



STRUCTURAL CALCULATIONS

AUX686

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Project name: **Retaining walls**

Client name: **Nick Meaney**

Property address: **Land near Six Bells,
Hoelgerrig,
Merthyr Tydfil**

Document prepared by: **Marcin Krawucki**
BSc (Hons) MCIOB, MIET, ACABE, GMICE
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CABE Membership no.: 80455303
ICE Membership no.: 92007313

Address: **50 Quarry Row,
Merthyr Tydfil,
CF47 8PS**

Date of preparation: **31/03/2026**

Job reference number: **AUX686**



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1 Introduction

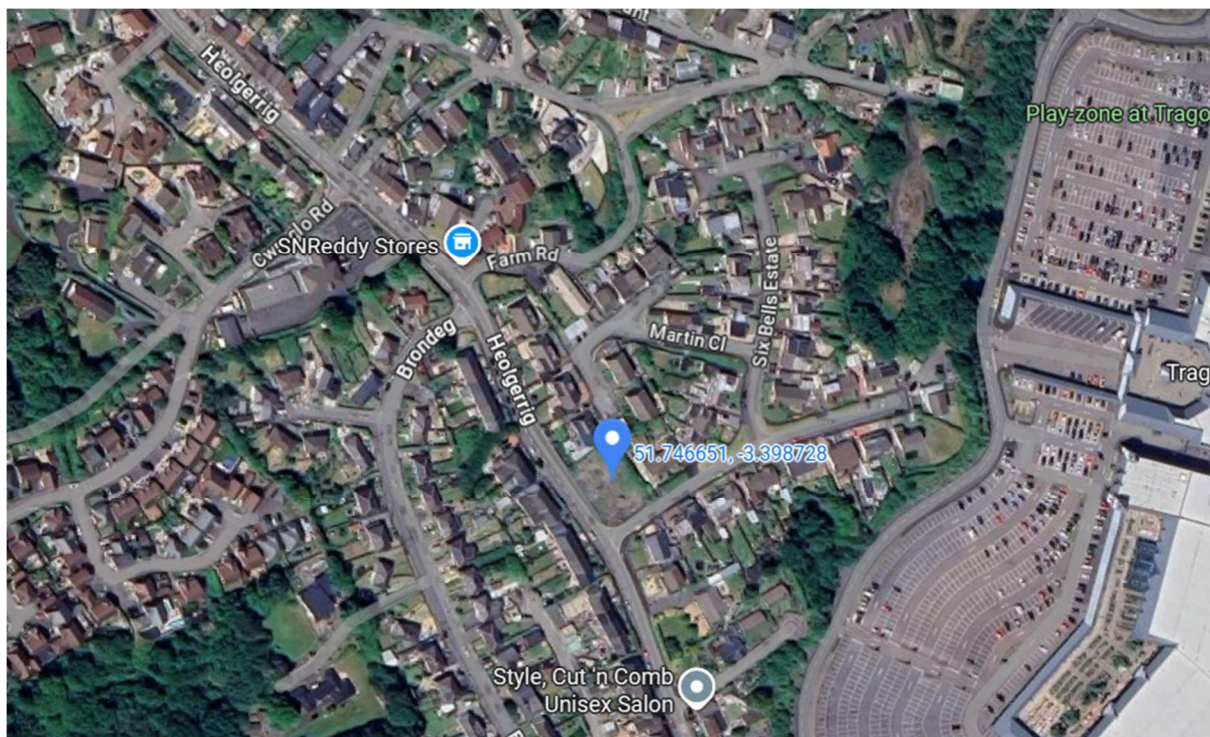
In accordance with instructions received from the client I have carried out a Structural calculation in relation to the **Retaining walls**.

2 Location of the Property

The property is situated at

**Land near Six Bells,
Hoelgerrig,
Merthyr Tydfil**

See below the satellite view from Google Maps.





3 Construction Works Description: Mass Masonry Retaining Wall

Standards: BS EN 1996 (Eurocode 6), BS EN 1997 (Eurocode 7), and BS 8000.

1. Site Clearance and Excavation

Clearance: Clear the site of all vegetation, topsoil, and organic matter to the required working area.

Excavation: Excavate to the formation level as indicated on the drawings. The sides of the excavation must be battered back or shored up in accordance with temporary works requirements and CDM 2015 regulations.

Formation Inspection: The exposed formation level (subgrade) is to be inspected by the Engineer or Building Control Officer to confirm the allowable ground bearing capacity matches the design assumption (typically $> 100\text{kN/m}^2$ or as specified).

Soft Spots: Any soft spots encountered at formation level must be excavated and replaced with lean mix concrete or compacted granular material.

2. Concrete Foundation

Blinding: If the formation is clay or susceptible to softening, place a 50mm layer of blinding concrete immediately after excavation.

Reinforcement (if applicable): Place reinforcement cages (if the design is a reinforced strip) on approved spacers to ensure minimum cover (typically 50mm-75mm for earth-facing concrete).

Concreting: Pour the mass concrete strip footing using the specified mix (e.g., C30/37 or GEN3).

Keyway: If the design requires a shear key, form a rebate in the wet concrete or install starter bars as detailed.

Curing: Allow the foundation to cure for a minimum of 48 hours before commencing masonry work.

3. Masonry Construction

Setting Out: Accurately set out the wall line. Ensure the wall remains within the legal boundary.

Materials: Use masonry units (brick, block, or stone) and mortar designation (typically Designation (ii) / M6 or Designation (i) / M12 for earth-retaining structures) as specified in the calculation design output.

Bonding: Construct the wall in the specified bond (e.g., English Bond or Flemish Bond for brickwork) to ensure monolithic action.

Note: There must be no vertical continuous joints.

Wall Ties (for Double Skin): If the wall consists of a facing brick and backing block, install stainless steel wall ties at the frequency specified (typically 900mm horizontal, 450mm vertical) to ensure the two skins act as a composite mass.

Movement Joints: Install vertical movement joints at maximum centres (typically 6m to 12m depending on material) to prevent thermal cracking. Ensure the joint continues through the coping.

4. Drainage and Waterproofing

Rear Face Protection: Apply two coats of bituminous paint or a proprietary waterproof



membrane to the rear (earth-retaining) face of the masonry to prevent moisture penetration.

Weep Holes: Form weep holes using 75mm plastic tubes or weep vents at 900mm – 1000 mm horizontal centres, located 150mm above external ground level.

Rear Filter Drain: Install a perforated land drain (min 100mm diameter) at the heel of the wall, surrounded by clean gravel and wrapped in a geotextile membrane to prevent silt clogging. This must discharge to a suitable outfall or soakaway.

5. Backfilling (Critical Stage)

Timing: Do not commence backfilling until the masonry mortar has reached sufficient strength (typically 7 days minimum, subject to temperature).

Material: Backfill using free-draining granular material (e.g., SHW Clause 600 series, Class 6I or 6J, or clean crushed stone). Do not use cohesive clay or site-won topsoil as backfill.

Placement: Place backfill in horizontal layers not exceeding 150mm in depth.

Compaction:

Compact each layer using a vibrating plate or pedestrian roller.

Warning: Heavy compaction plant (ride-on rollers) must not be used within 2.0m of the rear of the wall to prevent generating excessive lateral earth pressures that could overturn the wall.

Hand compaction only is permitted within 500mm of the masonry face.

6. Finishing

Coping: Bed coping stones on the top of the wall using a high-bond mortar. Copings should overhang the wall face by at least 40mm and feature a drip throat to shed water away from the masonry face.

Pointing: Finish joints with a bucket handle or weather-struck profile to maximise durability against frost action. Recessed pointing is not recommended for retaining walls

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4 *Appendices*

4.1. Calculations

4.2. Drawings

STRUCTURAL CALCULATIONS

Using
MASTERSERIES POWERPAD

ADDRESS :
Land near Six Bells, Hoelgerrig, Merthyr Tydfil

STRUCTURAL ENGINEERS
AUXILIUM

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MasterSeries Sample Output

3 Castle Street
Carrickfergus,
County Antrim, BT38 7BE

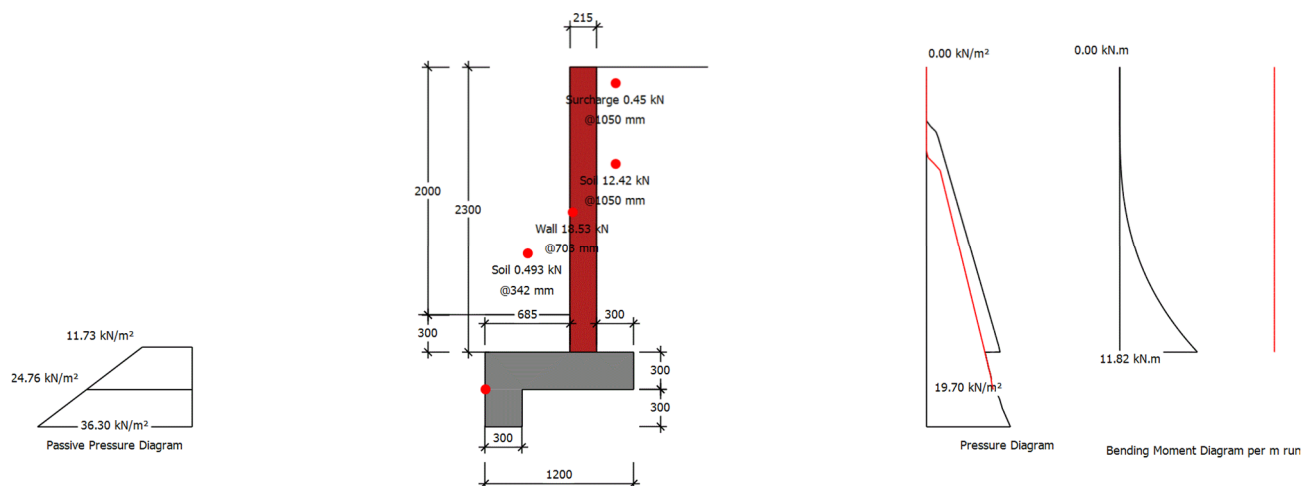
Tel: (028) 9036 5950

Job ref : Job Ref
Sheet : Sheet Ref / 2 -
Made By :
Date : 02 Apr 2026/ Version 2015.04
Checked :
Approved :

MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994, BS EN 1996-1-1:2005+A1:2012 AND BS 8110 : 1997

Wall 1 (2m high)

Reinforced Masonry Retaining Wall with Reinforced Concrete Base



Summary of Design Data

EC6 National Annex	UK
Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Soil 18.00, Concrete 24.00, Masonry 20.00
Concrete grade	fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm², fyt 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 1.50 kN/m², Fully drained
Unplanned excavation depth	Front of wall 260 mm
† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice	

Soil Properties

Bearing pressure	Premissable service pressure @ front 100.00 kN/m², @ back 100.00 kN/m²
Back Soil Friction and Cohesion	$\phi = \text{Atn}(\tan(25)/1.2) = 21.24^\circ$, $c = 3/1.5 = 2 \text{ kN/m}^2$
Base Friction and Cohesion	$\delta = \text{Atn}(0.75 \times \tan(\text{Atn}(\tan(25)/1.2))) = 16.25^\circ$
Front Soil Friction and Cohesion	$\phi = \text{Atn}(\tan(25)/1.2) = 21.24^\circ$, $c = 3/1.5 = 2 \text{ kN/m}^2$

Loading Cases

G_{Soil} - Soil Self Weight, G_{Wall} - Wall & Base Self Weight, $F_{V\text{Heel}}$ - Vertical Loads over Heel,	
P_a - Active Earth Pressure, $P_{\text{surcharge}}$ - Earth pressure from surcharge, P_p - Passive Earth Pressure,	
$P_a(\text{nib})$ - Nib Passive Earth Pressure, $P_p(\text{nib})$ - Nib Active Earth Pressure	
Case 1: Geotechnical Design	1.00 G_{Soil} + 1.00 G_{Wall} + 1.00 $F_{V\text{Heel}}$ + 1.00 P_a + 1.00 $P_{\text{surcharge}}$ + 1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil} + 1.40 G_{Wall} + 1.60 $F_{V\text{Heel}}$ + 1.00 P_a + 1.00 $P_{\text{surcharge}}$ + 1.00 P_p + 1.00 $P_a(\text{nib})$ + 1.00 $P_p(\text{nib})$

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	11.997/26.709	0.449	OK
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Wall Sliding - Virtual Back Pressure

$F_x / (R_{X\text{Friction}} + R_{X\text{Passive}})$	23.317 / (11.341 + 15.363)	0.873	OK
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Soil Pressure

Virtual Back (No uplift)	Max(45.011/100, 8.144/100) kN/m²	0.450	OK
Wall Back	68.645/100 kN/m², Length under pressure 0.929 m	0.686	OK

MasterSeries Sample Output

3 Castle Street
Carrickfergus,
County Antrim, BT38 7BE

Tel: (028) 9036 5950

Job ref : **Job Ref**
Sheet : **Sheet Ref / 3 -**
Made By :
Date : **02 Apr 2026/ Version 2015.04**
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Structural Design**Masonry Wall Details**

Partial Safety Factor (γ_{mc}/γ_{mf})	Units Category II, Execution Control Class 2	3/2.7	Table NA.1
Material	Concrete blocks, $\gamma=20 \text{ kN/m}^3$		
Units and Mortar Strength	7.3 N/mm ² , Mortar designation M12/(i)		
Blocks Ratio	Unit height=215, Least horizontal dimensions=215	1.00	
Compressive Strength (f_k)	Group 1	5.48 N/mm ²	Table NA.4

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	H10@200 (30 mm)	393 mm ²	OK
Leverarm $z=fn(d,b,As,f_y,f_k)$	180 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 5.5 N/mm ²	138 mm	
$Mr=fn(above,\gamma_{mf},\gamma_{ms})$	2.70, 1.15	23.5 kN.m	
Moment Capacity Check (M/Mr)	M 11.8 kN.m, Mr 23.5 kN.m	0.502	OK
Shear Capacity Check	F 17.1 kN, f_{vk} 0.598 N/mm ² , Fvr 43.0 kN	0.40	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm $z=fn(d,b,As,f_y,F_{cu})$	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 30 N/mm ²	233 mm	
$Mr=fn(above,As',d',x,x/d)$	393 mm ² , 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 2.5 kN.m, Mr 39.8 kN.m	0.064	OK
Shear Capacity Check	F 16.2 kN, vc 0.412 N/mm ² , Fvr 101.0 kN	0.16	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm $z=fn(d,b,As,f_y,F_{cu})$	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 30 N/mm ²	233 mm	
$Mr=fn(above,As',d',x,x/d)$	393 mm ² , 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 9.3 kN.m, Mr 39.8 kN.m	0.233	OK
Shear Capacity Check	F 26.1 kN, vc 0.412 N/mm ² , Fvr 101.0 kN	0.26	OK

Nib Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm $z=fn(d,b,As,f_y,F_{cu})$	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 30 N/mm ²	233 mm	
$Mr=fn(above,As',d',x,x/d)$	393 mm ² , 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 0.5 kN.m, Mr 39.8 kN.m	0.013	OK
Shear Capacity Check	F 2.9 kN, vc 0.412 N/mm ² , Fvr 101.0 kN	0.03	OK

MasterSeries Sample Output

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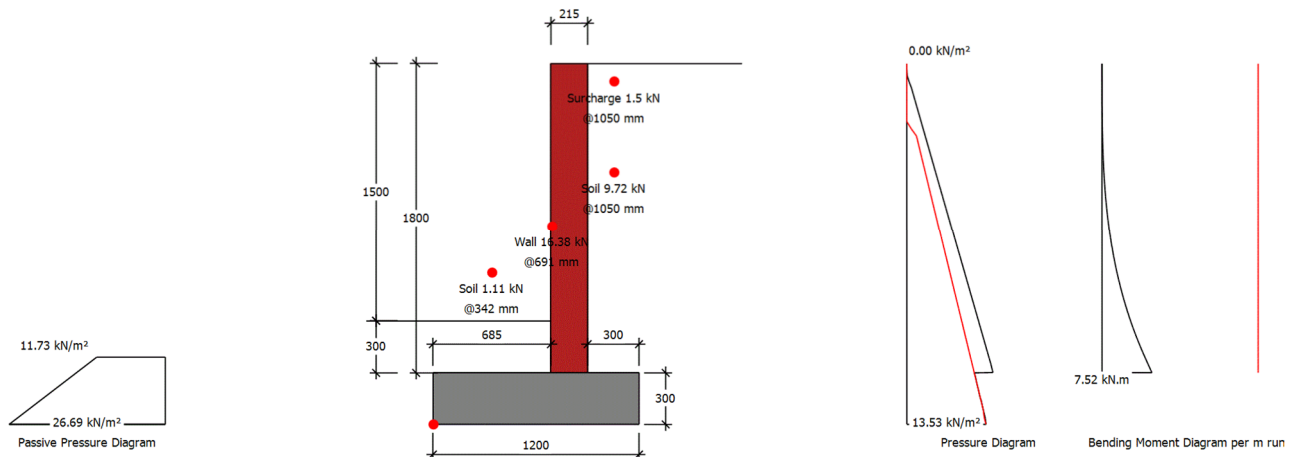
Tel: (028) 9036 5950

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Date : 02 Apr 2026/ Version 2015.04
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MASTERKEY : RETAINING WALL DESIGN TO BS 8002 : 1994, BS EN 1996-1-1:2005+A1:2012 AND BS 8110 : 1997

Wall 2 (1.5m high)

Reinforced Masonry Retaining Wall with Reinforced Concrete Base



Summary of Design Data

EC6 National Annex	UK
Notes	All dimensions are in mm and all forces are per metre run
Material Densities (kN/m³)	Soil 18.00, Concrete 24.00, Masonry 20.00
Concrete grade	fcu 30 N/mm², Permissible tensile stress 0.250 N/mm²
Concrete covers (mm)	Wall inner cover 30 mm, Wall outer cover 30 mm, Base cover 50 mm
Reinforcement design	fy 500 N/mm², fyb 500 N/mm² designed to BS 8110: 1997
Surcharge and Water Table	Surcharge 5.00 kN/m², Fully drained
Unplanned excavation depth	Front of wall 210 mm
† The Engineer must satisfy him/herself to the reinforcement detailing requirements of the relevant codes of practice	

Soil Properties

Bearing pressure	Premissible service pressure @ front 100.00 kN/m², @ back 100.00 kN/m²
Back Soil Friction and Cohesion	$\phi = \text{Atn}(\tan(25)/1.2) = 21.24^\circ$, $c = 3/1.5 = 2 \text{ kN/m}^2$
Base Friction and Cohesion	$\delta = \text{Atn}(0.75 \times \tan(\text{Atn}(\tan(25)/1.2))) = 16.25^\circ$
Front Soil Friction and Cohesion	$\phi = \text{Atn}(\tan(25)/1.2) = 21.24^\circ$, $c = 3/1.5 = 2 \text{ kN/m}^2$

Loading Cases

G_{Soil} - Soil Self Weight, G_{Wall} - Wall & Base Self Weight, $F_{V\text{Heel}}$ - Vertical Loads over Heel,	
P_a - Active Earth Pressure, $P_{\text{surcharge}}$ - Earth pressure from surcharge, P_p - Passive Earth Pressure	
Case 1: Geotechnical Design	1.00 G_{Soil} + 1.00 G_{Wall} + 1.00 $F_{V\text{Heel}}$ + 1.00 P_a + 1.00 $P_{\text{surcharge}}$ + 1.00 P_p
Case 2: Structural Ultimate Design	1.40 G_{Soil} + 1.40 G_{Wall} + 1.60 $F_{V\text{Heel}}$ + 1.00 P_a + 1.00 $P_{\text{surcharge}}$ + 1.00 P_p

Geotechnical Design

Wall Stability - Virtual Back Pressure

Case 1 Overturning/Stabilising	8.116/23.483	0.346	OK
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Wall Sliding - Virtual Back Pressure

$F_x / (R_{x\text{Friction}} + R_{x\text{Passive}})$	12.922 / (8.367 + 7.490)	0.815	OK
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Soil Pressure

Virtual Back (No uplift)	Max(31.673/100, 16.177/100) kN/m²	0.317	OK
Wall Back (No uplift)	Max(42.575/100, 5.275/100) kN/m²	0.426	OK

Structural Design

Masonry Wall Details

Partial Safety Factor (γ_{mc}/γ_{mf})	Units Category II, Execution Control Class 2	3/2.7	Table NA.1
Material	Concrete blocks, $\gamma = 20 \text{ kN/m}^3$		

MasterSeries Sample Output

3 Castle Street
Carrickfergus,
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Job ref : Job Ref
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Made By :
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Units and Mortar Strength	7.3 N/mm ² , Mortar designation M12/(i)		
Blocks Ratio	Unit height=215, Least horizontal dimensions=215	1.00	
Compressive Strength (f_k)	Group 1	5.48 N/mm ²	Table NA.4

Wall Design (Inner Steel)

Critical Section	Critical @ 0 mm from base, Case 2		
Steel Provided (Cover)	H10@200 (30 mm)	393 mm ²	OK
Leverarm $z=fn(d,b,As,f_y,f_k)$	180 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 5.5 N/mm ²	138 mm	
$Mr=fn(above,y_{mf},y_{ms})$	2.70, 1.15	23.5 kN.m	
Moment Capacity Check (M/Mr)	M 7.5 kN.m, Mr 23.5 kN.m	0.319	OK
Shear Capacity Check	F 11.7 kN, f_{vk} 0.624 N/mm ² , Fvr 45.0 kN	0.26	OK

Base Top Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm $z=fn(d,b,As,f_y,F_{cu})$	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 30 N/mm ²	233 mm	
$Mr=fn(above,As',d',x,x/d)$	393 mm ² , 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 1.6 kN.m, Mr 39.8 kN.m	0.041	OK
Shear Capacity Check	F 10.7 kN, vc 0.412 N/mm ² , Fvr 101.0 kN	0.11	OK

Base Bottom Steel Design

Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	OK
Compression Steel Provided (Cover)	Main H10@200 (50 mm) Dist. H10@200 (60 mm)	393 mm ²	
Leverarm $z=fn(d,b,As,f_y,F_{cu})$	245 mm, 1000 mm, 393 mm ² , 500 N/mm ² , 30 N/mm ²	233 mm	
$Mr=fn(above,As',d',x,x/d)$	393 mm ² , 55 mm, 14 mm, 0.06	39.8 kN.m	
Moment Capacity Check (M/Mr)	M 6.1 kN.m, Mr 39.8 kN.m	0.154	OK
Shear Capacity Check	F 16.9 kN, vc 0.412 N/mm ² , Fvr 101.0 kN	0.17	OK

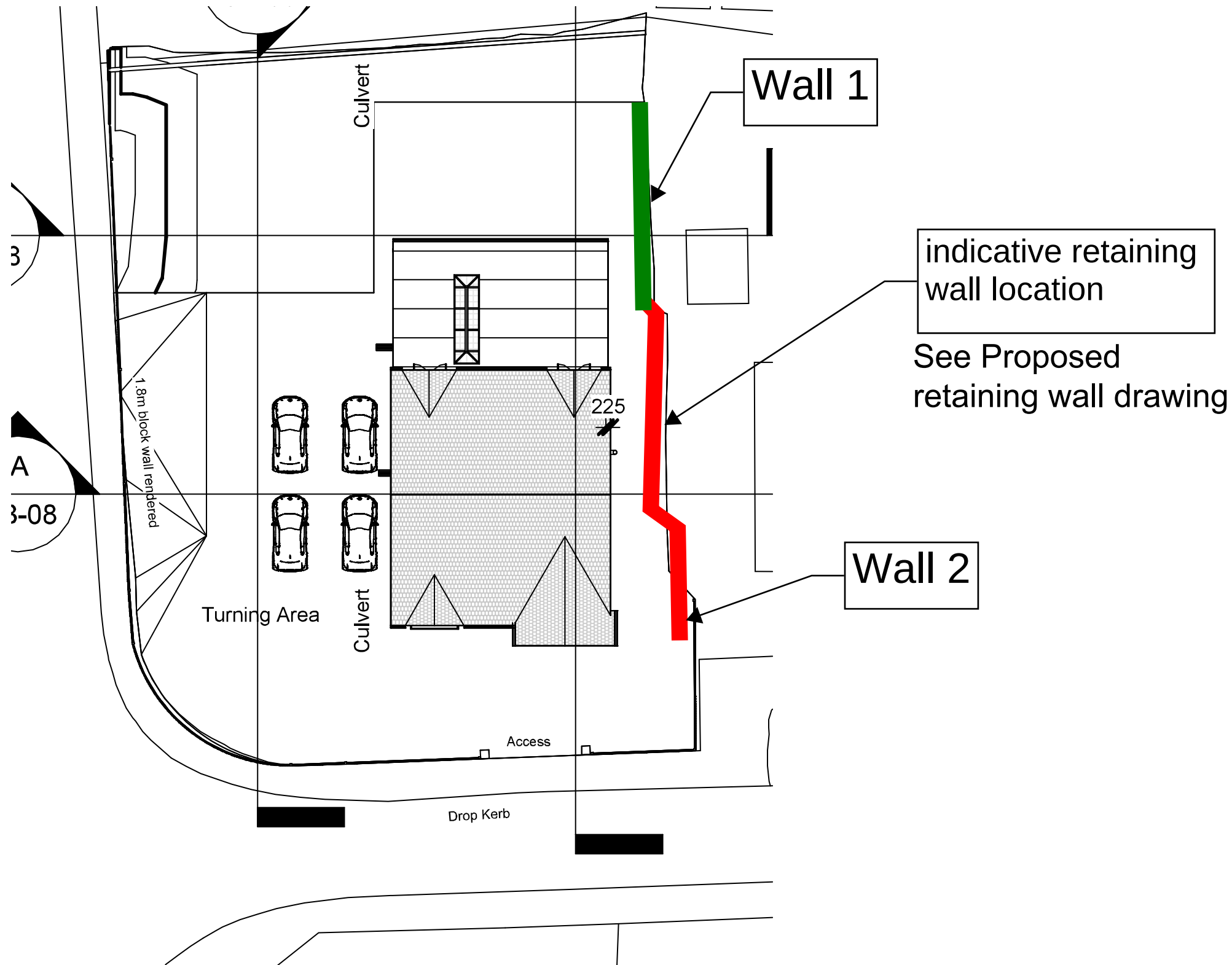
Tel: (028) 9036 5950

Job ref	: Job Ref
Sheet	: Sheet Ref / 6 -
Made By	:
Date	: 02 Apr 2026/ Version 2015.04
Checked	:
Approved	:

NOTE : WATERPROOFING FOR RETAINING WALL TO BE DONE BY SPECIALIST.
AUXILIUM STRUCTURAL ENGINEERS ARE NOT RESPONSIBLE FOR
WATERPROOFING.

NOTES:

1. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.
2. DO NOT SCALE FROM THIS DRAWING.
3. ALL DIMENSIONS TO BE VERIFIED ON SITE PRIOR TO COMMENCING WORKS



Client
Nick Meaney

Project
Land near Six Bells, Hoelgerrig, Merthyr
Tydfil

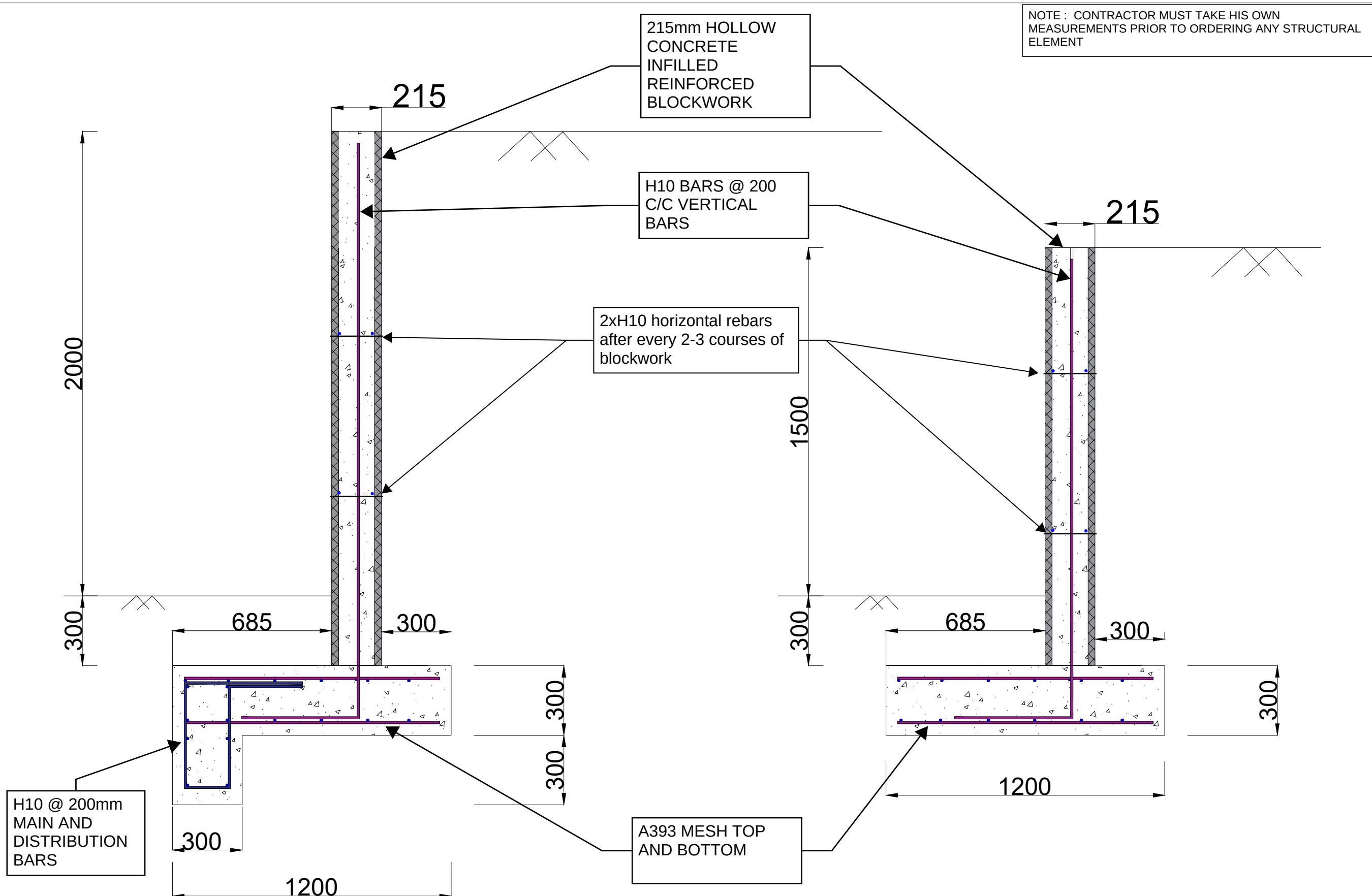
Drawing Title
INDICATIVE RETAINING WALL
SECTION

Drawing Status
For Construction

Drawn By:	Date:	Checked By:	Date:
MK	31-03-2026		

Original Size	Scale	Issue Date
A3	1:50	

Project Number	Drawing Number	Revision
AUX- 686	101	C01



NOTE : CONTRACTOR MUST TAKE HIS OWN MEASUREMENTS PRIOR TO ORDERING ANY STRUCTURAL ELEMENT

- NOTES:
1. ALL DIMENSIONS IN mm UNLESS NOTED OTHERWISE.
 2. DO NOT SCALE FROM THIS DRAWING.
 3. ALL DIMENSIONS TO BE VERIFIED ON SITE PRIOR TO COMMENCING WORKS

WALL 1

WALL 2

RETAINING WALL SECTION

			
Client Nick Meaney			
Project Land near Six Bells, Hoelgerrig, Merthyr Tydfil			
Drawing Title RETAINING WALL SECTION			
Drawing Status For Construction			
Drawn By: MK	Date: 31-03-2026	Checked By:	Date:
Original Size A3	Scale NTS	Issue Date	
Project Number AUX- 686	Drawing Number 102	Revision C01	



AUXILIUM

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