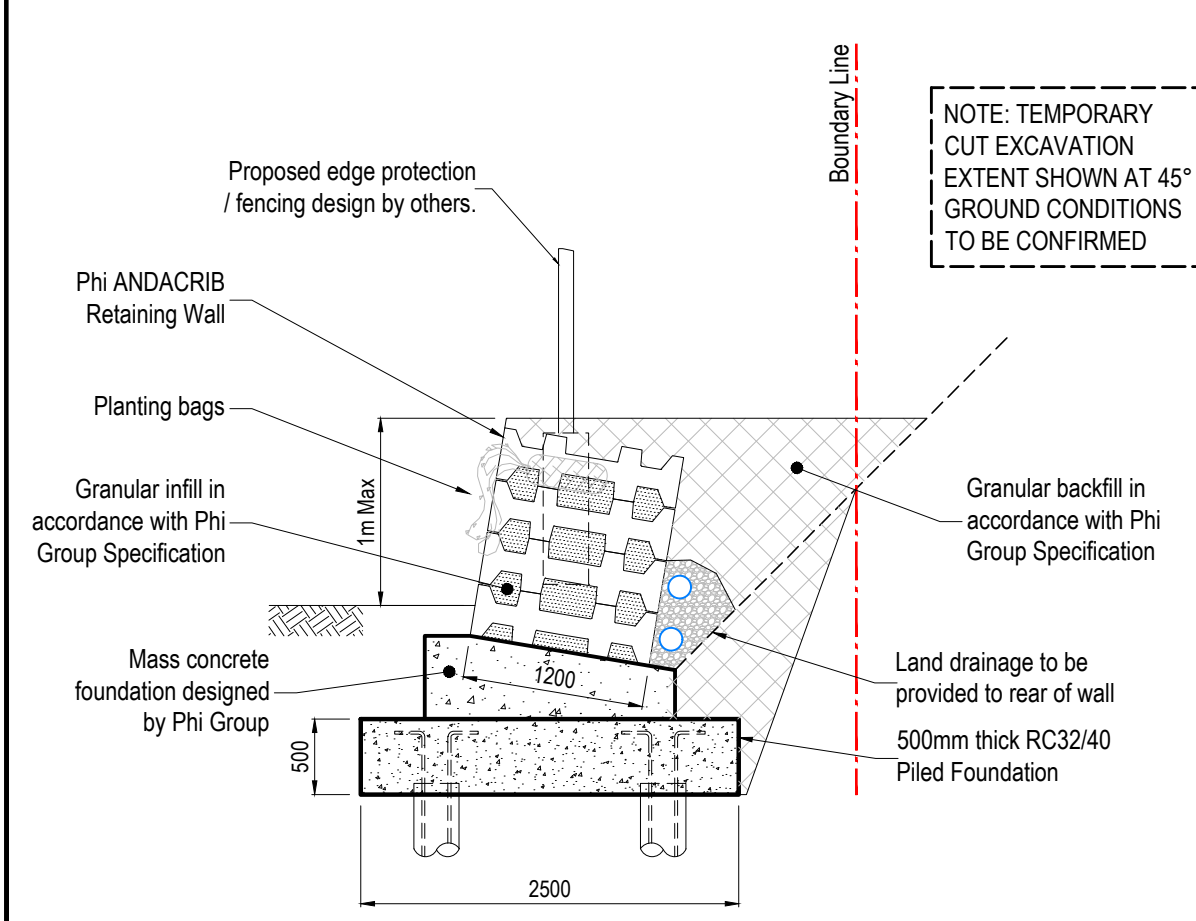
THIS DRAWING IS NOT FOR CONSTRUCTION AND IS TO ASSIST WITH DISCHARGING PLANNING CONDITIONS.

FURTHER SITE INVESTIGATION WORKS ARE REQUIRED TO TAKE PLACE ONCE OVERGROWN TREES AND BUSHES HAVE BEEN REMOVED . SITE INVESTIGATION REPORT REFERS TO GROUTING TO STABILISE EXISTING MADE GROUND. PHI GROUP TO CONFIRM ADEQUACY OF THIS WITHIN THEIR DESIGN. A PILED FOUNDATION HAS BEEN DESIGNED AS WORST CASE SCENARIO.

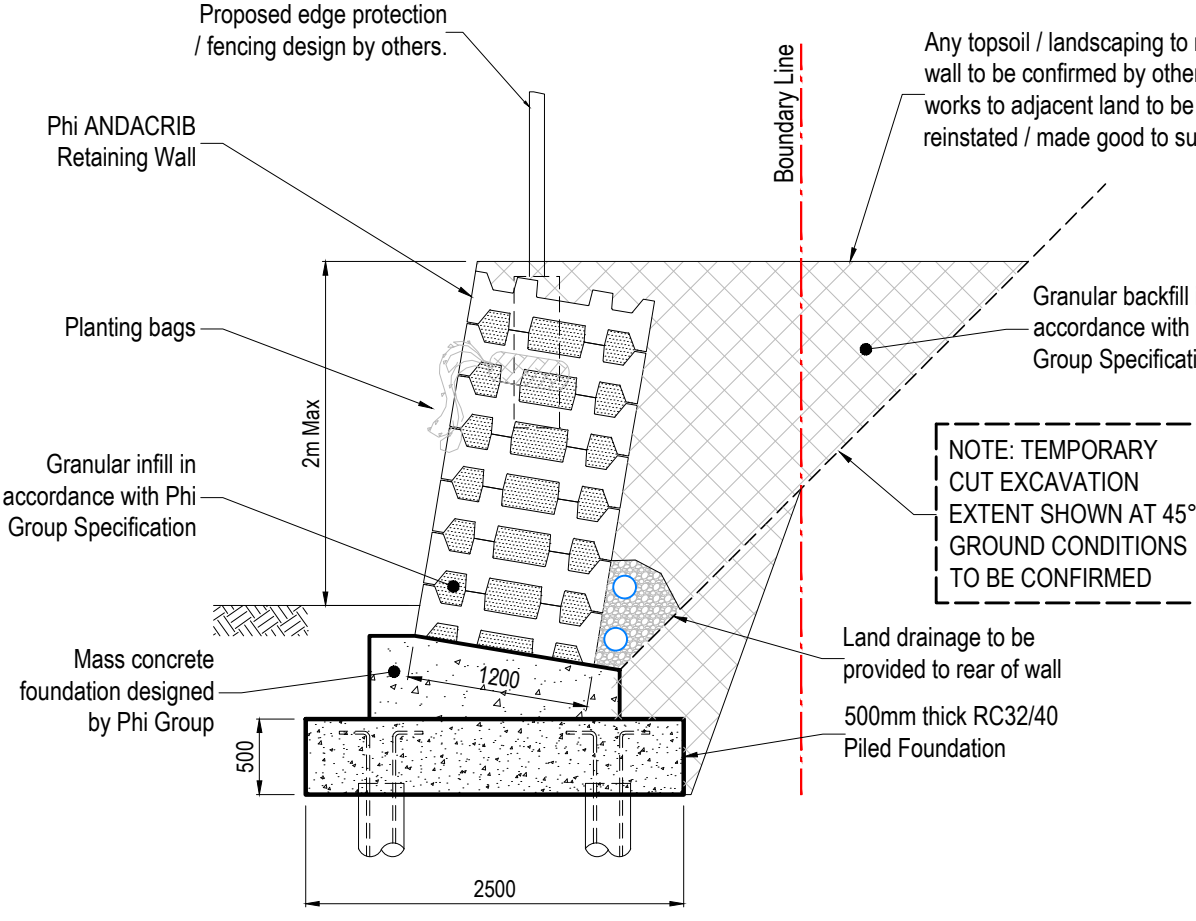
FURTHER TOPOGRAPHICAL SURVEY TO TAKE PLACE ONCE OVERGROWN TREES AND BUSHES HAVE BEEN REMOVED .



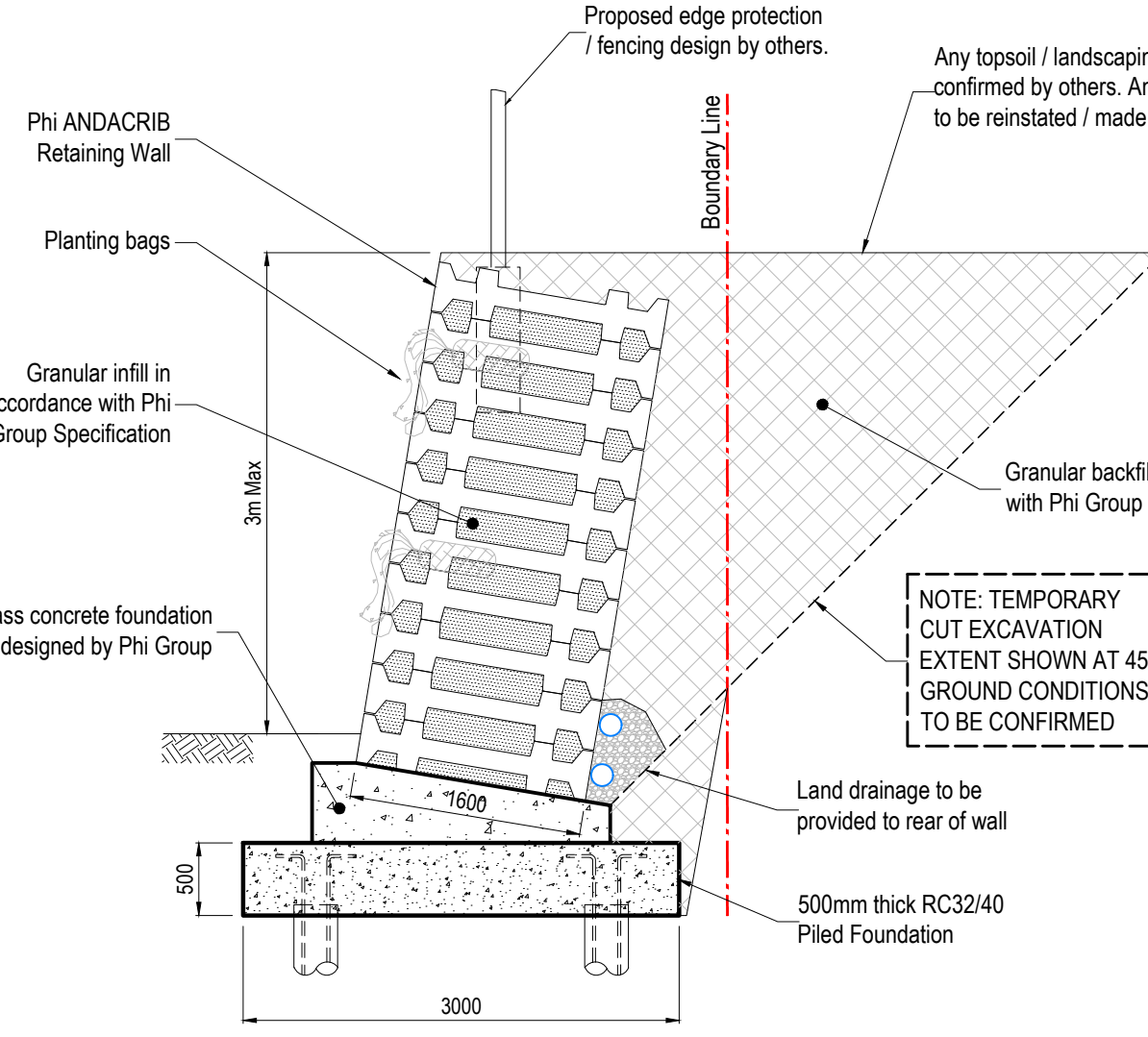
5m CRIB WALL (SCALE 1:50)



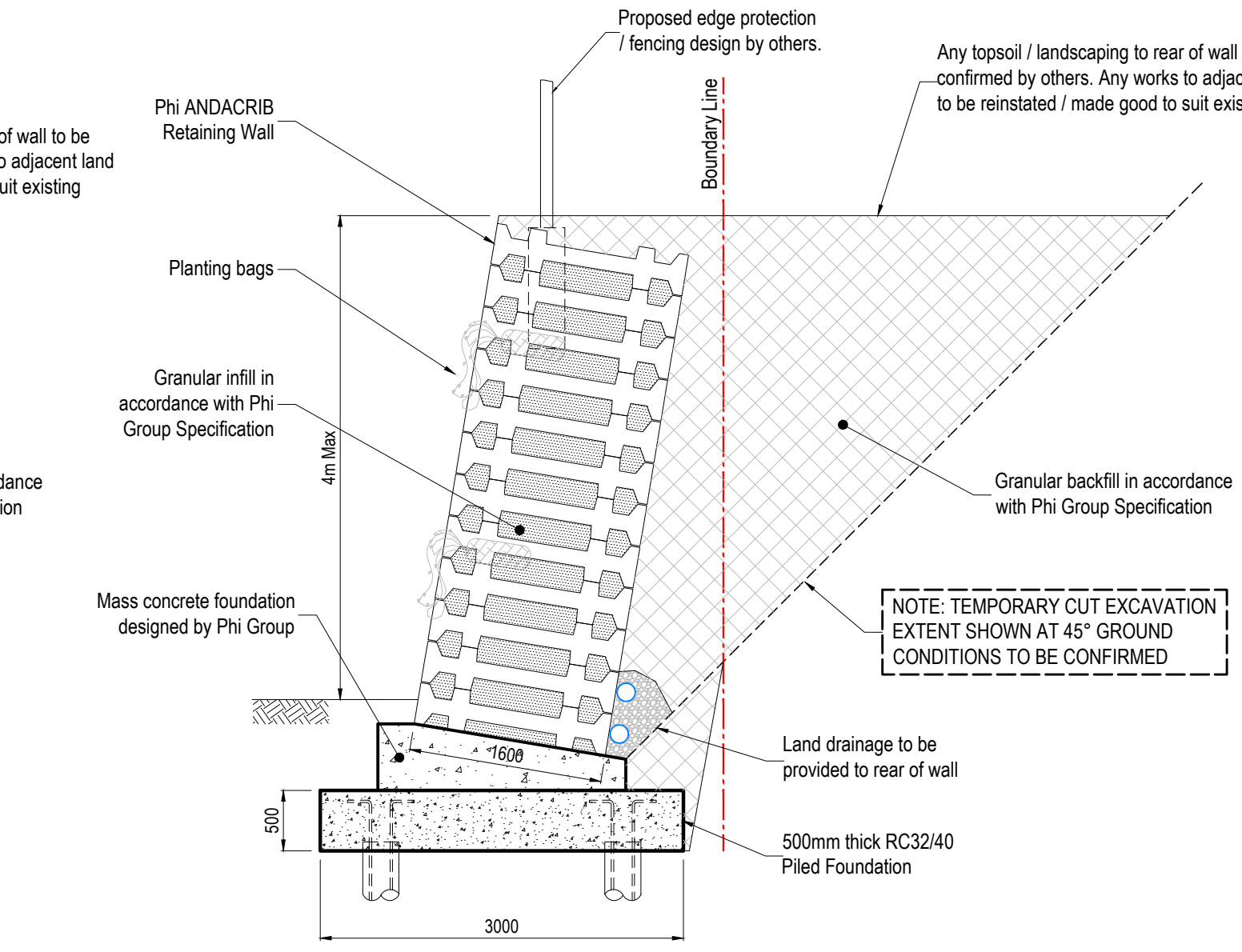
1m CRIB WALL (SCALE 1:50)



2m CRIB WALL (SCALE 1:50)



3m CRIB WALL (SCALE 1:50)



4m CRIB WALL (SCALE 1:50)

NOTES :-

GENERAL

1. DO NOT SCALE FROM THIS DRAWING, USE FIGURED DIMENSIONS ONLY.
2. ALL DIMENSIONS ARE IN MILLIMETRES. ALL LEVELS ARE IN METRES.
3. THIS DRAWING TO BE READ IN CONJUNCTION WITH THE LATEST ARCHITECTS, ENGINEERS & SPECIALISTS DRAWINGS & SPECIFICATIONS.
4. ALL WORK TO BE UNDERTAKEN & MATERIALS SUPPLIED IN ACCORDANCE WITH RELEVANT BRITISH STANDARDS, CODES OF PRACTICE & BUILDING REGULATIONS. WORKMANSHIP AND QUALITY OF ALL ELEMENTS ARE TO BE REVIEWED BY BUILDING CONTROL OR SUITABLY QUALIFIED PERSON / COMPANY AT VARIOUS STAGES THROUGHOUT THE CONSTRUCTION.

FOUNDATIONS

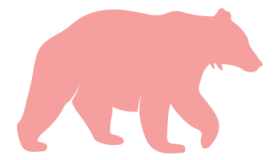
1. ALL PROPOSED SETTING OUT TO BE CO-ORDINATED WITH ARCHITECTS / ENGINEERS DETAILS & DRAWINGS.
2. PRIOR TO EXCAVATION CARE MUST BE TAKEN TO LOCATE & CLEARLY MARK ALL EXISTING SERVICES. CONTINGENCY TO BE MADE FOR DIVERTING SERVICES TEMPORARILY OR PERMANENTLY DURING CONSTRUCTION WORKS.
3. ALL GRASS AND SURFACE VEGETATION INCLUDING ROOTS TO BE EXCAVATED AND REMOVED.
4. FORMATION LEVEL TO BE PROTECTED BY BLINDING OR SIMILAR APPROVED IMMEDIATELY AFTER EXCAVATION.
5. ALLOWANCE SHOULD BE MADE FOR PUMPING / REMOVAL OF GROUNDWATER PARTICULARLY IN TIMES OF HEAVY RAINFALL. SEASONAL VARIATION OF WATER TABLE TO BE CONSIDERED.
6. ALL SOFT SPOTS TO BE REMOVED & REPLACED WITH WELL COMPACTED IMPORTED GRANULAR MATERIAL AS DIRECTED BY THE ENGINEER.
7. THE PILED RETAINING WALL BASE HAS BEEN DESIGNED TO AN ASSUMED ALLOWABLE BEARING PRESSURE OF 150kPa. - TBC FOLLOWING FURTHER SITE INVESTIGATION WORKS.
8. ALL COMPACTION TO BE CARRIED OUT IN ACCORDANCE WITH THE MANUAL OF CONTRACT DOCUMENTS FOR HIGHWAY WORKS VOLUME 1 (MCHW1) SPECIFICATION FOR HIGHWAY WORKS SERIES 800 AND TO A LEVEL TOLERANCE OF +0mm TO -15mm

9. PRIOR TO CONCRETING, FORMATION LEVEL TO BE INSPECTED & APPROVED BY GEOTECHNICAL ENGINEER OR SUITABLY QUALIFIED PERSON.

CONCRETE

1. ALL CONCRETE TO TO BE GRADE RC32/40 TO BS EN 206-1 AND BS 8500.
2. CUBE TESTING TO BE UNDERTAKEN IN ACCORDANCE WITH BEST PRACTICE.
3. ONLY PLASTIC OR CONCRETE SPACERS ARE TO BE LAID DIRECTLY ONTO DPM .
4. ALL REINFORCEMENT TO BE HIGH GRADE 500 N/mm² UNLESS NOTED OTHERWISE.
5. WEATHERPROOFING MEMBRANE TO BE LAID IN ACCORDANCE WITH THE MANUFACTURERS INSTRUCTIONS. ALL JOINTS TO BE LAPPED AND TAPED
6. PILED BASE NOT TO BE LOADED FOR A MINIMUM OF 7 DAYS SUBJECT TO THE APPROVAL OF THE ENGINEER. CURING AGENT TO BE ALLOWED FOR TO BE AGREED WITH ENGINEER / CONTRACTOR SHOULD THE BASE NEED TO BE LOADED EARLIER.

Rev.	Date.	Details.	By.	Chk.	
Amendments					
Bear Structures Rugged by design 35 Stow Park Circle Newport NP20 4HF United Kingdom					
Project: M DELACEY & SONS, GOAT MILL ROAD, DOWLAIS, METHYR TYDFIL					
Title: PROPOSED BOUNDARY RETAINING WALLS AND TYPICAL DETAILS					
Drawing Status: INFORMATION					
Drawn: RB	Checked: AB	Scale(s) at A1: As Noted			
Date: 27.06.22	Job No. P0379	Drawing No. 01	Revision -		



Appendix 1 – Retaining Wall Calculations

	Project				Job Ref.	
	Goat Mill Road, Dowlais				P0379	
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	Crib Retaining Wall Design				1	
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	BE	23/06/2022	AB	23/06/2022		

Introduction

Crib wall acts as a gravity wall. Due to design software limitations, a gabion wall design is used instead of a specific crib wall retaining wall design, as both are gravity retaining walls and the principles are the same.

Width of steps based on Anda-Crib 1600 Double Maxi Model.

Limitations

Due to the ground encountered (deep made ground) at the location of the retaining walls, the base of the wall requires piling. In the gabion retaining wall calculation below, this cannot be designed for and as such a bearing capacity of 150kN/m² has been allowed for.

Geometry

Retaining Height = 5m

Infill stone to be Limestone.(16 kN/m²)

Incline = 9.6 degrees

Surcharge = Allow for 10kN/m² Live Load

GABION RETAINING WALL ANALYSIS & DESIGN

In accordance with EN 1997-1:2004 - Code of Practice for Geotechnical design and the UK National Annex

Tedds calculation version 2.0.03

Design summary

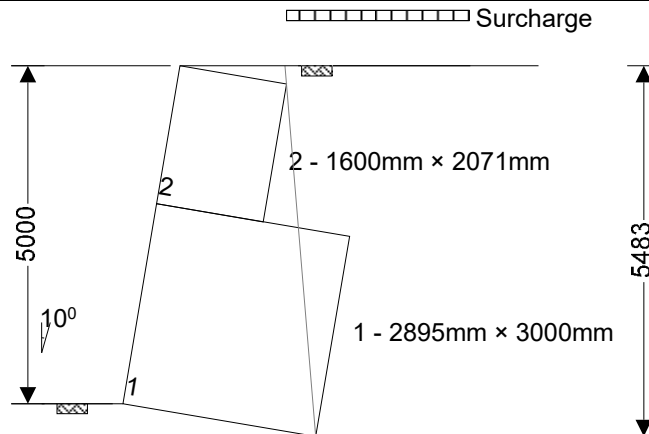
Combination 1

Action	Resistance	Force	FoS	Allowable FoS	Status
Overturning, sliding and bearing at base level					
Overturning (kNm/m)	440.3	224.3	1.964	1.000	PASS
Sliding (kN/m)	151.1	108.1	1.397	1.000	PASS
Bearing (kN/m ²)	150.0	148.6	1.009	1.000	PASS
Eccentricity (mm)	Reaction acts within the middle third of base				PASS
Overturning and sliding between courses 1 and 2					
Overturning (kNm/m)	55.9	15.6	3.595	1.000	PASS
Sliding (kN/m)	41.5	15.3	2.719	1.000	PASS

Combination 2

Action	Resistance	Force	FoS	Allowable FoS	Status
Overturning, sliding and bearing at base level					
Overturning (kNm/m)	443.3	213.9	2.072	1.000	PASS
Sliding (kN/m)	120.7	99.2	1.216	1.000	PASS
Bearing (kN/m ²)	150.0	148.6	1.009	1.000	PASS
Eccentricity (mm)	Reaction acts within the middle third of base				PASS
Overturning and sliding between courses 1 and 2					
Overturning (kNm/m)	55.3	16.1	3.428	1.000	PASS
Sliding (kN/m)	33.0	15.7	2.105	1.000	PASS

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Wall geometry

Width of gabion 1;	$w_1 = 2895$ mm;	Height of gabion 1;	$h_1 = 3000$ mm
Width of gabion 2;	$w_2 = 1600$ mm;	Height of gabion 2;	$h_2 = 2071$ mm
Step to front face (1 and 2);	$s_2 = 0$ mm		
Wall inclination;	$\varepsilon = 9.6$ deg		

Gabion properties

Unit weight of fill;	$\gamma_d = 16.0$ kN/m ³ ;	Friction between gabions;	$\delta_{bg,k} = 35.0$ deg
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Loading

Variable surcharge;	$p_{o,Q} = 10$ kN/m ²
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Soil properties

Slope of retained soil;	$\beta = 0.0$ deg;	Char. shearing resist. angle;	$\phi'_{r,k} = 30.0$ deg
Char. saturated density of soil;	$\gamma_{sr} = 21.0$ kN/m ³		
Coefficient for wall friction;	$k_{membrane} = 0.75$;	Wall friction angle;	$\delta_{r,k} = 22.5$ deg
Char base friction angle;	$\delta_{bb,k} = 30.0$ deg;	Bearing capacity of soil;	$q = 150$ kN/m ²

Wall geometry

Horiz dist to CoG gabion 1;	$x_{g1} = 1448$ mm;	Vert dist to CoG gabion 1;	$y_{g1} = 1500$ mm
Weight of gabion 1;	$W_{g1} = 139.0$ kN/m		
Horiz dist to CoG gabion 2;	$x_{g2} = 800$ mm;	Vert dist to CoG gabion 2;	$y_{g2} = 4036$ mm
Weight of gabion 2;	$W_{g2} = 53.0$ kN/m		
Weight of entire gabion;	$W_g = 192.0$ kN/m;	Horiz distance to CoG;	$x_g = 1269$ mm
Vert distance to CoG;	$y_g = 2200$ mm;	Correcting for wall inclination;	$X_g = 1618$ mm
Vert height diff - inclination;	$H_f = 338$ mm		

Design dimensions

Effect. angle rear plane of wall;	$\alpha = 85.3$ deg;	Effective face angle;	$\theta = 80.4$ deg
Effective height of wall;	$H = 5483$ mm;	Height - toe to top gabion;	$H_{incl} = 5000$ mm
Active pressure;	$K_a = 0.332$		
Active thrust due to soil;	$P_{a,soil} = 104.9$ kN/m		

Pressure at base

Horizontal forces

Retained soil;	$F_{soil,h,q} = 93.3$ kN/m
Height of soil thrust (vert);	$d_{h,soil} = 1345$ mm
Surcharge;	$F_{surch,h,q} = 16.2$ kN/m
Height of surcharge (vert);	$d_{h,surch} = 2259$ mm

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Vertical forces

Gabion weight;	$F_{\text{gabion_v,q}} = 192.0 \text{ kN/m};$	Retained soil;	$F_{\text{soil_v,q}} = 48.0 \text{ kN/m}$
Horiz dist to soil thrust acts;	$b_{\text{v,soil}} = 2703 \text{ mm}$		
Surcharge;	$F_{\text{surch_v,q}} = 8.3 \text{ kN/m}$		
Horiz dist to surch thrust acts;	$b_{\text{v,surch}} = 2628 \text{ mm}$		
Force normal to base;	$N_s = 263.1 \text{ kN/m};$	Eccentricity;	$e = 306 \text{ mm}$
		Reaction acts within middle third of base	
Pressure at toe;	$\sigma_{\text{toe}} = 148.6 \text{ kN/m}^2;$	Pressure at heel;	$\sigma_{\text{heel}} = 33.2 \text{ kN/m}^2$
Factor of safety;	$\text{FoS}_Q = 1.009;$	Allowable factor of safety;	$\text{FoS}_{Q_allow} = 1.000$

PASS - Design FoS for allowable bearing pressure exceeds min allowable pressure to base

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 1

Perm. unfavourable action;	$\gamma_G = 1.35;$	Permanent favourable action;	$\gamma_{G,f} = 1.00$
Variable unfavourable action;	$\gamma_Q = 1.50;$	Variable favourable action;	$\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 1

Angle of shearing resistance;	$\gamma_{\phi'} = 1.00;$	Weight density;	$\gamma_{\gamma} = 1.00$
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Design soil properties

Design shearing resist angle;	$\phi'_{r,d} = 30.0 \text{ deg};$	Design sat. density of soil;	$\gamma_{s,d} = 21 \text{ kN/m}^3$
Design wall friction angle;	$\delta_{r,d} = 22.5 \text{ deg};$	Design base friction angle;	$\delta_{bb,d} = 30.0 \text{ deg}$
Active pressure;	$K_a = 0.332$		
Active thrust due to soil;	$P_{a,\text{soil}} = 104.9 \text{ kN/m}$		

Horizontal forces

Retained soil;	$F_{\text{soil_h}} = 125.9 \text{ kN/m};$	Soil thrust height resolved vert.;	$d_{h,\text{soil}} = 1345 \text{ mm}$
Surcharge;	$F_{\text{surch_h}} = 24.3 \text{ kN/m};$	Surcharge thrust height (vert);	$d_{h,\text{surch}} = 2259 \text{ mm}$

Vertical forces

Gabion weight;	$F_{\text{gabion_v,f}} = 192.0 \text{ kN/m};$	Retained soil;	$F_{\text{soil_v,f}} = 48.0 \text{ kN/m}$
Surcharge;	$F_{\text{surch_v,f}} = 0.0 \text{ kN/m}$		

Overturning stability - take moments about the toe

Overturning moment;	$M_o = 224.3 \text{ kNm/m};$	Restoring moment;	$M_R = 440.3 \text{ kNm/m}$
Factor of safety;	$\text{FoS}_M = 1.964;$	Allowable factor of safety;	$\text{FoS}_{M_allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force;	$T = 150.2 \text{ kN/m};$	Total vertical force;	$N = 240.0 \text{ kN/m}$
Sliding force;	$F_f = 108.1 \text{ kN/m};$	Sliding resistance;	$F_R = 151.1 \text{ kN/m}$
Factor of safety;	$\text{FoS}_S = 1.397;$	Allowable factor of safety;	$\text{FoS}_{S_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2;	$x_{g2} = 800 \text{ mm};$	Vert dist to CoG gabion 2;	$y_{g2} = 1036 \text{ mm}$
Weight of gabion 2;	$W_{g2} = 53.0 \text{ kN/m}$		
Weight of entire gabion;	$W_g = 53.0 \text{ kN/m};$	Horiz distance to CoG;	$x_g = 800 \text{ mm}$
Vert distance to CoG;	$y_g = 1036 \text{ mm};$	Correcting for wall inclination;	$x_g = 961 \text{ mm}$
Vert height diff - inclination;	$H_f = 296 \text{ mm}$		

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Design dimensions

Effect. angle rear plane of wall; $\alpha = 99.6$ deg; Effective face angle; $\theta = 80.4$ deg
Effective height of wall; $H = 2309$ mm; Height - toe to top gabion; $H_{incl} = 2042$ mm
Active pressure; $K_a = 0.232$
Active thrust due to soil; $P_{a,soil} = 13.0$ kN/m

Horizontal forces

Retained soil; $F_{soil_h} = 17.1$ kN/m; Soil thrust height resolved vert.; $d_{h,soil} = 503$ mm
Surcharge; $F_{surch_h} = 7.8$ kN/m; Surcharge thrust height (vert); $d_{h,surch} = 888$ mm

Vertical forces

Gabion weight; $F_{gabion_v,f} = 53.0$ kN/m; Retained soil; $F_{soil_v,f} = 2.9$ kN/m
Surcharge; $F_{surch_v,f} = 0.0$ kN/m

Overturning stability - take moments about the toe

Overturning moment; $M_o = 15.6$ kNm/m; Restoring moment; $M_R = 55.9$ kNm/m
Factor of safety; $FoS_M = 3.595$; Allowable factor of safety; $FoS_{M_allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 24.9$ kN/m; Total vertical force; $N = 55.9$ kN/m
Sliding force; $F_r = 15.3$ kN/m; Sliding resistance; $F_R = 41.5$ kN/m
Factor of safety; $FoS_S = 2.719$; Allowable factor of safety; $FoS_{S_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Design approach 1

Partial factors on actions - Section A.3.1 - Combination 2

Perm. unfavourable action; $\gamma_G = 1.00$; Permanent favourable action; $\gamma_{G,f} = 1.00$
Variable unfavourable action; $\gamma_Q = 1.30$; Variable favourable action; $\gamma_{Q,f} = 0.00$

Partial factors for soil parameters - Section A.3.2 - Combination 2

Angle of shearing resistance; $\gamma_{\phi'} = 1.25$; Weight density; $\gamma_f = 1.00$

Design soil properties

Design shearing resist angle; $\phi'_{r,d} = 24.8$ deg; Design sat. density of soil; $\gamma_{s,d} = 21$ kN/m³
Design wall friction angle; $\delta_{r,d} = 18.3$ deg; Design base friction angle; $\delta_{bb,d} = 24.8$ deg

Wall geometry

Horiz dist to CoG gabion 1; $x_{g1} = 1448$ mm; Vert dist to CoG gabion 1; $y_{g1} = 1500$ mm
Weight of gabion 1; $W_{g1} = 139.0$ kN/m
Horiz dist to CoG gabion 2; $x_{g2} = 800$ mm; Vert dist to CoG gabion 2; $y_{g2} = 4036$ mm
Weight of gabion 2; $W_{g2} = 53.0$ kN/m
Weight of entire gabion; $W_g = 192.0$ kN/m; Horiz distance to CoG; $x_g = 1269$ mm
Vert distance to CoG; $y_g = 2200$ mm; Correcting for wall inclination; $x_g = 1618$ mm
Vert height diff - inclination; $H_f = 338$ mm

Design dimensions

Effect. angle rear plane of wall; $\alpha = 85.3$ deg; Effective face angle; $\theta = 80.4$ deg
Effective height of wall; $H = 5483$ mm; Height - toe to top gabion; $H_{incl} = 5000$ mm
Active pressure; $K_a = 0.397$
Active thrust due to soil; $P_{a,soil} = 125.4$ kN/m

Horizontal forces

Retained soil; $F_{soil_h} = 115.3$ kN/m; Soil thrust height resolved vert.; $d_{h,soil} = 1345$ mm

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Surcharge; $F_{surch_h} = 26.0$ kN/m; Surcharge thrust height (vert); $d_{h,surch} = 2259$ mm

Vertical forces

Gabion weight; $F_{gabion_v,f} = 192.0$ kN/m; Retained soil; $F_{soil_v,f} = 49.1$ kN/m

Surcharge; $F_{surch_v,f} = 0.0$ kN/m

Overturning stability - take moments about the toe

Overturning moment; $M_o = 213.9$ kNm/m; Restoring moment; $M_R = 443.3$ kNm/m

Factor of safety; $FoSM = 2.072$; Allowable factor of safety; $FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 141.4$ kN/m; Total vertical force; $N = 241.1$ kN/m

Sliding force; $F_f = 99.2$ kN/m; Sliding resistance; $F_R = 120.7$ kN/m

Factor of safety; $FoS_S = 1.216$; Allowable factor of safety; $FoS_{S_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Check overturning and sliding between courses 1 and 2

Wall geometry

Horiz dist to CoG gabion 2; $x_{g2} = 800$ mm; Vert dist to CoG gabion 2; $y_{g2} = 1036$ mm

Weight of gabion 2; $W_{g2} = 53.0$ kN/m

Weight of entire gabion; $W_g = 53.0$ kN/m; Horiz distance to CoG; $x_g = 800$ mm

Vert distance to CoG; $y_g = 1036$ mm; Correcting for wall inclination; $x_g = 961$ mm

Vert height diff - inclination; $H_f = 296$ mm

Design dimensions

Effect. angle rear plane of wall; $\alpha = 99.6$ deg; Effective face angle; $\theta = 80.4$ deg

Effective height of wall; $H = 2309$ mm; Height - toe to top gabion; $H_{incl} = 2042$ mm

Active pressure; $K_a = 0.298$

Active thrust due to soil; $P_{a,soil} = 16.7$ kN/m

Horizontal forces

Retained soil; $F_{soil_h} = 16.5$ kN/m; Soil thrust height resolved vert.; $d_{h,soil} = 503$ mm

Surcharge; $F_{surch_h} = 8.8$ kN/m; Surcharge thrust height (vert); $d_{h,surch} = 888$ mm

Vertical forces

Gabion weight; $F_{gabion_v,f} = 53.0$ kN/m; Retained soil; $F_{soil_v,f} = 2.5$ kN/m

Surcharge; $F_{surch_v,f} = 0.0$ kN/m

Overturning stability - take moments about the toe

Overturning moment; $M_o = 16.1$ kNm/m; Restoring moment; $M_R = 55.3$ kNm/m

Factor of safety; $FoSM = 3.428$; Allowable factor of safety; $FoSM_{allow} = 1.000$

PASS - Design FOS for overturning exceeds min allowable FOS for overturning

Sliding stability - ignore any passive pressure in front of the structure

Total horizontal force; $T = 25.3$ kN/m; Total vertical force; $N = 55.5$ kN/m

Sliding force; $F_f = 15.7$ kN/m; Sliding resistance; $F_R = 33.0$ kN/m

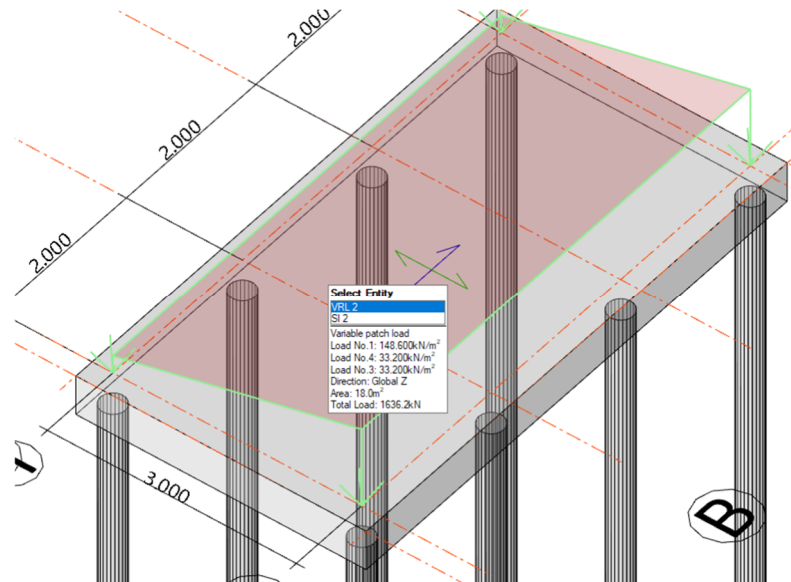
Factor of safety; $FoS_S = 2.105$; Allowable factor of safety; $FoS_{S_allow} = 1.000$

PASS - Design FOS for sliding exceeds min allowable FOS for sliding

Project Goat Mill Road, Dowlais				Job Ref. P0379	
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Foundation Base

Base to be supported by 2No. Piles (3m apart) at every 2m centres
Thickness = 500mm



VDL loads used (Worst case , therefore loads taken as live load):

VDL1 = 148.6 kN/m²

VDL2 = 33.2 kN/m²

Mat: MF 2, Panel: SI 2

Static & RSA

Reinforcement Design Summary

Reinforcement Layer	Reinforcement Provided	Area Provided [mm ² /m]	Area Required [mm ² /m]	Utilization
Bottom-X	H12-150.0-B2	754	503	0.667
Bottom-Y	H12-150.0-B1	754	485	0.644
Top-X	H12-150.0-T2	754	240	0.319
Top-Y	H12-150.0-T1	754	220	0.292

Static & RSA

Reinforcement Design Details

Bottom-X

Summary

Utilization ratio $A_{s,reqd} / A_{s,prov} = 0.667$

Analysis method First-order linear

Critical combination 1 STR₁-1.35G+1.5Q+1.5RQ



Pass

Moment Capacity Check

$A_{s,prov}$ X Bottom 754 mm²/m

M_{dX} Bottom -93.827 kNm/m

$A_{s,req}$ X Bottom 503 mm²/m

Utilization ratio $A_{s,reqd} / A_{s,prov} = 0.667$

 Bear Structures Rugged by design 35 Stow Park Circle Newport NP20 4HF	Project				Job Ref.	
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✓ Pass

Limiting Reinforcement Parameters Checks

Check Minimum Diameter	Pass	
Check Maximum Diameter	Pass	
Check Minimum Bar Distance	Pass	EN 1992-1-1:2004 Section 8.2(2)
Check Maximum Spacing Tension Bars	Pass	EN 1992-1-1:2004 Section 9.3.1.1(3)
Check Maximum Spacing Tension Bars (h > 200)	Pass	EN 1992-1-1:2004 Table 7.3N
Check Minimum Area of Reinforcement	Pass	EN 1992-1-1:2004 Sections 9.2.1.1(1) and 7.3.2(2)
Check Maximum Area of Reinforcement	Pass	EN 1992-1-1:2004 Section 9.2.1.1(3)

Bottom-Y

Summary

Utilization ratio	$A_{s,reqd} / A_{s,prov} = 0.644$
Analysis method	First-order linear
Critical combination	1 STR ₁ -1.35G+1.5Q+1.5RQ

✓ Pass

Moment Capacity Check

$A_{s,prov}$ Y Bottom	754	mm ² /m
M_{dY} Bottom	-93.032	kNm/m
$A_{s,req}$ Y Bottom	485	mm ² /m
Utilization ratio	$A_{s,reqd} / A_{s,prov} = 0.644$	

✓ Pass

Limiting Reinforcement Parameters Checks

Check Minimum Diameter	Pass	
Check Maximum Diameter	Pass	
Check Minimum Bar Distance	Pass	EN 1992-1-1:2004 Section 8.2(2)
Check Maximum Spacing Tension Bars	Pass	EN 1992-1-1:2004 Section 9.3.1.1(3)
Check Maximum Spacing Tension Bars (h > 200)	Pass	EN 1992-1-1:2004 Table 7.3N
Check Minimum Area of Reinforcement	Pass	EN 1992-1-1:2004 Sections 9.2.1.1(1) and 7.3.2(2)
Check Maximum Area of Reinforcement	Pass	EN 1992-1-1:2004 Section 9.2.1.1(3)

Top-X

Summary

Utilization ratio	$A_{s,reqd} / A_{s,prov} = 0.319$
Analysis method	FE chase-down
Critical combination	1 STR ₁ -1.35G+1.5Q+1.5RQ

✓ Pass

Moment Capacity Check

$A_{s,prov}$ X Top	754	mm ² /m
M_{dX} Top	44.882	kNm/m
$A_{s,req}$ X Top	240	mm ² /m
Utilization ratio	$A_{s,reqd} / A_{s,prov} = 0.319$	

✓ Pass

Limiting Reinforcement Parameters Checks

Check Minimum Diameter	Pass	
Check Maximum Diameter	Pass	
Check Minimum Bar Distance	Pass	EN 1992-1-1:2004 Section 8.2(2)
Check Maximum Spacing Tension Bars	Pass	EN 1992-1-1:2004 Section 9.3.1.1(3)
Check Maximum Spacing Tension Bars (h > 200)	Pass	EN 1992-1-1:2004 Table 7.3N

 Bear Structures Rugged by design 35 Stow Park Circle Newport NP20 4HF	Project				Job Ref.	
	Goat Mill Road, Dowlais				P0379	
	Section				Sheet no./rev.	
	Crib Retaining Wall Design				8	
	Calc. by	Date	Chk'd by	Date	App'd by	Date
	BE	23/06/2022	AB	23/06/2022		

Check Minimum Area of Reinforcement	Pass	EN 1992-1-1:2004 Sections 9.2.1.1(1) and 7.3.2(2)
Check Maximum Area of Reinforcement	Pass	EN 1992-1-1:2004 Section 9.2.1.1(3)

Top-Y

Summary

Utilization ratio $A_{s,reqd} / A_{s,prov} = 0.292$
Analysis method FE chase-down
Critical combination 1 STR₁-1.35G+1.5Q+1.5RQ

✓ Pass

Moment Capacity Check

$A_{s,prov} \text{ Y Top}$ 754 mm²/m
 $M_{dY} \text{ Top}$ 42.156 kNm/m
 $A_{s,req} \text{ Y Top}$ 220 mm²/m
Utilization ratio $A_{s,reqd} / A_{s,prov} = 0.292$

✓ Pass

Limiting Reinforcement Parameters Checks

Check Minimum Diameter	Pass	
Check Maximum Diameter	Pass	
Check Minimum Bar Distance	Pass	EN 1992-1-1:2004 Section 8.2(2)
Check Maximum Spacing Tension Bars	Pass	EN 1992-1-1:2004 Section 9.3.1.1(3)
Check Maximum Spacing Tension Bars (h > 200)	Pass	EN 1992-1-1:2004 Table 7.3N
Check Minimum Area of Reinforcement	Pass	EN 1992-1-1:2004 Sections 9.2.1.1(1) and 7.3.2(2)
Check Maximum Area of Reinforcement	Pass	EN 1992-1-1:2004 Section 9.2.1.1(3)

Base Summary

500mm Deep Concrete

Concrete Grade C32/40

Reinforcement = H12 @ 150mm c/c in both directions – Top and Bottom

Cover = 50mm Top, 50mm Side and 75mm Bottom