

Proposed Piling Strategy for

Residential Development, Herbert Road, Newport

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Signed

Steve Morgan B.Eng (Hons) M.I.C.E.

Date... 19.03.2018



1.0 INTRODUCTION

Steve Morgan Associates Limited (SMA) were appointed by POBL Group to design and detail the proposed Civil and Structural elements of the proposed redevelopment at Herbert Road, Newport.

The purpose of this report is to detail the piling strategy for the development.

2.0 DESCRIPTION OF EXISTING SITE

The site is located at:

Land To South Of Glan Usk Primary School

Herbert Road

Newport

The National Grid Reference for the site is ST 31608 88970 (E 331608 N 188970).

A site plan is included within Appendix A. It is bounded to the west by the river Usk, and to east by the residential properties off Courtney Street & Morgan Street, the industrial area off Herbert Road & Crawford Street and the Welsh Marches Railway line.

As part of the development, the site is being raised. The fill material has been monitored by Terra Firma. The sequence of the filling to the site has also been agreed with POBL and carried out in accordance with the specification set out by Terra Firma.

The site is currently under construction with phase 1 of the development nearing completion. The site was formerly utilised for industrial development.



3.0 DESCRIPTION OF PROPOSED DEVELOPMENT

Subject to approval of planning permission(s), the site is to be occupied by a large residential development. The Phase 1 works (currently under construction) consist of;

- construction of the site access road including ancillary enabling works
- construction of three apartment blocks
- enlargement of the existing re-en/drainage channel.

Phases 2, 3 & 4;

- construction of 206 residential units.

4.0 PILING STRATEGY

Phases 2 and 3

Based on the site investigation report reference 12032 prepared by Terra Firma (Wales) Limited, the following is recommended with regard to the proposed foundations: -

Due to the presence of soft clay bands beneath the site, traditional shallow foundations are not recommended. Such foundations are likely to lead to high total and differential settlements.

A piled foundation is advised for the proposed residential properties. Precast concrete driven piles founded within the underlying very weak red brown and grey mudstone are recommended.

An extract of the report is included as Appendix 1.0.

Due to the increase in the level of the site to comply with the requirements of the Floor Risk Assessment, the piling is to be installed through the increased ground levels. A piling mat was therefore incorporated into the fill material. The design of the piling mat was based on the plate load tests undertaken by Terra Firma (Wales) (TF). A copy of the results is included as Appendix 2.0. A copy of the piling mat design, undertaken by SMA and based on the TF tests, is enclosed as Appendix 3.0.



Phases 2 and 3 (Cont.....)

The layout of the piles and associated loading will be calculated by SMA. A detailed piling layout will be provided for each plot together with pile loads. The piles will then be designed by the chosen piling contractor. Based on initial calculations, it is considered that the loads will not exceed those advised in the TF report in Appendix 1.0.

Phase 4

Phase 4 of the development is located to the west of the site and is bounded the access road to its full perimeter. Phase 4 can be seen in Appendix 4.0. A main sewer was identified as traversing the site. The sewer is approximately 25m below ground level. Details of the line of the sewer has been provided by DCWW. The line has also been plotted on the proposed development drawing attached within Appendix 4. The drawing prepared by SMA provides a section through the site incorporating the location and depth of the sewer.

Discussions with DCWW were undertaken to establish the parameters for the design of the residential units over the sewer. Discussions were also undertaken with Roger Bullivant (RB) piling contractors. The ground conditions at this location comprise a competent St Maughan's formation mudstone at between 10.2m and 12.9m below the existing ground level.

In view of the relatively shallow depth of the mudstone compared to the depth of the sewer, it was considered that a piled solution would be suitable. To reduce the surcharge over the pipe, RB proposed friction piles of 323mm diameter with a steel casing. Friction piles work on a different principle to end bearing piles where the loads are transmitted to the competent material at the base of the pile. The friction pile transfers the load of the structure to the soil across the full length of the pile by friction, i.e. the entire surface of the pile, which is cylindrical in shape, works to transfer the forces to the soil hence minimising the direct vertical loads.

RB provided a method statement, attached as Appendix 5.0. In order to ensure that the method statement was acceptable, the proposals were reviewed by TF. A copy of the comments is attached as Appendix 6.0.



Phase 4 (Cont....)

The proposals were submitted to DCWW for comment. These proposals were referred to independent consultants appointed by DCWW. It is understood that the proposals were considered to be acceptable. The submission is currently being progressed to technical approval. A copy of the comments from the technical report prepared by SWECO on behalf of DCWW is attached as Appendix 7.0. The report, in summary, agrees with the proposed principles and recommends a survey of the sewer to assess the capacity of the sewer considering its age and potential deterioration. It is further understood that DCWW have commented that inspection is unlikely due to the pipe running at near full capacity.

Proposals have also been discussed with DCWW with regard to the foul sewer running parallel to Plot 46. Due to the depth of the sewer, the easement will encroach on to Plot 46 and the car parking spaces at the rear of Plot 46 (See Appendix 8.0). Discussions have been undertaken with DCWW on site. It has been agreed that a contiguous piled foundation parallel to the sewer will ensure that then pipe can be maintained in the event of any damage. The contiguous piled wall is required to the car park boundary only. Reference should be made to the letter received from DCWW dated 01 March 2018 (See Appendix 9.0) confirming acceptance of the proposals in principle subject to the preparation of additional details, particularly with reference to the works in the proximity of Plot 46.



Appendix 1.0

Extract from Terra Firma (Wales) report ref 12032



8.3 Foundation and Floor Slab Solution

Due to the presence of soft clay bands beneath the site traditional shallow foundations are not recommended. Such foundations are likely to lead to high total and differential settlements.

A piled foundation is advised for the proposed residential properties. Precast concrete driven piles founded within the underlying very weak red brown and grey mudstone are recommended.

For a 275mm square precast concrete pile driven to an appropriate set within the underlying gravels a safe working load of typically 500kN should be achieved. Based upon the site investigation data, pile lengths should vary between 12m and 15m beneath current ground levels. Following placement of the fill piles lengths will be increase to approximately 14 and 17m.

The estimated working loads, pile type and lengths should be confirmed by a specialist piling contractor. It may be prudent to test drive piles at select locations.

For the quoted pile size, founded within the competent gravels, total settlements should not exceed 10mm with differential movements between adjacent piles being less than half this value.

Allowances should be made for re-driving piles should buried obstructions be encountered.

Floor slabs should be designed as suspended.

Measurements should be kept on pile vibrations during driving. Measures should also be taken to dampen such vibrations. If, however, vibrations exceed permissible values then consideration should be given to using a contiguous flight auger (cfa)/bored pile solution.

Network Rail may also require a bored pile solution close to the railway.

As stated in Section 8.2, the site is to be raised by between 1.0 and 2.0m. Consolidation settlements of between 100 to 200mm have been estimated.

As the building foundations are to be piled this will result in differential settlements between the development infrastructure and the buildings of a similar order.

Therefore either the development is designed to accommodate this level of differential settlement with flexible constructions and service entries into buildings or alternatively the fill is placed prior to development and allowed to settle prior to construction. The settlement process can be speeded up by surcharging the site by 'over filling'. Should this be the desired option then appropriate instrumentation should be installed to determine when 90% consolidation has been achieved.

SECTION 4 Field Investigation

4.1 Site Works

A geotechnical and geo-environmental site investigation was carried out between the 31st of October and the 8th of November 2012 comprising 19 trial pits and six cable percussive boreholes and three mini percussive boreholes. Three in-situ soakaway tests were also undertaken during the site investigation.

The trial pits were excavated using a JCB 3CX excavator.

The cable percussive boreholes, 200mm in diameter were sunk using a conventional drilling rig. Within the boreholes Standard/Cone (SPT/CPT) Tests were carried out at close and regular intervals. All of the boreholes were terminated within in-situ hard strata after a minimum of 1 hours chiselling in each hole for a nominal penetration.

The mini percussive boreholes were sunk using a Terrier 2000 mini percussive drilling rig. The mini percussive boreholes were sunk within the vicinity of the historic landfill at the north of the site. The holes were sunk for the installation of gas monitoring wells to check the ground gas potential from the landfill.

The fieldworks were supervised by Terra Firma (Wales) Limited. The trial pits and boreholes were logged to the requirements of BS5930:1999.

The trial pit logs, cable percussive logs and mini percussive borehole logs are presented in **Annex D, Annex E and Annex F** respectively and their positions are shown on **Drawing 02**.

4.2 Ground Conditions

The ground conditions encountered can in general be summarised as shown in **Table 4.1**.

Depth (m)	Thickness (m)	Stratum
GL - 0.20/3.30	0.20/3.30	MADE GROUND
0.30 - 3.90/10.30	2.20/8.40	Soft grey and brown mottled CLAY
3.90/10.30 - 4.10/8.60	0.60/2.30	PEAT
4.10/8.60 - 5.90/9.70	0.00/1.80	SAND & GRAVEL (intermittent)
5.90/10.30 - 10.00/12.70	0.50/4.10	Firm becoming very stiff red brown gravelly CLAY
10.00/12.70 - >12.90	-	MUDSTONE

The basal Sand & Gravel layer was not encountered in BH1, BH2, BH4 and BH5.

Very loose red brown silty SAND and very soft red sandy SILT was encountered between 6.20m and 7.00m and 7.00m and 8.80m respectively.

Soft grey sandy SILT was encountered between 6.20m and 9.10m.

Appendix 2.0

Terra Firma (Wales) plate load tests

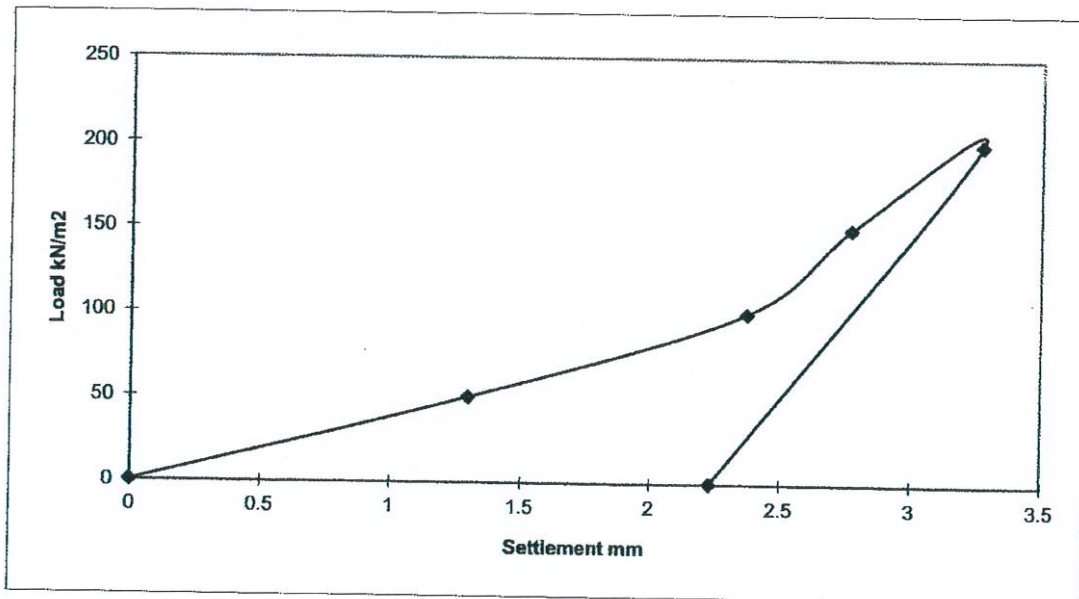


SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 2	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
1.30	50	4
2.37	100	8
2.77	150	12
3.27	200	17
2.23	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:

Herbert Road, Newport

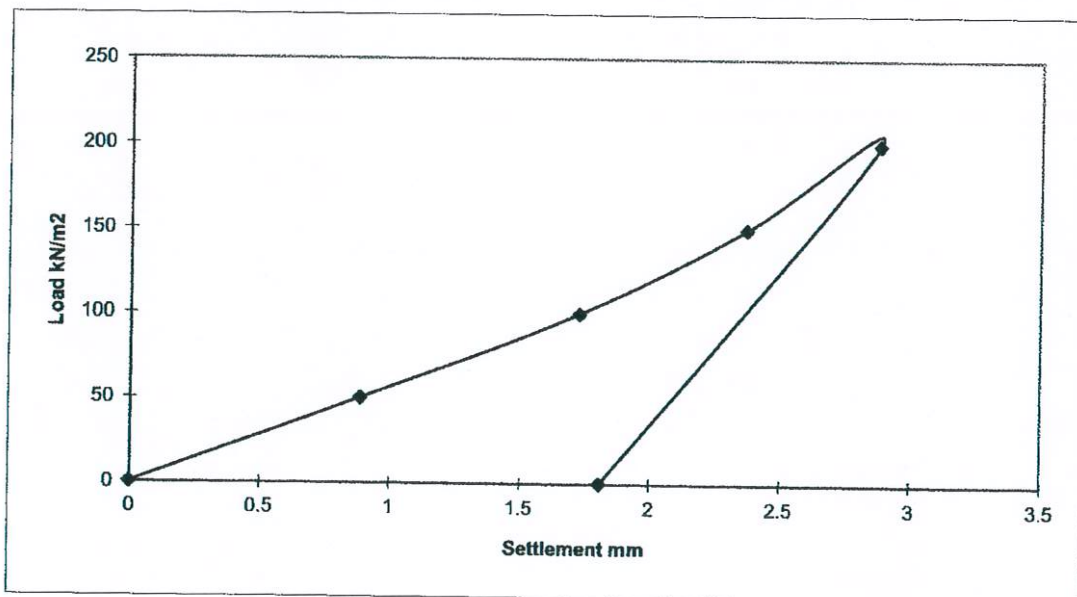
Date: 17.08.17
Sheet 1 of 1

SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 3	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
0.89	50	4
1.73	100	8
2.37	150	12
2.88	200	16
1.81	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:
Herbert Road, Newport

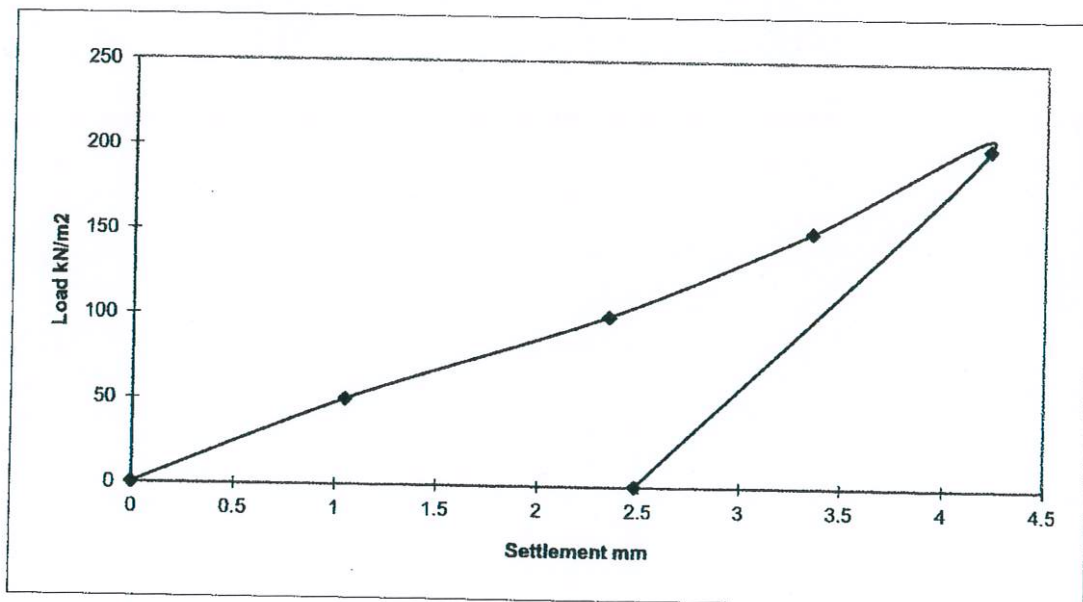
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Sheet 1 of 1

SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 4	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
1.05	50	4
2.35	100	8
3.35	150	13
4.22	200	17
2.48	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:
Herbert Road, Newport

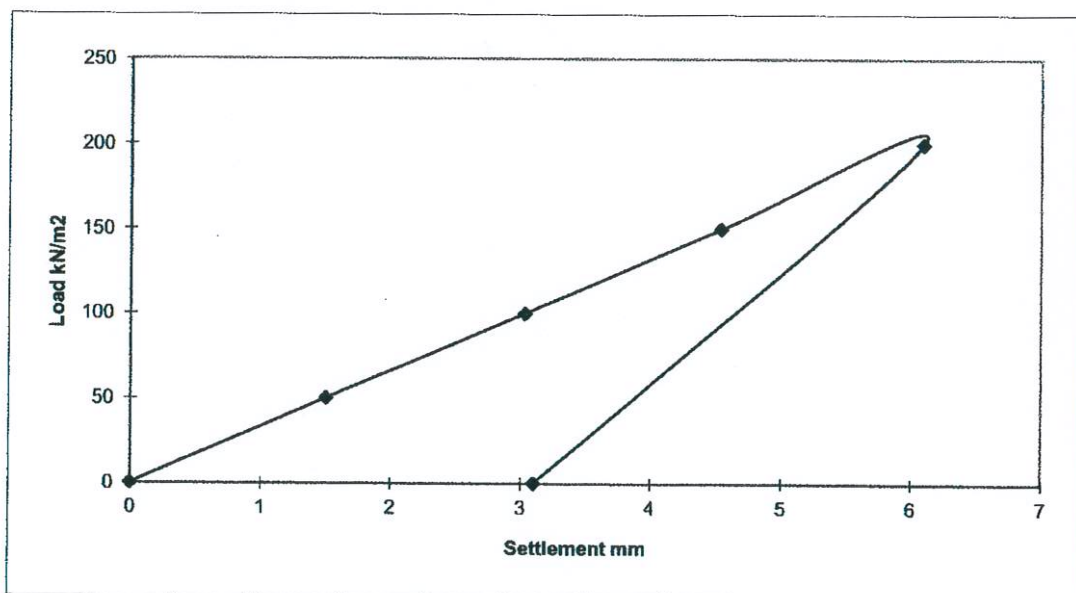
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Sheet 1 of 1

SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 5	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
1.51	50	4
3.03	100	8
4.54	150	12
6.09	200	17
3.10	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:

Herbert Road, Newport

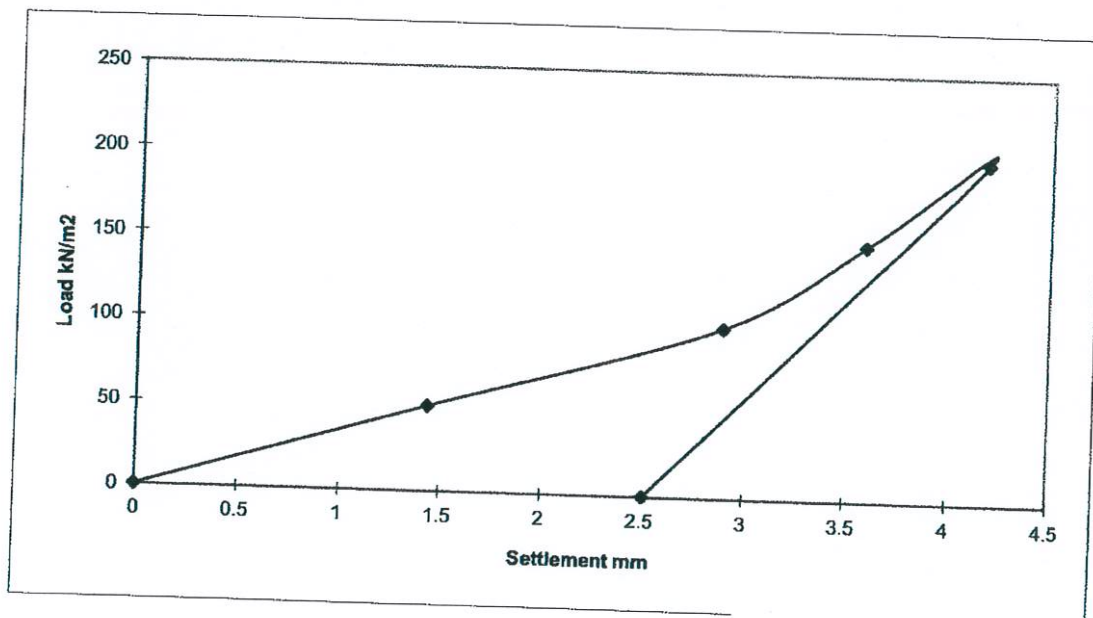
Date: 17.08.17
Sheet 1 of 1

SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 6	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
1.44	50	4
2.89	100	8
3.59	150	12
4.18	200	16
2.51	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:

Herbert Road, Newport

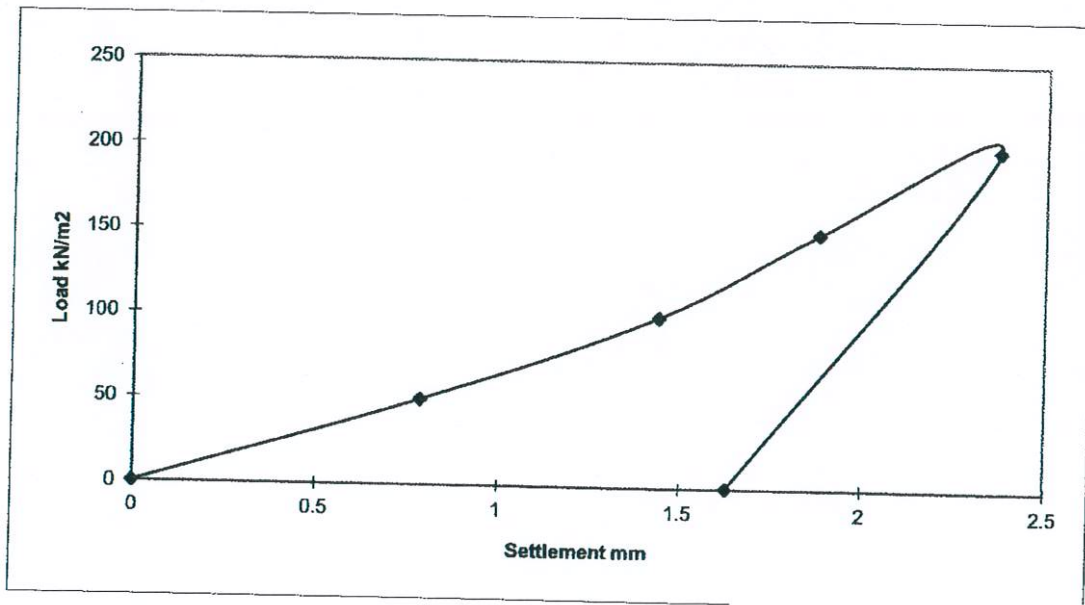
Date: 17.08.17
Sheet 1 of 1

SOUTHERN GROUND TESTING

PLATE LOAD TEST SUMMARY

Test Reference: Test 1	Test Depth: GL	Plate Diameter: 600mm	Soil Description: Crushed and compacted demolition rubble
------------------------	----------------	-----------------------	---

Average Plate Settlement (mm)	Load (kN/m ²)	Time (mins)
0	0	0
0.79	50	4
1.44	100	8
1.88	150	12
2.37	200	17
1.63	0	20



Notes:

- 1: Circular steel plate bedded on uniform coarse sand.
- 2: Tracked excavator used as counter weight.
- 3: Load applied to plate via hydraulic jack and loading columns.
- 4: Each load increment applied until plate settlement less than 0.01mm per minute.
- 5: Plate settlement measured by three travel gauges fixed to datum beams.
- 6: Load measured using electric load cell.



REMARKS: Test carried out in accordance with BS1377.1990, Part 9.

CONTRACT:

Herbert Road, Newport

Date: 17.08.17
Sheet 1 of 1

Appendix 3.0

SMA Piling Mat design



SUBGRADE DATA

subgrade type: **COHESIVE**
undrained shear strength 'C_{uk}' [kPa] = **25.00**
bearing capacity factor 'N_c' = **5.14**

PLATFORM DATA

angle of shearing resistance 'φ_{pk}' [deg.] = **35.00**
platform material unit weight 'γ_{pk}' [kN/m³] = **18.00**
punching shear coefficient 'K_ptanδ' = **3.10**
bearing capacity factor 'N_{γp}' = **48.00**

CRANE LOADING

Loadcase 1	Loadcase 2
Q _{1k} [kPa] = 71.00	Q _{2k} [kPa] = 105.00
L _{1k} [m] = 3.12	L _{2k} [m] = 2.26
W _k [m] = 0.90	W _k [m] = 0.90

SHAPE FACTORS

Loadcase 1	Loadcase 2
S _{c1} = 1.06	S _{c2} = 1.08
S _{γ1} = 0.91	S _{γ2} = 0.88
S _{p1} = 1.29	S _{p2} = 1.40

SOIL FORMATION

GEOSYNTHETIC REINFORCEMENT DATA

product: **Woven Polypropylene Geogrid Rhyno GW8139**
reinforcement tensile strength 'T_{ult}' [kN/m] = **30.00**

SUBGRADE BEARING RESISTANCE

Y _{1d} =	2.00
Y _{2d} =	1.50
Q _{1d} = 2 * 71 =	142.00 kPa
Q _{2d} = 1.5 * 105 =	157.50 kPa
R _d = 25 * 5.14 * 1.06 =	135.97 kPa

R_d < q_d. Working platform required

WORKING PLATFORM BEARING RESISTANCE

Y _{1d} =	1.60
Y _{2d} =	1.20
Q _{1D} = 1.6 * 71 =	113.60 kPa
Q _{2D} = 1.2 * 105 =	126.00 kPa
R _{1D} = 0.5 * 18 * 0.9 * 48 * 0.91 =	355.15 kPa
R _{2D} = 0.5 * 18 * 0.9 * 48 * 0.88 =	342.35 kPa

RD > R_d. Working platform stronger than subgrade
RD > q_D. Working platform can provide required resistance

REQUIRED WORKING PLATFORM THICKNESS

D ₁ = √{0.9 * (113.6 - 25 * 5.14 * 1.06) / (18 * 3.1 * 1.29)} =	0.00 m
D ₂ = √{0.9 * (126 - 25 * 5.14 * 1.08) / (18 * 3.1 * 1.4)} =	0.00 m

Required working platform thickness = 0.30 m

WORKING PLATFORM WITH GEOSYNTHETIC REINFORCEMENT

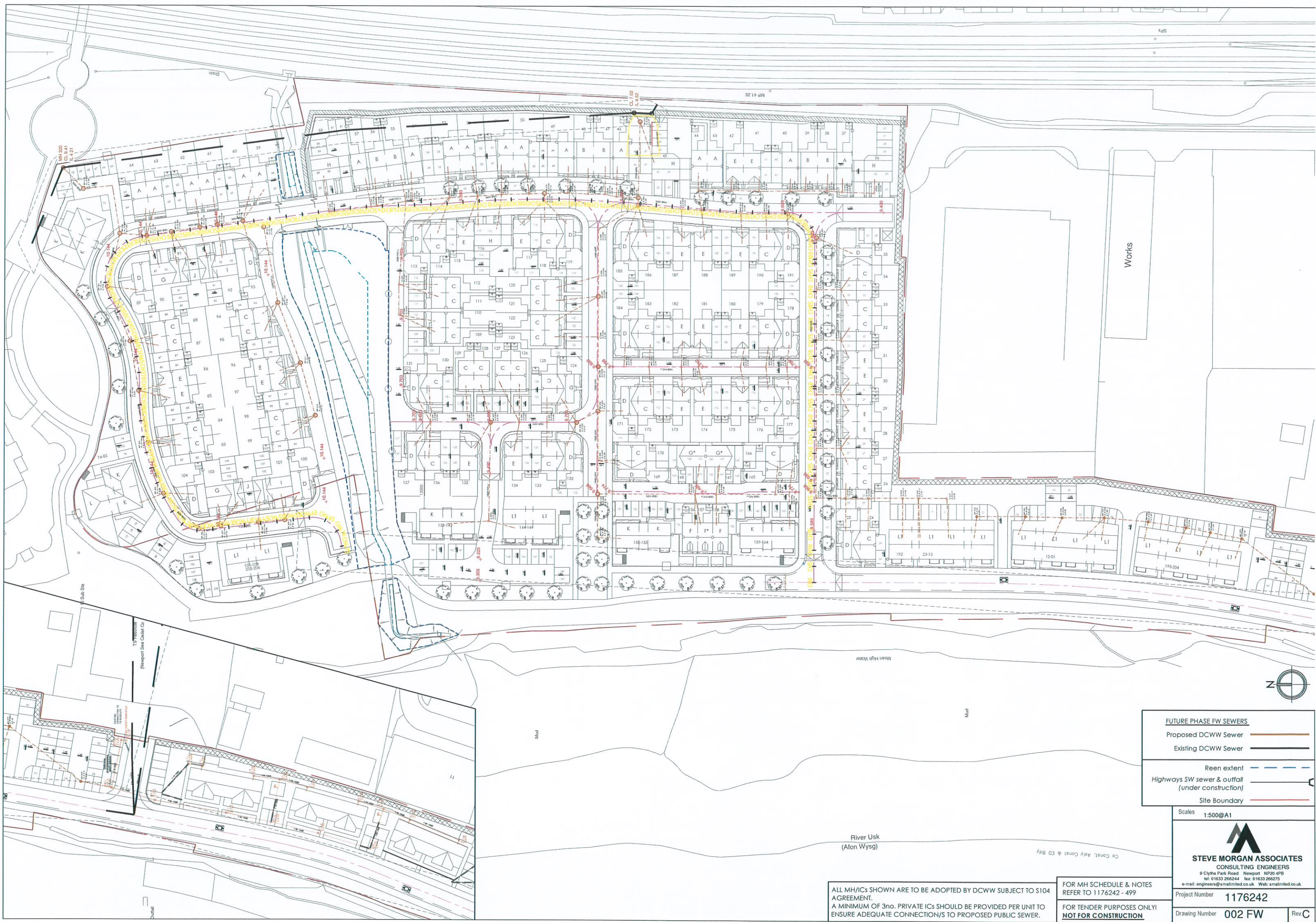
T _d = 30 / 2 =	15.00 kN/m
D ₁ = √{0.9 * [113.6 - 25 * 5.14 * 1.06 - (2 * 15 / 0.9)] / (18 * 3.1 * 1.29)} =	0.00 m
D ₂ = √{0.9 * [126 - 25 * 5.14 * 1.08 - (2 * 15 / 0.9)] / (18 * 3.1 * 1.4)} =	0.00 m

Required working platform thickness with Woven Polypropylene Geogrid Rhyno GW8139 = 0.30 m

NOTE: minimum thickness is 300mm when using reinforcement

Appendix 4.0 _____

DCWW Sewer layout and proposed phase 4 layout



FUTURE PHASE FW SEWERS	
Proposed DCWW Sewer	
Existing DCWW Sewer	
Reen extent	
Highways SW sewer & outfall (under construction)	
Site Boundary	

Scales 1:500@A1

STEVE MORGAN ASSOCIATES
 CONSULTING ENGINEERS
 9 Clytha Park Road Newport NP20 4PB
 tel: 01633 266244 fax: 01633 266275
 e-mail: engineers@smallimited.co.uk Web: smallimited.co.uk

Project Number **1176242**
 Drawing Number **002 FW** Rev **C**

ALL MH/ICs SHOWN ARE TO BE ADOPTED BY DCWW SUBJECT TO S104 AGREEMENT.
 A MINIMUM OF 3no. PRIVATE ICs SHOULD BE PROVIDED PER UNIT TO ENSURE ADEQUATE CONNECTION/S TO PROPOSED PUBLIC SEWER.

FOR MH SCHEDULE & NOTES REFER TO 1176242 - 499
 FOR TENDER PURPOSES ONLY!
NOT FOR CONSTRUCTION

River Usk
 (Afon Wysg)

Works



Appendix 5.0

Roger Bullivant Method Statement for piling over DCWW sewer





ROGER BULLIVANT

METHOD STATEMENT

Contract No: PP16/2035

Contract Name: Herbert Street, Newport

Doc No: UMP-MS 1304

Revision D

Page 1 of 3

Document Title:

METHOD STATEMENT FOR CASED AUGER BORED PILES

1.0 Purpose and Scope

1.1 This method statement defines the Company Procedure for the installation of Cased Auger Bored Piles.

2.0 References

2.1 PGI-PMS 1317 Preparation of the Pile Head for Static Load Testing (Wet Cast Piles)

3.0 Health and Safety Controls

3.1 See all relevant Risk assessments.

3.2 The safety method statement for operation of auger rigs (Ref: **UMP-SMS-1301**) must be on site and have been read and understood by all Operatives before any works commence.

3.3 Before any piles can commence an Underground Services Permit to Dig / Avoidance of Overhead Services Permit to Work must be completed by the Client / Main Contractor.

4.0 Environmental Controls

4.1 The skips, water bowser and licensed carriers will be provided by the Main Contractor, unless otherwise is stated in the contract.

4.2 Operation should only take place within specified working hours.

4.3 All waste shall be segregated into the relevant skips.

4.4 Hazardous waste, such as oil contaminated materials, used oil spill kits, etc. shall be disposed of by a licensed carrier.

4.5 Fuel/ oil spills should be prevented. Drip trays and emergency oil spill kits shall be used to catch and clean the spills/ leaks. Oil spill kits contain colour coded bags to contain any used spill equipment.

4.6 Arising shall be removed by the main contractor.

Prepared by:

D. J. J. J.
Name

[Signature]
Sig

Authorised
Position

1/9/16
Date



ROGER BULLIVANT

METHOD STATEMENT

Contract No: **PP16/2035**

Contract Name: **Herbert Street, Newport**

Doc No: **UMP-MS 1304**

Revision **D**

Page 2 of 3

Document
Title:

**METHOD STATEMENT FOR CASED AUGER BORED
PILES**

4.7 The vehicles shall not be run unnecessarily. Engines shall be extinguished when not in use.

5.0 Method and/or Process

5.1 Method

- 5.1.1 All plant and materials will be delivered to site using a wagon and off loaded and placed in the specified areas.
- 5.1.2 The bored pile is formed by screwing a string of segmental auger flights into the underlying ground to rock head. The top of the bore is cased through the unstable ground.
- 5.1.3 Following concreting of the bore the casings are left in place and the concrete level maintained. The specified reinforcement is then introduced to the concreted bore.
- 5.1.4 Set up the piling rig over the pile position. Ensure that it is stable.
- 5.1.5 Lift the lead flight into the guide on the rig, and insert the drilling head.
- 5.1.6 Commence augering. Once the lead flight has been screwed into the ground add a second segmental auger flight and couple it to the first using coupling pins.
- 5.1.7 Insert the drilling head and continue augering, adding subsequent flights until the required depth is reached.
- 5.1.8 Spin the temporary cases around the auger flights to the full depth.
- 5.1.9 To extract the flights: lift the head and auger string out of the bore. As each flight is extracted remove the arisings from the flight, insert support plate at base of flight to prevent auger string from falling back and disconnect the flight. This process should be repeated until the auger string has been completely removed from the bore.
- 5.1.10 Once the rock head is reached drill the rock socket to required depth.

Prepared by: D. Johnson
Name

[Signature]
Sig

A. Mangan
Position

11/9/16
Date



ROGER BULLIVANT

METHOD STATEMENT

Contract No: **PP16/2035**

Contract Name: **Herbert Street, Newport**

Doc No: **UMP-MS 1304**

Revision **D**

Page 3 of 3

Document
Title:

METHOD STATEMENT FOR CASED AUGER BORED PILES

- 5.1.11 Lower a tremmie pipe to the base of the pile and fill with concrete extracting the pipe as the pile bore is being filled. Adhere to handling requirements of COSHH.
- 5.1.12 Place the steel reinforcement into the concrete as required, using spacers if necessary.
- 5.1.13 Move to a new pile position and repeat steps 5.1.4 to 5.1.12.
- 5.1.14 All protruding vertical reinforcement bars to have end caps fitted until such times as piles are to be incorporated into the pile caps.

Prepared by:

D. Johnson
Name

[Signature]
Sig

A. Manager
Position

1/9/16
Date

Appendix 6.0

Terra Firma (Wales) letter dated 07 September 2016

Our Ref: RH/12032/let26

Your Ref:

Contact:

Terra Firma (Wales) Ltd.

Consulting Geotechnical & Geo-Environmental Engineers
Site Investigation Contractors

5 Deryn Court, Wharfedale Road,
Pentwyn, Cardiff CF23 7HA
Tel: 029 2073 5354 Fax: 029 2073 5433
Email: info@terrafirmawales.co.uk
www.terrafirmawales.co.uk

7th September 2016

Via Email

Steve Morgan Associates Ltd

For the attn. of Mr Steve Morgan

Dear Steve

TRUNK SEWER: HERBERT ROAD, NEWPORT

For the new development a concrete precast piled foundation solution is proposed. However, a trunk sewer passes beneath the site and the use of precast concrete piles is prohibited along its route.

Due to these restrictions it is understood that all new dwellings to be built along the sewer route are to be founded upon bored piles.

The sewer lies at around 25m depth below ground level, within the underlying mudstone. Competent St Maughan's Formation mudstone was confirmed by Terra Firma to be present at a depth of 10.2m and 12.9m depth below original ground level.

I confirm that we have reviewed the method statement for installation of the bored piles provided by Roger Bullivant and in view of the underlying geology and depth of the sewer we confirm that the proposed borehole pile method would be acceptable.

I trust that the above is to your satisfaction, however, if you have any queries or require any further information please do not hesitate to contact me.

Yours sincerely
for: Terra Firma (Wales) Ltd



Mrs Ruth Howells

Appendix 7.0

SWECO report commissioned by DCWW



Developer Services,
Dwr Cymru Welsh Water,
P.O. Box 3146,
Linea,
Fortran Road,
Cardiff,
CF30 0EH4th March 2017Project:
Herbert Road,
NewportOur Reference:
118728/100**For the attention of Mr Colin Evans****Herbert Road, Newport, Independent Review of Proposed Piling****1 Introduction**

Sweco UK were instructed by Colin Evans of Dwr Cymru Welsh Water (DCWW) by email on 13th February 2017 to review the pile design for the proposed residential development off Herbert Road, Newport in relation to a tunnel sewer located approximately 25m beneath the site. The scope of this review was to assess the pile capacities for Continuous Flight Auger (CFA) piles and to determine the potential effect that they will have on the underlying sewer.

2 Information Received

Below is a list of the documents/drawings received from Dwr Cymru Welsh Water:

- Terrafirma (2013) Geotechnical and Geo-environmental Report: Proposed Residential Development, Land off Herbert Road, Newport;
- Roger Bullivant (2009) Method Statement for Cased Auger Bored Piles;
- WYG (2009) Remediation Validation Report;
- Terrafirma (2016) Piling Risk Assessment Report: Proposed Residential Development at Herbert Road, Newport;
- Steve Morgan Associates (2016) Drawing No. 506 entitled 'Piling over DCWW Sewer'; and
- Roger Bullivant (2017) Herbert Road Newport, Bored Pile Calculations.

3 Ground Model Summary

The ground conditions encountered during the site investigation carried out by Terrafirma are summarised in Table 1 below:

Table 1 - Summary of Ground Conditions

Depth (m bgl)	Thickness (m)	Stratum
Ground level – 0.7/3.3	0.2/3.3	MADE GROUND
0.7/3.3 – 3.9/10.3	2.2/8.4	Soft grey and brown mottled CLAY
3.9/7.1 – 4.1/8.6	0.6/2.3	PEAT
5.0/8.6 – 5.9/9.7	0.8/1.1	SAND and GRAVEL
5.9/10.3 – 9.5/12.7	0.5/4.1	Firm becoming very stiff red brown gravelly CLAY.
9.5/12.7 – depth	-	St. Maughans Mudstone – very weak to weak red brown and grey MUDSTONE.

The two ground models used in the pile calculations are based on the borehole data provided by Terrafirma. Both the 'worst-case' and expected ground models are considered, the 'worst-case' comprises the thickest layer of the soft Alluvium, the thinnest layer of the stiff clay and uses conservative parameters for undrained shear strength (c_u) derived from standard penetration test (SPT) data. The expected ground profile scenario comprises a thinner layer of soft Alluvium, a thicker layer of the stiff clay and higher characteristic N value and c_u parameters. In the pile capacity calculations the Alluvium layer comprises both the soft clay and the peat.

The undrained shear strength of the soil and weathered rock strata have been estimated using the relationship proposed by Stroud (1989) with SPT N values using data provided in the Terrafirma borehole logs and has been used in the following pile capacity calculations.

The ground model used in the calculations carried out by Roger Bullivant differs slightly to the one shown above. Sweco have incorporated a layer of stiff clay overlying the Mudstone which is identified in a number of the boreholes carried out by Terrafirma.

4 Pile Capacity Calculations

Pile capacity calculations for a 300mm diameter and 400mm diameter 14m long CFA piles were undertaken by Bullivant, which estimated a working capacity of 233kN and 311kN respectively. These estimates appear to have been undertaken using a traditional British Standard (BS:8004-1986) approach where by ultimate loads were divided by a factor of safety of 3. In their calculations, Bullivants have deliberately ignored any end-bearing resistance.

To enable our assessment of the potential effects of piling upon DCWW asset, Sweco undertook independent pile capacity calculations to EC7 which are summarised and compared below in Table 2.

The following assumptions were made in our pile capacity calculations:

- 100kN of the load has assumed to be variable and 200kN has assumed to be permanent.
- It was assumed that the St. Maughans Mudstone extends to the level of the sewer, however the boreholes carried out were not deep enough to confirm this. Based on information available on the BGS Geology of Britain Viewer this is likely to be a reasonable assumption.
- The shaft friction in the Made Ground and Alluvium/Peat was ignored due to the low strength of these deposits.
- Estimates of negative skin friction (NSF) were made for each pile size.
- Following Bullivants approach, Sweco have ignored any positive contribution from end-bearing resistance in the pile capacity calculations.

5 Pile Pressure Bulb Calculations

To establish the potential net increase in the load on the tunnel as a result of transfer of loads to the piles, Sweco have estimated the potential pressure bulbs beneath the piles for a 14m length CFA pile, using the working loads provided by Bullivants.

Figure 1 has been adapted from Drawing No. 506 provided by Steven Morgan Associates. The pressure bulb created by these piles and, hence, their effect on the tunnel has been calculated using an 'equivalent raft' method at 2/3 depth of the piles (O'Brien, 2012), see Figure 1. It is accepted that the stress distribution for piles will be different as it is usually as combination of shaft adhesion and end-bearing resistance, however, the proposed approach is considered to be conservative.

Figure 1: Equivalent raft method (O'Brien, 2012)

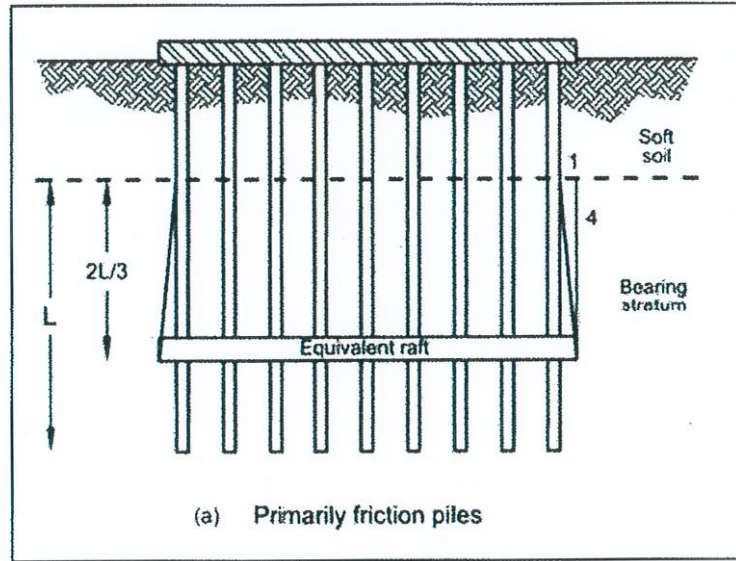
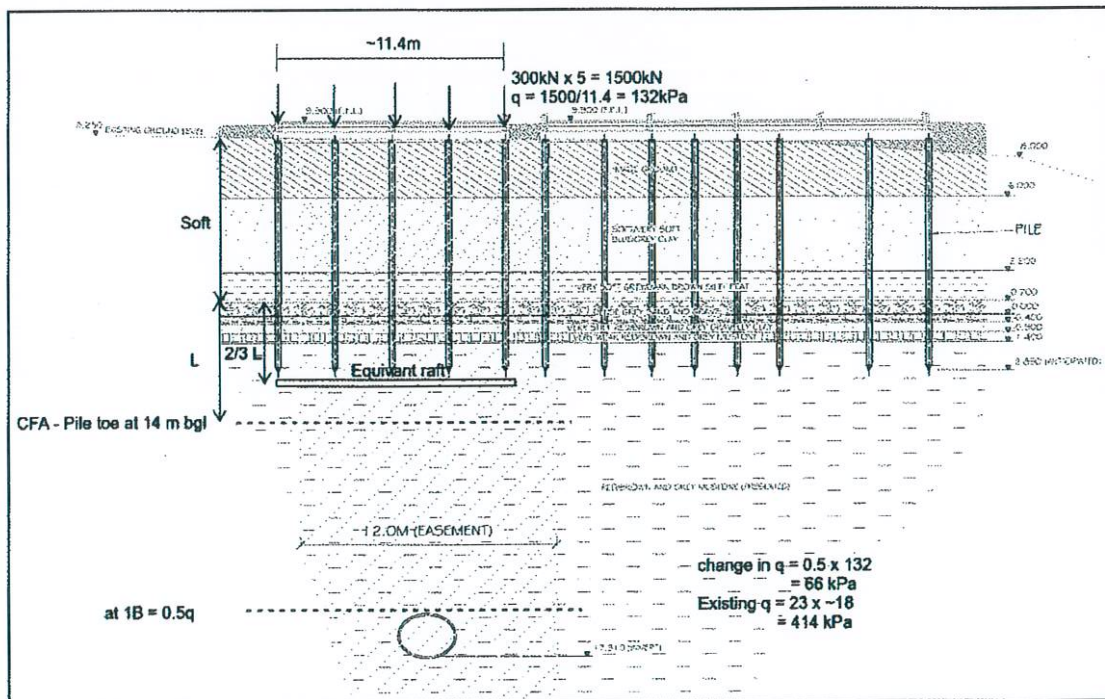


Figure 2 - Schematic diagram showing the pressure bulb calculation for a 300kN load



6 Conclusions and Recommendations

The following conclusions can be made using both a 'worst-case' (GM1) and expected ground model (GM2) to calculate the pile capacity:

Table 2 – Estimated Pile Working Loads for 14m Long CFA piles

Pile Dia (mm)	Pile Length (m)	Bullivant NSF (kN)	Bullivant Proposed Allowable Capacity (kN)	Sweco NSF (kN) – unfactored	Sweco Allowable Capacity (kN)
300	14	71	233	GM 1: 188	GM 1: 139
				GM 2: 100	GM 2: 291
400	14	94	311	GM 1: 250	GM 1: 186
				GM 2: 134	GM 2: 388

The calculations carried out by Roger Bullivant indicate that a pile length of 14m at a diameter of 400mm is sufficient to support a working load of approx. 311kN. Sweco's calculations are broadly similar, indicating that a load of 303kN can be supported by a 14m pile of 300mm diameter and that a load of 404kN can be supported by a 14m pile of 400mm diameter. Therefore, Sweco's calculations indicate that a 14m long pile 400mm pile is suitable for supporting a 300kN working load and this length has been adopted for the calculation of increase of effective stress in the Sewer.

Regarding Sweco's calculations, component loads are unknown and therefore have not been taken account of in the pile capacity calculations. Following on from this, no tensile or lateral loads have been provided for the calculations.

The 'worst-case' ground model was identified in one borehole giving a lower pile capacity for piles of 14m length. The depth of the boreholes carried out by Terrafirma do not comply with best practice, as presented in Eurocode 7.

Regarding the pressure bulb calculations, it is important to note that the method adopted, using an equivalent raft, is a very conservative approach given that the 'raft' would be located in the Mudstone bedrock, especially if the piles are designed to achieve the working load wholly in shaft friction. Using this conservative approach, calculations have identified that the net increase in vertical stress imparted on the tunnel at 23m bgl as a result of the load transfer from the piles is likely to be 11-16% (for 200 to 300kN pile working load).

A net vertical stress increase of 16% is likely to fall within the allowable factor of safety for the original tunnel design, assuming it was designed using traditional British Standard type design

methods, but the current state of the tunnel should be assessed by a structural engineer to confirm if the original tunnel capacity is likely to have been reduced over time by damage, fatigue etc.

For and on behalf of Sweco UK



Des Treanor
Technical Manager

E: Des.Treanor@sweco.co.uk

References:

Barnes, G. E. (2010). Soil Mechanics: Principles and Practice, Palgrave Macmillan Limited.

BGS. (2016). Geology of Britain Viewer.

British Standards Institute (2004). BS EN 1997-1:2004+A1:2013 Eurocode 7: Geotechnical design. General rules.

British Standards Institute. (1986). BS8004:2015: Code of Practice for Foundations.

O'Brien, A. S. (2012). Piled Group Design - ICE Manual of Geotechnical Engineering, ICE Publishing

Stroud, M. A. (1989). 'The Standard Penetration Test – its application and interpretation'. *Proceedings of the ICE Conference on Penetration Testing in the UK, Birmingham. Thomas Telford. London.*

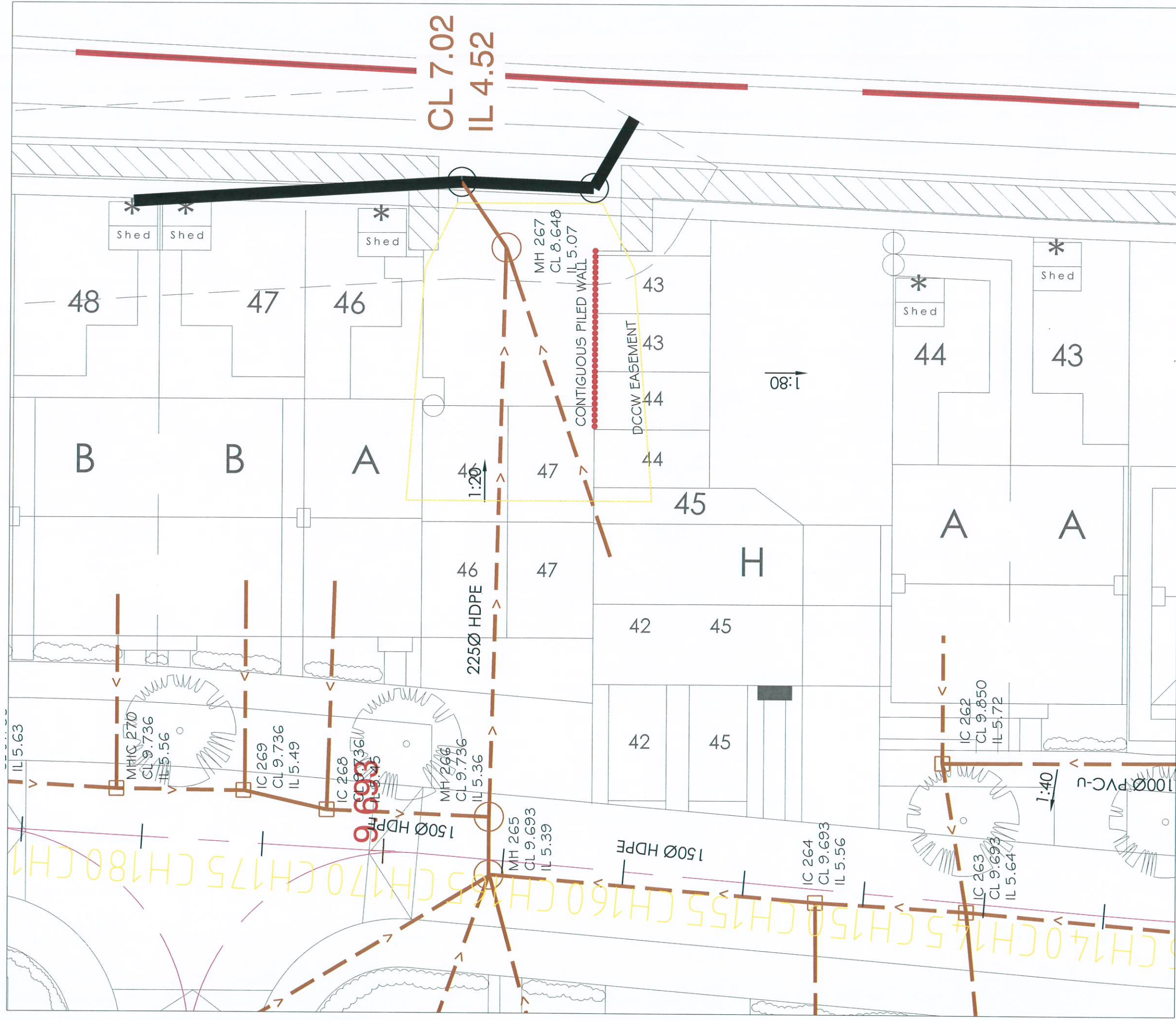
Appendix 8.0


DCWW Sewer parallel to Plot 46



General Notes :

- 1.) Do not scale from this drawing.
- 2.) All dimensions are in millimetres.
- 3.) All levels are in metres relative to datum.
- 4.) All dimensions stated are to be confirmed on site prior to commencement of any works and any discrepancies found are to be reported to Steve Morgan Associates Limited immediately.



Client PHASE 4	 STEVE MORGAN ASSOCIATES CONSULTING ENGINEERS	Project Description HERBERT ROAD, NEWPORT 46 DRAINAGE EXTRACT OF PLOT		REV/By	Date	Description	Scale	Project Number
		9 Ciytha Park Road Newport NP20 4PB tel: 01633 266244 e-mail: engineers@smallimited.co.uk Web: smallimited.co.uk		Drawn	SM	Date	MAR '18	NTS @ A3
				Checked		Date		Drawing Number
								SK-EX01
								Rev.

Appendix 9.0

DCWW letter dated 01 03 18





Dŵr Cymru
Welsh Water

Developer Services
PO Box 3146
Cardiff
CF30 0EH

Tel: +44 (0)800 917 2652
Fax: +44 (0)2920 740472
E.mail: developer.services@dwrwymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

Ffôn: +44 (0)800 917 2652
Ffacs: +44 (0)2920 740472
E.bost: developer.services@dwrwymru.com

Asbri Planning Ltd.
Unit 9
Oak Tree Court
Cardiff Gate Business Park
Cardiff
CF23 8RS

Date: 01/03/2018
Our Ref: PPA0002802

Dear Sirs,

Grid Ref: 331705, 189327

Site Address: Land South of Glan Usk Primary School, Herbert Road, Newport, NP19 7BH

Development: Construction of 206 residential units, internal road network, parking, landscaping and associated works

I refer to the Schedule 1C - Article 2D notice received and your formal request for a pre-application consultation response before applying for planning permission from Dwr Cymru Welsh Water as a 'Specialist Consultee' as defined by Paragraph (y) of Schedule 4 of the Town & Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016. It is acknowledged that the consultation request relates to a major development site and thus seeks a substantive response within 28 days from the date of the notice, as per the requirements of Article 2E. This request includes our views on the capacity of our network of assets and infrastructure to accommodate your proposed development.

Having reviewed the details submitted I would advise there is **no objection** to the proposed development and offer the following standing advice which should be taken into account within any future planning application for the development.

SEWERAGE

It can be confirmed that the foul flows only from the proposed development can be accommodated within the public sewerage system. We are also satisfied with the proposed discharge of surface water to the watercourse as shown on drawing number 001 Revision B within the drainage strategy.

Having previously been in extensive dialog with the developer regarding this site, the applicant is aware that the site is crossed by a number of large diameter sewers (as shown on the attached public sewer extract plan).

Under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times. No part of any building will be permitted within 4 metres either side of the centreline of 750mm public sewer and 6 metres either side of the centreline of the 1200mm public sewer. As stated to the developer, we request that upon the submission of the planning application the drainage plans (001



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Mae Dŵr Cymru yn eiddo i Glas Cymru – cwmni 'nid-er-elw'.

We welcome correspondence in
Welsh and English

Dŵr Cymru Cyf, a limited company registered in
Wales no 2366777. Registered office: Pentwyn Road,
Nelson, Treharris, Mid Glamorgan CF46 6LY

Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

Revision B & 002 FW Revision B) within the drainage strategy are amended to also show all existing public assets crossing the site (including the 2100mm sewer crossing the north of the site).

We have also noted that the existing easement shown on drawing 002 FW Revision B is encroached upon by plot 46. In discussion with the developer it has been agreed that a piling strategy is to be submitted within the future Section 104 agreement demonstrating that the existing public sewer within this area will not be adversely affected.

You are also advised that some public sewers and lateral drains may not be recorded on our maps of public sewers because they were originally privately owned and were transferred into public ownership by nature of the Water Industry (Schemes for Adoption of Private Sewers) Regulations 2011. The presence of such assets may affect the proposal. In order to assist you may contact Dwr Cymru Welsh Water on 0800 085 3968 to establish the location and status of the apparatus in and around your site. Please be mindful that under the Water Industry Act 1991 Dwr Cymru Welsh Water has rights of access to its apparatus at all times.

SEWAGE TREATMENT

No problems are envisaged with the Waste Water Treatment Works for the treatment of domestic discharges from this site.

WATER SUPPLY

A water supply can be made available to service this proposed development.

The proposed development is crossed by a trunk/distribution watermain, the approximate position being shown on the attached plan. Dwr Cymru Welsh Water as Statutory Undertaker has statutory powers to access our apparatus at all times.

I trust the above information is helpful and will assist you in forming water and drainage strategies that should accompany any future planning application. I also attach copies of our water and sewer extract plans for the area, and a copy of our Planning Guidance Note which provides further information on our approach to the planning process, making connections to our systems and ensuring any existing public assets or infrastructure located within new development sites are protected.

Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning officers, either on 0800 917 2652 or via email at developer.services@dwrcymru.com. Please quote our reference number in all communications and correspondence.



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Rydym yn croesawu gohebiaeth yn y
Gymraeg neu yn Saesneg

Dŵr Cymru Cyf, cwmni cyfyngedig wedi'i gofrestru yng
Nghymru rhif 2366777. Swyddfa gofrestredig: Heol Pentwyn
Nelson, Treharris, Morgannwg Ganol CF46 6LY.

Yours faithfully,



Owain George
Planning Liaison Manager
Developer Services

Enclosed. Sewer plan, Water plan, Pre planning notes.

Please Note that demands upon the water and sewerage systems change continually; consequently the information given above should be regarded as reliable for a maximum period of 12 months from the date of this letter.

glas
Glas Cymru Cyfyngedig

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