Wilde

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STOCKPORT
METROPOLITAN BOROUGH COUNCIL

WARREN WOOD RETAINING WALL
MARPLE ROAD A626
STOCKPORT

RETAINING WALL DESIGN REVIEW REPORT

DOC REF: 294663-WCL-XX-XX-RP-C-0001

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DOCUMENT CONTROL SHEET

Version	Date	Status	Prepared By	Checked By	Approved By
0	Jan 2023	First Issue	J Kok Shun CEng MICE	D Freeman CEng MICE	D Freeman CEng MICE

CONTENTS

LOCATION PLAN

STOCKPORT
METROPOLITAN BOROUGH COUNCIL

Marple Road at Warren Wood (Opp Shearwater Road) Damaged Footway

Task Ref:

Scale: 1:1,250

Date: 24/11/2022

1. INTRODUCTION AND STRUCTURE DESCRIPTION

1.1 Wilde Consultants Ltd (WCL) have been engaged by Stockport Metropolitan Borough Council (SMBC) to undertake a design review of a retaining wall know as Warren Wood Retaining Wall, which supports a section of the A626 Marple Road in Stockport.

1.2 The retaining wall structure is located at grid reference SJ 93281 88738 (approximate postcode SK2 5HF). A location plan can be seen on the previous page.

1.3 The wall was constructed in 2013 after a United Utilities water main burst causing extensive damage to the footway, existing wall and embankment. As a result, United Utilities were responsible for undertaking the required repair works. A photo of the site, showing the damage prior to the commencement of works, can be seen below.

Photo of damaged footway / retaining wall circa 2013, prior to the commencement of works (provided by SMBC)

1.4 It is understood that the repair works comprised repairs to drainage runs, construction of a new reinforced concrete reverse L-shaped retaining wall and reinstatement of the footway. The works were undertaken late 2013. It is noted that no formal as-built drawings have been made available for review.

1.5 It is understood that, at the time, SMBC considered these works to be a private matter, as the existing wall damaged by the burst water main was believed to be a private boundary wall belonging to the adjacent Warren Lodge estate (see Appendix A for Land Registry information provided by SMBC). However, as a Highway Authority, SMBC were provided with a copy of the drawings and calculations for the replacement structure as it does provide support to the footway and carriageway.

1.6 From the archive drawings made available by SMBC (contained within Appendix B), the wall is shown to be 1.2m tall with a stem thickness of 450mm, a base thickness of 400mm and a base width of 1000mm. An additional 450mm thick (approximately) mass concrete infill strip is indicated below the RC wall to ensure that the wall bears onto the clay strata. Atop the RC wall stem is a random stone masonry parapet wall of thickness 450mm with a minimum height of 1450mm above top of concrete wall level.

1.7 The overall length of the new wall indicated on the drawings is 22.52m. The wall is detailed as 5no discrete 'bays' with dowel bars detailed to the stem and base for shear continuity across the joints between bays.

1.8 The proposed sections shown on the drawings indicate a steep slope to the toe of the wall with a maximum slope angle in the region of 30-33° to the horizontal.

1.9 The footway width varies along the length of the wall from approximately 1.7-2.0m.

1.10 It is understood that SMBC do not consider this structure to be a highway structure. No information on the ownership and maintenance liability of the wall itself has been provided. This matter has not been explored any further as it is considered to be outside the scope of this design review.

1.11 More recently, since approximately 2020, the retaining wall has shown significant signs of movement down the slope. A large gap has opened up between the internal face of the stone masonry parapet and the back of the footway. The condition at the time of writing this report is shown in the photo on the following page.

Gap between back of footway and stone masonry parapet, January 2023

1.12 SMBC have confirmed that they initially considered that the movement was due to a build-up of water pressure to the rear of the wall, due to damaged or ineffectual gulley tails and that efforts were made to divert any surface water falling on the highway away from this location. However, we understand that the efforts were ineffective in arresting movement of the wall.

1.13 This design review has been undertaken bearing in mind the time of the design (2013) and the appropriate / commonly used design standards and industry practice associated with this particular time. A list of the design standards referred to throughout (in order of appearance) this report is included below:

- BD 2/12 Technical Approval of Highway Structures
- BS 5400-2 Steel, concrete and composite bridges – Specification for loads
- BD 30/87 Backfilled Retaining Walls and Bridge Abutments
- CP2 Earth Retaining Structures
- BS EN 1990 Basis of Structural Design
- BS 5400-4 Steel, concrete and composite bridges – Code of practice for design of concrete bridges

2. SCOPE OF THIS REPORT

2.1 The scope of this report is in accordance with the Model Order Form agreed and signed by SMBC and WCL (ref: 08/1554/W20).

2.2 The scope of works allows for a structural review of the retaining wall design only. No allowance has been made for the following:

- Undertaking geotechnical reviews of the ground conditions
- Consideration of any effect that water from the burst water main may have had on the ground conditions or long-term stability of the slope
- Slope stability analysis or any other form of ground modelling to consider the temporary or permanent stability of the embankment that the wall is founded on

2.3 The comments made in this report relate to structural issues only. Discussion on the ownership / responsibility for maintenance and repair works is not within the scope of this report.

3. AVAILABLE INFORMATION

3.1 The following information was provided by SMBC to assist with the design review:

i. Land ownership plan
ii. 2013 pre-start photos for repair works
iii. Drillers logs for 2no boreholes (undertaken within carriageway extents)
iv. Calculation sheets for retaining wall (by Johnston Consulting Engineers Ltd)
v. Scheme drawings as below:

No.	Title	Rev
C/5869-01	Existing Site Plan	A
C/5869-02	Proposed Site Plan New RC Retaining Wall GA, Sections and Details	A
C/5869-03	Proposed Site Sections Showing New RC Retaining Wall	-
C/5869-04	Retaining Wall Reinforcement and Bar Bending Schedule	-

vi. Handwritten construction records from site dated December 2013 (comprising hand sketches assumed to be from a site engineer's notebook).

4. REVIEW OF DESIGN CALCULATIONS

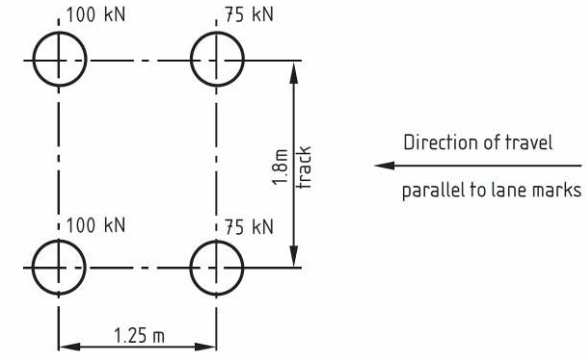
Following a detailed review of the design calculations (contained in Appendix C) prepared by Johnston Consulting Engineers Ltd, WCL make the following design-related comments:

4.1 It is noted that the design of the retaining wall is not undertaken in accordance with Eurocode design standards. If the wall is considered to be a highway structure, then the DMRB standards should have been applied and the Overseeing Organisation should have been consulted in order to confirm the requirement to use Eurocode standards for the design. However, we understand that SMBC do not consider the wall to be a highway structure.

4.2 DMRB document BD 2/12 is referenced in the design calculations to classify the structure as Category 0 and therefore not needing an Approval in Principle. WCL agree that the structure could be considered as Category 0 in accordance with BD 2/12: 3.4.1.

4.3 On page 1 of the calculations, BS 6399 is referred to for the loading to the wall. BS 6399 is titled “Loading for buildings” and doesn’t appear to be a suitable code for determining vehicle loading to retaining walls. However, an appropriate value for vehicle surcharge (10kN/m^2) was selected for the vehicle loading. This value matches the value recommended in BS 5400-2: 5.8.2.1.

4.4 No allowance has been made for accidental wheel loads acting on the footway. These loads are considered to be significant, especially on short height retaining walls. An appropriate accidental wheel loading configuration at the time of design would have been as below (in accordance with BS 5400-2: Figure 14).



4.5 The design calculations do not consider hydrostatic pressures acting on the back face of the wall. The decision to not design for this load case is considered to be appropriate as the design drawings clearly indicate a back of wall drainage system. However, this clearly could not have been installed due to the presence of sheet piles directly to the rear of the wall.

4.6 It is noted that the design does not take into account any restoring effect of the passive soil resistance to the front face of the wall. WCL agree with this design decision as the available passive resistance from an embankment falling away from the toe of a wall is often low / negligible. Furthermore, section C-C on drawing C/5869-03 shows the entire toe of the RC wall (as well as some of the mass concrete infill) projecting above ground level.

4.7 The calculation methodology (i.e., working with unfactored loads and applying overall factors of safety to the design) is considered to be appropriate and in line with standard industry practice at the time of design. However, it is unclear on what basis the allowable factors of safety, 2 for overturning and 1.4 for sliding, have been selected.

4.8 DMRB document BD 30/87: 5.2.4.2 recommends overall factors of safety in accordance with CP2 and BSCP 2004. CP2 recommends factors of safety (FoS) of 2 for both overturning and sliding, and that the base thrust remains within the middle third of the base width. The design calculations consider an FoS of 2 for overturning and maintain the base thrust within the middle third of the base width, however, they adopt a lower FoS of 1.4 for sliding, as opposed to 2 as recommended by CP2.

4.9 Despite not knowing the reasoning behind adopting an FoS of 1.4 for sliding, WCL do not consider this value to necessarily be inappropriate for design. The reason for this being that the current Eurocodes generally adopt the following partial factors for highway bridges / retaining wall structures:

- Unfavourable loads (concrete self-weight, road traffic actions), $\gamma = 1.35$
- Favourable loads (concrete self-weight, road traffic actions), $\gamma = 0.95$

Reference: NA to BS EN 1990: Table NA.A2.4(B)

Combining the above into a single load factor would give 1.35/0.95 = 1.42, which is comparable to the 1.4 value adopted by Johnston Consulting Engineers Ltd.

4.10 Page 3 of the calculations shows an initial failure in the sliding case. The design goes on to consider a mass concrete infill block beneath the RC wall and proposes dowels between the RC wall and mass concrete block in order to gain enough mass to pass the sliding check. However:

i. There is no evidence of the dowel requirements on the drawings, therefore, there is the possibility this requirement was not conveyed adequately to the contractor and thus may not have been installed.
ii. The design calculations do not go on the consider the increase in effective retained height due to the inclusion of the dowelled mass concrete block.

4.11 With respect to point (ii) above, WCL have undertaken an independent set of calculations in order to investigate the effects of increasing the effective retained height of the wall by 450mm (the approximate depth of the mass concrete infill indicated on the drawings). The calculations are based on section C-C on drawing C/5869-03. The WCL calculations can be found in Appendix D. A summary of the calculation results is as follows:

- Overturning FoS = 2.66 > 2, OK
- Sliding FoS = 1.24 < 1.4, NOT OK
- Bearing thrust eccentricity = 0.10m < 1.0/6 = 0.17m, OK within middle third
- Peak bearing pressure assuming triangular stress distribution = 68.0kN/m^2

4.12 It was found that the additional weight of the mass concrete infill is not enough to counteract the additional lateral earth pressures associated with increasing the effective retained height of the wall by 450mm. As such, the factor of safety against sliding drops to 1.24, which is considered to be inappropriately low for design.

4.13 The calculation determines a peak ground bearing pressure of 57kN/m^2 (as opposed to WCL's value of 68.0kN/m^2), but does not justify whether or not this value is considered to be acceptable and the reasons for this. Also, the design does not consider the stability of the slope or the implications of founding the retaining wall at such a shallow depth on a steep slope inclined approximately 30-33° to the horizontal.

4.14 The only site investigation information made available for review was 2no handwritten drillers logs (contained in Appendix E). Only Borehole No. 2 undertook any in-situ testing within the firm brown silty clay layer, which is where the proposed wall is indicated to be founded (see sections B-B and D-D on drawing C/5869-03). The SPT N value associated with this layer is 13 (4+3+3+3). A preliminary allowable bearing pressure for a strip footing on dry soil is considered to be 7N (reference: page 30 of the Structural Engineer's Pocket Book, Third Edition). 7N = 7 x 13 = 91.0kN/m^2, which is greater than the WCL calculated applied bearing pressure of 68.0kN/m^2.

4.15 Independent reinforced concrete design checks were undertaken by WCL in order to verify the strength of the RC sections (see Appendix D). The calculations were undertaken in accordance with BS 5400-4 and are based on the reinforcement arrangement as shown on drawing C/5869-04. The calculation considers the following parameters:

- f_y = 460N/mm^2
- f_{cu} = 40N/mm^2
- A_s = 754mm^2/m (equivalent to 12mm diameter bars at 150mm centres)
- Cover = 50mm
- Section thickness = 450mm (stem), 400mm (base)
- Width of section = 1000mm (assume a metre width)

4.16 A summary of WCL's RC design results can be seen in the table below:

Section	Thickness (mm)	Bending Resistance (kNm/m)	Shear Resistance (kN/m)	Comments
Wall stem	450	112.9	176.2	By inspection the bending moment and shear force capacities far exceed the globally applied moments and shears, therefore, the RC sections are considered to have sufficient strength.
Wall base	400	98.7	160.7	

5. REVIEW OF CONSTRUCTION RECORDS

5.1 No formal as-built drawings were made available at the time of writing this report. The only available construction records come in the form of handwritten site notes dated December 2013 (comprising hand sketches assumed to be from a site engineer's notebook). These notes are contained within Appendix F.

5.2 The site notes make reference to "front" and "back" sheet piles, which were presumably used as temporary works in order to create the space to cast the in-situ concrete wall. The sheet piles prohibit the installation of the back of wall drainage. No reference is made to this element within the site notes.

5.3 The site notes also refer to 4no concrete bays of length 3.60m, 4.15m, 4.15m and 4.20m for a total wall length of 16.10m. It is noted that this is different to what is shown on the available scheme drawings, which indicate 5no bays for a total wall length of 22.52m.

5.4 The reason for not constructing the full length of the wall is not known, however, there is a note on the site notes that reads "Mawsons boss instructed not to go full extent and stop short of double manhole. Short by 6.30m length", suggesting that there was a reason for not constructing the full length of the wall.

6. REVIEW OF SITE OBSERVATIONS

6.1 As part of the design review WCL visited site in order to gain a better understanding of the site and failure modes associated with the wall. The site visit was undertaken on 24th January 2023. A photolog from the site visit is included in Appendix G.

6.2 The retaining wall appears to have been constructed using steel sheet piles as temporary works. The design drawings make no reference to sheet piles, or any other temporary works. The handwritten construction records (made available by SMBC) refer to a line of “front sheets” and “back sheets”. It is presumed that the “back sheets” were installed along the back of the footway and the “front sheets” along the line of the wall toe to enable casting of concrete between the two lines of piles. No further details about the sheet piles are known (section size, embedment depth, steel grade etc.).

6.3 The “back sheets” can be clearly seen on site (see photo on following page). The back face of the RC wall has the same profile as the sheet piles, suggesting that the concrete was cast directly against the piles.

View looking down gap between sheet piles and RC wall, January 2023
Note: Profile of concrete matches profile of sheet pile, no evidence of back of wall drainage

6.4 There was no evidence of any back of wall drainage visible within the gap between the sheet piles and RC wall. Casting the concrete wall directly against the sheet piles would have prohibited the installation of any drainage to the rear of the wall. It is suspected that this drainage element was not installed in accordance with the design drawings. Hydrostatic pressures acting on the back of the wall are therefore considered to be a possible load case, assuming that the loads acting on the temporary sheet piles are transferred directly to the back of the RC wall.

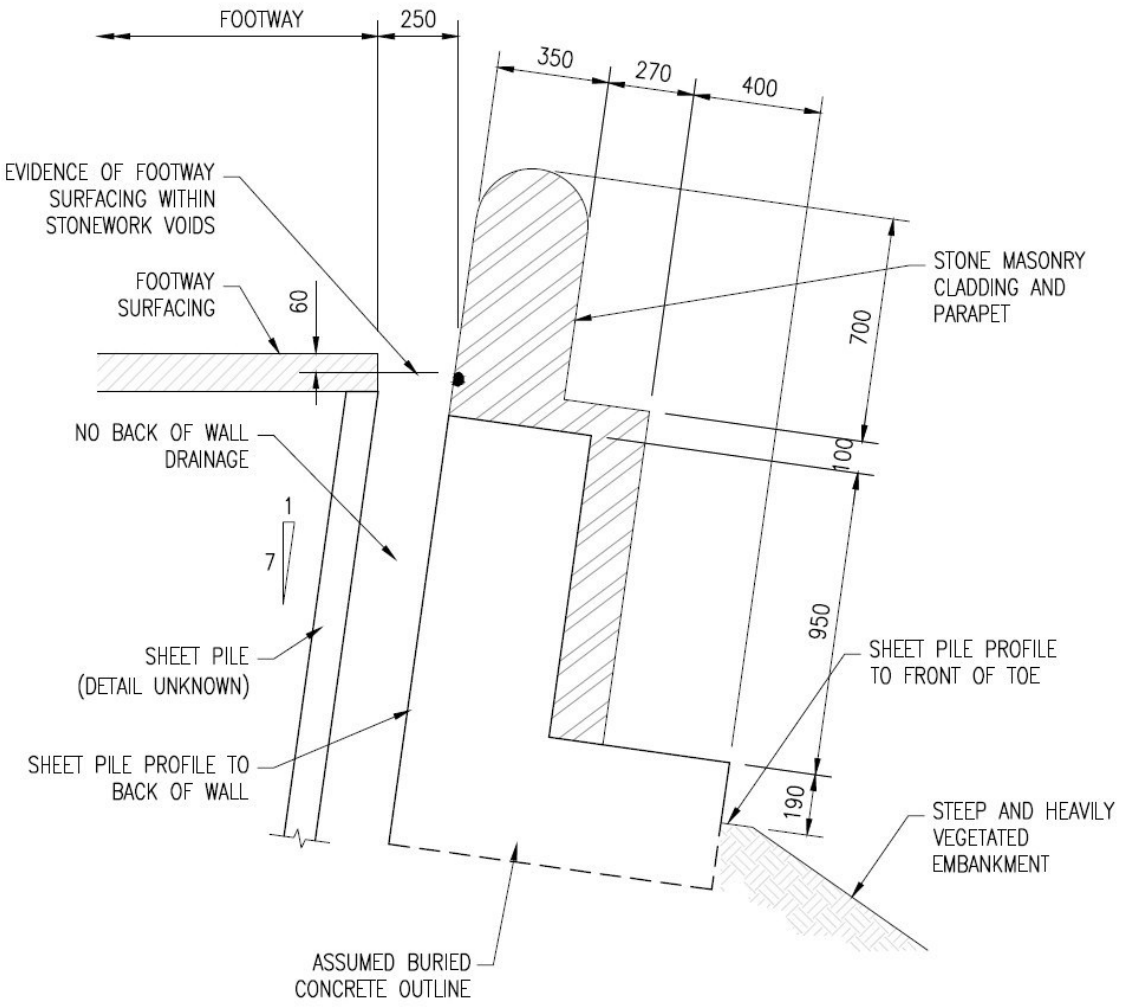
6.5 There was evidence of the “fronts sheets” on site as the concrete toe of the wall has the profile of a sheet pile (see photo below). However, it is suspected that these sheet piles were removed upon completion of the works as they could not be found on site.

View looking on the concrete toe of the wall, January 2023

Note: Profile of concrete matches profile of a sheet pile

6.6 Based on measurements taken on site, an approximate typical cross-section through the wall in its existing condition can be seen below. The following approximate wall movements were recorded during the site visit:

- Vertical movement: ~60mm downwards.
- Horizontal movement: ~250mm away from footway.
- Verticality: ~ 1 horizontal to 7 vertical (8° from the vertical) leaning away from footway.



Approximate cross-section through existing wall based on site measurements

6.7 The air void between the sheet piles and RC wall suggests that the sheet piles are providing support to the footway and any associated live loads / hydrostatic loads. The sheet piles appear to be out of plumb, which may be due to the following:

- A result of the applied loads that were originally intended to be resisted by the concrete wall.
- An installation defect whereby the piles were not installed vertically in the first place.

6.8 No significant cracking was observed to the footway surfacing. This suggests that the sheet piles are currently acting adequately to support the footway and any associated live loads. However, there is no certainty in how long this will continue to be the case, nor can the performance of the sheet pile wall be verified should it be subject to accidental wheel loads acting on the footway. There is inadequate information available regarding the pile type, strength and embedment in order to justify the sheet pile wall in the permanent case.

6.9 The stone masonry parapet was measured as being approximately 800mm above top of concrete wall level and 350mm thick. This is not what is indicated on the scheme drawings, drawing C/5869-02 shows a minimum height of 1450mm above top of concrete wall level and a thickness of 450mm.

6.10 It was also noted that the front face of the concrete stem is clad in stone masonry to match the parapet. The requirement for cladding does not appear to be part of the original design shown on the available archive scheme drawings.

6.11 There appeared to be evidence of localised slips throughout the embankment within the vicinity of the toe of the wall. However, it was not possible to confirm or photograph these defects due to the steepness of the embankment and the heavy vegetation throughout.

6.12 Numerous trees observed on site appeared to be leaning towards the downside of the slope (refer to photos 11 and 12 in the photolog in Appendix G), which may suggest movement of the slope.

7. CONCLUSIONS AND RECOMMENDATIONS

7.1 The movement of the wall is not considered to have been caused by either hydrostatic pressure or lateral earth pressures acting on the back of the wall. These load cases are not possible as the footway backfill material is not in contact with the back face of the RC wall.

7.2 It is considered likely that the wall movement is a result of a combination of the following:

i. Instability of the slope itself (noting that the slope is quite steep at 30-33° to the horizontal). The long-term embankment stability could have been affected by washout of sands during the UU water main failure, which in turn, affected the stability of the subsequent wall.

ii. The shallow founded base of the retaining wall and the allowable bearing pressures at this level.

7.3 The numerical wall design is considered to be inadequate in sliding resistance. WCL calculations suggest that the FoS associated with sliding failure is 1.24, which is not considered to be robust enough for the design method adopted. However, observations on site suggest that the theoretical deficiency in sliding resistance is not the cause of movement, as described in section 5.2 above.

7.4 It is our opinion that there has been a design oversight regarding the implications of founding the retaining wall at such a shallow depth on a steep slope inclined approximately 30-33° to the horizontal.

7.5 We therefore recommended that a geotechnical specialist review the design information and comment the suitability of the slope for founding the retaining wall. This would require additional site investigation and slip circle analysis to be undertaken by a specialist geotechnical expert.

APPENDIX A – LAND REGISTRY INFORMATION (PROVIDED BY SMBC)

C: Charges register

This register contains any charges and other matters that affect the land.

1 (05.07.2002) The land is subject to the rights granted by a Deed of Grant dated 31 December 1931 made between (1) Frederick Brindley and (2) Central Electricity Board.

NOTE:-Copy in Certificate.

2 (05.07.2002) The land is subject to the rights granted by a Conveyance of an electricity substation site tinted green on the filed plan dated 16 February 1968 made between (1) Joseph William Smith and (2) The North Western Electricity Board.

NOTE:-Copy in Certificate. Duplicate filed.

3 (05.07.2002) The land is subject to the rights granted by a Deed of Grant dated 21 February 1968 made between (1) Joseph William Smith and (2) Central Electricity Generating Board.

The said Deed also contains restrictive covenants by the grantor.

NOTE:-Copy in Certificate.

4 (10.03.2003) REGISTERED CHARGE dated 7 March 2003 to secure the moneys including the further advances therein mentioned.

5 (10.03.2003) Proprietor: THE CO-OPERATIVE BANK PLC (Co. Regn. No. 990937) of The Pyramid, Yew Street, Stockport, Cheshire SK4 2JZ.

End of register

Official copy of register of title

Title number GM903732 Edition date 10.03.2003

- This official copy shows the entries in the register of title on 4 December 2008 at 11:49:36.
- This date must be quoted as the "search from date" in any official search application based on this copy.
- The date at the beginning of an entry is the date on which the entry was made in the register.
- Issued on 4 December 2008.
- Under s.67 of the Land Registration Act 2002, this copy is admissible in evidence to the same extent as the original.
- For information about the register of title see Land Registry website www.landregistry.gov.uk or Land Registry Public Guide *1 - A guide to the information we keep and how you can obtain it.*
- This title is dealt with by Land Registry Lytham Office.

A: Property register

This register describes the land and estate comprised in the title.

GREATER MANCHESTER : STOCKPORT

1 (05.07.2002) The Freehold land shown edged with red on the plan of the above title filed at the Registry and being Warren Lodge, Marple Road, Offerton, (SK2 5HF).

B: Proprietorship register

This register specifies the class of title and identifies the owner. It contains any entries that affect the right of disposal.

Title absolute

1 (05.07.2002) PROPRIETOR: MARK JASON POULSTON of 7 Waterside Avenue, Marple, Stockport, Cheshire SK6 7LZ.

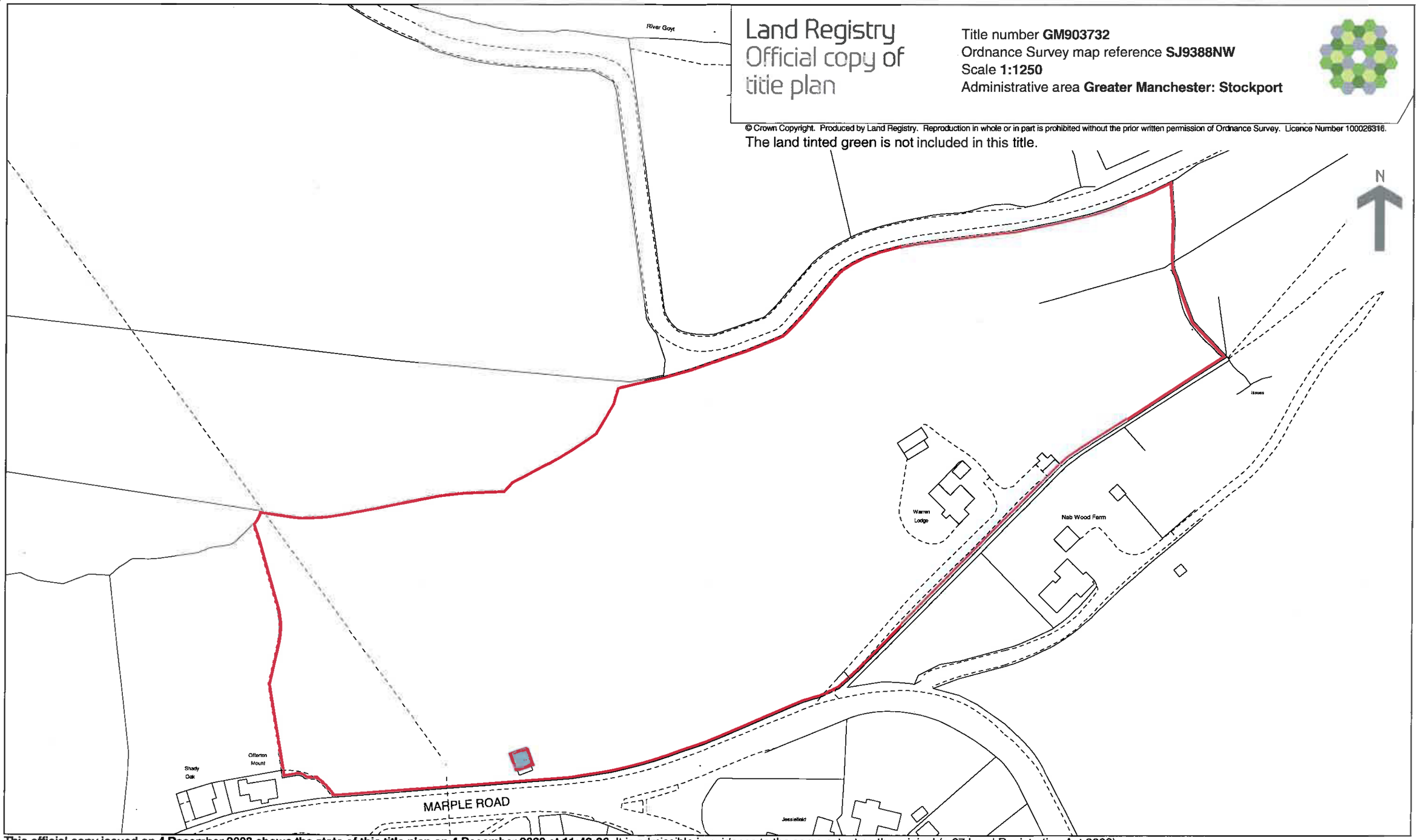
2 (05.07.2002) The value stated as at 5 July 2002 was £230,000.

3 (10.03.2003) RESTRICTION: Except under an order of the registrar no disposition by the proprietor of the land is to be registered without the consent of the proprietor of the Charge dated 7 March 2003 in favour of The Co-Operative Bank PLC referred to in the Charges Register.

Land Registry
Official copy of
title plan

Title number **GM903732**
Ordnance Survey map reference **SJ9388NW**
Scale **1:1250**
Administrative area **Greater Manchester: Stockport**

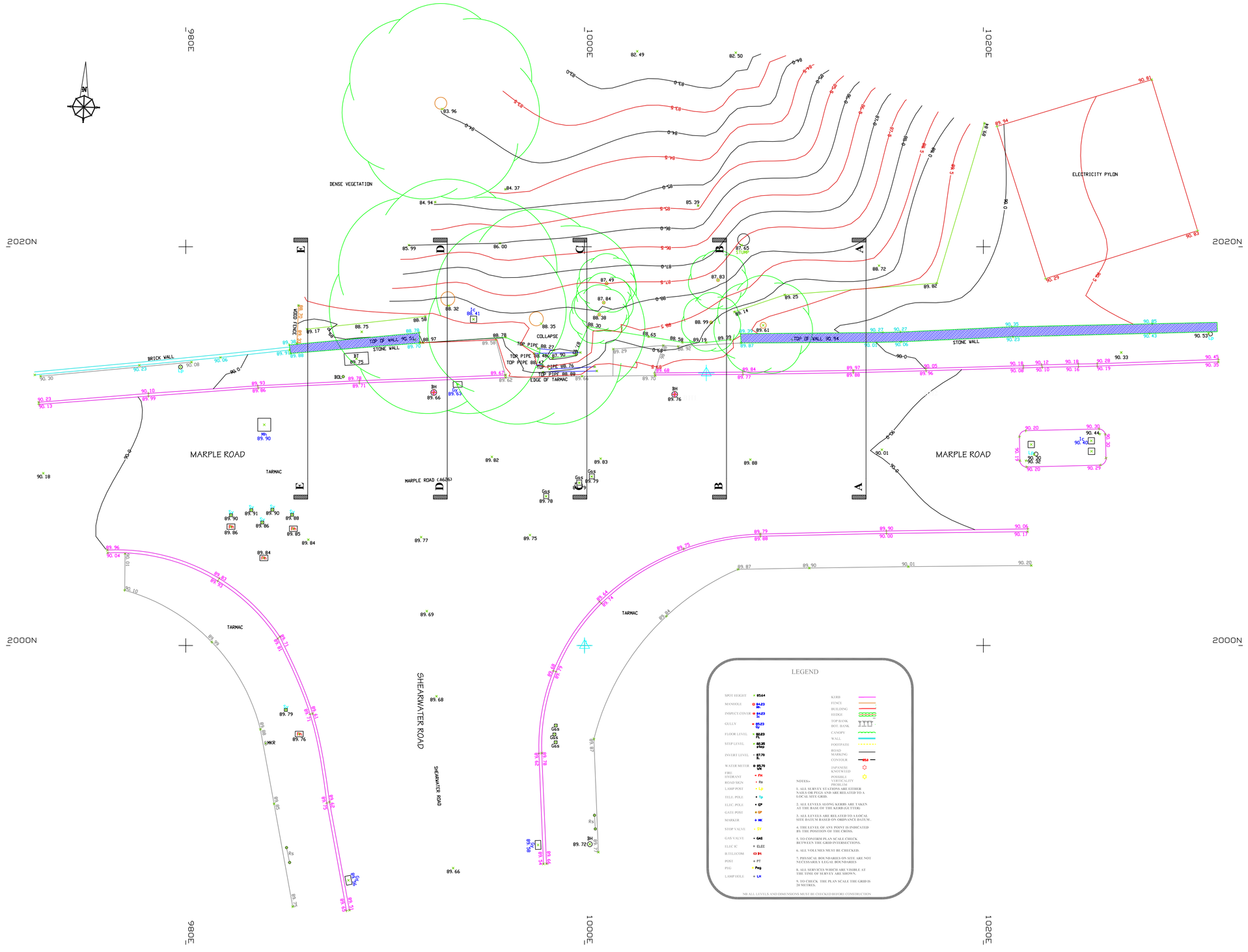
The land tinted green is not included in this title.



This official copy issued on 4 December 2008 shows the state of this title plan on 4 December 2008 at 11:49:36. It is admissible in evidence to the same extent as the original (s.67 Land Registration Act 2002).
This title plan shows the general position, not the exact line, of the boundaries. It may be subject to distortions in scale. Measurements scaled from this plan may not match measurements between the same points on the ground. See Land Registry Public Guide 19 - Title Plans and Boundaries.
This title is dealt with by Land Registry, Lytham Office.

1420038003

APPENDIX B – ARCHIVE SCHEME DRAWINGS (PROVIDED BY SMBC)



PLAN ON EXISTING RETAINING WALL / COLLAPSE
(SCALE 1:100)

LEGEND

SPOT HEIGHT	× 85.44	KERB	
MANHOLE	⊡ 84.62 MH	FENCE	
INSPECT.COVER	⊡ 84.62 IC	BUILDING	
GULLY	⊡ 85.23 GY	HEDGE	
FLOOR LEVEL	× 88.23 FL	TOP BANK, BOT. BANK	
STEP LEVEL	× 88.35 STEP	CANOPY	
INVERT LEVEL	• 87.79 INV	WALL	
WATER METER	⊡ 85.79 WM	FOOTPATH	
FIRE HYDRANT	• FH	ROAD MARKING	
ROAD SIGN	• Rs	CONTOUR	85.0
LAMP POST	• LO	JAPANESE KNOTWEED	
TELE. POLE	• Tp	POSSIBLE VERTICALITY PROBLEM	
ELEC. POLE	• EP		
GATE POST	• GP		
MARKER	+ MK		
STOP VALVE	• SV		
GAS VALVE	• GAS		
ELEC IC	⊡ ELEC		
B.T.ELECOM	⊡ BT		
POST	⊕ PT		
PEG	⊕ Peg		
LAMP HOLE	⊕ LH		

NOTES:-

1. ALL SURVEY STATIONS ARE EITHER NAILS OR PEGS AND ARE RELATED TO A LOCAL SITE GRID.
2. ALL LEVELS ALONG KERBS ARE TAKEN AT THE BASE OF THE KERB (GUTTER)
3. ALL LEVELS ARE RELATED TO A LOCAL SITE DATUM BASED ON ORDNANCE DATUM.
4. THE LEVEL OF ANY POINT IS INDICATED BY THE POSITION OF THE CROSS.
5. TO CONFIRM PLAN SCALE CHECK BETWEEN THE GRID INTERSECTIONS.
6. ALL VOLUMES MUST BE CHECKED.
7. PHYSICAL BOUNDARIES ON SITE ARE NOT NECESSARILY LEGAL BOUNDARIES
8. ALL SERVICES WHICH ARE VISIBLE AT THE TIME OF SURVEY ARE SHOWN.
9. TO CHECK THE PLAN SCALE THE GRID IS 20 METRES.

NB ALL LEVELS AND DIMENSIONS MUST BE CHECKED BEFORE CONSTRUCTION

REV	DATE	REVISION
A	NOV. '13	DRAWING NOS. REVISED.

CONTRACT
BOUNDARY RETAINING WALL, MARPLE ROAD, OFFERTON, STOCKPORT

CLIENT
GALLAGHER LTD.

TITLE
EXISTING SITE PLAN

Johnston Consulting Engineers Ltd.
CONSULTING STRUCTURAL & CIVIL ENGINEERS

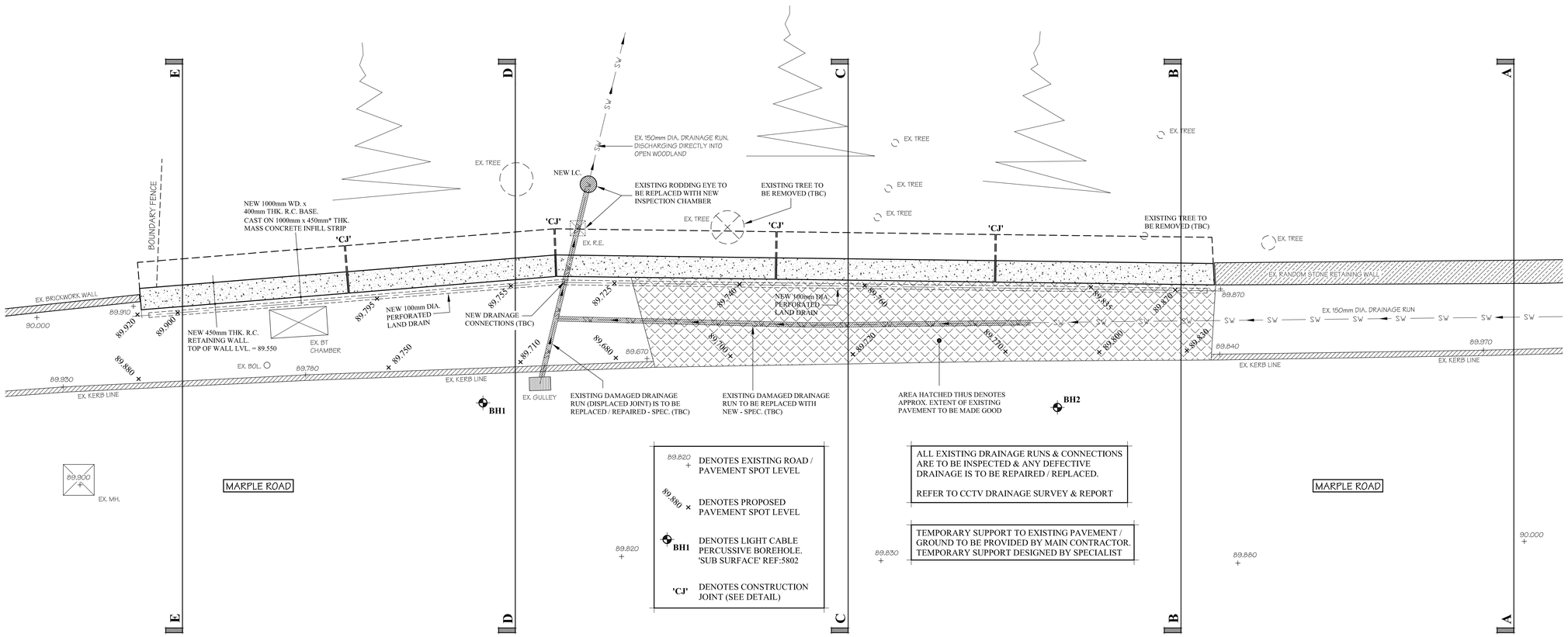
BLACKPOOL OFFICE:
41 STOCKYDALE ROAD
BLACKPOOL
LANCASHIRE
FY4 5HP
TEL: (01253) 400650

CHORLEY OFFICE:
23 QUEENS ROAD
CHORLEY
LANCASHIRE
PR7 1JU
TEL: (01257) 267272

ORIGIN ORIGIN

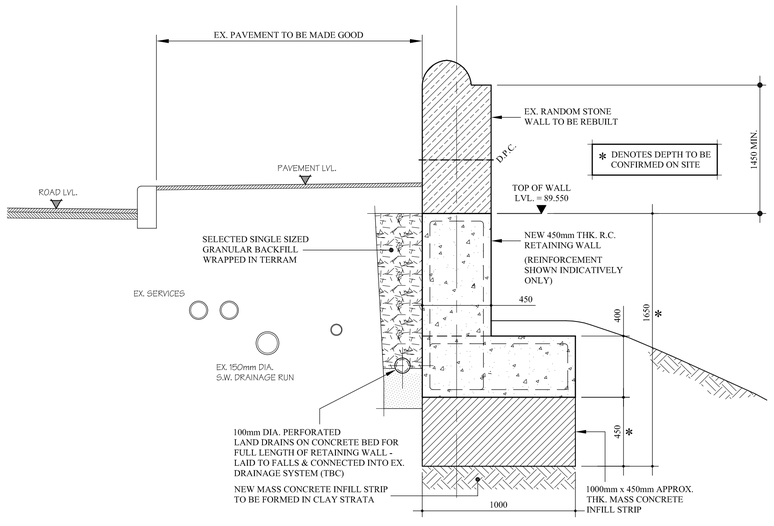
DATE	NOV. 2013	DRAWN BY	SW
SCALE	AS SHOWN @ A1	CHECKED BY	DPJ

DRAWING NUMBER C/5869-01 REVISION

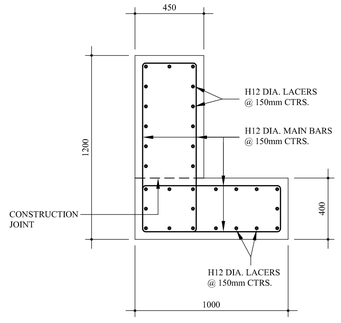


SERVICES EXIST WITHIN THE GROUND, LOCATE EXISTING SERVICES PRIOR TO COMMENCING WORKS. STABILITY OF EXISTING PAVEMENT / GROUND. TEMPORARY SUPPORT REQUIRED.		
CONSTRUCTION RISKS	MAINTENANCE/CLEANING RISKS	DEMOLITION/ADAPTATION RISKS
IN ADDITION TO THE HAZARDS/RISKS NORMALLY ASSOCIATED WITH THE TYPES OF WORK DETAILED ON THIS DRAWING, TAKE NOTE OF THE ABOVE. IT IS ASSUMED THAT ALL WORKS ON THIS DRAWING WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROVED METHOD STATEMENT.		
SAFETY HEALTH AND ENVIRONMENTAL INFORMATION BOX		

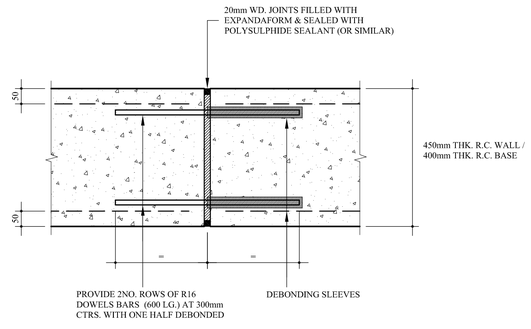
PROPOSED PLAN ON NEW R.C. RETAINING WALL
(SCALE 1:50)



TYPICAL SECTION 'THRU' RET. WALL
(SCALE 1:20)



TYPICAL REBAR
(SCALE 1:20)



'CJ' DETAIL - (WALL & BASE)
(SCALE 1:10)

PRELIMINARY

GENERAL NOTES :-

NO DIMENSIONS TO BE SCALED OFF THIS DRAWING.

ALL DIMENSIONS TO BE CHECKED ON SITE BY CONTRACTOR.

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MASONRY / CONCRETE NOTES :-

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ALL NEW CONCRETE TO BE A C40 READY MIX DESIGN IN ACCORDANCE WITH BS8110.

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ALL FABRIC TO HAVE 400mm MIN. LAPS UNLESS STATED OTHERWISE.

ALL H12 DIA. BARS TO HAVE MIN. 500mm LAP.

REV	DATE	REVISION
A	DEC. '13	GENERAL UPDATE

CONTRACT
BOUNDARY RETAINING WALL, MARPLE ROAD, OFFERTON, STOCKPORT

CLIENT
GALLAGHER LTD.

TITLE
PROPOSED SITE PLAN
NEW R.C. RETAINING WALL G.A. SECTIONS & DETAILS

Johnston Consulting Engineers Ltd.
CONSULTING STRUCTURAL & CIVIL ENGINEERS

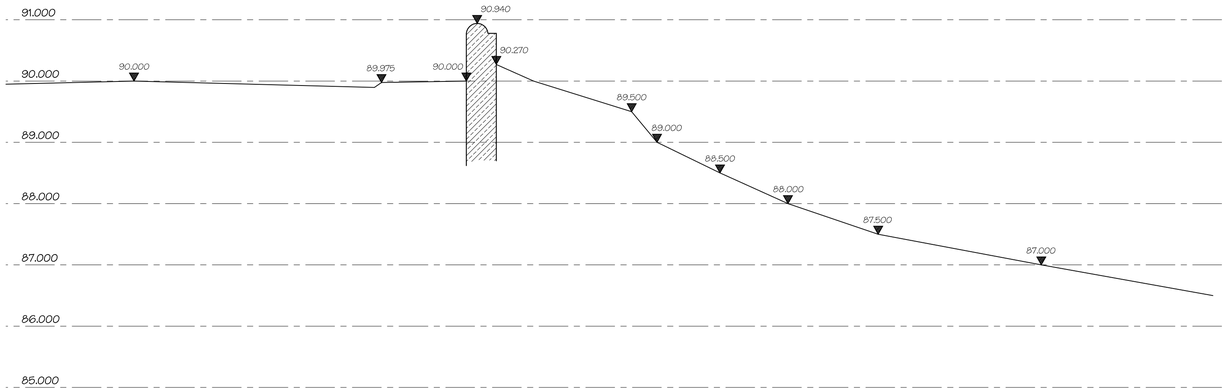
BLACKPOOL OFFICE:
41 STOCKYDALE ROAD
BLACKPOOL
LANCASHIRE
FY4 5HP
TEL: (01253) 400650

CHORLEY OFFICE:
23 QUEENS ROAD
CHORLEY
LANCASHIRE
PR7 1JU
TEL: (01257) 267272

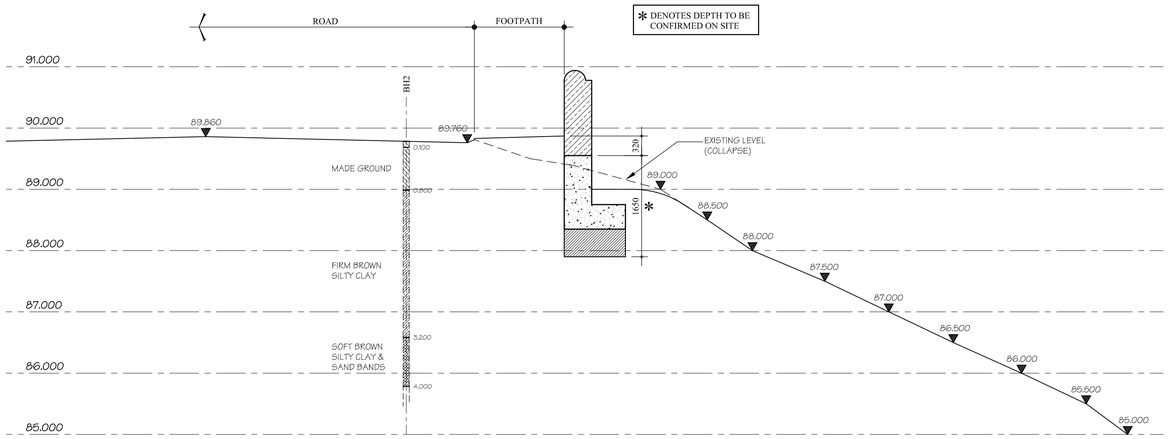
☐ ORIGIN ☑ ORIGIN

DATE OCT. 2013	DRAWN BY SW
SCALE AS SHOWN @ A1	CHECKED BY DPJ

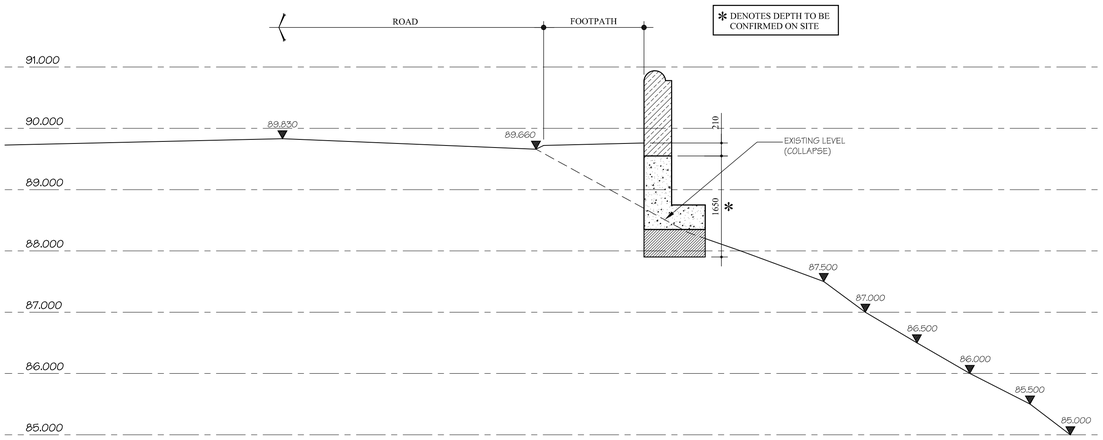
DRAWING NUMBER C/5869-02 REVISION A



SECTION 'A-A'
(SCALE 1:50)



SECTION 'B-B'
(SCALE 1:50)



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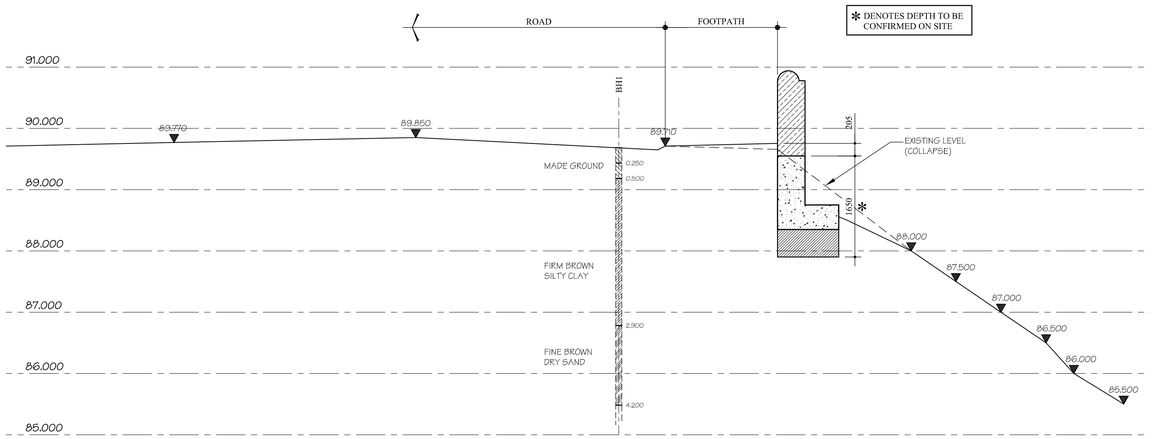

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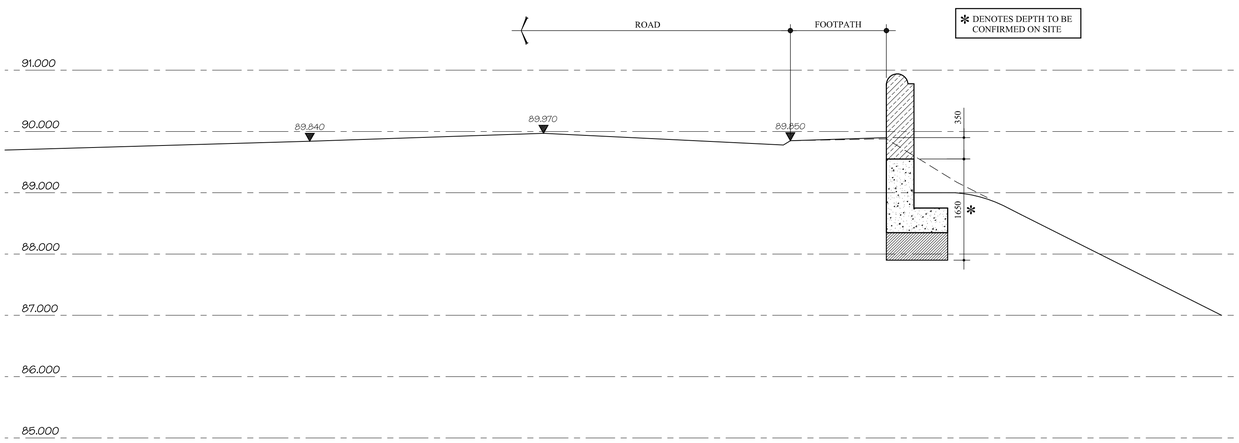

SECTION 'E-E'
(SCALE 1:50)

PRELIMINARY

REV	DATE	REVISION

CONTRACT
BOUNDARY RETAINING WALL,
MARPLE ROAD, OFFERTON,
STOCKPORT

CLIENT
GALLAGHER LTD.

TITLE
PROPOSED SITE SECTIONS
SHOWING NEW R.C. RETAINING WALL

Johnston Consulting Engineers Ltd.
CONSULTING STRUCTURAL & CIVIL ENGINEERS

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CHORLEY
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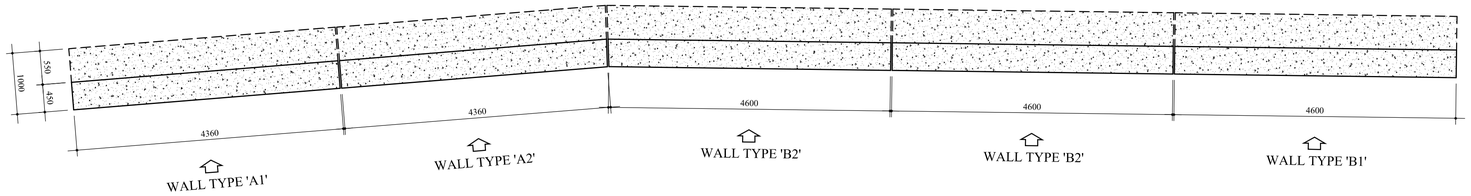
TEL: (01257) 267272

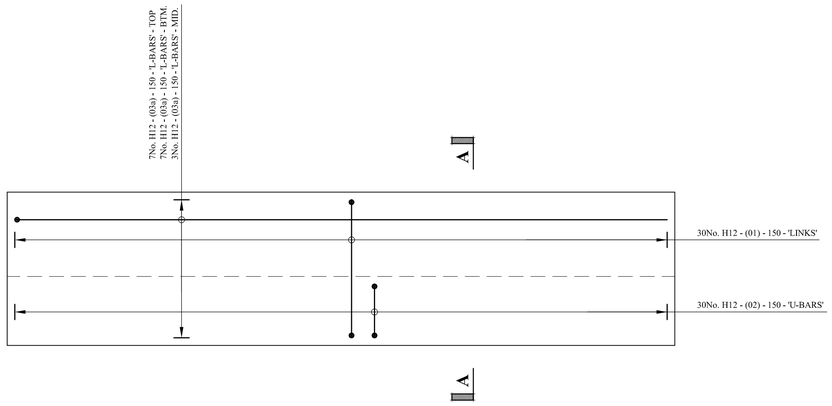
☐ ORIGIN ☑ ORIGIN

DATE	NOV. 2013	DRAWN BY	SW
SCALE	AS SHOWN @ A1	CHECKED BY	DPJ

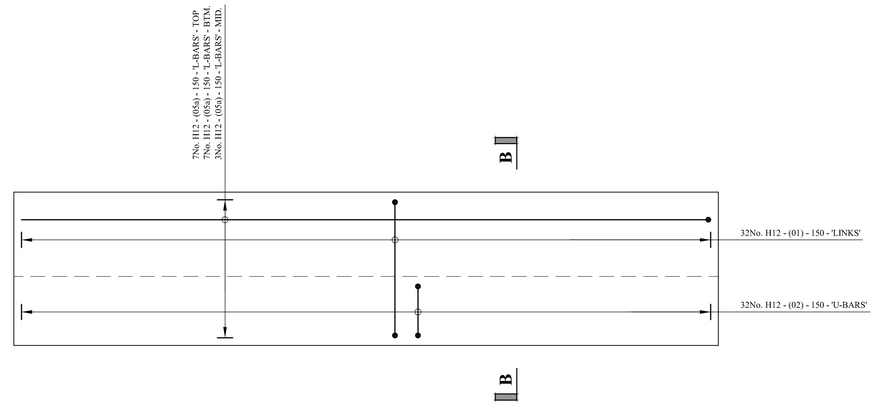
DRAWING NUMBER C/5869-03 REVISION



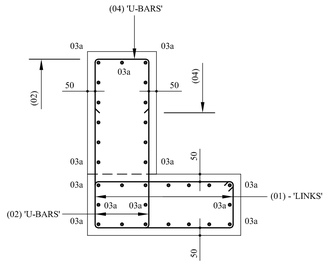
PLAN ON RETAINING WALL
(SCALE 1:50)



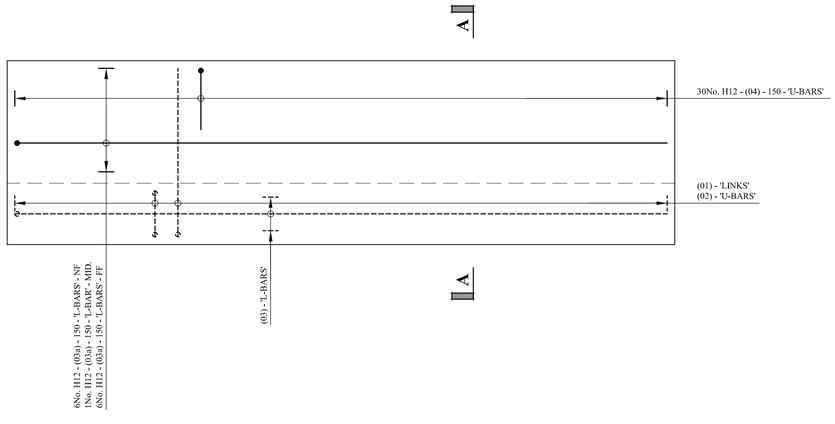
WALL TYPE 'A1' - BASE (TYPE 'A2' SIMILAR)
(SCALE 1:20)



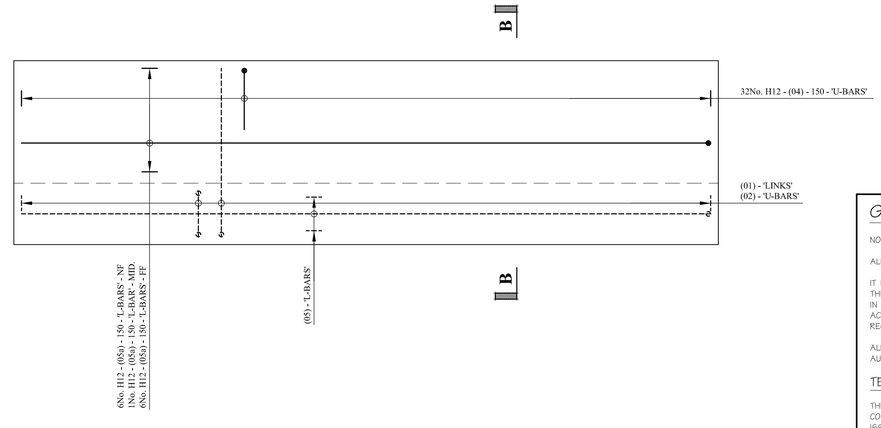
WALL TYPE 'B1' - BASE (TYPE 'B2' SIMILAR - 2NO.)
(SCALE 1:20)



SECTION 'A-A' ('B-B' SIMILAR)
(SCALE 1:20)



WALL TYPE 'A1' - STEM (TYPE 'A2' SIMILAR)
(SCALE 1:20)



WALL TYPE 'B1' - STEM (TYPE 'B2' SIMILAR - 2NO.)
(SCALE 1:20)

GENERAL NOTES :-

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FOR REINFORCEMENT REFER TO BAR BENDING SCHEDULE C5869-BBS-04 - SHEET 01.

REV	DATE	REVISION

CONTRACT
BOUNDARY RETAINING WALL, MARPLE ROAD, OFFERTON, STOCKPORT

CLIENT
GALLAGHER LTD.

TITLE
RETAINING WALL REINFORCEMENT

Johnston Consulting Engineers Ltd.
CONSULTING STRUCTURAL & CIVIL ENGINEERS

BLACKPOOL OFFICE:
41 STOCKYDALE ROAD
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CHORLEY OFFICE:
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PR7 1JU

TEL: (01257) 267272

☐ ORIGIN ☑ ORIGIN

DATE	NOV. 2013	DRAWN BY	SW
SCALE	AS SHOWN @ A1	CHECKED BY	DPJ

DRAWING NUMBER C/5869-04 | REVISION

APPENDIX C – RETAINING WALL DESIGN CALCULATIONS PREPARED BY JOHNSTON CONSULTING ENGINEERS LTD (PROVIDED BY SMBC)

Johnston Consulting Engineers Ltd.
CONSULTING STRUCTURAL & CIVIL ENGINEERS

JOB NO. c/5869.
SHEET/~~SKETCH NO.~~ 01.
CONTRACT MARPLE RD, STOCKPORT
BY DPJ.
DATE NOV.13.

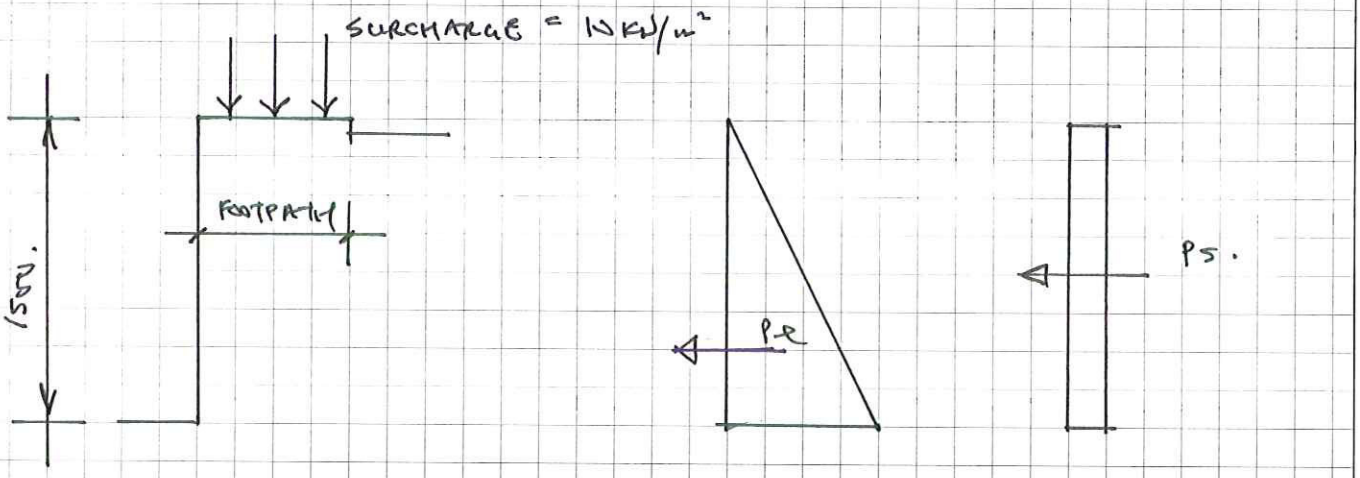
RETAINING WALL.

RETAINED HEIGHT APPROX. 1.50m.

WITH REFERENCE TO BD/2/12. CATEGORY 0 APPLICABLE. AIP NOT REQD.

DESIGN IN ACCORDANCE WITH:-

BS. 6399 : LOADING
BS. 8110 : CONCRETE.



γ. EARTH = 18 KN/m³
ϕ = 0.33

RETAINED MATERIAL MIXTURE OF FILL / SANDY CLAY.

MAX. EARTH PRESS. = $18 \times 0.33 \times 1.50 = 8.91$ KN/m²

$\therefore Pe = 8.91 \times 1.50/2 = 6.7$ KN.

SURCHARGE - $h/e = 10/18 = 0.550$m

MAX. SURCH. PRESS = $18 \times 0.33 \times 0.550 = 3.30$ KN/m²

$\therefore Ps = 3.30 \times 1.50 = 4.95$ KN.

23 Queens Road, Chorley, Lancashire, PR7 1JU
41 Stockydale Rd, Blackpool, Lancashire, FY4 5HP
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Tel: 01253 400650

Johnston Consulting Engineers Ltd.

CONSULTING STRUCTURAL & CIVIL ENGINEERS

JOB NO. c/5869

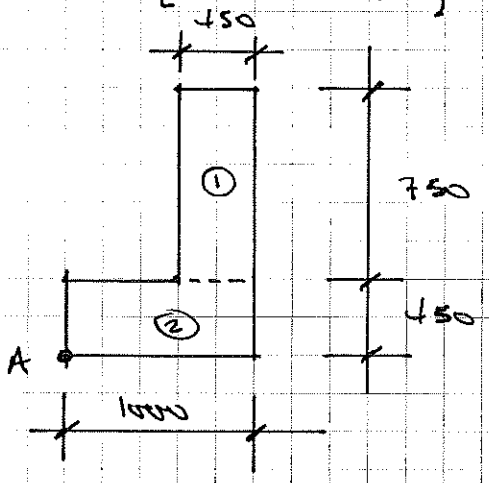
SHEET/~~SKETCH NO.~~ 02

CONTRACT MARPLE RD.

BY DPJ.

DATE NOV. 13.

OTM = $\left[6.7 \times 1.50/3\right] + \left[4.95 \times \frac{1.50}{2}\right]$ = 7 KNm



LOAD FROM STONE WALL ON TOP. γ STONE = 21 KN/m³

LOAD = 21 × 0.45 × 1.0 = 9.45 KN/m.

LOADS.

				La	A↓	
①	24 × 0.45 × 0.75	=	8.10	× 0.775	=	6.28
②	24 × 0.45 × 1.0	=	10.80	× 0.50	=	5.40
STONE		=	9.45	× 0.775	=	7.32
			28.35 KN/m			19 KNm

∴ FOS. = 19/7 = 2.7 ∴ OK.

$\bar{x}$ = 19/28.35 = 0.67 m ∴ e = 0.17m

(D/6 = 0.17) ∴ WITHIN MIDDLE 1/3.

∴ GBP. = $\frac{28.35}{1.0 \times 1.0} \pm \frac{28.35 \times 0.17 \times 6}{1.0 \times 1.0^2}$

= 28.35 ± 28.9 KN/m²

= 57 KN/m² OR 0. ∴ MAX. GBP. = 57 KN/m² (1/2 T/ft²)

∴ OK.

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CHECK SLIDING.

SLIDING FORCE = Pe + Ps.
= 6.7 + 4.95
= 11.65 KN.

TOT. VERT. LOAD = 28.35 KN.

$\mu = 0.40$

∴ RESISTANCE = $28.35 \times 0.40 = 11.34$ (< 11.65)

NOT OK.

DOWEL INTO MASS CONCRETE SUB BASE. 100W x 400 DP.

SELF WEIGHT = $24 \times 1.0 \times 0.40 = 9.6$ KN/m.

TOT. LOAD = 28.35 + 9.6 = 38 KN.

RESISTANCE = $38 \times 0.40 = 15.18$ KN

FOS. = $15.18 / 11.65 = 1.30$ (< 1.4) NOT OK.

HEIGHT OF STONE WALL ACTUALLY 1.30 m. (1m ASSUMED).

∴ ADD. LOAD = $21 \times 0.45 \times 0.30 = 2.84$ KN/m.

TOT. LOAD = 38 + 2.84 = 40.84 KN

RESISTANCE = 40.84 p 0.40 = 16.34 KN.

FOS. = $16.34 / 11.65 = 1.402$ ∴ OK.

23 Queens Road, Chorley, Lancashire, PR7 1JU Tel: 01257 267272
41 Stockydale Rd, Blackpool, Lancashire, FY4 5HP Tel: 01253 400650

REINFORCEMENT.

WALL.

BASE OF WALL AT 1.05m BELOW GL.

MAX. EARTH PRESS. = $18 \times 0.33 \times 1.05 = 6.24$ KN/m².

Pe. = $6.24 \times 1.05/2 = 3.27$ KN.

MAX. SURCH. PRESS = 3.30 KN/m²

Ps. = $3.30 \times 1.05 = 3.47$ KN.

BM. = $\left[3.27 \times \frac{1.05}{3}\right] + \left[3.47 \times \frac{1.05}{2}\right] = 2.97$ KNm

ULT. BM. = 2.97×1.50 (Yf) = 4.5 KNm

d.eff = 450 − 50 − 10 − 10 = 380mm

fy = 460 N/mm² fcu = 40 N/mm².

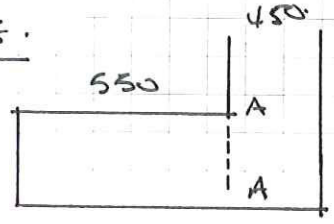
BY INSPECTION - USE MIN % STEEL.

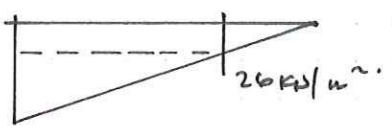
= $\frac{0.13}{100} \times 450 \times 1000 = 585$ mm².

∴ USE H12 BARS @ 150 c/c

(754).

BASE.





57KN/m².

BM ALONG A-A.

$26 \times 0.55 \times 0.275 = 3.93$

$57 \times \frac{0.55}{2} \times \frac{2}{3} \times 0.55 = 5.75$

9.7 KNm.

BY INSPECTION USE MIN % STEEL.

USE H12 BARS @ 150 c/c.

APPENDIX D – WCL RETAINING WALL STABILITY & RC DESIGN CALCULATIONS

DESIGN CALCULATION

Brindley Lodge
Adcroft Street
Stockport
SK1 3HS
www.wildecivil.co.uk
wp@wilde.uk.com

Tel: 0161 474 7479
Fax: 0161 474 7492

Wilde

Consulting Engineers

nqa ISO 9001 QUALITY MANAGEMENT

Project Title:

Warren Wood Retaining Wall Design Review

Calculation Number:	**Project Number:**	**Sheet 1 of 5**	**Date:** Jan 2023
294663-WCL-XX-XX-CA-C-0001	294-663		

Client:	**Client Project Number:**
Stockport MBC	N/A

Calculation Title:
Retaining Wall Global Stability & RC Design Calculation

Project Engineer:	**Signature:**	**Calculation Originator:**	**Signature:**
J Kok Shun	J A Kok Shun **Date:** Jan 2023	J Kok Shun	J A Kok Shun **Date:** Jan 2023
Verified By:	**Signature:**	**Approved By:**	**Signature:**
D Sinclair	D. S. **Date:** Jan 2023	D Freeman	D Freeman **Date:** Jan 2023

RECORD OF REVISION AND ISSUE

REV	DATE	DESCRIPTION	SHEET REF	BY	VERIFIED BY	APPROVED BY	DATE
0	Jan 2023	FIRST ISSUE	ALL	JKS	DJS	DRF	Jan 2023

Wilde
Brindley Lodge, Adcroft Street, Stockport, SK1 3HS
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www.wildecivil.co.uk
wp@wilde.uk.com

CALCULATION SHEET

Design By	Date	Check By	Date	Set	Page No	Rev
JKS	Jan 23	DJS	Jan 23	294-663	2	0

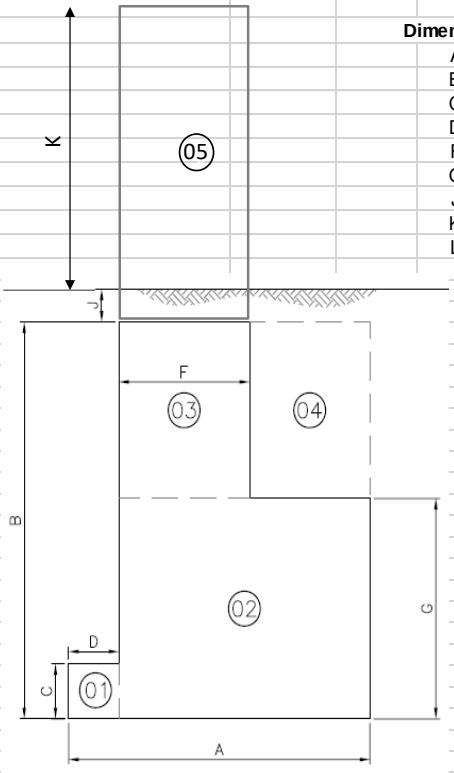
Reference	Calculations	Output
	Warren Wood RW Global Stability & RC Design	

Global Stability

(Enter data in red cells)

Material Densities and Structure Loading

Density of Reinforced Concrete	24	kN/m^3	***as per original design calcs***
Density of Backfill	18	kN/m^3	***BS 8002: Table 1 (dense gravel)***
Surcharge (normal traffic)	10	kN/m^2	***BS 5400-2: 5.8.2.1***
Density of masonry parapet	21	kN/m^3	***as per original design calcs***



Dimensions

A	1	m	width of base
B	1.65	m	retainined height of wall
C	0.85	m	thickness of toe
D	0.55	m	length of toe
F	0.45	m	thickness of upper wall
G	0	m	height of lower section of wall
J	0.1	m	distance between GL and top of wall
K	1.45	m	height of parapet above GL at top of wall
L	0.45	m	thickness of parapet above top of wall

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wp@wilde.uk.com

CALCULATION SHEET

Design By	Date	Check By	Date	Set	Page No	Rev
JKS	Jan 23	DJS	Jan 23	294-663	3	0

Reference	Calculations	Output
	Warren Wood RW Global Stability & RC Design	

Ø'd (degrees)	30										
K_a	0.33										
Founding material: Ø'd (deg)	30										

Destabilising		"Load"	h(m)	k_a	γ	Force (kN)	LA (m)	Moment (kNm)
Lateral earth pressure	σ_{max} (kN/m^2)	18	1.75	0.33	1.00	9.10	0.58	5.31
Surcharge	q_k (kN/m^2)	10	1.75	0.33	1.00	5.78	0.88	5.05
				Total:		14.87		10.36

Restoring	x	y	Area (m^2)	Density (kN/m^3)	γ	Restoring Force (kN)	LA (m)	Moment (kNm)
Concrete 1	0.85	0.55	0.47	24	1.00	11.22	0.28	3.09
Concrete 2	0.45	0.00	0.00	24	1.00	0.00	0.78	0.00
Concrete 3	1.65	0.45	0.74	24	1.00	17.82	0.78	13.81
Fill 4	0.00	1.65	0.00	18	1.00	0.00	1.00	0.00
Parapet 5	0.45	1.45	0.65	21	1.00	13.70	0.78	10.62
				Total:		42.74		27.52

Check Overturning

Overturning moment =	10.36	kNm			
Restoring moment =	27.52	kNm			
			Overturning moment FoS =	**2.66**	>2 OK

Check Sliding

Destabilising force =	14.87	kN			
From BS 8002: 3.2.6: Design tanδ_b = 0.75 x design tanø' =			0.43		
Sliding resistance = design tanδ_b x total vertical load =			18.5	kN	
			Sliding force FoS =	**1.24**	< 1.5 NOT OK

Check Bearing

x =	0.40	m			
e =	0.10	m			
D/6 =	0.17	m			
inside middle third			CP2 requires that the eccentricity of the base thrust remains within the middle third of the base width.		
Enter 1 for 'inside middle third' or enter 2 for 'outside middle thir			1		
Max Bearing Pressure	**68.0**	kN/m^2	(assuming a triangular distribution)		

Wilde
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Design By	Date	Check By	Date	Set	Page No	Rev
JKS	Jan 23	DJS	Jan 23	294-663	4	0
Reference	Calculations: Warren Wood RW Global Stability & RC Design				Output	

Reinforcement Design

In accordance with BS 5400-4: 5.6.3 “Short reinforced walls resisting moments and axial forces”.

Input:

- f_y = 460N/mm^2
- f_{cu} = 40N/mm^2
- A_s = 754mm^2/m (equivalent to 12mm diameter bars at 150mm centres)
- Cover = 50mm
- Section thickness = 450mm (stem), 400mm (base)
- Width of section = 1000mm (assume a metre width)

Bending moment designed in accordance with 5.3.2:

For sections without compression reinforcement the ultimate moment of resistance may be taken as the lesser of:

(Eq 1) $M_u = (0.87f_y)A_sz$, or

(Eq 2) $M_u = 0.15f_{cu}bd^2$

Consider 450mm thick stem section:

Take Eq 1:

$z = (1 – (1.1f_yA_s) / (f_{cu}bd)) d$

$d = 450 – 50 – 12/2 = 394mm$

$z = (1 – (1.1x460x754) / (40x1000x394)) x 394 = 384mm$

$0.95d = 374mm$

Therefore, take z = 374mm

$M_u = (0.87x460) x 754 x 374 x 10^{-6} = 112.9kNm/m$

Take Eq 2:

$M_u = 0.15 x 40 x 1000 x 394^2 x 10^{-6} = 931.4kNm/m$

Therefore, M_u = 112.9kNm/m

Wilde
Brindley Lodge, Adcroft Street, Stockport, SK1 3HS
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www.wildecivil.co.uk
wp@wilde.uk.com

CALCULATION SHEET

Design By	Date	Check By	Date	Set	Page No	Rev
JKS	Jan 23	DJS	Jan 23	294-663	5	0
Reference	**Calculations** Warren Wood RW Global Stability & RC Design				**Output**	

Shear resistance designed in accordance with 5.4.4.1:

$v = V / (bd) \Rightarrow V = v.bd$

No shear reinforcement is required when the stress, v, is less than $\xi_c v_c$.

$\xi_c = 1.05$ (Table 9)

$v_c = (0.27/1.25) \times (100 \times 754 / (1000 \times 394))^{1/3} \times 40^{1/3} = 0.216 \times 0.576 \times 3.42 = 0.426$ (Table 8)

$V = 1.05 \times 0.426 \times 1000 \times 394 \times 10^{-3} = 176.2$kN/m

Therefore, V_u = 176.2kN/m

<u>Consider 400mm thick base section:</u>

Bending moment:

Take Eq 1:

$z = (1 - (1.1 f_y A_s) / (f_{cu} bd)) d$

$d = 400 - 50 - 12/2 = 344$mm

$z = (1 - (1.1 \times 460 \times 754) / (40 \times 1000 \times 394)) \times 344 = 334$mm

$0.95d = 327$mm

Therefore, take $z = 327$mm

$M_u = (0.87 \times 460) \times 754 \times 327 \times 10^{-6} = 98.7$kNm/m

Take Eq 2:

$M_u = 0.15 \times 40 \times 1000 \times 344^2 \times 10^{-6} = 710.0$kNm/m

Therefore, M_u = 98.7kNm/m

Shear resistance designed in accordance with 5.4.4.1:

$v = V / (bd) \Rightarrow V = v.bd$

No shear reinforcement is required when the stress, v, is less than $\xi_c v_c$.

$\xi_c = 1.05$ (Table 9)

$v_c = (0.27/1.25) \times (100 \times 754 / (1000 \times 344))^{1/3} \times 40^{1/3} = 0.216 \times 0.603 \times 3.42 = 0.445$ (Table 8)

$V = 1.05 \times 0.445 \times 1000 \times 344 \times 10^{-3} = 160.7$kN/m

Therefore, V_u = 160.7kN/m

APPENDIX E – DRILLERS LOGS (PROVIDED BY SMBC)

SUB SURFACE 3 Peel Street, Preston, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Cable Percussion Boring Daily Record — **Borehole No.** 1

Site Name: MAPLE RD STOCKPORT | Job No: 5802 | Day: FRIDAY | Date: 8/11/013 | Sheet 1 of 3

Depth (m)	Description	Sample/Test Type	Sample/Test No.	Depth (m) From	Depth (m) To	U Samples Blows	U Samples Length	Standard Penetration Tests 1	2	3	4	5	6	Pen	Casing Depth (m)	Water Level (m)
GL	Start of Shift	J	535	0.50												
	TARMAC	B	536	0.50	1m											
0.25		U	537	1.20	1.70	30									1.20	Dry
	STONE FILL	J	538	1.70												
0.50		J	539	1.80												
	FIRM BROWN SILTY CLAY	U	540	2m	2.50	40									2m	Dry
2.90		J	541	2.50												
	FINE BROWN DRY	J	542	2.90												
	SAND	S/B	543 544	3m	3.45		0.45	2	3	3	4	3	3		3m	2.60
4.20		J	545	3.80												
	DENSE FINE BROWN SAND	S/B	546 547	4m	4.45		0.45	3	4	6	8	10	11		4m	3.10
5.30		J	548	4.80												
	FIRM BROWN SANDY	S/B	549 550	5m	5.45		0.45	3	4	5	5	5	6		5m	Dry
	LAMINATED CLAY	J	551	5.80												
7.70		U	552	6m	6.50	69									6m	Dry
	DRY FINE BROWN SAND	J	553	6.50												
9.60		J	554	7.80												
	FINE BROWN SAND &	S/B	555 556	8m	8.45		0.45	4	5	7	8	9	11		8m	7.20
	SMALL MEDIUM GRAVEL &	J	557	8.80												
	COBBLES.	S/B	558 559	9m	9.45		0.45	2	3	5	8	8	13		9m	8.10
		J	560	10m												
		S/B	561	10.50	10.95		0.45	3	4	6	9	8	10		10.50	8.20
10.95	End of Shift - Borehole Complete/Incomplete ✓														10.50	8.20

Chiselling

Depth (m) From	Depth (m) To	Time From	Time To	Hours

Water Entries	1	2	3
Depth Struck			
Casing Depth			
Depth 5 mins			
Depth 10 mins			
Depth 15 mins			
Depth 20 mins			
Cut off at			

Water Added	From	To	Qty
Water Added	2.90	4.20	
	7.70	10.95	
Borehole Kept Full			

Piezometer/Standpipe	From	To
Porous Element/Tip		
Slotted Pipe		
Filter		
Bentonite Seal		
Grout/Backfill		

Remarks: (standing time, dayworks, visitors, weather etc.)
FROM 8-0AM TO 9AM WAITING FOR CLEARANCE OF BHS
9-0AM TO 10AM TRIAL PIT

Driller: S. MOSS | Rig: NO 1 | Borehole Diameter (mm) 0.150 | BH No. 1

Crew: S. HEWITT | Additional Equipment:

Completed: BH Yes / No ✓ | Job Yes / No ✓ | Backfill: No

Total Number of Samples

SPT	U	D	B	W	P	Other
6	3	12	7	/		

Driller's Signature: James Moss

Job For: GALLAGHER LTD | Approved:

SUB SURFACE 3 Peel Street, Preston, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Cable Percussion Boring Daily Record

Borehole No. 1

Site Name: MAPLE RD STOCKPORT.

Job No: 5802 | Day: FRIDAY | Date: 8/11/13

Sheet 1 of 3

Depth (m)	Description	Sample/Test Type	Sample/Test No.	Depth (m) From	Depth (m) To	U Samples Blows	U Samples Length	Standard Penetration Tests 1	2	3	4	5	6	Pen	Casing Depth (m)	Water Level (m)
10.50	Start of Shift	J	563	11.50												
	FINE BROWN SAND & SMALL MEDIUM GRAVEL & FINE BROWN GRAVEL & COBBLES.	C		12m	12.45		0.45	9	6	11	10	10	13		12m	11.30.
12m																
12m	End of Shift - Borehole Complete/Incomplete ✓														12m	11.30

Chiselling

Depth (m) From	Depth (m) To	Time From	Time To	Hours

Water Entries	1	2	3
Depth Struck			
Casing Depth			
Depth 5 mins			
Depth 10 mins			
Depth 15 mins			
Depth 20 mins			
Cut off at			

Water Added	From	To	Qty
Water Added	7.70	12m	
Borehole Kept Full			

Piezometer/Standpipe	From	To
Porous Element/Tip		
Slotted Pipe		
Filter		
Bentonite Seal		
Grout/Backfill		

Remarks: (standing time, dayworks, visitors, weather etc.)

Driller: S. MOSS

Crew: S. HEWITT

Completed: BH Yes / No ✓ | Job Yes / No ✓

Backfill: NO.

Rig: NO 1

Additional Equipment:

Borehole Diameter (mm) 0.150

BH No 1

Total Number of Samples

SPT	U	D	B	W	P	Other
1		1				

Driller's Signature James Moss.

Job For: GALLAGHER LTD

Approved:

SUB SURFACE 3 Peel Street, Preston, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

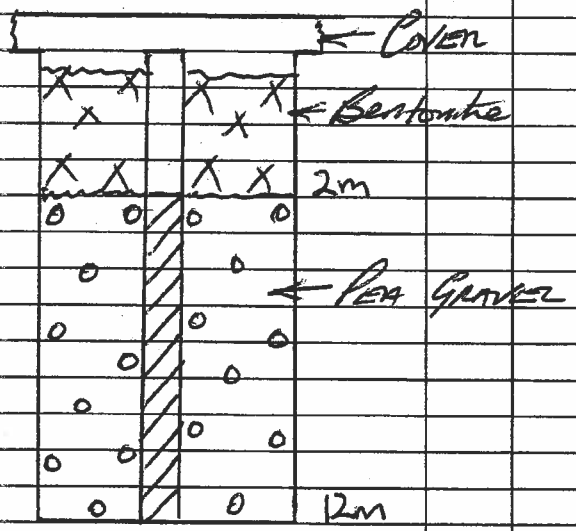
Cable Percussion Boring Daily Record

Borehole No. 1

Site Name: MAPLE RD STOCKPORT.

Job No: 5802 | Day: MONDAY | Date: 11/11/2013

Sheet 2 of 3

Depth (m)	Description	Sample/Test Type	Sample/Test No.	Depth (m) From	Depth (m) To	U Samples Blows	U Samples Length	Standard Penetration Tests 1	2	3	4	5	6	Pen	Casing Depth (m)	Water Level (m)
	Start of Shift															
																
	End of Shift - Borehole Complete/Incomplete															

Chiselling

Depth (m) From	Depth (m) To	Time From	Time To	Hours

Water Entries	1	2	3
Depth Struck			
Casing Depth			
Depth 5 mins			
Depth 10 mins			
Depth 15 mins			
Depth 20 mins			
Cut off at			

Water Added	From	To	Qty
Water Added			
Borehole Kept Full			

Piezometer/Standpipe	From	To
Porous Element/Tip		
Slotted Pipe		
Filter		
Bentonite Seal		
Grout/Backfill		

Remarks: (standing time, dayworks, visitors, weather etc.)

INSTALLATION 1HR ALSO INCLUDES TARMACING TRIAL PIT.

Driller: S. MOSS | Rig: NO 1 | Borehole Diameter (mm) 0·150

Crew: S. HEWITT | Additional Equipment:

Completed BH Yes	Completed BH No	Completed Job Yes	Completed Job No	Backfill:
✓			✓	No

Total Number of Samples SPT	U	D	B	W	P	Other

BH No. 1

Driller's Signature James Moss.

Job For: JOHNSTON CONSULTING.

Approved:

SUB SURFACE 3 Peel Street, Preston, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Cable Percussion Boring Daily Record

Borehole No. 2

Site Name: MARPLE RD STOCKPORT | Job No: 5802 | Day: MONDAY | Date: 11/11/2013 | Sheet 1 of 3

Depth (m)	Description	Sample/Test Type	Sample/Test No.	Depth (m) From	Depth (m) To	U Samples Blows	U Samples Length	Standard Penetration Tests 1	2	3	4	5	6	Pen	Casing Depth (m)	Water Level (m)
GL	Start of Shift	J	564	0.80												
	TARMAC	B	565	0.80	1.20											
0.10		U	566	1.20	1.70	40									1.20	Dry
	STONE FILL	J	567	1.70												
0.80		J	568	1.80												
	FIRM BROWN SILTY	S/B	569 570	2m	2.45		0.45	2	3	4	3	3	3		2m	Dry
	CLAY	J	571	2.80												
3.20		U	572	3m	3.50	30									3m	"
	SOFT BROWN SILTY CLAY	J	573	3.50												
	& SAND BANDS.	J	574	3.80												
4m		U	575	4m	4.50	41									4m	3.80
	FIRM BROWN SILTY SANDY	J	576	4.50												
	LAMINATED CLAY	J	577	4.80												
7.30		U	578	5m	5.50	43									5m	Dry
	FINE BROWN DRY SAND.	J	579	5.50												
		J	580	6m												
		U	581	6.50	7m	40									6.50	Dry
8.70		J	582	7m												
	SMALL MEDIUM GRAVEL &	J	583	7.30												
	FINE BROWN SAND.	S/B	584 585	7.50	7.95		0.45	4	5	7	9	9	10		7.50	Dry
		J	586	8.80												
		C/B	587	9m	9.45		0.45	4	6	6	8	11	10		9m	Dry
9.45	End of Shift - Borehole Complete/Incomplete ✓														9m	Dry.

Chiselling

Depth (m) From	Depth (m) To	Time From	Time To	Hours

Water Entries	1	2	3
Depth Struck	3.80		
Casing Depth	3.50		
Depth 5 mins	SLOW		
Depth 10 mins	NO RISE.		
Depth 15 mins			
Depth 20 mins			
Cut off at			

Water Added	From	To	Qty
Water Added	7.30	9.45	
Borehole Kept Full			

Piezometer/Standpipe	From	To
Porous Element/Tip		
Slotted Pipe		
Filter		
Bentonite Seal		
Grout/Backfill		

Remarks: (standing time, dayworks, visitors, weather etc.)
TRIAL PIT 1452.

Driller: J. MOSS.
Crew: S. HEWITT
Rig: NO 1
Additional Equipment:
Borehole Diameter (mm) 0.150

Completed BH Yes	Completed BH No	Completed Job Yes	Completed Job No	Backfill:
	✓		✓	

Total Number of Samples

SPT	U	D	B	W	P	Other
3	5	13	4	—		

BH No. 2

Driller's Signature James Moss.

Job For: JOHNSTON CONSULTING.

Approved:

SUB SURFACE 3 Peel Street, Preston, PR2 2QS. Tel: (01772) 561135 Fax: (01772) 204907

Cable Percussion Boring Daily Record

Borehole No. 2

Site Name: MAPLE RD STOCKPORT | Job No: 5802 | Day: MONDAY | Date: 11-11-2013 | Sheet 1 of 3

Depth (m)	Description	Sample/Test Type	Sample/Test No.	Depth (m) From	Depth (m) To	U Samples Blows	U Samples Length	Standard Penetration Tests 1	2	3	4	5	6	Pen	Casing Depth (m)	Water Level (m)
9.45	Start of Shift	J	588	11.50												
	SMALL MEDIUM GRAVEL & FINE BROWN SAND & COBBLES.	C		12m	12.45		0.45	8	7	8	9	9	10		12m	16.76
12.45																
12.45	End of Shift - Borehole Complete/Incomplete														12m	16.76

Chiselling

Depth (m) From	Depth (m) To	Time From	Time To	Hours

Water Entries	1	2	3
Depth Struck			
Casing Depth			
Depth 5 mins			
Depth 10 mins			
Depth 15 mins			
Depth 20 mins			
Cut off at			

Water Added	From	To	Qty
Water Added	11.50	12m	
Borehole Kept Full			

Piezometer/Standpipe	From	To
Porous Element/Tip		
Slotted Pipe		
Filter		
Bentonite Seal		
Grout/Backfill		

Remarks: (standing time, dayworks, visitors, weather etc.)
BH BACKFILLED & CLEANED UP PLUS TARMACED TRIAL PIT 3/4HR.

Driller: S. MOSS.
Crew: S. HEWITT
Completed: BH Yes ✓ / No; Job Yes ✓ / No
Backfill: YES

Rig: NO 1
Additional Equipment:
Borehole Diameter (mm) 0.150

Total Number of Samples

SPT	U	D	B	W	P	Other
1	/	1	-			

BH No. 2

Driller's Signature: James Moss.
Job For: JOHNSTON CONSULTING.
Approved:

APPENDIX F – CONSTRUCTION RECORDS (HANDWRITTEN SITE NOTES PROVIDED BY SMBC)

MARPLE RD RETAINING WALL

TOP OF SHEET PILES 50mm LOWER THAN CARRIAGEWAY

STOCKPORT ← → MARPLE

PLAN

FRONT SHEETS

BACK SHEETS

2100 mm DIPS 2700 mm DIPS 2100 mm DIPS 1650 mm

MEASURES ABOVE FROM FORMATION LEVEL TO TOP OF BACK SHEET PILES

* GROUND CONDITIONS (WET) = DOWN TO SANDY CLAY (FIRM UNDER FOOT)

CONCRETE FOUNDATIONS POURED ON 16/12/2013

* MAWSONS BOSS ■ INSTRUCTED NOT TO GO FULL EXTENT AND STOP SHORT OF DOUBLE BY MANHOLE

SHORT BY = 6.30m LENGTH

STOCKPORT

MAR

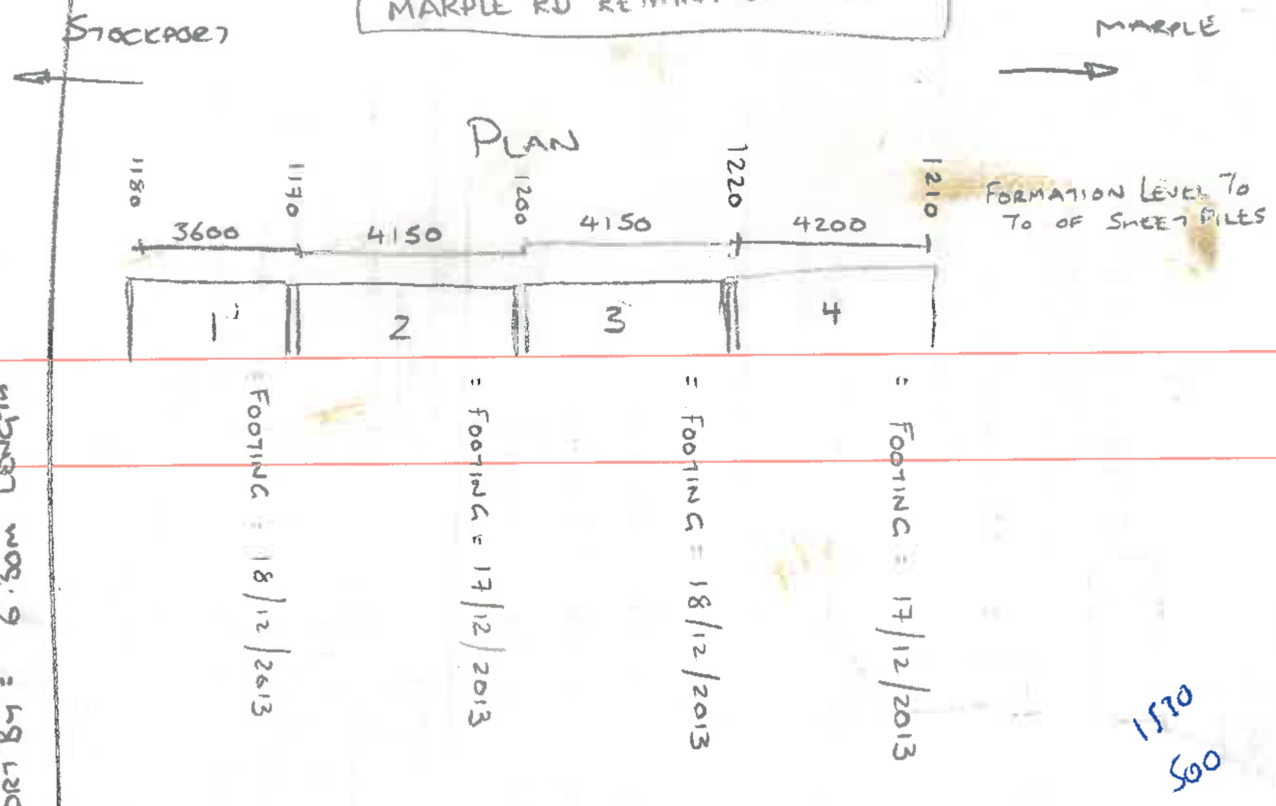
1180 1140

3600 4150

1 2

FOOTING 18/12/2013

MARPLE RD RETAINING WALL



* MAWSONS BOSS INSTRUCTED NOT TO GO FULL EXTENT AND STOP SHORT OF DOUBLE BT MANHOLE

SHORT BY = 6.30M LENGTH

STOCKPORT ← **MARPLE RD RETAINING WALL** → MARPLE

COPING : 0.2m WIDE

DEPTH OF STEM TO BASE = 840mm

840mm | 830mm | 840mm

WIDTH OF STEM = 560mm

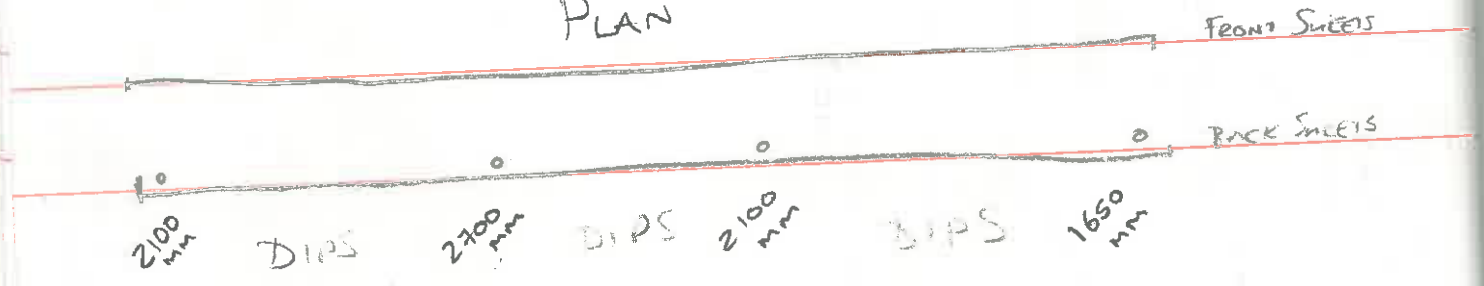
560mm | 650mm | 790mm

MARPLE RD RETAINING WALL

TOP OF SHEET PILES 50MM LOWER THAN CARRIAGEWAY

STOCKPORT ← MARPLE →

PLAN



MEASURES ABOVE FROM FORMATION LEVEL TO TOP OF BACK SHEET PILES

* GROUND CONDITIONS (WET) - DOWN TO SANDY CLAY (FIRM UNDER FOOT)

CONCRETE FOUNDATIONS POURED ON 16/12/2013

APPENDIX G – WCL SITE VISIT PHOTOLOG (JANUARY 2023)

Photo 1:

General view along the top of the wall looking east (towards Marple).

Photo 2:

General view along the top of the wall looking west (towards Stockport).

Photo 3:

Gap between sheet piles (temporary works) and concrete wall / stone masonry parapet.

Note: evidence of bituminous material on stone masonry where the footpath used to abut.

Note: no back of wall drainage.

Photo 4:

Close-up of back of footway / sheet pile.

Photo 5:

General view along the drop-side elevation of the wall. Note: stone cladding to face of wall, which is not indicated on the scheme drawings.

Photo 6:

Well-developed sapling/tree growth typical along the bottom of the retaining wall (roots buried within the fill material to the top of the retaining wall toe.

Photo 7:

Concrete toe to drop-side of retaining wall covered in foliage / mulch. Note: sheet pile profile to concrete toe. Sheet piles no longer present on site.

Photo 8:

Base of wall at the west end, beyond the beginning of the 2013 concrete wall. Note: ~100mm gap between front face of wall and soil, which may indicate movement of the slope.

Photo 9:

View on PVC drainage pipe projecting from the concrete toe of the wall. Note: it is unknown what the intention of this pipe is or what area it picks up.

Photo 10:

View looking over the parapet from footway. Note: steep, heavily vegetated embankment.

Photo 11:

View looking over the parapet from footway. Note: steep, heavily vegetated embankment.

Photo 12:

Large mature tree growth predominantly vertical, however, a slight lean to towards the downside of the slope was noted.

Photo 13:

2no large mature tree growths in the distance appear to the leaning towards the downside of the embankment.