DRAINAGE STRATEGY REPORT

RESIDENTIAL DEVELOPMENT AT

FORMER INFANT SCHOOL,

BRODOG LANE,

FISHGUARD,

PEMBROKESHIRE

SA65 9NF

JOB No.: 20092

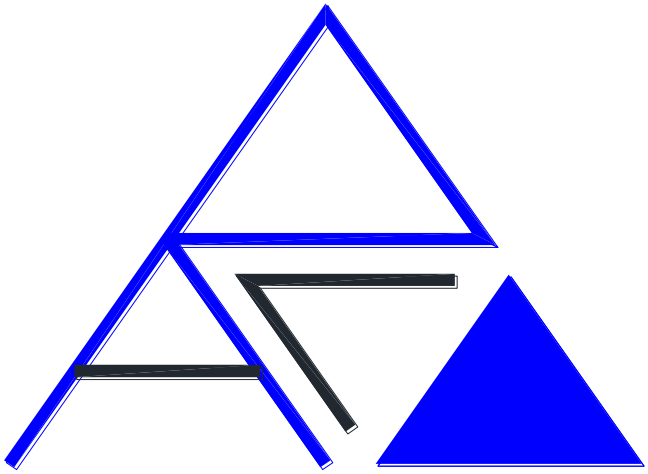
VERSION: 01

REPORT REF.: 20092/001/RCA/CE/RP/001

DRAFT

Roger Casey Associates

Consulting Civil & Structural Engineers



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DRAINAGE STRATEGY REPORT

FOR

RESIDENTIAL DEVELOPMENT AT

FORMER INFANT SCHOOL

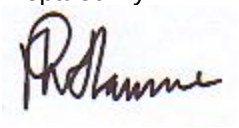
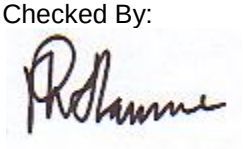
BRODOG LANE

FISHGUARD

PEMBROKESHIRE

SA65 9NF

Job No.: 20092

Prepared By: 	Date: September 2018
Checked By: 	Date: September 2018
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DOCUMENT REVISION RECORD

Version	Description	Date	Originator	Approver
01	Initial draft issue.		PWJL	RSC

CONTENTS

1.0 Introduction

Roger Casey Associates has been instructed to prepare a Drainage Strategy Report in respect of the construction of a new residential development on a former Infant School brownfield area of land at Brodog Lane, Fishguard, Pembrokeshire SA65 9NF.

This report has been prepared on behalf of ateb group who the Applicant and Developer of the proposed development. The Report is intended to support the Pre-Application Consultation (PAC) and in turn the Planning Application process only to inform Planning Condition scope relating to proposed drainage solutions.

The purpose of this report is to describe the existing site and associated drainage infrastructure and to identify a sustainable solution for the proposed foul and surface water drainage to serve the new development.

The National Grid Reference of the approximate centre point of the proposed development site is SM 95590 37388, Easting 195590, Northing 237388.

This document relies upon geotechnical and geoenvironmental site investigations undertaken by Terra Firma (Wales) Ltd acting as Geotechnical Consultants on behalf of the Applicant.

This Drainage Strategy Report is purely for information only and outlines the proposals to ensure all foul and surface water drainage design and management is carried out in accordance with current best practice and statutory guidelines and inform the detail drainage design stage.

2.0 Site Conditions and Topography

The site is located to the north of the centre of the town of Fishguard. The site is currently occupied by the redundant Infant School building, external metalled play and parking areas with the remaining site area laid out in soft landscaping and vegetation. The site is bounded by residential premises to all boundaries with the site access off Brodog Lane to the southeast corner.

The total site area is approximately 0.7022 hectares.

A copy of the site location plan is included in Appendix A.

The ground profile of the land generally slopes downwards in level in a north-easterly direction. The site survey, to Ordnance Survey Datum, shows a maximum level difference of (60.2-57.3) = 2.9 m over an approximate distance of 137 m. The drop in level equates to an approximate gradient of 1:47 or 2.117%.

A copy of the topographical site survey is included in Appendix B.

3.0 Flood Risk

The proposed use of the site being for a residential development will classify the risk as being a 'Highly Vulnerable Development' (TAN 15, Figure 2). However, in accordance with Natural Resources Wales Flood and Welsh Government TAN 15 Development Advice Maps the site is located within an area designated being in Flood Zone A.

A copy of the proposed architectural site plan is included in Appendix C.

In accordance with guidance contained within TAN 15, Figure 1, further flood risks and justification tests are not required to sites located within Zone A and sound drainage design incorporating aspects of Sustainable Urban Drainage Systems (SuDS) is applicable to the development.

National Resources Wales Flood Risk Map and Welsh Government TAN 15 Development Advice Map are included in Appendix D.

Planning Policy and Technical Advice Note (TAN) 15 lists six sources of flooding which need to be considered in the assessment of flood risk and the probability of flooding at the Site Location.

Flooding from Rivers or Fluvial

Not applicable due to Site Location and demonstrated on Flood Maps in Appendix D.

Flooding from the Sea or Tidal Flooding

Not applicable due to Site Location and demonstrated on Flood Maps in Appendix D.

Flooding from Land

Not applicable due to surface water management within the proposed drainage strategy leading to detail design. Proposed external ground formation/levels must form appropriate informal overland flow routes within the landscaping and external area design to safely transfer any flood water away from the proposed dwellings and any other existing premises.

Flooding from Groundwater

No groundwater was observed during the trial pit investigations by Terra Firma (Wales) Ltd.

Flooding from Sewers

Not applicable due to foul and surface water management within drainage design. Notwithstanding blockage or catastrophic failure of drainage systems upstream of development site resulting in overland flows not being contained within kerb upstand heights, surface gradients, etc.

Flooding from Reservoirs, Canals and Other Artificial Sources

Not applicable due to Site Location and demonstrated on Flood Maps in Appendix D.

4.0 Existing Drainage and Site Investigations

Foul Water Drainage

Pre-Planning Advice has been sought from Dwr Cymru Welsh Water (DCWW) by RCA on behalf of the Developer. DCWW have advised by their response referenced PPA0002947 and dated 24 April 2018 that enough capacity exists within their networks to serve the proposed development. A copy of DCWW PPA response is included in Appendix E.

Surface Water Drainage

Considering the Welsh Government (WG), recommended non-statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems. Where surface water runoff destination is considered in five priority levels:

Priority Level	Flow Destination
1	Surface water run-off is collected for use;
2	Surface water runoff is infiltrated to ground;
3	Surface water runoff is discharged to a surface water body;
4	Surface water runoff is discharged to a surface water sewer, highway drainage, or another drainage system;
5	Surface water runoff is discharged to a combined sewer.

Following investigations and in response to each of the Priority Levels:

1. The Client has advised that they do not wish to install a formal rainwater harvesting system to collect all the roof water runoff for reuse due to capital installation costs and passing whole life costs of a collection system including its maintenance on to their tenants. There is a likelihood, to comply with WG Standards, that rainwater harvesting butts will be provided to one rainwater downpipe per Plot. These butts will have an overflow provision into the general rainwater collection pipework. For the purposes of design, these butts are considered as being full.

2. Geotechnical site investigations were undertaken by Terra Firma (Wales) Ltd in January and June 2018. Part of these works included successful soakaway testing within trial pits. Therefore, infiltration to ground is available as a surface water disposal option at this site location.

3. Not considered due to available surface water drainage destination at Priority Level 2.

4. Not considered due to available surface water drainage destination at Priority Level 2.

5. Not considered due to available surface water drainage destination at Priority Level 2.

5.0 Proposed Drainage Strategy and Summary

The site will be served by new separate foul and surface water drainage systems discharging as follows based on existing drainage and site investigations outlined above (Refer to Appendix F for Proposed Drainage Strategy Engineering Site Plan and Appendix G for Initial Surface Water Infiltration Calculations):

Foul Water Drainage

All foul water only drainage flows will be collected from the proposed residential development via a new gravity sealed pipe system and connected into the existing public combined water sewer network. The point of connection is envisaged to the one of the final lengths of existing 150 mm diameter foul water pipe on site which communicates with the public sewer in Brodog Lane.

Where the new foul water drainage system lies outside of the legal curtilage of each proposed dwelling, it will need to be adopted by Dwr Cymru Welsh Water under a Water Industry Act Section 104 Adoption Agreement between DCWW and the Developer.

Surface Water Drainage

From a surface water drainage point of view, the proposed site area is constrained by its width, existing public sewer rising main with easement along the east boundary and the proposed dwelling density. Due to the constraints it will not be possible to use soakaway pits located minimum 5 m away from buildings. Therefore, it is proposed to construct all road and parking areas in permeable surfaces to allow infiltration through clean sub base material into the underlying ground strata. Roof water flows will be drained into the clean sub base layer. Permeable surfaces also have the added benefit of pollution removal properties. The sub base storage depth is designed to accommodate 6 hour 1:100-year return storm with +30% allowance for climate change and half empty within 24 hours.

Positive early discussions have been held between RCA and Pembrokeshire County Council (PCC) Highways Adoption in relation to the permeable road becoming a public asset and constructed as part of a Highways Act 1980 Section 38 Agreement between PCC and the Developer.

Flooding

The site is generally located in a low flood risk location considered by TAN 15.

Philip Lawrence MCIHT GMICE
Technical Director – Civil Engineering
for Roger Casey Associates

Appendix A - Site Location Plan

DO NOT SCALE
STATUS: OS

ORIGINAL DRAWING A4
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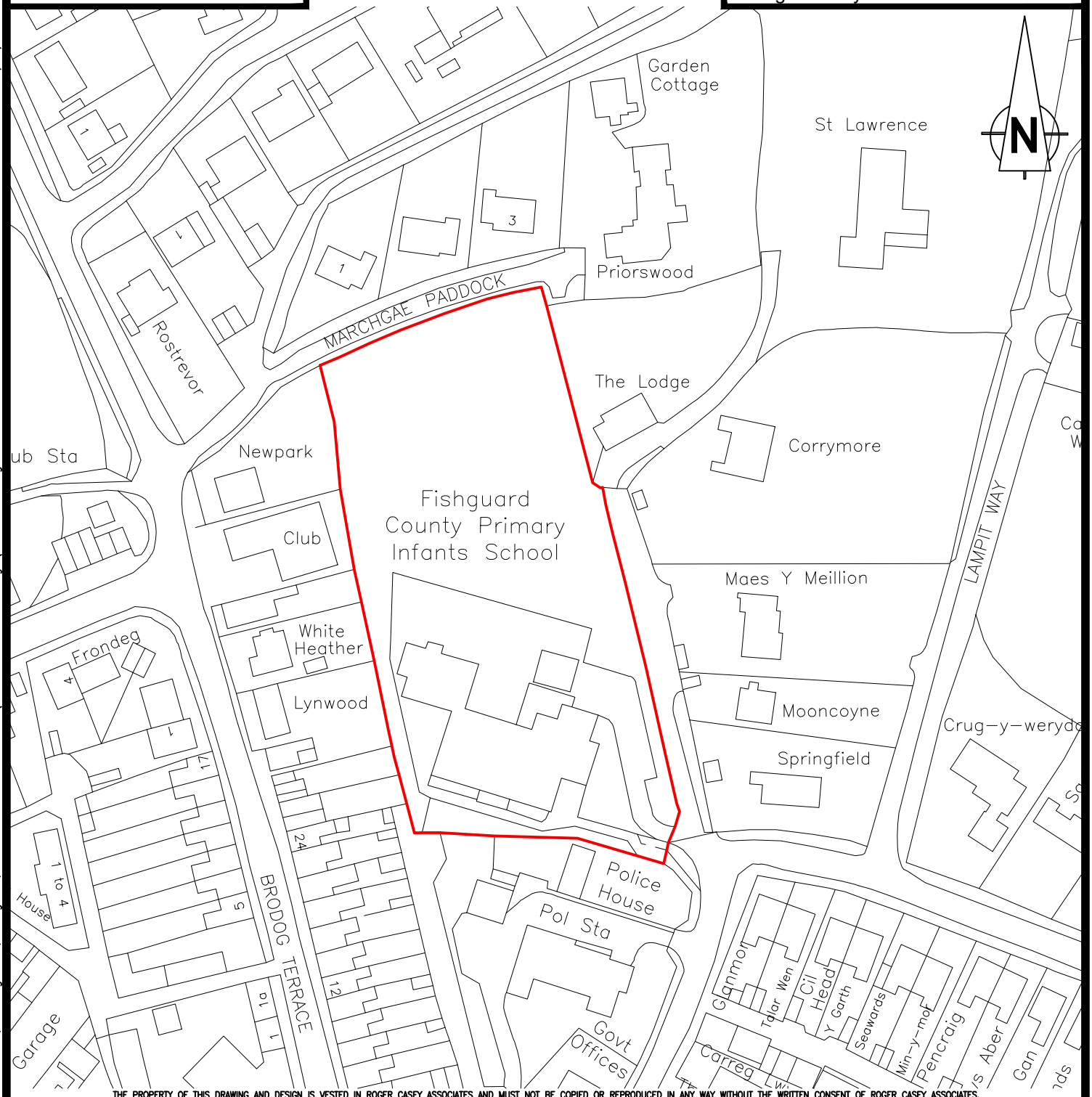

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WORK TO FIGURED DIMENSIONS IN PREFERENCE TO SCALING.

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CLIENT:
ateb group limited

PROJECT:
RESIDENTIAL DEVELOPMENT AT former Infant School, Brodog Lane, Fishguard, Pembrokeshire SA65 9NF

RCA A4 Portrait Version 1

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W: www.rca-eng.co.uk

DRAWING TITLE:
SITE LOCATION PLAN

DRAWN BY:	DATE:	SCALES:
PWJL	27/09/18	1:1250
DESIGN BY:	DRAWING No.:	REVISION:
-	20092/02	
CHECKED BY:		
RSC		

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Appendix B - Topographical Survey Plan

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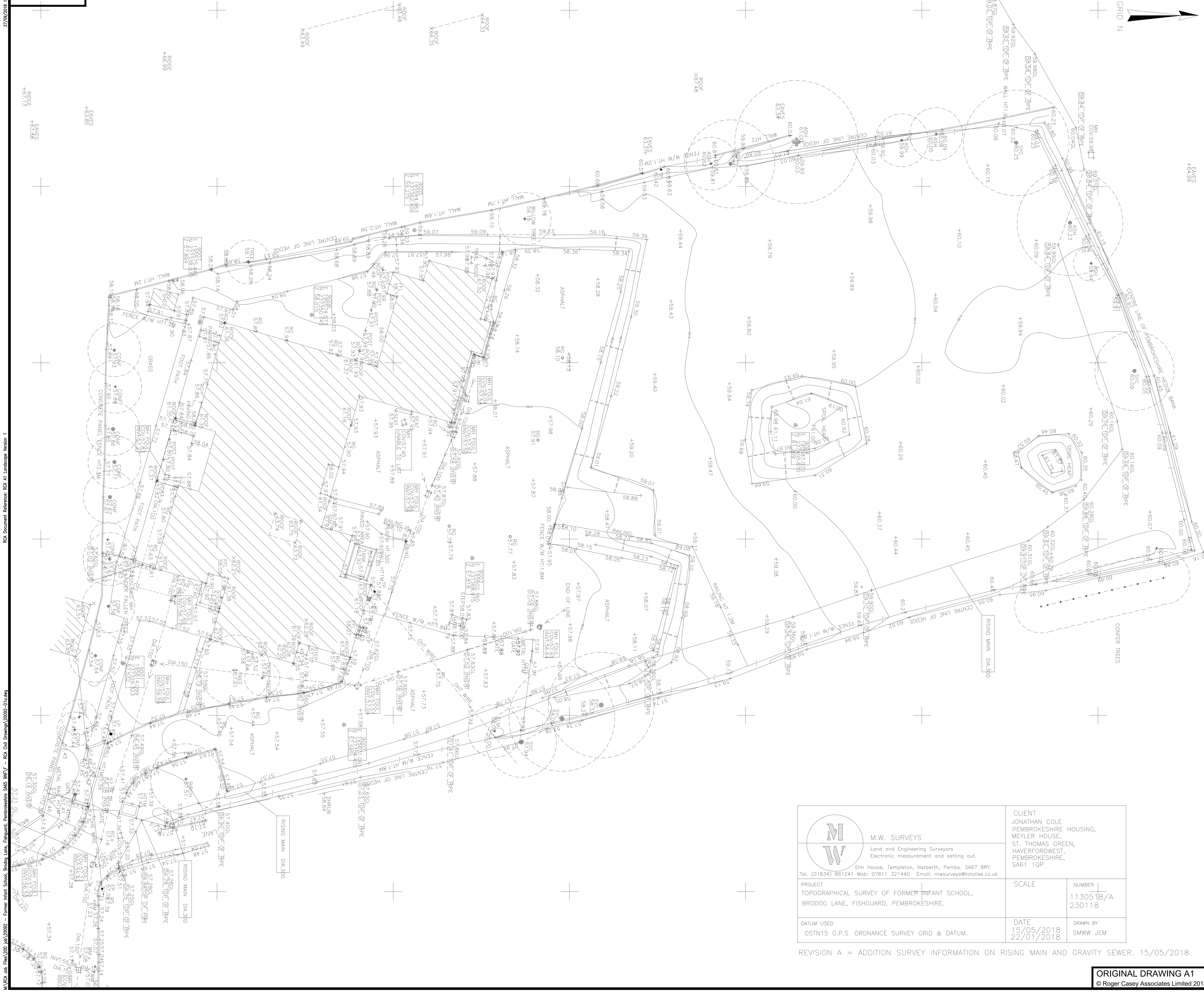

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REV.	DESCRIPTION	DRAWN	CHECK	DATE

DRAWING STATUS:

SURVEY

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Consulting Civil & Structural Engineers

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CLIENT:
ateb group limited

ARCHITECT:
PEMBROKE DESIGN LIMITED

PROJECT:
RESIDENTIAL DEVELOPMENT AT former Infant School, Brodog Lane, Fishguard, Pembrokeshire SA65 9NF

DRAWING TITLE:
EXISTING SITE SURVEY PLAN

DRAWN BY:	DESIGN BY:	CHECKED BY:	DATE:
PWJL	-	RSC	13/06/18
SCALES: 1:200	DRAWING No.: 20092/01		REVISION:

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Land and Engineering Surveyors
Electronic measurement and setting out.
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PEMBROKESHIRE HOUSING,
MEYLER HOUSE,
ST. THOMAS GREEN,
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SA61 1QP

PROJECT
TOPOGRAPHICAL SURVEY OF FORMER INFANT SCHOOL, BRODOG LANE, FISHGUARD, PEMBROKESHIRE.

SCALE

NUMBER
11305 18/A
230118

DATUM USED
OSTN15 G.P.S. ORDNANCE SURVEY GRID & DATUM.

DATE
15/05/2018
22/01/2018

DRAWN BY
SMWW JEM

REVISION A = ADDITION SURVEY INFORMATION ON RISING MAIN AND GRAVITY SEWER. 15/05/2018.

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RCA Document Reference: RCA A1 Landscape Version 1
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Appendix C - Proposed Architectural Site Plan

SCHEDULE OF ACCOMMODATION:

10 X 3 PERSON BUNGALOW - UNITS
1, 2, 3, 4, 5, 6, 7, 8, 11, 12

8 X 2 PERSON BUNGALOW - UNITS
9, 10, 13, 14, 15, 16, 17, 18

NOTE:
EACH UNIT TO HAVE 2 CAR PARKING SPACES EACH.

N

KEY:

- LP STREET LIGHT
- PARKING SPACE
- 1.8M HIGH BOARDED GATE
- 1.8M HIGH BOARDED FENCE
- 1.2M HIGH BOARDED FENCE WITH 600MM HIGH TRELLIS ABOVE
- 1.2M POST AND RAIL FENCE
- RETAINING WALL
- ROTARY DRYING LINE
- COMPOST BIN
- WASTE BIN
- RECYCLING BIN
- SHED AND CYCLE STORE
- RAINWATER BUTT
- 3.0 X 3.0 PATIO AND PAVED PATHS
- AWARENESS STRIP
- MACADAM TO SHARED WAY AND SERVICE STRIP
- BLOCK PAVER ROADWAY
- GRASSED SERVICE STRIP
- REAR GARDEN LAWN
- DEMOLISHED BUILDING
- EXISTING TREE RETAINED
- EXISTING TREE REMOVED
- NEW TREE, SHADBUSH (TBC)
- NEW TREE, NORTHERN RED OAK (TBC)

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The contractor is to check all levels and dimensions before work commences, and any discrepancies to be reported immediately to the consultants.

Work to figured dimensions. Do not scale.

The contractor is expected to supply and do everything necessary for the proper execution of he works that may be reasonably inferred from the drawings and specification, whether referred to in detail or not, without extra payment in respect thereof.

The finished building will require service maintenance in accordance with custom and practice and the manufacturers recommendations.

The architects drawings are to be read in conjunction with the engineers and all specialist manufacturers / suppliers drawings.

FOR PLANNING PURPOSES ONLY

PARKING AMENDED	18.09.18 F
LANDSCAPING AMENDED AS CLIENT'S EMAIL 21.08.18	29.08.18 E
LANDSCAPING AMENDED	13.08.18 D
ROAD LAYOUT AMENDED ACCORDING TO RCA PLAN	02.08.18 C
RISING FOUL MAIN AMENDED	14.05.18 B
PLOT 13 CAR PARKING SPACES AMENDED	13.03.18 A

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Drwg
PROPOSED SITE PLAN

Project
PROPOSED RESIDENTIAL DEVELOPMENT AT FORMER INFANT'S SCHOOL SITE, BRODOG LANE, FISHGUARD

Client
PEMBROKESHIRE HOUSING ASSOCIATION

PEMBROKE DESIGN LIMITED

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hwest@pembrokedesign.co.uk

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CHARTERED ARCHITECTS
BUILDING SURVEYORS
QUANTITY SURVEYORS
CDM CO-ORDINATORS

SCALE IN METRES
0 5 10 15 20

DRAFT

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Appendix D - Natural Resources Wales Flood Risk Map and Welsh Government TAN 15 Development Advice Map

Cyfoeth Naturiol Cymru
Natural Resources Wales

Former Infant School Site, Brodog Lane, Fishguard, Pembrokeshire

Map Perygl Llifogydd / Flood Risk Map

Allwedd / Map Key

- Zone C1
- Zone C2
- Zone B
- Zone A

Graddfa / Scale 1: 5,001

Dyddiad / Date
28/09/2018

0.3 0 0.13 0.3

British_National_Grid Kilometers

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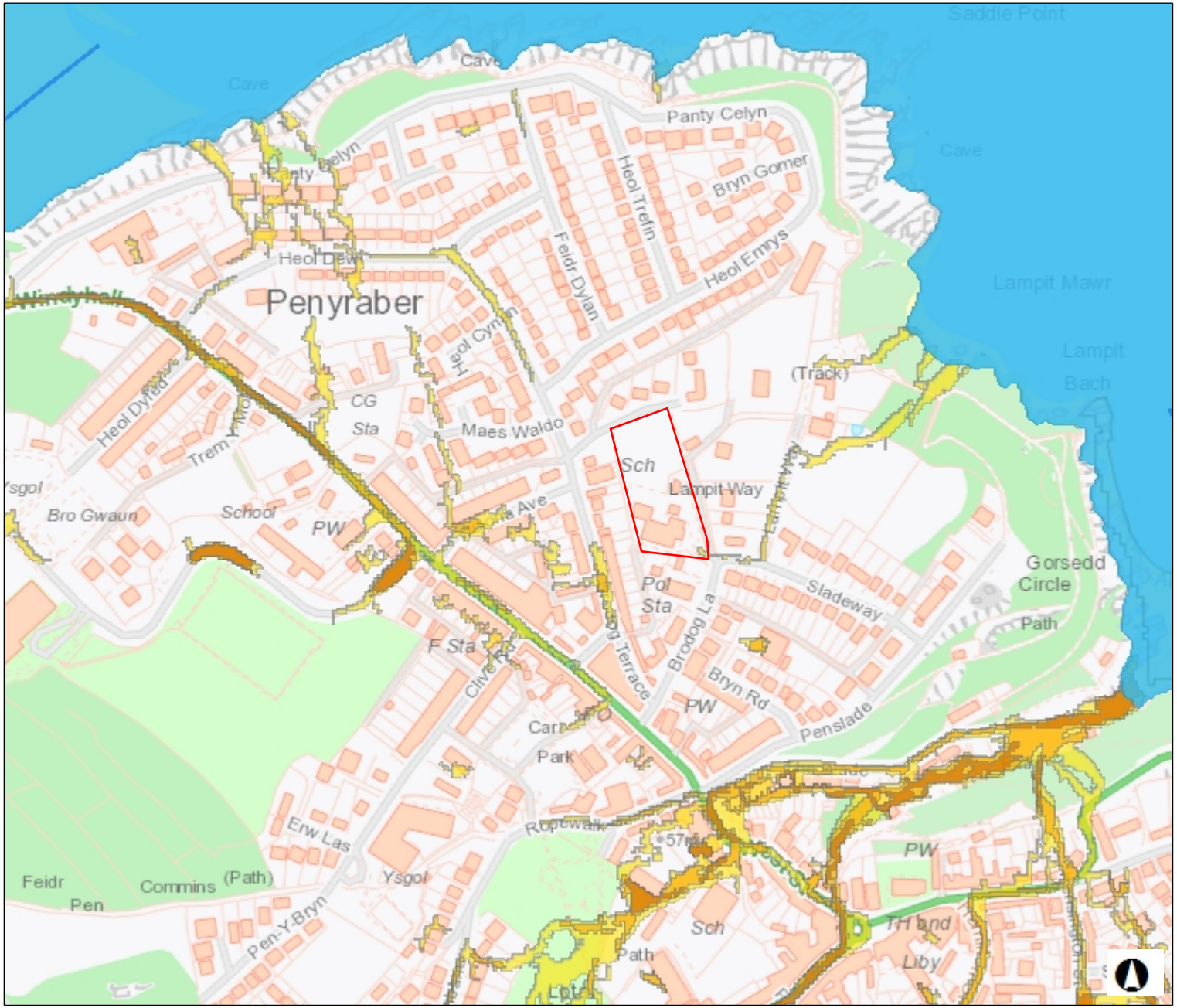

Cyfoeth Naturiol Cymru
Natural Resources Wales

Former Infant School Site, Brodog Lane, Fishguard, Pembrokeshire

Map Perygl Llifogydd / Flood Risk Map

Allwedd / Map Key

- Main Rivers
- Flood Defences
- Areas Benefiting from Flood Defences
- Shoreline Management Plan & Coastal Erosion
- Flood Storage Areas
- Floodmap Flood Zone 3
- Floodmap Flood Zone 2
- Reservoir Depths
  - 0 - 0.3m
  - 0.3 - 2.0m
  - Greater than 2.0m
- High Surface Water Flood Risk - Extent
- Medium Surface Water Flood Risk - Extent
- Low Surface Water Flood Risk - Extent

Graddfa / Scale 1: 5,001

Dyddiad / Date
28/09/2018

0.3 0 0.13 0.3

British_National_Grid Kilometers

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Appendix E - Dwr Cymru Welsh Water Pre-Planning Advice

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@dwrcymru.com

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
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Mr Jonathan Cole
Ateb group limited
Roger Casey Associates
6 Mansel Street
Carmarthen
Carmarthenshire
SA31 1PX

Date: 24/04/2018
Our Ref: PPA0002947

Dear Mr Cole

Grid Ref: 195591 237383
Site Address: Former Fishguard County Primary Infants School, Brodog Lane, Fishguard, Pembrokeshire, SA65 9NF
Development: 18 dwellings

I refer to your pre-planning enquiry received relating to the above site, seeking our views on the capacity of our network of assets and infrastructure to accommodate your proposed development. Having reviewed the details submitted I can provide the following comments which should be taken into account within any future planning application for the development.

SEWERAGE

The foul flows only from the proposed development can be accommodated within the public sewerage system. We advise that the flows should be communicated with to the foul/combined sewer between manholes SM95375302 and SM95375301 located south of the development site.

Should a planning application be submitted for this development we will seek to control these points of communication via appropriate planning conditions and therefore recommend that any drainage layout or strategy submitted as part of your application takes this into account.

However, should you wish for an alternative connection point to be considered please provide further information to us in the form of a drainage strategy, preferably in advance of a planning application being submitted.

With reference to the surface water flows from the proposed development, surface water should be discharged by sustainable means. We refer you to the Welsh Government 'Recommended non-statutory standards for sustainable drainage (SuDS)' of which there are four levels of sustainable surface water disposal methods outlined in a hierarchal approach (including rain water harvesting, infiltration, watercourses etc). Any future drainage scheme for the development site should include the

implementation, where possible, of these sustainable drainage methods for surface water disposal. Please also refer to further detailed advice relating to surface water management included in our attached Advice & Guidance note.

In addition, please note that no highway or land drainage run-off will be permitted to discharge directly or indirectly into the public sewerage system.

You may need to apply to Dwr Cymru Welsh Water for any connection to the public sewer under Section 106 of the Water industry Act 1991. However, if the connection to the public sewer network is either via a lateral drain (i.e. a drain which extends beyond the connecting property boundary) or via a new sewer (i.e. serves more than one property), it is now a mandatory requirement to first enter into a Section 104 Adoption Agreement (Water Industry Act 1991). The design of the sewers and lateral drains must also conform to the Welsh Ministers Standards for Foul Sewers and Lateral Drains, and conform with the publication "Sewers for Adoption"- 7th Edition. Further information can be obtained via the Developer Services pages of www.dwrcymru.com

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.

The proposed development site is crossed by a public sewer with the approximate positions being marked on the attached Statutory Public Sewer Record. 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 3 metres either side of the centreline of the 300mm rising main.

Our strong recommendation is that your site layout takes into account the location of the assets crossing the site and should be referred to in any master-planning exercises or site layout plans submitted as part of any subsequent planning application. Further information regarding Asset Protection is provided in the attached Advice & Guidance note.

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. However, this would require the installation of off-site mains from our water main. Under Sections 40 - 41 of the Water Industry Act 1991 the above cost is requisitionable and, subject to us receiving your detailed site layout plan and your

programme for construction, we would be able to provide a more accurate assessment of the developer's contribution. These details should be sent to the above address.

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.

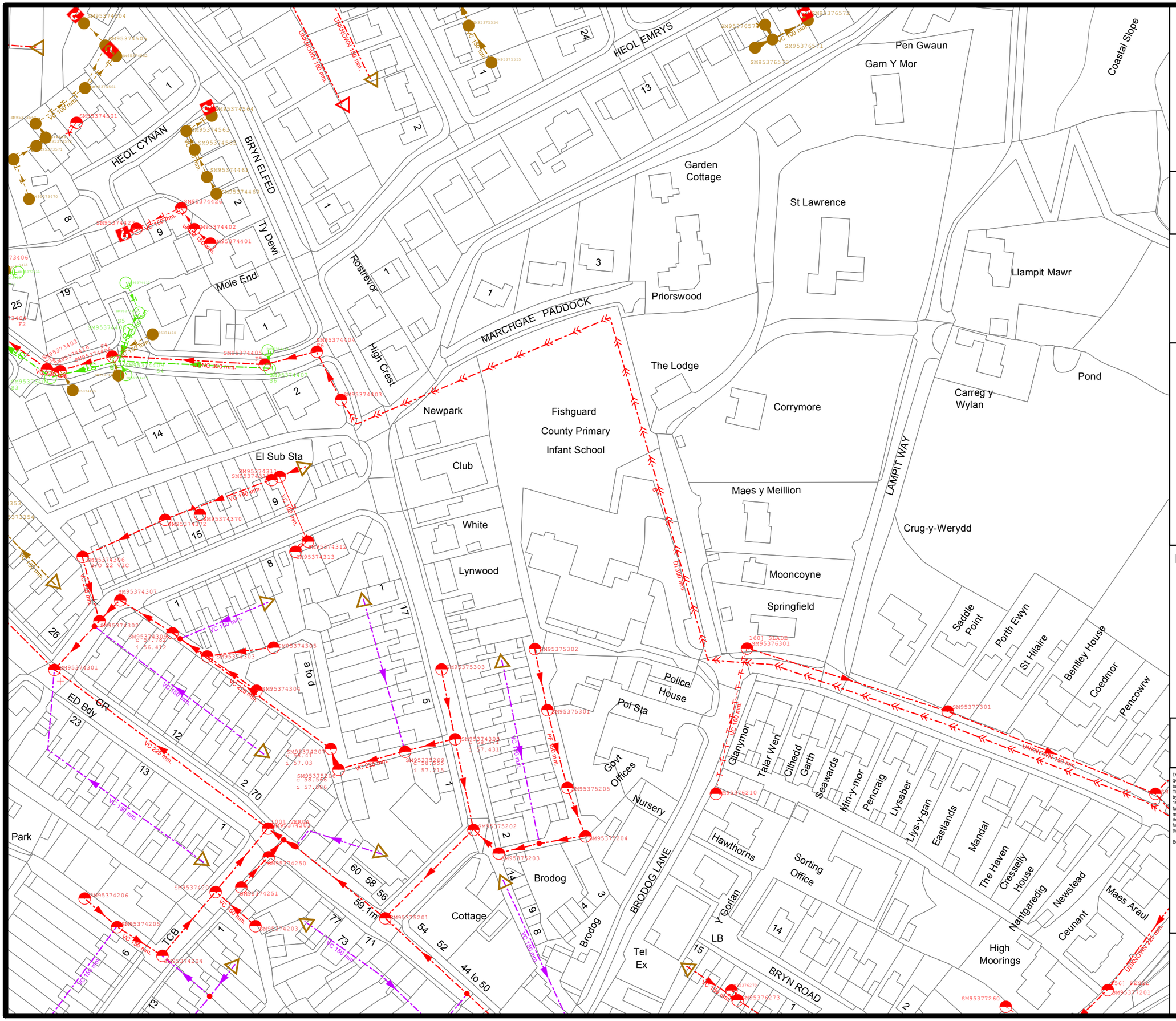
Please note that our response is based on the information provided in your enquiry and should the information change we reserve the right to make a new representation. Should you have any queries or wish to discuss any aspect of our response please do not hesitate to contact our dedicated team of planning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

Please quote our reference number in all communications and correspondence.

Yours faithfully,

Owain George
Planning Liaison Manager
Developer Services

***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.*



Dŵr Cymru Welsh Water

PPA0002947

N
W E
S

LEGEND(Representative of most common features)

Waste network:

- Foul chamber
- Surface water chamber
- Combined chamber
- Combined sewer overflow
- Special purpose chamber
- Treatment works
- Pumping station
- Outfall
- Lamphole
- Storm Overflow
- Rising main
- Gravity sewer
- Private sewer
- Private sewer subject to Sect. 104 adoption agreement
- Private Sewer Transfer
- Lateral Drain
- Inspection Chamber

NB: Sewer symbol colour indicates the type.

RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former S24 sewers (for indicative purposes only)

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best Information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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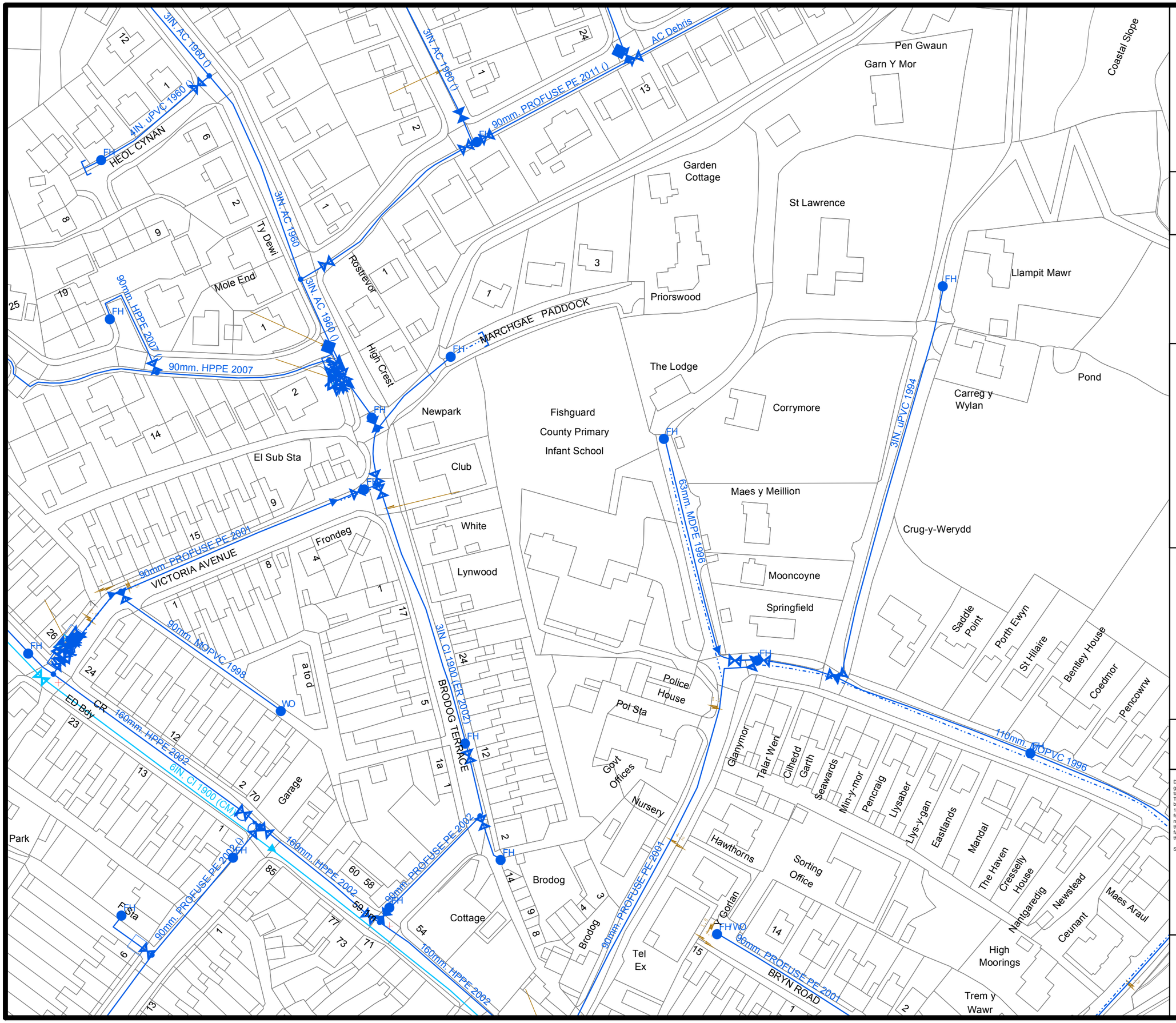
Map Ref:	195591,237379
Map scale:	1:1250
Printed by:	Harris Cerianne
Printed on:	24 Apr 2018



Dŵr Cymru
Welsh Water

PPA0002947

N
W E
S

LEGEND

Clean network:

- Sluice valve
- Pressure reducing valve
- Meter
- Bulk meter
- Hydrant
- Cap end
- Air valve
- Stop tap
- Water Treatment Works
- Water Pumping Station
- Existing main
- Non-operational main
- Raw Water

NB: Water main symbol colour indicates the type.

LIGHT BLUE - Trunk
DARK BLUE - Distribution
YELLOW - Raw Water

Notes:

Whilst every reasonable effort has been taken to correctly record the pipe material of DCWW assets, there is a possibility that in some cases pipe material (other than Asbestos Cement or Pitch Fibre) may be found to be asbestos cement (AC) or Pitch Fibre (PF) . It is therefore advisable that the possible presence of AC or PF pipes be anticipated and considered as part of any risk assessment prior to excavation

Dŵr Cymru Cyfyngedig ('the Company') gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the company's apparatus. The onus of locating apparatus before carrying out any excavations rests entirely on you. The information which is supplied by the Company, is done so in accordance with statutory requirements of sections 198 and 199 of the Water Industry Act 1991 which is based upon the best information available and, in particular, but without prejudice to the generality of the foregoing, it should be noted that the records that are available to the Company may not disclose the existence of a water main, service pipe, sewer, lateral drain or disposal main and any associated apparatus laid before 1 September 1989, or, if they do, the particulars thereof including their position underground may not be accurate. It must be understood that the furnishing of this information is entirely without prejudice to the provision of the New Roads and Street Works Act 1991 and the Company's right to be compensated for any damage to its apparatus.

Service pipes are not generally shown but their presence should be anticipated.

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref:	195591,237379
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Printed by:	Harris Cerianne
Printed on:	24 Apr 2018

PLANNING AND NEW DEVELOPMENT

Pre-Planning Advice & Next Steps

Dŵr Cymru Welsh Water

Dŵr Cymru Welsh Water has a key role to play in the town and country planning process as the services provided are at the forefront of public health and protection of the environment.

Our engagement in the planning process allows us to ensure that we can suitably service new development from a clean water and sewerage treatment perspective, but also provides us with the controls to enable us to mitigate any potential negative impact that new development is likely to have on the performance of our infrastructure, the service we provide to customers, and the wider environment. Crucially, the planning process also enables us to identify where new development and growth is planned so that we are able to target investment in our existing infrastructure within these areas.

Our Pre Planning Advice to you

You have now received our pre-planning advice which will provide you with information regarding the impact of your proposed development upon our assets and apparatus. Our letter will advise whether the local network can support the proposal, whether off-site water mains and/or sewers will need to be provided, and whether there are any apparatus located within the land you wish to develop and the requirements for these apparatus.

However, in some circumstances we may require further information from you to fully evaluate the impact of your development. If this is the case please proceed to submit the required detail as requested in the letter. Upon receipt of the information we can consider our position and provide you with an updated pre-planning response.

Please note that the advice provided is valid for a period of 12 months from the date of issue and will help us inform our response to the planning application for the development.

Next Steps....

You may now be proceeding to submit your planning application to the Local Planning Authority. Our preference is to see that drainage matters are resolved at pre-planning stage which will allow us to provide positive comments at planning consultation stage. In light of our pre-planning advice to you, it may therefore be in your interest to:

- Consider the drainage requirements and how the installation of new water mains/ sewers shapes the layout of your development. You will need to ensure that the design of the drainage layout will (where relevant) meet the appropriate standards for formal adoption by us (see further advice provided overleaf regarding Connecting to our Networks)
- Consider how your site layout ensures that any assets/ apparatus that may be located at the site are protected in line with the requirements set out in our letter
- Submit further information and/ or drainage plans so that we can review your proposal in greater detail
- Where further assessments are recommended, to commission those before the planning application is submitted to avoid any delays (see further advice provided overleaf on Network Modelling/WwTW Feasibility Studies)
- Provide a copy of our pre-planning enquiry response to the Local Planning Authority as part of your planning application submission to demonstrate you have considered drainage aspects of your development at pre-application stage, and that we are aware of your proposal.

Our Involvement in the Planning Application Process

We provide Local Planning Authorities with advice on the ability of our assets to accommodate proposed development. Our comments are crucial in providing comfort to the Local Authority that new development sites can be effectively drained and can be supplied with clean water.

When sites can be accommodated in our networks we will recommend drainage related planning conditions which may seek to control the point of communication with our networks and the type of discharges that we may permit. We may also recommend conditions to secure the submission of further details, such as drainage plans and strategies (please note that we will resist the physical communication to our networks until drainage related conditions have been discharged)

However, there are instances where further assessments are required and we will seek to work collaboratively with you and the Local Planning Authority to establish a positive outcome for all parties.

PLANNING AND NEW DEVELOPMENT

General Advice and Guidance

Dŵr Cymru
Welsh Water

Our pre-planning response will provide advice dedicated to your development. However, we also offer the following general advice around drainage matters and communicating to our networks.

Managing Surface Water at your Development Site

As with all new development sites, you will need to consider how to deal with the surface water runoff from new buildings and hard standings. Traditionally, surface water has been managed by installing new pipes and large storage tanks to take flow away from land as quickly as possible. However, Dŵr Cymru actively encourage the use of Sustainable Urban Drainage Systems (SUDS), which is an approach to managing surface water run-off by imitating natural drainage systems and retaining water on or near the site.

SUDS involve a range of techniques including green roofs, rainwater harvesting, permeable pavements, etc. SUDS offer significant advantages over conventional piped drainage systems in reducing flood risk by attenuating the rate and quantity of surface water run-off from a site, promoting groundwater recharge, and improving water quality and amenity. The variety of SUDS techniques available means that virtually any development should be able to include a scheme based around these principles. Good justification would be required not to incorporate a SUDS scheme on the site.

All new developments will therefore be expected to consider surface water management techniques and fully exhaust all technical options outlined under Sections 3.2 and 3.4 of Part H of the publication 'Building Regulations 2000'. These regulations ensure that disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to watercourses in liaison with the Land Drainage Authority and/or Natural Resources Wales or the Evironment Agency in England. Discharge of surface water to the public sewer is only to be made as a last resort. The management of highway or land drainage run off will also need to be considered as these flows will not be allowed to discharge directly or indirectly into the public sewerage system.

Network Hydraulic Modelling/ WwTW Feasibility Studies

Our pre-planning advice will provide you with an indication of whether our networks can accommodate your development. However there may be instances where our assets cannot at present service your site.

Our aim is to support economic development and growth within our operational area and we do not want to resist new development where possible. However we must be mindful of our assets, existing customers and the environment. In areas where there are issues either on our network or at the Wastewater Treatment Works (WwTW), we may already have proposals in place to address these concerns and to create capacity within the network for new developments.

However, there may be instances where you intend to develop your site in advance of Dwr Cymru undertaking improvements. If this is the case, to ensure there is no detriment to our existing customers you may be required to implement solutions identified by an assessment of either the network or Wastewater Treatment Works. Please note that you will not be expected to resolve any operational issues that exist.

Where further assessments are recommended, please be advised that you will need to allow sufficient time in your development program for these studies to be undertaken and for any improvements to be implemented, as in some circumstances we will not permit a communication to our networks until these works are completed.

Where possible, we will seek to control the delivery of any solutions as part of the planning process. Dependent on the progress of the assessment, we may be in a position to recommend appropriate planning conditions so that the outcomes of the assessment can be delivered as part of any planning permission. This approach allows us to support the progression of the site through the planning process, however in the absence of a completed assessment and known solutions we may need to work with you and the Local Planning Authority until the assessment is completed and the outcomes are known.

PLANNING AND NEW DEVELOPMENT

Making Connections to our Networks

Dŵr Cymru
Welsh Water

Installing Your Drainage System and Making Connections to the Public Sewer

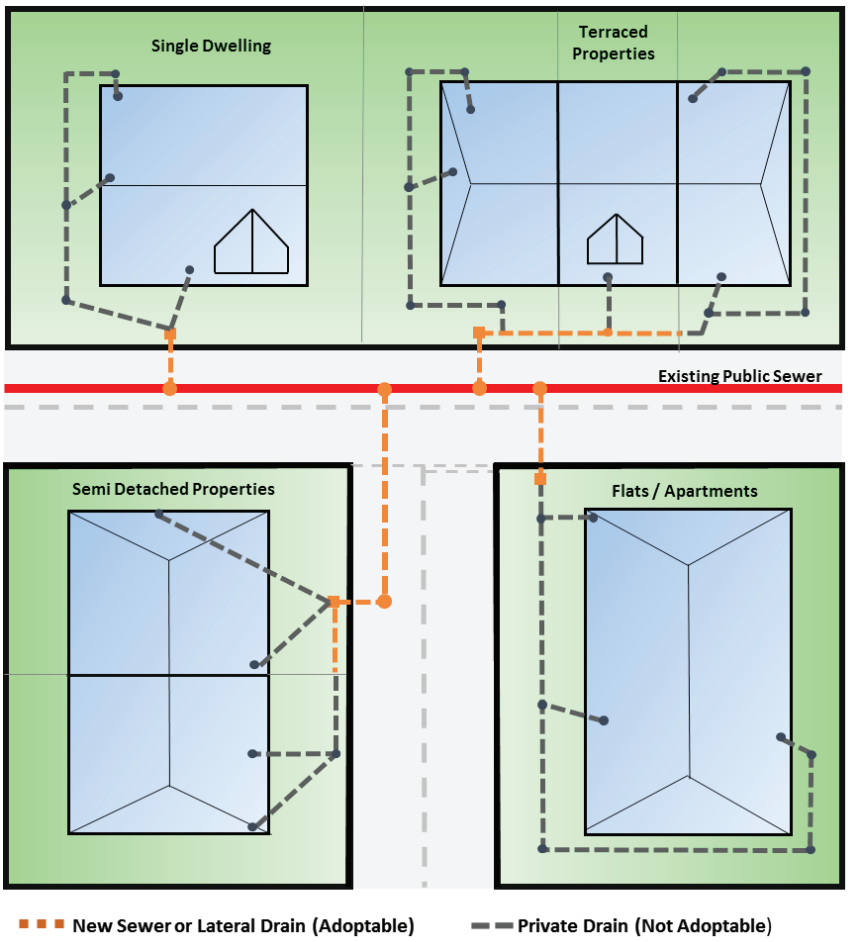
You will need to apply to us to make a connection to the public sewer, and depending on the layout of the drainage system you are proposing for your site, you may also be required to enter into an Adoption Agreement with us.

If your connection to the public sewer network is either via a lateral drain (i.e. a drain which extends beyond the connecting property boundary) or via a new sewer (i.e. serves more than one property), it is now a mandatory requirement to first enter into a Section 104 Adoption Agreement (Water Industry Act 1991) with us.

The design of the sewer and lateral drain must also conform to the Welsh Ministers Standards for Gravity Foul Sewers and Lateral Drains, and conform with the publication "Sewers for Adoption"- 7th Edition.

Please be advised that we will not enter into a sewer adoption agreement for any sewer or lateral drain which is constructed in advance of the adoption agreement being in place. Further information on whether you will require a Section 104 Adoption Agreement and the adoption process can be obtained by contacting us.

To make the physical communication to the public sewer you will need to apply under Section 106 of the Water Industry Act 1991. An application pack can be obtained from our website and as part of the submission you will need to demonstrate that an adoption



agreement (if applicable) is in place, and that you have the relevant planning permissions in place for your development. Please be advised that if your site is subject to an Adoption Agreement we will not permit your communication until the agreement is in place.

Your New Water Supply

Our pre-planning advice will indicate whether your site can be adequately serviced by our clean water network. If new connections are required, we would invite you to submit an application to us at www.dwrcymru.com under Developer Services. Here you will find information about the services we have available and all our application forms and guidance notes. You can complete forms online and also make payments via our website.

Upon approval of your Application and Water Regulations Notification we will notify you accordingly, send you a quotation for our estimated cost of your connection and a plan advising you of the work you need to carry out.

Our quotation is valid for 6 months. If payment is not received during this period you will need to re-submit a new application plus application fee if you wish to continue.

PLANNING AND NEW DEVELOPMENT

Requisitions and Asset Protection

Dŵr Cymru
Welsh Water

Requisition a Water Main or Public Sewer

As the Statutory Water and Sewerage Undertaker we have a duty under the Water Industry Act 1991 to comply with a Requisition Notice served on us for the provision of a water main and/or public sewer to serve the development site.

Two main reasons exist for the person(s) exercising the rights to serve Notice. The first is where a person(s) wishes us to lay water mains and/or sewers in private land (by us serving Notice under Section 159 (WIA91) so that a communication with an existing watermain or public sewer can be achieved; the second is where, as a consequence of the provision of the new watermain/public sewer, reinforcement of the existing network is required to ensure that the development, and the local area, has an effective system (refer to Section 37 (water) and Section 94 (sewers) of the Water Industry Act 1991)

Under the provisions of the WIA 1991, we are entitled to recover the costs we incur in providing a requisitioned watermain or sewer. This includes, among other things, the reasonable costs of design, labour, plant, materials, reinstatement, land purchase (if applicable), compensation, and quality testing, inspection, supervision, administration and overhead costs.

Further information on the Requisition process can be obtained by contacting our team of dedicated Engineers or by visiting the Developer Services pages of our website.

Assets Located at your Development Site

Our pre-planning advice letter may have drawn your attention to assets and/or apparatus located within your development site. It is important to note that under section 159 of the Water Industry Act 1991, Welsh Water has rights of access in order to inspect, maintain adjust repair or alter any asset or apparatus at all times.

Locating an Asset

Our pre-planning letter will be accompanied by water main and sewer extract plans, providing you with an indication of the asset location within the site. However, we provide this information as general guidance only and on the strict understanding that it is on the best information available (see notes within our plans for further information). The onus of locating the apparatus before carrying out any excavation rests entirely with you. To accurately locate any assets, please contact our team of planning officers for further guidance.

Protecting an Asset

The presence of an asset within the development site will have an impact on the layout and general arrangement of the site. Our pre-planning advice letter will provide you with the requirements for the protection of the asset(s) and you will need to ensure that the layout incorporates these requirements. Our recommendation is that our assets are incorporated into any site layout plan that is submitted as part of any planning application, so that we and the Local Planning Authority can be satisfied that you have acknowledged the presence of such assets and have taken the necessary steps to protect them at the site.

Diverting a Water Main or Public Sewer

If you have concluded that the asset located within the site could not be incorporated within the layout of the new development, or our rights of access to the asset may be hindered by your proposal, you may request the alteration or removal, including diversion of that apparatus to accommodate a proposed improvement of that land (e.g. development or change of use). This provision is provided under Section 185 of the Water Industry Act 1991. Further information on diverting an asset can be obtained by contacting our team of dedicated Engineers or by visiting the Developer Services pages of our website.

Contact Us

For more information, contact Welsh Water's Planning team:

Email: developer.services@dwrcymru.com

Visit: www.dwrcymru.com

Tel: 0800 917 2652

Appendix F - Foul & Surface Water Drainage Strategy Site Plan

DO NOT SCALE

GRID N

ALL ADOPTABLE CARRIAGEWAY AREAS LAID IN PERMEABLE PAVING WITH SURFACE WATER INFILTRATING INTO UNDERLYING GROUND STRATA

DWELLING ROOF WATER ONLY FLOWS DRAINED INTO CLEAN SUB BASE LAYER OF PERMEABLE SURFACED PARKING AREAS

GRASS VERGE AREAS TO BREAK UP CROSSOVERS

FOOTPATHS AND CROSSOVERS LAID IN IMPERMEABLE MACADAM LAID TO 1:40 CROSSFALL ON TO PERMEABLE CARRIAGEWAY

GRASS VERGE AREAS TO BREAK UP CROSSOVERS

ALL PARKING AREAS LAID IN PERMEABLE PAVING WITH SURFACE WATER INFILTRATING INTO UNDERLYING GROUND STRATA

DWELLING ROOF WATER ONLY FLOWS DRAINED INTO CLEAN SUB BASE LAYER OF PERMEABLE SURFACED PARKING AREAS

ALL ADOPTABLE CARRIAGEWAY AREAS LAID IN PERMEABLE PAVING WITH SURFACE WATER INFILTRATING INTO UNDERLYING GROUND STRATA

TRACED ALIGNMENT OF EXISTING DCWW PUBLIC SEWER RISING MAIN AND ASSOCIATED 6m WIDE EASEMENT TO BE RETAINED AND PROTECTED

1.8m WIDE FOOTPATHS AT SITE ENTRY TO ALLOW UNDERGROUND UTILITY COMPANY MAINS LAY IN ACCORDANCE WITH NRSWA REQUIREMENTS

NEW GRAVITY FOUL WATER COLLECTION SYSTEM DRAINING DWELLING FOUL WATER ONLY FLOWS TO EXISTING FOUL WATER DRAINAGE MANHOLE CHAMBER PREVIOUSLY SERVING INFANT SCHOOL

BRODOG LANE

CONIFER TREES

NOTES:

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WORK TO FIGURED DIMENSIONS IN PREFERENCE TO SCALING.

THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER ROGER CASEY ASSOCIATES DRAWINGS AND SPECIFICATIONS AND ALL OTHER CONSULTANTS DRAWINGS AND SPECIFICATIONS RELATING TO THIS PROJECT.

REV.	DESCRIPTION	DRAWN	CHECK	DATE

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CLIENT:
ateb group limited

ARCHITECT:
PEMBROKE DESIGN LIMITED

PROJECT:
RESIDENTIAL DEVELOPMENT AT former Infant School, Brodog Lane, Fishguard, Pembrokeshire SA65 9NF

DRAWING TITLE:
DRAINAGE STRATEGY SITE PLAN

DRAWN BY:	DESIGN BY:	CHECKED BY:	DATE:
PWJL	PWJL	RSC	28/09/18

ORIGINAL DRAWING A1	SCALES:	DRAWING No:	REVISION:
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28/09/2018 15:16:24
RCA Document Reference: RCA A1 Landscape Version 1
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Appendix G - Initial Surface Water Infiltration Calculations

Roger Casey Associates
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Job No.	:	**20092**
Sheet	:	**S1**
Made by	:	PWJL
Date	:	11-Jul-18
Checked	:	RSC
Revision	:	-

Ref:	CALCULATIONS	Output.

RESIDENTIAL DEVELOPMENT AT FORMER INFANT SCHOOL, BRODOG LANE, FISHGUARD, PEMBROKESHIRE SA65 9NF

Client: ateb group limited

RCA Brief: Private and Adoptable Permeable Paving for infiltration

Design Data:
1 Percolation Test Results.
2 BRE 365.
3 Building Regulations Approved Document Part H.
4 Sewers for Adoption 7th Edition.
5 Site Location Co-Ordinates:
E 195590
N 237388
6 Site Grid Reference: SM 95590 37388
7 Time of Entry = 4 minutes.
8 Welsh Ministers Standards.

Information Provided:
Architectural Site Plan.
Percolation Test Result.
Land Survey.

Drainage Design By:
Micro Drainage Network - Version 2017.1.2
Micro Drainage Source Control - Version 2017.1.2
Micro Drainage Simulation- Version 2017.1.2

Revisions:

Revision Version:	Description:	Date:

Calculations Prepared By:		Calculations Checked By:	
Philip Lawrence		Roger Casey	
Signed:	Date:	Signed:	Date:
	11/07/2018		11/07/2018

Template Issue Date: 21/03/2016

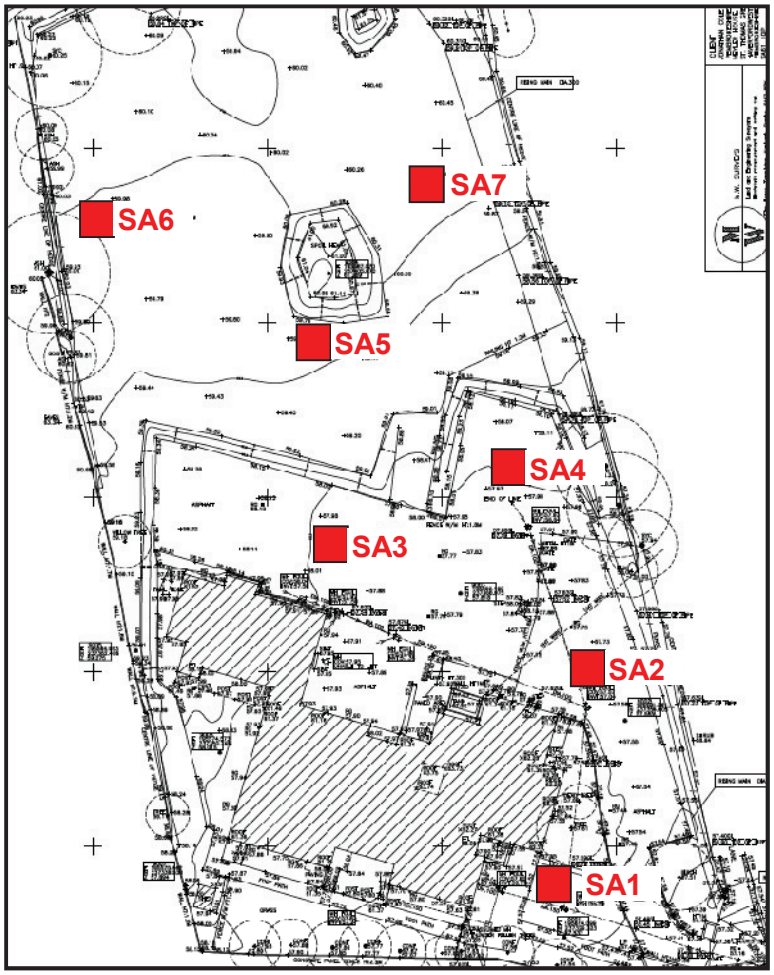

Figure 1: Soakaway Test Locations

Table 1 Soakaway Test Results

Test Location	Infiltration Rate (m/s)	Test Location	Result
SA1		**SA5**	
Fill 1	1.09×10^{-5}	Fill 1	7.74×10^{-5}
Fill 2	6.26×10^{-6}	Fill 2	4.78×10^{-5}
Fill 3	Insufficient time to complete third fill	Fill 3	3.46×10^{-5}
SA2		**SA6**	
Fill 1	3.69×10^{-5}	Fill 1	6.51×10^{-5}
Fill 2	3.42×10^{-5}	Fill 2	4.8×10^{-5}
Fill 3	3.49×10^{-5}	Fill 3	3.41×10^{-5}
SA3		**SA7**	
Fill 1	Infiltration too quick to measure. Pit emptied on each fill within 2 minutes.	Fill 1	1.59×10^{-5}
Fill 2		Fill 2	1.39×10^{-5}
Fill 3		Fill 3	Insufficient time to complete third fill
SA4			
Fill 1	2.20×10^{-4}	Average 10^-5 Soil Infiltration Rate = 4.132 x 10^-5 m/s = 0.148752 m/hr	
Fill 2	6.68×10^{-5}		
Fill 3	5.80×10^{-5}		

Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 20 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.877	0.177	0.8	1.0	O K
30 min Summer	9.901	0.201	0.9	1.3	Flood Risk
60 min Summer	9.913	0.213	1.0	1.5	Flood Risk
120 min Summer	9.908	0.208	0.9	1.4	Flood Risk
180 min Summer	9.896	0.196	0.9	1.3	O K
240 min Summer	9.883	0.183	0.8	1.1	O K
360 min Summer	9.862	0.162	0.7	0.9	O K
480 min Summer	9.846	0.146	0.7	0.7	O K
600 min Summer	9.832	0.132	0.6	0.6	O K
720 min Summer	9.821	0.121	0.5	0.5	O K
960 min Summer	9.804	0.104	0.5	0.4	O K
1440 min Summer	9.781	0.081	0.4	0.2	O K
2160 min Summer	9.762	0.062	0.3	0.1	O K
2880 min Summer	9.750	0.050	0.2	0.1	O K
4320 min Summer	9.743	0.043	0.2	0.1	O K
5760 min Summer	9.739	0.039	0.1	0.0	O K
7200 min Summer	9.736	0.036	0.1	0.0	O K
8640 min Summer	9.733	0.033	0.1	0.0	O K
10080 min Summer	9.731	0.031	0.1	0.0	O K
15 min Winter	9.891	0.191	0.9	1.2	O K
30 min Winter	9.914	0.214	1.0	1.5	Flood Risk
60 min Winter	9.922	0.222	1.0	1.6	Flood Risk
120 min Winter	9.910	0.210	1.0	1.5	Flood Risk
180 min Winter	9.891	0.191	0.9	1.2	O K
240 min Winter	9.873	0.173	0.8	1.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	100.735	0.0	15
30 min Summer	70.415	0.0	23
60 min Summer	47.182	0.0	40
120 min Summer	30.519	0.0	74
180 min Summer	23.240	0.0	106
240 min Summer	18.971	0.0	136
360 min Summer	14.245	0.0	198
480 min Summer	11.606	0.0	258
600 min Summer	9.889	0.0	318
720 min Summer	8.670	0.0	376
960 min Summer	7.036	0.0	494
1440 min Summer	5.228	0.0	736
2160 min Summer	3.872	0.0	1100
2880 min Summer	3.123	0.0	1444
4320 min Summer	2.305	0.0	2188
5760 min Summer	1.860	0.0	2936
7200 min Summer	1.576	0.0	3560
8640 min Summer	1.376	0.0	4296
10080 min Summer	1.228	0.0	5136
15 min Winter	100.735	0.0	15
30 min Winter	70.415	0.0	25
60 min Winter	47.182	0.0	44
120 min Winter	30.519	0.0	78
180 min Winter	23.240	0.0	110
240 min Winter	18.971	0.0	142

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	9.845	0.145	0.7	0.7	O K
480 min Winter	9.825	0.125	0.6	0.5	O K
600 min Winter	9.809	0.109	0.5	0.4	O K
720 min Winter	9.798	0.098	0.4	0.3	O K
960 min Winter	9.781	0.081	0.4	0.2	O K
1440 min Winter	9.760	0.060	0.3	0.1	O K
2160 min Winter	9.748	0.048	0.2	0.1	O K
2880 min Winter	9.743	0.043	0.2	0.1	O K
4320 min Winter	9.737	0.037	0.1	0.0	O K
5760 min Winter	9.733	0.033	0.1	0.0	O K
7200 min Winter	9.730	0.030	0.1	0.0	O K
8640 min Winter	9.728	0.028	0.1	0.0	O K
10080 min Winter	9.727	0.027	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.245	0.0	202
480 min Winter	11.606	0.0	262
600 min Winter	9.889	0.0	322
720 min Winter	8.670	0.0	378
960 min Winter	7.036	0.0	500
1440 min Winter	5.228	0.0	736
2160 min Winter	3.872	0.0	1096
2880 min Winter	3.123	0.0	1424
4320 min Winter	2.305	0.0	2188
5760 min Winter	1.860	0.0	2904
7200 min Winter	1.576	0.0	3744
8640 min Winter	1.376	0.0	4464
10080 min Winter	1.228	0.0	5088

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.279	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.009

Time (mins) From:	To:	Area (ha)
0	4	0.009

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Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.14875	Width (m)	5.5
Membrane Percolation (mm/hr)	1000	Length (m)	10.0
Max Percolation (l/s)	15.3	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.700	Membrane Depth (m)	0

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Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 38 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.798	0.248	1.1	2.4	O K
30 min Summer	9.856	0.306	1.1	3.3	O K
60 min Summer	9.893	0.343	1.1	3.9	O K
120 min Summer	9.902	0.352	1.1	4.1	Flood Risk
180 min Summer	9.887	0.337	1.1	3.8	O K
240 min Summer	9.865	0.315	1.1	3.5	O K
360 min Summer	9.823	0.273	1.1	2.8	O K
480 min Summer	9.785	0.235	1.1	2.2	O K
600 min Summer	9.755	0.205	1.1	1.8	O K
720 min Summer	9.734	0.184	1.1	1.4	O K
960 min Summer	9.710	0.160	0.9	1.1	O K
1440 min Summer	9.678	0.128	0.8	0.7	O K
2160 min Summer	9.650	0.100	0.6	0.4	O K
2880 min Summer	9.632	0.082	0.5	0.3	O K
4320 min Summer	9.611	0.061	0.4	0.2	O K
5760 min Summer	9.600	0.050	0.3	0.1	O K
7200 min Summer	9.596	0.046	0.2	0.1	O K
8640 min Summer	9.593	0.043	0.2	0.1	O K
10080 min Summer	9.590	0.040	0.2	0.1	O K
15 min Winter	9.822	0.272	1.1	2.8	O K
30 min Winter	9.889	0.339	1.1	3.9	O K
60 min Winter	9.933	0.383	1.1	4.5	Flood Risk
120 min Winter	9.936	0.386	1.1	4.6	Flood Risk
180 min Winter	9.907	0.357	1.1	4.1	Flood Risk
240 min Winter	9.870	0.320	1.1	3.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	100.735	0.0	21
30 min Summer	70.415	0.0	32
60 min Summer	47.182	0.0	50
120 min Summer	30.519	0.0	86
180 min Summer	23.240	0.0	120
240 min Summer	18.971	0.0	152
360 min Summer	14.245	0.0	216
480 min Summer	11.606	0.0	276
600 min Summer	9.889	0.0	332
720 min Summer	8.670	0.0	388
960 min Summer	7.036	0.0	506
1440 min Summer	5.228	0.0	744
2160 min Summer	3.872	0.0	1104
2880 min Summer	3.123	0.0	1468
4320 min Summer	2.305	0.0	2172
5760 min Summer	1.860	0.0	2880
7200 min Summer	1.576	0.0	3608
8640 min Summer	1.376	0.0	4344
10080 min Summer	1.228	0.0	4984
15 min Winter	100.735	0.0	22
30 min Winter	70.415	0.0	33
60 min Winter	47.182	0.0	56
120 min Winter	30.519	0.0	92
180 min Winter	23.240	0.0	130
240 min Winter	18.971	0.0	164

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Summary of Results for 100 year Return Period (+30%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	9.801	0.251	1.1	2.5	O K
480 min Winter	9.749	0.199	1.1	1.7	O K
600 min Winter	9.722	0.172	1.0	1.3	O K
720 min Winter	9.705	0.155	0.9	1.0	O K
960 min Winter	9.680	0.130	0.8	0.7	O K
1440 min Winter	9.648	0.098	0.6	0.4	O K
2160 min Winter	9.624	0.074	0.4	0.2	O K
2880 min Winter	9.609	0.059	0.3	0.2	O K
4320 min Winter	9.597	0.047	0.3	0.1	O K
5760 min Winter	9.592	0.042	0.2	0.1	O K
7200 min Winter	9.589	0.039	0.2	0.1	O K
8640 min Winter	9.586	0.036	0.2	0.1	O K
10080 min Winter	9.584	0.034	0.1	0.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.245	0.0	226
480 min Winter	11.606	0.0	280
600 min Winter	9.889	0.0	334
720 min Winter	8.670	0.0	392
960 min Winter	7.036	0.0	510
1440 min Winter	5.228	0.0	748
2160 min Winter	3.872	0.0	1104
2880 min Winter	3.123	0.0	1472
4320 min Winter	2.305	0.0	2204
5760 min Winter	1.860	0.0	2848
7200 min Winter	1.576	0.0	3640
8640 min Winter	1.376	0.0	4360
10080 min Winter	1.228	0.0	5072

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Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	18.000	Shortest Storm (mins)	15
Ratio R	0.279	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.019

Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)	Time (mins) From:	To:	Area (ha)
0	4	0.007	4	8	0.006	8	12	0.006

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Model Details

Storage is Online Cover Level (m) 10.000

Porous Car Park Structure

Infiltration Coefficient Base (m/hr)	0.14875	Width (m)	7.1
Membrane Percolation (mm/hr)	1000	Length (m)	7.3
Max Percolation (l/s)	14.4	Slope (1:X)	40.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	9.550	Membrane Depth (m)	0

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