

Maes Emlyn, Rhyl

Drainage Strategy

September 2023

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Client:	TACP Architects Ltd
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Approval Record	
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01	28/02/2023	First issue
02	21/04/2023	Report update to include ground investigations
03	18/09/2023	Report updated following DCWW correspondence

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This report will remain valid for a period of twelve months (from the date of last issue) after which the source data should be reviewed in order to reassess the findings and conclusions on the basis of latest available information.

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Introduction

Waterco has been instructed to prepare a Drainage Strategy in respect of a proposed residential development at Maes Emlyn, Rhyl, LL18 3SF.

The aim of the Sustainable Drainage Strategy is to identify water management measures, including Sustainable Drainage Systems (SuDS), to provide surface water runoff reduction and treatment. This report has been prepared in accordance with the Welsh Government 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems' (2018) – herein referred to as 'the Statutory Standards for SuDS'.

This report has been prepared in consultation with Denbighshire County Council as the Sustainable Drainage Approval Body (SAB) and Dŵr Cymru Welsh Water (DCWW).

Existing Conditions

The site covers an area of approximately 8,900m² and is located at National Grid Reference (NGR) 301448, 381587. A location plan and an aerial image are included in Appendix A.

Online mapping (including Google Maps / Google Streetview imagery, accessed February 2023) shows that the site comprises existing residential properties (59 units) with associated access and parking. The site is bordered by residential properties to the north, north-east and west, and a railway line to the east and south. Access to the site is provided from Churton Road to the north.

Local Topography

Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Natural Resources Wales (NRW) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR data shows that the site slopes from approximately 7.08m AOD in the south-west to approximately 6.45m AOD in the east. A LiDAR extract is included as Appendix B.

Ground Conditions

Published Geology

The British Geological Survey (BGS) online mapping (1:50,000 scale) indicates that the site is underlain by superficial deposits of blown sand. The superficial deposits are identified as being underlain by the Kinnerton Sandstone Formation.

The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

The closest historical BGS borehole record (BGS Reference: SJ08SW10) is located 320m north-west of the site and is included in Appendix C. The borehole record generally identifies sand to approximately 2.5 metres below ground level (m.bgl) underlain by silty clay to approximately 3.3 m.bgl.

Ground Investigation

GroundSolve Ltd have undertaken an intrusive ground investigation in January 2023 (project no. GSL2841). The intrusive ground investigation comprised 6No. windowless sample (WS) boreholes advanced to a maximum depth of 5.45 metres below ground level (m.bgl). Windowless sample logs are included as Appendix D.

The ground conditions identified in the intrusive investigation are summarised below:

- Made Ground was observed in WS04 from ground level to 0.50m.bgl.
- Topsoil was observed in all windowless sample boreholes, except WS04, from ground level to a maximum depth of 0.40m.bgl. Topsoil generally consisted of loose dark brown, slightly gravelly silt with rootlets.
- Made Ground was observed in WS03 from a minimum depth of 0.15m.bgl to a maximum depth of 0.70m.bgl. Made Ground generally consisted of loose brown slightly silty gravelly sand.
- Beach deposits were observed in all windowless sample boreholes from a minimum depth of 0.20m.bgl to a maximum depth of 2.00m. Beach deposits generally consisted of loose to medium, dense brown/grey sand.
- Glacial till was observed in all windowless sample boreholes from a minimum depth of 0.70m.bgl to a maximum depth of 5.45m.bgl.

Infiltration tests have been undertaken as part of the intrusive ground investigation undertaken by GroundSolve Ltd in January 2023. The tests show that all of the trial pits failed the first cycle, as the water failed to percolate through the underlying superficial deposits.

Groundwater was encountered within all of the exploratory hole locations within either the Made Ground or wind-blown sand, at depths between 0.60m.bgl and 1.00m.bgl.

Hydrogeology

According to NRW's Aquifer Designation data, obtained from the BGS GeoIndex online mapping [accessed February 2023], the blown sand is classified as a Secondary A Aquifer. Secondary A aquifers are 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers.

The underlying Kinnerton Sandstone Formation is classified as a Principal Aquifer. Principal Aquifers are layers of rock or drift deposits that have high intergranular and/or fracture permeability – meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale.

Local Drainage

Public sewer records have been obtained from DCWW and are included in Appendix E. The DCWW sewer records show that there is a 300mm public combined sewer originating in the eastern extent of the site

flowing east. There are also public foul and surface water sewers serving residential properties in Y Gorlan to the north-west of the site. The public foul and surface water sewers in Y Gorlan discharge to a public combined sewer in Churton Road immediately north of the site.

A GPR utility survey was undertaken by PM Surveys UK Ltd in August 2022 and is included in Appendix F. The GPR survey shows that foul flows from the site drain to the public combined sewer in the eastern extent of the site. The GPR survey identifies surface water connections into the foul drains on site, indicating that the drainage system is combined.

A drainage connectivity survey was undertaken by Invek Surveys in June 2023 and is included in Appendix G. The drainage survey confirms that foul and surface water flows from the site drain to the 300mm public combined sewer in the eastern extent of the site. The public combined manhole in the eastern extent of the site has an identified downstream invert level of 5.08m AOD.

Development Proposals

The proposal is for a residential re-development to include the demolition of 59no. existing dwellings and the erection of 38no. dwellings with associated access roads, parking and gardens. A proposed development plan is included in Appendix H.

The proposed development will include hardstanding areas in the form of residential buildings, parking and access. The proposed new hardstanding areas will cover approximately 4,930m². Measurements have been taken from a PDF copy of the 'Site Layout' (MEH-TACP-PS-ST-DR-A-701) and are approximate only.

Policy Context

The Denbighshire County Council Local Development Plan contains the following policies relating to water management and drainage:

'Policy VOE 6 – Water Management.

All development will be required to incorporate water conservation measures, where practicable. Major development proposals (greater than 1,000 sqm floorspace or 10 dwellings) should be accompanied by a Water Conservation Statement.

All development will be required to eliminate or reduce surface water run-off from the site, where practicable. The run-off rates from the site should maintain or reduce pre-development rates.

Justification

The use of Sustainable Drainage Systems (SuDS) to manage surface water flows can also be an important tool in minimising flood risk by increasing permeable surfaces in an area which allows water to seep into the

ground rather than running off into the drainage system. The effective use of permeable surfaces, soakaways and water storage areas should be incorporated in all new development where technically possible. SuDS can also reduce the impact of diffuse pollution from run-off and flooding securing environmental, biodiversity and aesthetic benefits. Early consideration of SuDS is required in order that a range of techniques can be considered and developers are encouraged to enter into early discussions with the Council.'

Consultation

A consultation request was submitted to the SAB in December 2022. In their response (Appendix I), the SAB have stated that:

'We would have no objections in principle to your intention of discharging the surface water from the site into the public combined sewer, providing the following conditions are met:

- 1. Evidence that the hierarchy has been followed and that you have explored and exhausted alternative surface water drainage options.*
- 2. Confirmation from Welsh Water that they are happy to accept flows from the site.'*

A pre-development enquiry request was submitted to DCWW in November 2022. In their response (Appendix E), DCWW have stated:

'Public Sewerage Network

The proposed development site is located in the immediate vicinity of a separate sewerage system, comprising combined, foul and surface water public sewers, which drains to Kimmel Bay Wastewater Treatment Works (WwTW).

Asset Protection

This site is crossed by public watermains with their approximate position being marked on the attached Statutory Public Sewer Record. In accordance with the Water Industry Act 1991, Dŵr Cymru Welsh Water requires access to its apparatus at all times in order to carry out maintenance and repairs.

No part of any building will be permitted within the protection zone of the public watermains measured 3 metres either side of the centreline of the 100mm public watermain.

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.

Surface Water Drainage

As of 7th January 2019, this proposed development is subject to Schedule 3 of the Flood and Water Management Act 2010. The development therefore requires approval of Sustainable Drainage Systems (SuDS) features, in accordance with the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems'. As highlighted in these standards, the developer is required to explore and fully exhaust all surface water drainage options in accordance with

a hierarchy which states that discharge to a combined sewer shall only be made as a last resort. Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to a surface water drainage body in liaison with the Land Drainage Authority and/or Natural Resources Wales.

It is therefore recommended that the developer consult with Denbighshire Council, as the determining SuDS Approval Body (SAB), in relation to their proposals for SuDS features. Please note, DCWW is a statutory consultee to the SAB application process and will provide comments to any SuDS proposals by response to SAB consultation.

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.

Foul Water Drainage

We have considered the impact of foul flows generated by the proposed development and concluded that flows can be accommodated within the public sewerage system. We advise that the flows should be connected to the combined sewer at or downstream of manholes SJ01814602, located to the north-west.

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

Further discussion with DCWW concluded that an agreement in principle to connect surface water flows to the public combined sewer cannot be made until the drainage hierarchy has been exhausted. To agree a connection with DCWW, ground investigations which discount the use of infiltration techniques will be required.

Surface Water Management

The site comprises existing residential properties with associated access and parking. Surface water currently drains to the 300mm public combined sewer in the north-eastern extent of the site.

The proposed development will include 4,930m² of hardstanding in the form of residential properties, access and parking.

Discharge Method

Standard S1 of the Statutory Standards for SuDS sets out the following hierarchy of drainage options:

Priority Level 1: Surface water runoff is collected for use;

Priority Level 2: Surface water runoff is infiltrated to ground;

Priority Level 3: Surface water runoff is discharged to a surface water body;

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or

another drainage system;

Priority Level 5: Surface water runoff is discharged to a combined sewer.

Priority Level 1: Surface water runoff collected for use

In line with section G1.4 of the Statutory Standards for SuDS, rainwater harvesting is not proposed for this site as:

1. There is no foreseeable need to harvest water at the site as DCWW water resources and drought management plans do not identify potential stresses on mains water supplies;
2. The use of rainwater harvesting is not a viable/ cost-effective part of the solution for managing surface water runoff on the site, taking account of the potential water supply benefits of such a system.

With regards to point 2 above, section G1.6 of the Statutory Standards for SuDS states that; in most cases, rainwater harvesting alone will not be adequate to deal with the site drainage and provision will be required for an overflow to a Level 2 or lower priority runoff destination. As downstream provision of attenuation storage will be required to accommodate for rainwater harvesting system overflows, rainwater harvesting is not considered a cost-effective solution for managing surface water runoff.

Priority Level 2: Surface water runoff is infiltrated to ground

The next consideration for the disposal of surface water is infiltration (soakaways). As described above, the site is underlain by superficial deposits of blown sand which is underlain by Kinnerton Sandstone Formation.

Anecdotal information from the Client suggests a high groundwater table is present locally. Therefore, the use of infiltration techniques may not be feasible.

Soakaway tests have been carried out by GroundSolve Ltd in January 2023 and are included in Appendix J. The tests show that all of the trial pits failed the first cycle, as the water failed to percolate through the underlying superficial deposits. It can therefore be concluded that infiltration techniques such as soakaways will not be suitable for the discharge of surface water runoff.

Priority Level 3: Surface water runoff is discharged to a surface water body.

As infiltration is not suitable, a connection to a watercourse is the next consideration. The nearest watercourse is The Cut which is located approximately 260m east of the site. The site is separated from The Cut by third party, urbanised land. A connection to a watercourse is therefore not a feasible option.

Priority Level 4: Discharge to a surface water sewer or highway drain

Where disposal of surface water to a watercourse is not possible, a connection to the public surface water sewer system is the next consideration. There is a 150mm public surface water sewer located immediately north-west of the site within Y Gorlan residential area. The 150mm public surface water sewer discharges to a public combined sewer system within Churton Road. There are no surface water sewers in the vicinity of the site (which do not connect into the public combined sewer system) which form a suitable point of connection.

Priority Level 5: Surface water runoff is discharged to a combined sewer

There is a 300mm public combined sewer located within the north-eastern extent of the site. Surface water flows from the site currently connect into the public combined sewer. A connection to this sewer appears to be a feasible option.

The drainage connectivity survey (Appendix G) identifies that public combined manhole SJ01815601 in the north-eastern extent of the site has a cover level of 6.55m AOD and an invert level of 5.08m AOD. A gravity connection appears feasible subject to utilising shallow depth attenuation storage features.

Proposed Discharge Rate

In order to establish the proposed discharge rate, the greenfield runoff rates and existing brownfield runoff rates have been estimated.

Greenfield runoff rates have been estimated using the Revitalised Flood Hydrograph Model (ReFH2) method. A summary of the greenfield runoff rates for a range of events is provided as Appendix K. The existing 1 in 1 year greenfield runoff rate for the 0.89ha development site is 0.58 l/s.

Existing brownfield runoff rates have been estimated using the modified rational method $Q=CiA$, whereby:

- Q is the peak discharge (l/s);
- C is the dimensionless coefficient (2.78);
- i is the average rainfall intensity derived from FEH point data for a 6 hour storm event;
- A is the existing contributing drainage area (0.3428 ha).

A summary of the existing brownfield runoff rates is provided in Table 1.

Table 1 – Existing Brownfield Runoff Rates

Storm Event (Year)	Rainfall Intensity (mm)	Runoff Rate (l/s)
1	18.67	17.79
30	55.26	52.66
100	73.78	70.31

In relation to surface water discharge for previously developed sites, the Statutory Standards for SuDS states that *'betterment of at least 30% should be considered as a minimum requirement'*.

Restricting discharge rates to the greenfield runoff rate is not considered feasible for this site. An initial review of attenuation storage volumes based on a limited discharge rate of 2 l/s (as close to the greenfield rate as practical) shows that attenuation storage depths would be in excess of 2m and would result in a requirement for a pumped solution. A pumped discharge is not in line with the principles set out in the Statutory standards

for SuDS.

As stipulated by Dŵr Cymru Welsh Water (Appendix E), a discharge rate of 5 l/s applies for a connection to the public combined sewer. A discharge rate of 5 l/s is proposed and provides 71.9% betterment on the existing 1 in 1 year brownfield runoff rate.

Attenuation Storage

In order to achieve a discharge rate of 5 l/s, attenuation storage will be required. In order to facilitate gravity drainage, attenuation storage will be distributed across the site. 2no separate attenuation storage features are proposed, one in the eastern extent of the site and one in the western extent of the site. A plan showing the contributing drainage areas into each attenuation feature is provided as Appendix L.

The proposed discharge rate will be split between the 2 drainage areas. Drainage Area 1 (eastern extent of the site) will have a limited discharge rate of 3.6 l/s. Drainage Area 2 (western extent of the site) will have a limited discharge rate of 1.4 l/s.

Attenuation storage estimates have been provided using MicroDrainage and are included in Appendix M.

Drainage Area 1

An estimated storage volume of 305m³ will be required to accommodate the 1 in 100 year plus 40% Climate Change (CC) event. The storage estimate is based on a discharge rate of 3.6 l/s, storage within a tank or pond structure, an impermeable drainage area of 3,540m², a design head of 1m and hydro-brake flow control.

Drainage Area 2

An estimated storage volume of 121m³ will be required to accommodate the 1 in 100 year plus 40% CC event. The storage estimate is based on a discharge rate of 1.4 l/s, storage within a tank or pond structure, an impermeable drainage area of 1,390m², a design head of 1m and hydro-brake flow control.

Sustainable Drainage Systems

Attenuation storage will be provided in the form of the sub-grade material of permeable surfaced access roads (non-adopted roads).

Drainage Area 1

To limit the overall sub-grade depth as to facilitate gravity drainage, the sub-grade in Drainage Area 1 will be formed from a combination of geo-cellular storm crates and clean stone. As to prevent groundwater ingress, the sub-grade will be lined with an impermeable geotextile. Groundwater floatation calculations will also be required at the detailed design stage to ensure suitable weight of cover over the geo-cellular storage crates.

Based on a permeable surfaced access road area of approximately 537m², a stone sub-grade depth of 0.16m underlain by a geo-cellular sub-grade of 0.55m in depth would provide 306.4m³ of storage, sufficient to accommodate the 1 in 100 year plus 40% CC event.

The 0.16m deep stone sub-grade, with a void ratio of 30%, would provide 25.8m³ of attenuation storage. The

0.55m geo-cellular sub-grade depth, with a void ratio of 95%, would provide 280.6m³ of attenuation storage.

Drainage Area 2

Based on a permeable surfaced access road area of approximately 707m², a 0.58m deep sub-grade depth and a void ratio of 30% (applicable to stone aggregate), there is potential to accommodate 123m³ of attenuation storage, sufficient to accommodate the 1 In 100 year plus 40% CC event.

A map showing the extents of the drainage areas is included as Appendix L.

Rain Gardens

In addition to the permeable surfacing (which will provide attenuation storage) a rain garden is proposed to provide water quality, amenity and biodiversity benefits. A rain garden is proposed adjacent to the site entrance and will accommodate runoff from the adjacent adopted access road. The rain garden will be fitted with an overflow to direct runoff to the downstream attenuation storage feature.

Concept Surface Water Drainage Scheme

Surface water runoff will be discharged to the public combined sewer in the eastern extent of the site at a limited rate of 5 l/s which provides 71.9% betterment over the 1 in 1 year brownfield runoff rate. Attenuation will be provided in the form of the sub-grade of the permeable surfaced access roads (excluding the section of adopted road) to accommodate the 1 in 100 year plus 40% CC event. A rain garden is also proposed in the north-western extent of the site.

A Concept Drainage Sketch is included in Appendix N.

The proposed surface water drainage scheme will ensure no increase in runoff over the lifetime of the development.

Exceedance Event

Storage will be provided for the 1 in 100 year plus 40% CC event. Storm events in excess of the 1 in 100 year plus 40% CC event should be permitted to produce temporary shallow depth flooding within the proposed access roads and landscaped areas. Finished floor levels will be set at a minimum of 150mm above surrounding ground levels ensuring exceedance flooding will not affect the buildings.

Surface Water Treatment

The Statutory Standards for SuDS sets out the following guidance for surface water treatment;

S3 - Surface water quality management

Treatment for surface water runoff should be provided to prevent negative impacts on the receiving water quality and/or protect downstream drainage systems, including sewers.

In accordance with the CIRIA C753 publication 'The SuDS Manual' (2015), residential roofs have a 'very low' pollution hazard level, with low traffic roads classified as having a 'low' pollution hazard level. Table 2 shows the pollution hazard indices for each land use.

Table 2 – Pollution Hazard Indices

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Residential Roofs	Very Low	0.2	0.2	0.05
Low Traffic Roads	Low	0.5	0.4	0.4

Table extract taken from the CIRIA C753 publication ‘The SuDS Manual’ – Table 26.2

* Indices values range from 0-1.

Runoff from roofs and roads will be directed to the proposed permeable surfacing. Table 3 demonstrates that permeable surfacing provides sufficient treatment.

Table 3 – SuDS Mitigation Indices

Type of SuDS	Mitigation Indices		
	Total Suspended Solids (TSS)	Metals	Hydrocarbons
Permeable Pavement	0.7	0.6	0.7

Table extract taken from the CIRIA C753 publication ‘The SuDS Manual’ – Table 26.3

Amenity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S4 – Amenity:

‘The design of the surface water management system should maximise amenity benefits.’

The proposed development will include permeable surfacing and a rain garden which will maximise the amenity value of the proposed drainage system.

Biodiversity

The Statutory Standards for SuDS provide the following guidance in relation to Standard S5 – Biodiversity:

‘The design of the surface water management system should maximise biodiversity benefits.’

The proposed rain garden will maximise the biodiversity value of the proposed drainage system.

Construction, Operation and Maintenance

Standard S6 of the Statutory Standards for SuDS states;

S6 – Design of drainage for Construction, Operation and Maintenance

- 1) All elements of the surface water drainage system should be designed so that they can be constructed easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
- 2) All elements of the surface water drainage system should be designed to ensure maintenance and operation can be undertaken (by the relevant responsible body) easily, safely, cost-effectively, in a timely manner, and with the aim of minimising the use of scarce resources and embedded carbon (energy).
- 3) The surface water drainage system should be designed to ensure structural integrity of all elements under anticipated loading conditions over the design life of the development site, taking into account the requirement for reasonable levels of maintenance.

All drainage systems will be readily accessible for maintenance access. The drainage system will be offered for adoption to the SAB who will then be responsible for maintenance. Alternatively, the drainage system will be managed and maintained by the site owner (Denbighshire County Council).

Maintenance schedules for an attenuation tank (geo-cellular storage) and permeable paving are included in Appendix O.

Shallow groundwater is present on site. As to prevent groundwater ingress, the sub-grade of the drainage system will be lined with an impermeable geotextile. Groundwater floatation calculations will also be required at the detailed design stage to ensure suitable weight of cover over the geo-cellular storage crates.

Foul Drainage

Correspondence from DCWW (Appendix E) states that:

'Foul Water Drainage – Sewerage Network

We have considered the impact of foul flows generated by the proposed development and concluded that flows can be accommodated within the public sewerage system. We advise that the flows should be connected to the combined sewer at or downstream of manholes SJ01814602, located to the north west.'

The connection point suggested by DCWW is located in Churton Road near the site access. In order to facilitate gravity drainage, a connection to public combined manhole SJ01815601 in the eastern extent of the site, as per the existing situation, is proposed. Manhole SJ01815601 has an invert level of 5.08m AOD and a gravity connection is considered feasible. Manhole SJ01814602 in Churton Road has an identified invert level of 5.2m AOD.

Conclusions

The proposal is for a residential re-development to include the demolition of 59no. existing dwellings and the erection of 38no. dwellings with associated access roads, parking and gardens.

All methods of surface water discharge have been assessed. Where soakaways are not possible, surface water runoff will be discharged to the public combined sewer in the eastern extent of the site at a limited rate of 5l/s which provides 71.9% betterment over the 1 in 1 year brownfield runoff rate. A gravity connection appears feasible subject to utilising shallow depth attenuation storage features.

Attenuation will be provided in the form of the sub-grade of the permeable surfaced access roads (excluding the section of adopted road) to accommodate the 1 in 100 year plus 40% CC event. A rain garden is also proposed in the north-western extent of the site. The sub-grade will be formed from a combination of stone and geo-cellular storage.

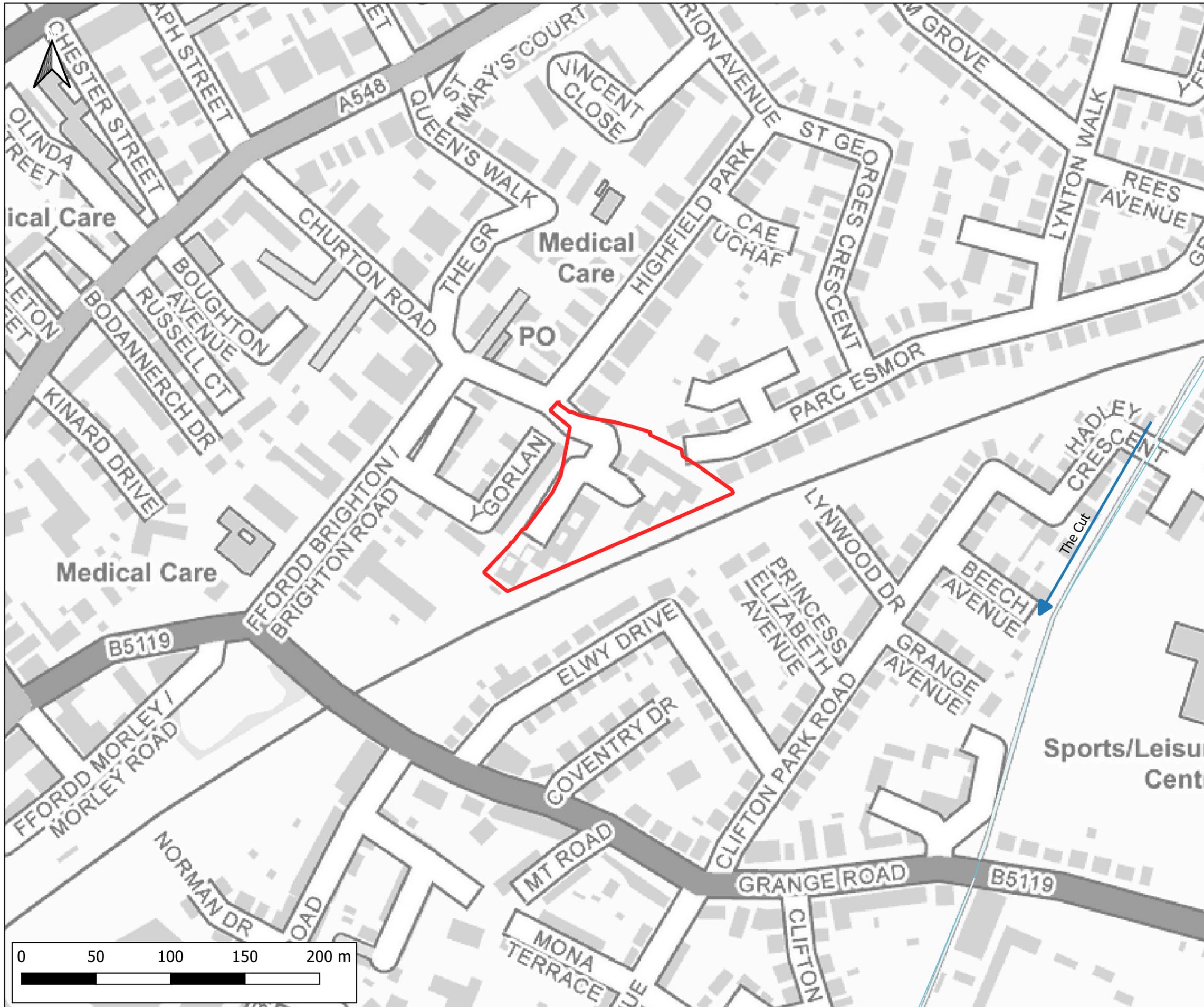
DCWW have confirmed that foul flows can discharge to the public combined sewer system. A gravity connection can be achieved.

A Concept Designer's Risk Assessment (cDRA) has been prepared to inform future designers of any identified hazards associated with the scheme. The cDRA has been included in Appendix P.

Recommendations

1. Submit this Drainage Strategy to the Planning Authority in support of the Planning Application.
2. Verify the attenuation volumes included in this report when undertaking detailed drainage design.

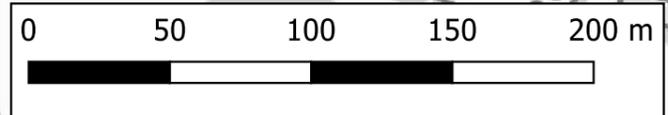
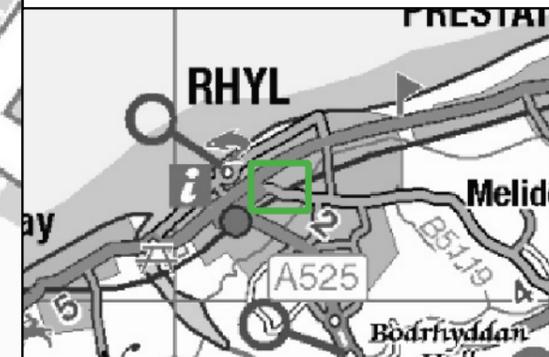
Appendix A Location Plan & Aerial Image



Notes:
 1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND

- Site Boundary
- Watercourses
- Waterbodies

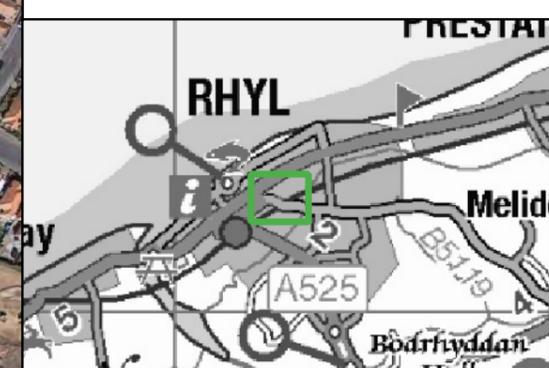


CLIENT:			
TACP Architects Ltd			
 www.waterco.co.uk			
SCHEME:			
Maes Emlyn, Rhyl			
PLOT TITLE:			
Location Plan			
PLOT STATUS:		DATE:	
FINAL		13-12-2022	
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
AM	JR	AW	1:2500
PLOT NAME:			REVISION:
14973_Location_Plan			-



Notes:
 1) All dimensions are in metres and all levels in metres above Ordnance Datum unless stated otherwise

LEGEND
 Site Boundary



CLIENT:
 TACP Architects Ltd



SCHEME:
 Maes Emlyn, Rhyll

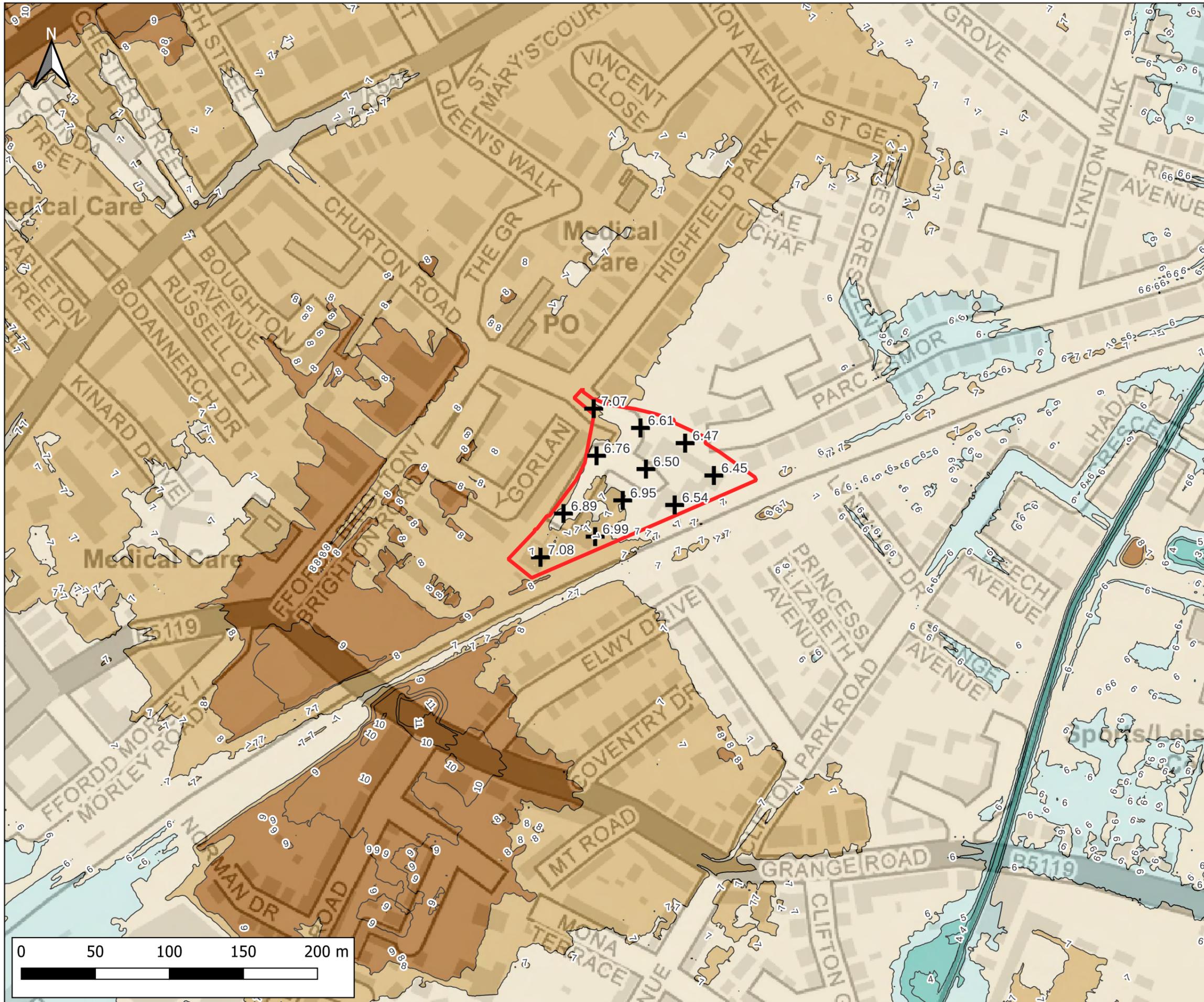
PLOT TITLE:
 Aerial Plan

PLOT STATUS: FINAL DATE: 13-12-2022

DRAWN: AM CHECKED: JR APPROVED: AW PLOT SCALE AT A3: 1:2500

PLOT NAME: 14973_Aerial_Plan REVISION: -

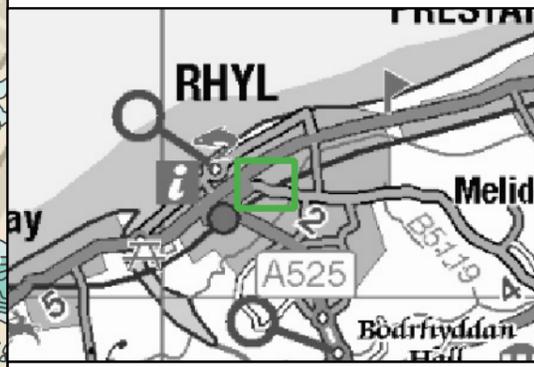
Appendix B Topographical Information



Notes:
1) All dimensions are in metres and all levels in metres above Ordnance Datum unless

LEGEND

- Site Boundary
- + Site Levels (m AOD)
- Ground Elevations (m AOD)
- <= 5
- 5 - 6
- 6 - 7
- 7 - 8
- > 8



CLIENT:		TACP Architects Ltd	
		www.waterco.co.uk	
SCHEME:		Maes Emlyn, Rhyll	
PLOT TITLE:		LiDAR Plan 1m Resolution Data from Natural Resources Wales	
PLOT STATUS:		FINAL	DATE: 11-11-2022
DRAWN: RM	CHECKED: JR	APPROVED: AW	PLOT SCALE AT A3: 1:2500
PLOT NAME: 14973_LiDAR_Plan			REVISION: -

Appendix C BGS Borehole Record



SJ 08 SW 10a

Geological Investigations Ltd.

RECORD OF BOREHOLE/TRIAL HOLE NO. 1.....

0140 (314) 8196
 (1" 95)

Scale 1 : 50 metric

SITE RHYL.
 Crown Building.
 JOB REF. NO. FCE/673
 GROUND LEVEL 8.02m
 METHOD/SIZE S&CC 172mm
 DATE 7.11.77

DESCRIPTION OF STRATA	Depth m	SAMPLES				SYMBOL	INTER-FACE LEVEL m	N
		U474	SPT	DIST.	BULK			
0 to 0.10m Tarmacadam surfacing, FILL.	0						7.93	
0.10 to 0.40m Mod.loose brick and stone FILL.	0.10						7.63	
0.40 to 1.30m Loose brown slightly silty medium grained SAND with very occasional fine to medium gravel, and small fragments of mortar, brick, and cinder. Possibly FILL.	1.30						6.73	6
1.30 to 2.20m Loose brown slightly silty medium grained SAND, with very occasional fine to medium gravel, and fine shells.	2.20						5.83	8
2.20 to 2.60m Loose saturated grey/brown patchy SILTY medium grained SAND.	2.60						5.43	
2.60 to 2.89m Mod compact dark grey/brown CLAYEY GRAVELLY SAND.	2.89						5.14	
2.89 to 3.15m Soft to firm orangy brown with grey fissures, SILTY CLAY with occasional fine to medium sub rounded and angular gravel with spent root traces.	3.15						4.88	
3.15 to 5.20m Firm to stiff reddish brown SILTY CLAY with occasional fine to medium sub rounded gravel, and fine near vertical fissures with spent root fibres.	5.20						2.83	
5.20 to 9.50m Firm to stiff reddish brown SILTY CLAY with occasional fine to medium sub rounded and angular gravel, and occasional partings and thin bands of wet sand.	9.50						-1.27	

Hole terminated at 10.00m
 Standpipe inserted to 4.0m

WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S. - NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING
1. Please refer to Section 5 of the written text.						
2.						

Geological Investigations Ltd. (1"95)

SJ 08 SW / 106.

RECORD OF BOREHOLE/TRIAL HOLE NO. 2

0140 8194

SITE RHYL.
Crown Building.

JOB REF. NO. FGE/673

GROUND LEVEL 7.72m OD

METHOD/SIZE S&CC 152mm

DATE 8-11-11-77

Scale 1 : 50 metric

DESCRIPTION OF STRATA	Depth	SAMPLES				SYMBOL	INTER-FACE LEVEL m	N
		U471X	SPT	DIST. BULK	Water			
0 to 0.70m Black TOPSOIL.	0							
0.70 to 1.80m Loose moist to saturated brown SILTY medium grained SAND with tree roots.	1					7.02	7	
1.80 to 2.90m Mod compact saturated dark grey SILTY medium grained SAND.	2							
2.90 to 4.50m Firm to stiff reddish brown with grey vertical fissures, SILTY CLAY with occasional fine to medium sub rounded gravel, spent root traces and small patches of silty fine to medium grained sand.	3					4.32		
4.50 to 5.50m Very stiff reddish brown with grey fissures SILTY CLAY with occasional fine to medium sub rounded and angular gravel and sandy partings.	5					3.22		
5.50 to 6.35m Firm reddish brown with grey fissures, SILTY CLAY with traces of fine sub rounded gravel.	6					2.22		
6.35 to 8.10m Firm reddish brown SILTY CLAY with traces of fine gravel.	7					1.37		
8.10 to 9.25m Stiff reddish brown SILTY laminated CLAY.	8					0.38		
9.25 to 10.00m Dense saturated grey/brown medium grained SAND with occasional gravel, grading into well graded SAND and fine to coarse sub rounded GRAVEL.	10					-1.53	10	

INTERSTRUCK TEST DEPTHS	DEPTH OF CASING WHEN SEALED N.S.—NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING
Please refer to Section 5 of the written text.						

Geological Investigations Ltd.

SI 088W 103

RECORD OF BOREHOLE/TRIAL HOLE NO. 2 continued.

SITE BHYL
 Crown Building.
 JOB REF. NO. FGE/67
 GROUND LEVEL 7.72m OD
 METHOD/SIZE
 DATE

Scale 1 : 50 metric

DESCRIPTION OF STRATA	Depth	SAMPLES				SYMBOL	INTER-FACE LEVEL m	N
		U4/1X	SPT	DIST. BULK	Water			
00 to 10.50m Dense saturated grey/brown well graded SAND and GRAVEL.	0-10.5					(Symbol: Sand with gravel)	-2.76	
50 to 12.00m Firm to stiff reddish brown SILTY CLAY with occasional fine to coarse sub rounded and angular gravel, and fine bands of wet silty sand.	10.5-12.0					(Symbol: Silty clay)		
00 to 13.50m Firm to stiff reddish brown SILTY laminated CLAY with bands of silty clay with gravel, and bands of wet silty fine to medium grained SAND.	12.0-13.5					(Symbol: Laminated clay)	-4.28	12
50 to 16.00m Firm to stiff reddish brown SILTY partially laminated CLAY with bands of clayey silt, and wet silty fine grained sand.	13.5-16.0					(Symbol: Silty clay)	-5.76	26
hole terminated at 16.00m standpipe inserted to 12.0m	16.0					(Symbol: Standpipe)	-3.28	
	17							
	18							
	19							
	20							

WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S. - NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING

Geological Investigations Ltd.

ST 08SW/10c

British Geological Survey

(1"95)

SITE RHYL

Crown Building.

RECORD OF BOREHOLE/TRIAL HOLE NO. 4A

JOB REF. NO. FGE/673

0138 8194

GROUND LEVEL 7.85m OD

METHOD/SIZE S&CO 152mm

DATE 9.11.11.77

Scale 1 : 50 metric

DESCRIPTION OF STRATA	Depth	SAMPLES				SYMBOL	INTER-FACE LEVEL m	N
		U4/TX	SPT	DIST.	BULK Water			
0 to 0.40m Concrete over stone FILL.								
0.40 to 2.10m Loose to mod compact brown SILTY medium grained sand with occasional small fragments of clinker, brick, mortar and coal. Probably FILL.						7.45	7	
	1				?		9	
							8	
2.10 to 3.30m Very loose wet grey/brown SILTY fine to medium grained SAND with traces of clay.	2					5.75	2	
+4.55							3	
3.30 to 3.50m Firm grey/brown SILTY CLAY with small pockets of greyish green SILT.	3					4.55		
+4.35						4.35		
3.50 to 7.50m Very stiff becoming stiff to firm reddish brown with grey fissures and streaks, SILTY CLAY with occasional fine to medium sub rounded and angular gravel.	4							
	5							
	6							
	7							
7.50 to 10.00m Soft to firm reddish brown partially laminated SILTY CLAY with traces of fine gravel.	8					0.35		
	9							
	10							

WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S.—NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING
1	Please refer to Section 5 of the written text.					

SJ 08 SW / 10c

Geological Investigations Ltd.

RECORD OF BOREHOLE/TRIAL HOLE NO. 4A
continued.

SITE RHYL.
Crown Building.
JOB REF. NO. FGE/613
GROUND LEVEL 7.85m OD
METHOD/SIZE
DATE

Scale 1:50 metric

DESCRIPTION OF STRATA	Depth	SAMPLES					SYMBOL	INTER-FACE LEVEL m	N
		U4/1X	SPT	DIST.	BULK	Water			
10.00 to 10.80m Soft to firm reddish brown partially laminated SILTY CLAY with occasional coarse gravel. -2.95							X	-2.95	
10.80 to 13.40m Compact saturated grey/brown slightly silty fine to coarse SAND, and fine to coarse sub rounded and angular GRAVEL.	11						(Symbol: dots and circles)		13
	12								
	13								15
13.40 to 15.80m Compact saturated orangy brown slightly silty fine to coarse SAND, and fine to coarse sub rounded and angular GRAVEL. -7.95	14						(Symbol: dots and circles)	-5.55	30
	15								
	16								43
15.80 to 17.50m Firm to mod. stiff reddish brown SILTY CLAY with occasional fine to medium sub rounded gravel, and silt partings.	17						X	-7.95	
	18						X	-9.65	
17.50 to 17.70m Stiff grey SILT							X	-9.85	
17.70 to 18.70m Bands of orangy brown slightly silty fine grained SAND, and firm to stiff reddish brown SANDY CLAY with occasional gravel.	19						(Symbol: dots and circles)	-10.85	
18.70 to 20.00m Firm to stiff reddish brown VERY SILTY CLAY with fine silt and sand partings.	20						X		29

WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S.—NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING

Geological Investigations Ltd.

SJ 08 SW/100

RECORD OF BOREHOLE/TRIAL HOLE NO. 4A continued.

SITE RHYL
Crown Building.
JOB REF. NO. FGE/673
GROUND LEVEL 7.85m OD
METHOD/SIZE
DATE

Scale 1 : 50 metric

DESCRIPTION OF STRATA	Depth m	SAMPLES				SYMBOL	INTER- FACE LEVEL m	N
		U/TK	SPT	DIST. BULK	Water			
20.00 to 23.50m Stiff reddish brown VERY SILTY CLAY, with occasional fine gravel, silt and sand partings (wet).	20 21					X	-15.65	48
23.50 to 25.00m Very stiff reddish brown VERY SILTY CLAY with occasional fine gravel, and thin wet sand partings.	22 23 24					X	-17.15	53
Hole terminated at 25.00m	25 26 27 28 29 30							

WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S.—NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION		
				DATE	WATER LEVEL	DEPTH OF CASING

Geological Investigations Ltd. (1"95)

SJ 08 SW/10a

RECORD OF BOREHOLE/TRIAL HOLE NO. 5

0136 8191

SITE RHYL
 Crown Building
 JOB REF. NO. RGE/673
 GROUND LEVEL 7.43m OD
 METHOD/SIZE S&CC 152mm
 DATE 14/15.11.77

Scale 1:50 metric

DESCRIPTION OF STRATA	3 Depth	SAMPLES				SYMBOL	INTER-FACE LEVEL m	N
		UW/TK	SPT	DIST.	BULK			
0 to 0.60m Black TOPSOIL.								
0.60 to 1.95m Loose grey/brown medium grained SAND with traces of shell, glass and clinker. Possibly FILL.						6.83	7	
1.95 to 2.50m Compact saturated grey/brown medium grained SAND.						5.48	24	
2.50 to 3.00m Compact grey/black VERY SILTY medium to coarse grained SAND with patches of grey/black SILT, and traces of organic matter.						4.93		
3.00 to 3.65m Stiff orangy brown with grey fissures and streaks, SILTY CLAY with fine to coarse sub rounded gravel, and spent root fibres.						4.43		
3.65 to 3.70m Fine GRAVEL.						3.78		
3.70 to 8.70m Firm with local firm to stiff bands, reddish brown SILTY CLAY with occasional fine to medium sub rounded and angular gravel, and thin wet sandy partings.						3.73		
8.70 to 10.00m Stiff reddish brown VERY SILTY CLAY with occasional brown medium grained wet sand partings.						-1.27		
						-2.57		
WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S. - NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION				
				DATE	WATER LEVEL	DEPTH OF CASING		
Please refer to Section 5 of the written text.								

SI 08 SW / 10 d

Geological Investigations Ltd.

SITE RHYL
 Crown Building.
 JOB REF. NO. FGE/673
 GROUND LEVEL 7.43m OD
 METHOD/SIZE
 DATE

RECORD OF BOREHOLE/TRIAL HOLE NO. 5 continued.

Scale 1 : 50 metric

DESCRIPTION OF STRATA	3 Depth	SAMPLES					SYMBOL	INTER-FACE LEVEL m	N
		U4/1K	SPT	DIST.	BULK	Water			
10.00 to 15.30m Firm to stiff reddish brown SILTY CLAY with occasional fine to medium sub rounded and angular gravel.	10	X					X _B		
	11						X _B		
	12	X					X _B		
	13						X _B		
	14						X _B		
15.30 to 18.20m Soft to firm reddish brown VERY SILTY CLAY with traces of fine to medium gravel.	15						X _B	-7.87	
	16	X					X _B		
	17						X _B		
18.20 to 19.50m Firm to stiff reddish brown SILTY CLAY with occasional fine to medium sub rounded and angular gravel.	18	X					X _B	-10.77	
	19						X _B		
Hole terminated at 19.50m Standpipe inserted to 4.0m	19.50	X					X _B	-12.07	
	20								
WATER STRUCK AT DEPTHS	DEPTH OF CASING WHEN SEALED N.S.—NOT SEALED	ESTIMATED FLOW	WATER ADDED AT DEPTHS TO ASSIST BORING	WATER LEVEL IN CASED/UNCASED BOREHOLE ON COMPLETION					
				DATE	WATER LEVEL	DEPTH OF CASING			

Appendix D Windowless Sample Logs

Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 18/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301418.00 N381546.00	
Project No. : 2841		Crew Name: Regional Drilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS01	Hole Type WLS	Level 7.20m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.10	ES		0.20	7.00		Loose dark brown slightly gravelly slightly sandy SILT with rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
		0.90	B					Loose to medium dense brown grey fine to coarse SAND. (BEACH DEPOSITS)	1	
		1.20	SPT	N=3 (1,1/0,1,1,1)						
		1.50			1.50	5.70		Stiff brown sandy CLAY. (GLACIAL TILL)		
		1.80	D							
		2.00	SPT	N=14 (2,2/3,3,4,4)						2
		2.40	D					<i>Pocket of SAND</i>		
		3.00	SPT	N=28 (4,5/6,6,8,8)					<i>Becomes less sandy between 3.0m and 5.45m</i>	3
		4.00	SPT	N=28 (5,5/6,7,7,8)						4
		4.10	D							
5.00	SPT	N=21 (3,4/5,5,5,6)						5		
				5.45	1.75		End of Borehole at 5.450m		6	
									7	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks

Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 18/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301494.00 N381588.00	
Project No. : 2841		Crew Name: Regional Drilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS02	Hole Type WLS	Level 6.70m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
▼		0.30	ES		0.40	6.30		Loose dark brown slightly gravelly slightly sandy SILT with rootlets. (TOPSOIL)	
		1.00	D					Loose to medium dense brown SAND. (BEACH DEPOSITS)	1
		1.20	SPT	N=2 (1,0/0,1,0,1)					
		2.00	SPT	N=15 (1,2/3,3,4,5)	1.60	5.10		Stiff brown sandy CLAY. (GLACIAL TILL) <i>Becomes less sandy with depth</i>	2
		2.50	D						
		3.00	SPT	N=14 (2,3/3,3,4,4)					
		3.70	D						
		4.00	SPT	N=21 (3,4/5,5,5,6)					
		5.00	SPT	N=19 (2,4/4,4,5,6)				<i>No sample recovery due to water</i>	4
									5
				5.45	1.25		End of Borehole at 5.450m	6	
								7	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks

Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 18/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301525.00 N381613.00	
Project No. : 2841		Crew Name: Regional Drilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS03	Hole Type WLS	Level 6.48m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.15	ES		0.15	6.33		Loose dark brown slightly gravelly slightly sandy SILT with rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)	
					0.70	5.78		Loose brown slightly silty gravelly SAND. Gravel is angular fine to coarse of brick. (MADE GROUND)	
			1.20	SPT	N=5 (0,0/0,1,2,2)				Loose to medium dense grey SAND. (BEACH DEPOSITS)
			1.40	ES		1.50	4.98		<i>Black patch in sand with slight hydrocarbon odour 1.3 to 1.5m</i>
			2.00	D					Stiff brown sandy CLAY. (GLACIAL TILL)
			2.00	SPT	N=24 (3,4/5,6,6,7)				
			3.00	D					
			3.00	SPT	N=27 (5,6/5,6,8,8)				
			4.00	SPT	N=25 (3,4/5,7,6,7)				<i>Becomes slightly gravelly 3.8m to 4.2m</i>
			5.00	SPT	N=22 (4,5/5,5,6,6)				
					5.45	1.03		End of Borehole at 5.450m	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks

Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 19/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301439.00 N381583.00	
Project No. : 2841		Crew Name: Regional Drilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS04	Hole Type WLS	Level 6.96m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
	▼	0.20	ES		0.15	6.81		Tarmac (MADE GROUND)	1	
					0.30	6.66		Loose black sandy angular fine to coarse GRAVEL.		
					0.50	6.46		Loose pinkish brown sandy angular fine to coarse GRAVEL of limestone. (HARCORE)		
					0.70	6.26		Loose to medium dense brown SAND. (BEACH DEPOSITS)		
		1.00	D							Soft grey sandy CLAY. (GLACIAL TILL)
		1.20	SPT	N=2 (1,0/0,0,1,1)						
		2.00	SPT	N=16 (2,3/3,4,4,5)		1.80	5.16			Stiff brown slightly sandy CLAY. (GLACIAL TILL)
		2.10	D							
		3.00	SPT	N=22 (3,4/4,5,7,6)						
		3.50	D							
4.00	SPT	N=14 (2,3/3,3,4,4)								
5.00	SPT	N=20 (3,4/5,5,5,5)								
				5.45	1.51		No sample recovery due to water			
							End of Borehole at 5.450m			

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks										Unit 1, Charter Court Well House Bams Chester Road Bretton Flintshire CH4 0DH	
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Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 19/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301477.00 N381641.00	
Project No. : 2841		Crew Name: Regional Drilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS05	Hole Type WLS	Level 7.15m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description		
		Depth (m)	Type	Results						
		0.30	ES		0.40	6.75		Loose dark brown slightly gravelly slightly sandy SILT with rootlets. Gravel is subangular to subrounded fine to coarse of mixed lithologies. (TOPSOIL)		
		0.90	B					Loose to medium dense brown SAND. (BEACH DEPOSITS)	1	
		1.20	SPT	N=1 (0,1/0,0,0,1)					<i>Becomes grey in colour</i>	
		2.00 2.10	SPT D	N=9 (1,2/1,2,3,3)	1.90	5.25		Firm grey sandy CLAY. (GLACIAL TILL) <i>Becomes brown in colour and less sandy with depth.</i>	2	
		3.00	SPT	N=23 (4,4/5,6,5,7)						3
		3.90 4.00	D SPT	N=21 (3,4/4,5,6,6)						4
	5.00	SPT	N=16 (3,3/4,3,5,4)					5		
				5.45	1.70		End of Borehole at 5.450m	6		
								7		

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks

Project Name: Maes Emlyn		Client: Denbighshire CC		Date: 19/01/2023	
Location: Rhyl		Contractor: Regional Drilling		Co-ords: E301491.00 N381621.00	
Project No. : 2841		Crew Name: Regional Dilling		Drilling Equipment: Premier Compact 110	
Borehole Number WS06	Hole Type WLS	Level 6.50m AoD	Logged By AB	Scale 1:35	Page Number Sheet 1 of 1

Well	Water Strikes	Sample and In Situ Testing			Depth (m)	Level (m)	Legend	Stratum Description	
		Depth (m)	Type	Results					
		0.20	ES		0.40	6.10		Loose dark brown slightly gravelly slightly sandy SILT with rootlets. (TOPSOIL)	
		0.80	D					Loose to medium dense brown grey SAND. (BEACH DEPOSITS)	
		1.20	SPT	N=3 (0,1/0,1,0,2)				<i>No sample recovery due to water</i>	1
		2.00	SPT	N=30 (5,5/6,8,8,8)	2.00	4.50		Still grey sandy CLAY. (GLACIAL TILL)	2
		2.30	D					<i>Becomes brown in colour</i>	
		3.00	SPT	N=26 (5,5/5,7,7,7)					3
		4.00	D					<i>No sample recovery due to water</i>	4
		4.00	SPT	N=19 (3,4/4,4,5,6)					
		5.00	SPT	N=17 (3,3/4,4,4,5)					5
					5.45	1.05		End of Borehole at 5.450m	6
								7	

Hole Diameter		Casing Diameter		Chiselling				Inclination and Orientation			
Depth Base	Diameter	Depth Base	Diameter	Depth Top	Depth Base	Duration	Tool	Depth Top	Depth Base	Inclination	Orientation
1.00	200	1.00	150								
2.00	100	2.00	150								
3.00	92										
4.00	79										
5.45	70										

Remarks



- Legend**
- Site Boundary
 - WS Windowless Sample Borehole Locations
 - HP Hand Pit Locations
 - TP Trial Pit Locations
 - TPO Areas

Revision	Description	Date
A	Original Drawing	24.01.23

GroundSolve Ltd
 Consulting Geotechnical Engineers
 Unit 1, Charter Court
 Mill House Farm
 Church Farm Lane
 Flintshire, CH4 0DH
 Tel: 01244 661361
 Fax: 01244 661289

Job Title
Maes Emlyn, Rhyll

Drawing Title
Existing Site Layout & Exploratory Hole Locations

Drawing Scale	Drawn By	Approved By
1:500 @ A3	ALB	SF
Drawing Status	Date of Issue	
Information	24.01.23	
Drawing No	Revision	
2841-DR-002	A	

Appendix E DCWW Sewer Plans & Correspondence



Dŵr Cymru
Welsh Water

Maes Emlyn Rhyl Denbighshire LL18 4AB



LEGEND(Representative of most common features)

- | | | |
|---|-------------------------|---|
| Foul chamber | Surface water chamber | Outfall |
| Combined chamber | Combined sewer overflow | Storm Overflow |
| Special purpose chamber | Treatment works | Rising main |
| Pumping station | Private sewer | Gravity sewer |
| NB: Sewer symbol colour indicates the type. | S 104 | Private sewer subject to Sect. 104 adoption agreement |
| RED - Combined | Lateral Drain | Private Sewer Transfer |
| GREEN - Surface Water | Inspection Chamber | |
| 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.

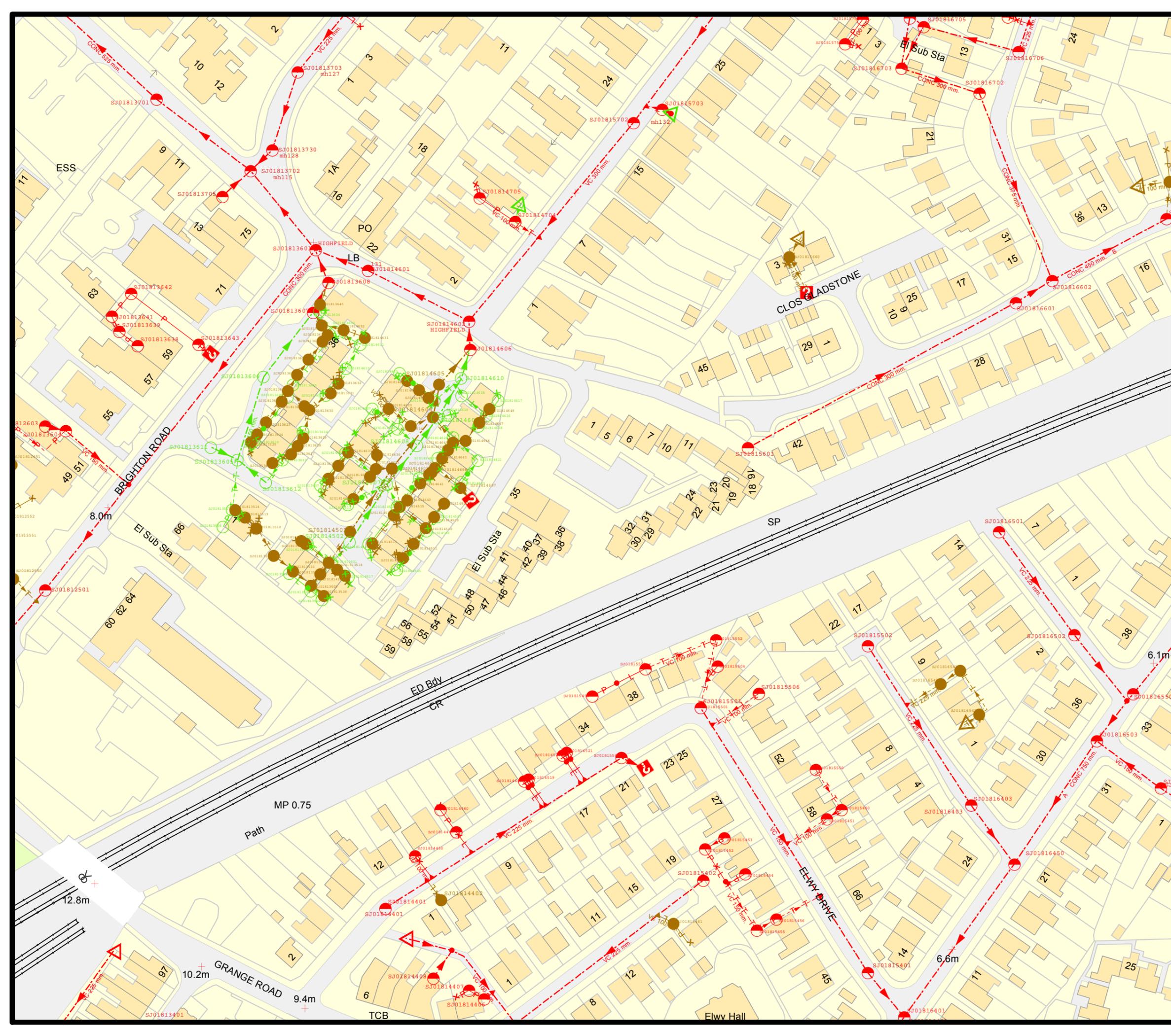
Dŵr Cymru Cyfyngedig (the Company) gives this information as to the position of its underground apparatus by way of general guidance only and on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations 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: 301491,381594
Map scale: 1:1250
Printed by: Zara Howells
Printed on: 18 Oct 2022



Adam McCulloch

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: 24 August 2023 10:49
To: Adam McCulloch
Subject: RE: PPA0007341

Hi Adam,

Apologies for the delayed response and thank you for your patience. In this instance I appreciate that investigations have taken place albeit the historic surveys lack the detail we would expect. We would therefore be amenable to an attenuated rate here, however we generally look to achieve a lower rate of 5 l/s, I would therefore request that you endeavour to achieve an attenuated rate in line with these flows.

Best regards,



Jake MacMillan

Development Planning Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



W: dwrcymru.com



A: PO Box 3146, Cardiff, CF30 0EH



E: developer.services@dwrcymru.com

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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: Wednesday, August 16, 2023 2:05 PM
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Good afternoon Jake,

Regarding my previous email dated 13th of July, please could you advise when we may receive a response.

Kind Regards,

Adam McCulloch
Environmental Consultant

 adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: Friday, July 7, 2023 4:35 PM

To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Apologies for the delayed response and thank you for providing this report.

Can you clarify further on how the audio tests confirm connectivity to the sewer, and can you forward any reports you have on this?

We would usually expect a detailed CCTV report to confirm connectivity, can you advise if it is possible to achieve this?

As the proposal is due for a SAB application, I'm unable to provide an agreement in principle, as this is the premise for the application/consultations.

Best regards,



Jake MacMillan

Development Planning Officer | Developer Services
Dŵr Cymru Welsh Water



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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: Thursday, June 15, 2023 9:28 AM
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Good morning Jake,

Please see attached a Drainage Layout from Invek surveys regarding the proposed development at Maes Emllyn, Rhyl. The survey shows that all surface water currently drains to the existing DCWW public combined sewer in the site's north-eastern extent.

Please can you advise if a surface water connection to the public combined sewer is acceptable.

Kind Regards,

Adam McCulloch
Environmental Consultant

 adam.mcculloch@waterco.co.uk

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From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: Thursday, May 11, 2023 3:07 PM
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

This is preferred in order to get a fuller understanding of the historical drainage arrangement, as a GPR isn't conclusive. We can arrange a sewer trace if you'd prefer however would be developer funded.

Best regards,



Jake MacMillan
Development Planning Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



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A: PO Box 3146, Cardiff, CF30 0EH



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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: 11 May 2023 10:32
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Good morning Jake,

No further intrusive CCTV drainage investigations have been undertaken. Please could you advise if this is required.

Kind Regards,

Adam McCulloch
Environmental Consultant

 adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: Tuesday, May 9, 2023 9:16 AM
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Thank you for providing this report which shows the intrusive soakaway testing results. Can you also advise if there has been any intrusive/cctv investigations looking at the historical drainage arrangement, building further on the GPR survey?

Best regards,



Jake MacMillan
Development Planning Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: 05 May 2023 16:34
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Good afternoon Jake,

Intrusive ground investigations have been undertaken by GroundSolve Ltd. The intrusive ground investigation comprised 6No. windowless sample (WS) boreholes and Infiltration tests. Please see attached for your reference.

Kind Regards,

Adam McCulloch
Environmental Consultant

 adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: Thursday, April 27, 2023 10:16 AM
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Thank you for providing the below, can you advise if there have been any cctv surveys or intrusive investigations that have taken place? Can you also advise what stage the site is at currently?

Best regards,



Jake MacMillan

Development Planning Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



A: PO Box 3146, Cardiff, CF30 0EH



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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>

Sent: 25 April 2023 16:19

To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>

Subject: RE: PPA0007341

***** External Mail *****

Good afternoon Jake,

A GPR survey has been undertaken by PM Surveys UK Ltd which shows the existing connection to the public combined manhole in the eastern extent of the site. Please see attached for your reference.

Kind Regards,

Adam McCulloch

Environmental Consultant

 adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>

Sent: Tuesday, April 25, 2023 2:53 PM

To: Adam McCulloch <adam.mcculloch@waterco.co.uk>

Subject: RE: PPA0007341

Hi Adam,

Thank you for the below email, can you confirm what investigations have been done to confirm that there is an existing connection to the public combined sewer?

Best regards,

Jake MacMillan

Development Planning Officer | Developer Services



Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



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E: developer.services@dwrcymru.com

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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>

Sent: 24 April 2023 09:44

To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>

Subject: RE: PPA0007341

***** External Mail *****

Hi Jake,

Further to your below email relating to PPA0007341, we have obtained a ground investigation report (see attached) from GroundSolve undertaken in January 2023.

The intrusive ground investigation shows that groundwater was encountered within all of the exploratory hole locations within either the Made Ground or wind-blown sand, at depths between 0.60 metres below ground level (m.bgl) and 1.00m.bgl. Infiltration tests were undertaken as part of the intrusive ground investigation and show that all of the trial pits failed the first cycle, as the water failed to percolate through the underlying superficial deposits.

As infiltration is not suitable, a connection to a watercourse is the next consideration. The nearest watercourse is The Cut which is located approximately 260m east of the site. The site is separated from The Cut by third party, urbanised land including a railway line. A connection to a watercourse is therefore not a feasible option.

There are no surface water sewers in the vicinity of the site (which do not connect into the public combined sewer system). As a result of these findings, we propose to connect to the public combined sewer located within the site's eastern extent per the existing scenario. I attach a GPR survey which demonstrates the existing connection. The 'foul drain' identified on the GPR accommodates rainfall runoff from the roof and is a combined drain.

We propose a surface water discharge rate of 13.7 l/s which provides 30% betterment on the existing 1 in 1 year brownfield runoff rate. Lower discharge rates have been considered however increase the amount and depth of attenuation storage required, which in turn limits the feasibility of a gravity connection.

Please can you advise if a surface water connection to the public combined sewer at 13.7 l/s is acceptable. Please don't hesitate to contact me if you have any questions.

Kind Regards,

Adam McCulloch
Environmental Consultant

 adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: Thursday, November 17, 2022 10:41 AM
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Thank you for the email, unfortunately we aren't a position to agree in principle, until the hierarchy has been exhausted and a historical connection has been confirmed.

Best regards,



Jake MacMillan
Development Control Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



A: PO Box 3146, Cardiff, CF30 0EH



W: dwrcymru.com



E: developer.services@dwrcymru.com

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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: 17 November 2022 09:26
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Hi Jake,

To confirm, the number of proposed units will be 35No. (including flats).

Regarding drainage on site we are awaiting results of ground investigations, however we assume that discharge is currently made to the public combined sewer.

Could a connection point to the sewer be agreed in principle for surface water at the stage, subject to review of infiltration techniques?

Kind Regards,

Adam McCulloch
Environmental Consultant

Teams: adam.mcculloch@waterco.co.uk

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 Please consider the environment before printing this email.

From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: 16 November 2022 10:34
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Thank you for the reply, so just to confirm this proposal comprises a demolition of 59 units and replacement with 56 units (35 dwellings and 21 flats).

In regards to the surface water I can see you've proposed to discharge to the public sewer, I am happy to continue these discussions via email. With the nature of this development a SAB application will be required which will assess the feasibility of sustainable drainage (collection, infiltration, surface water body, highways drainage/surface water sewer). Can you advise where the existing development discharges to and what investigations have been made into the sustainable drainage hierarchy? I'm also happy to discuss this at a later date if you're not a position to discuss at this stage.

Best regards,



Jake MacMillan

Development Control Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



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E: developer.services@dwrcymru.com

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From: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Sent: 15 November 2022 10:18
To: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Subject: RE: PPA0007341

***** External Mail *****

Good morning Jake,

Further to your previous email, please see attached an existing site layout plan. The existing layout comprises 59 no. dwellings in the form of houses and apartments. All existing properties are to be demolished.

The development is currently connected to the public sewer system.

If you require any further information, please don't hesitate to contact me.

Kind Regards,

Adam McCulloch
Environmental Consultant

Teams: adam.mcculloch@waterco.co.uk

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From: Jake MacMillan <Jake.MacMillan@dwrcymru.com>
Sent: 14 November 2022 12:11
To: Adam McCulloch <adam.mcculloch@waterco.co.uk>
Subject: RE: PPA0007341

Hi Adam,

Thank you for submitting the above pre planning application. It appears that this site comprises a redevelopment, can you advise on the existing housing structure that will be demolished? Can you also advise if this is connected to the public sewerage network?

Best regards,



Jake MacMillan
Development Control Officer | Developer Services
Dŵr Cymru Welsh Water



T: 0800 917 2652 | E: 45xxx | M: 07557860559



A: PO Box 3146, Cardiff, CF30 0EH



W: dwrcymru.com



E: developer.services@dwrcymru.com

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From: forms submission@dwrcymru.com <forms submission@dwrcymru.com>
Sent: 09 November 2022 16:35
To: Services Developer <developer.services@dwrcymru.com>
Cc: DSRevenue <DSRevenue@dwrcymru.com>
Subject: PPA0007341

Applicant details

Company Name: Waterco

Title: Mr

First Name: Adam

Surname: McCulloch

House Name:

House Number:

Street 1:

Street 2:

Town: Ruthin

County: Denbighshire

Post code: LL15 1NJ

Contact Telephone Number (1): 01824702220

Contact Telephone Number (2):

Email address: adam.mcculloch@waterco.co.uk

Name and Address of Agent

Company Name:

Title:

First Name:

Surname:

House Name:

House Number:

Street 1:

Street 2:

Town:

County:

Post code:

Contact Telephone Number (1):

Contact Telephone Number (2):

Email address:

Development Details

What is the nature of your proposal: Residential re-development

Name of Development: Maes Emlyn

House Name:

House Number:

Plots:

Street 1:

Street 2:

Town: Rhyl

County: Denbighshire

Post Code: LL18 4AB

National Grid Reference of development eg ST123456: SJ014816

X Coordinates: 301491

Y Coordinates: 381610

Quantity of Water

Important Consumption and flow rates are essential for the correct sizing of the supply and meter:

Please provide your estimated water quantities in litres for all nondomestic connections:

Minimum flow:

Maximum flow:

Quantity per 24 hours:

We need them to determine whether the existing distribution network can accommodate this demand without reinforcement ie laying new mains and these will form the basis of the supply agreement between you and us:

Development SupplyDemand

Is there an existing DCWW supply on site: Yes

Domestic Development

Please give details of the proposed development:

Housing total properties:

Units: 35

Area ha: 1

House Type:

Terraced Units: 6

Semi detachedDetached Units: 8

13 bedrooms Units: 14

4 bedrooms Units:

Flats:

Flats Number of storeys: 3

Flats Units: 21

Flat 1 bedroom Units: 18

Flat 2 bedroom: 3

Flat 2 bedroom: 0

Commercial Development

What is the intended use of the premises:

IndustrialWarehousing:

Staff: 0

Units:

Area ha:

Hotel:

Number of rooms:

Leisure:

Staff:

Units:

Area ha:

Retail fooddrink:

Staff:

Units:

Area ha:

Retail non fooddrink:

Staff:

Units:

Area ha:

Office:

Staff:

Units:

Area ha:

Other:

Staff:

Units:

Area ha:

If Other please specify:

Drainage Details

Method of surface water disposal: Public Sewer

Surface Water Attenuation: Yes

Is it proposed to use SuDS features within the site if so which type: Attenuation Tank

Method of foul water disposal: Public Sewer

Method of highway drainage disposal: Public Sewer

Will the proposal require a new amended trade effluent consent: No

Use of Commercial/Industrial Premises:

Specify trade and/or type of commercial or industrial activity eg Manufacturing processing mechanical electrical etc
Please provide as much detail as possible:

Will the development require the use of potable water in the treatment/cleaning process: No

Proposed Development Programme

Phasing of development:

Year: 2023

Type of Development: Residential

Units: 35

Area ha: 1

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Year:

Type of Development:

Units:

Area ha:

Planning Status

Is the site allocated in a Development Plan: No

Is Yes please provide Development Plan Name:

Development Plan Site Reference:

If Brownfield site what is was the previous site use eg school factory etc: Residential

Historical Information

If the site is a Brownfield site please provide information regarding the following:

Water Consumption:

Units:

Area ha:

Foul Sewage discharge rate:

Units:

Area ha:

Surface Water discharge rate:

Units:

Area ha:

Id: 071e2e41-bc90-4278-8628-dcc4dfe4305a

Price: 85.20

File Uploads

Do you have a Location Plan to upload: Yes

Please select the Location Plan file: /PPA/ea386961-11b3-4e9d-a75d-1508ce876746/LocationPlan.pdf

Please be aware that it is not possible to upload files when using an iPad or iPhone:

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rif cofrestredig yw 02366777, ,, ac mae ei swyddfa gofrestrdig yn Linea, Heol Fortran, Llaneirwg, Caerdydd, CF3 0LT.

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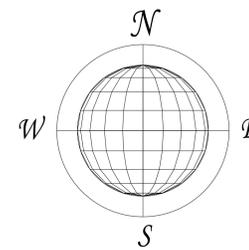
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Appendix F GPR Survey



Symbols/Abbreviations (Where Applicable):

- + AV: AIR VALVE
- + BB: BELUSHA BEACON
- + BH: BOREHOLE
- + BM: BENCHMARK
- + BOL: BOLLARD
- + B/S: BUS STOP
- + CAM: CAMERA
- + CS: CABLE STAY
- + CATV: C.A.T.V INSPECTION CHAMBER
- + CBOX: ELECTRICITY BOX, CABLE BOX, ETC.
- + C.PIT: CATCH PIT
- + C.T.V: C.C.T.V CAMERA
- + C.PIT: CATCH PIT
- + EC: ELECTRICITY COVER
- + EP: ELECTRICITY POLE
- + ER: EARTH ROD
- + FH: FIRE HYDRANT
- + FP: FLAG POLE
- + G: GULLY
- + GR: GULLY (ROUND)
- + GV: GAS VALVE
- + IC: INSPECTION COVER (SQUARE)
- + IC: INSPECTION COVER (ROUND)
- + IL: INVERT LEVEL
- + KO: KERB OUTLET
- + LB: LETTER BOX
- + LC: LIGHTING COLUMN
- + LP: LAMP POST
- + LP/BS: LAMP POST/BUS STOP
- + MH: MANHOLE (SQUARE)
- + MH: MANHOLE (ROUND)
- + MKR: MARKER
- + O: POST
- + RE: RODDING EYE
- + R/S: ROAD SIGN
- + S/P: SIGN POST
- + SNP: STREET NAME PLATE
- + ST: STOP TAP
- + SV: STOP VALVE
- + TCB: TELEPHONE CALL BOX
- + TL: TRAFFIC LIGHT
- + TP: TELEGRAPH POLE
- + TP/EP: TELEGRAPH POLE/ELECTRIC POLE
- + T/IC: TELECOM INSPECTION COVER
- + WO: WATER OUTLET
- + WM: WATER METER
- + GATE: GATE
- + D.P.: DEFINED POINT
- + C.P.: CONTROL POINT
- + T: TREE (CONIFEROUS)
- + D: TREE (DECIDUOUS)
- + F: FOLIAGE
- + H: HEDGE
- + DPC: 99.99m DAMP PROOF COURSE LEVEL
- + EL: 99.99m EAVES LEVEL
- + FL: 99.99m FLOOR LEVEL
- + RL: 99.99m RIDGE LEVEL
- + SL: 99.99m SOFFIT LEVEL
- + TL: 99.99m THRESHOLD LEVEL

- FENCE DESCRIPTIONS:**
- B/W: BARBED WIRE FENCE
 - C/B: CLOSE BOARDED FENCE
 - C/L: CHAIN LINK FENCE
 - C/P: CHESTNUT PALING FENCE
 - CONC/P: CONCRETE PANEL FENCE
 - I/R: IRON RAILING FENCE
 - P/R: POST AND RAIL FENCE
 - P/W: POST AND WIRE FENCE
 - P/C: POST AND CHAIN FENCE
 - S/PAL: STEEL PALISADE FENCE
 - S/B: SAFETY BARRIER
 - T/PAL: TIMBER PALISADE FENCE

Revision Information

Rev	Date	Description

INFORMATION

- 1) Ordnance Survey coordinates and level are derived from OSTN15 and OSGM15, transformed from WGS84.
- 2) Only services located during the site survey are shown on this plan. Further investigation may be required to ascertain the full extent of the site services.
- 3) Copyright of this drawing remains the property of PM Surveys UK Ltd. Do not scale from this drawing. In the event of any discrepancy, refer query to PM Surveys UK Ltd.

NOTES

-



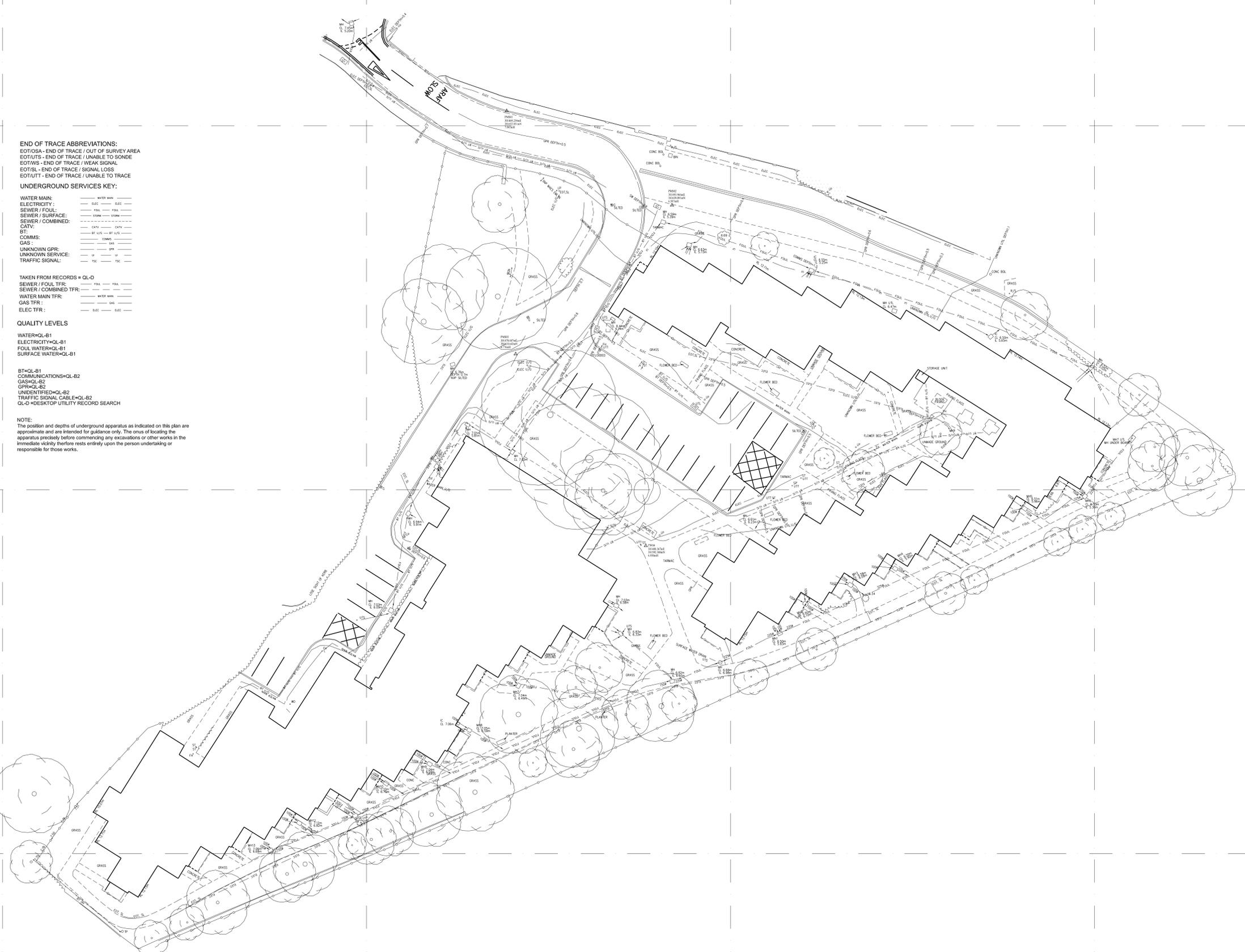
PM Surveys UK Ltd
 Unit 3, Queensferry Industrial Estate
 Pentre
 Flintshire, CH5 2DJ
 Tel: 01244 952477
 Email: info@pmsurveys.co.uk

Client Info
Denbighshire CC
 Caledfryn
 Smithfield Road
 Denbigh

Tel:
Email: melvyn.edwards@denbighshire.gov.uk

Project
Maes Emlyn
 Rhyll
 GPR Survey

Project No	Sheet	Surveyed By
PMS22185	A0	DJTW HBB
	Scale	Drawn By
	1:200	JW
		Approved By
		PM
Dwg	PMS22185-02	Issued
		30/08/22



- END OF TRACE ABBREVIATIONS:**
- EOT/OSA - END OF TRACE / OUT OF SURVEY AREA
 - EOT/US - END OF TRACE / UNABLE TO SONDE
 - EOT/MS - END OF TRACE / WEAK SIGNAL
 - EOT/SL - END OF TRACE / SIGNAL LOSS
 - EOT/TT - END OF TRACE / UNABLE TO TRACE
- UNDERGROUND SERVICES KEY:**
- WATER MAIN:** ——— WATER MAIN ———
- ELECTRICITY:** ——— ELEC ——— ELEC ———
- SEWER / FOUL:** ——— FWA ——— FWA ———
- SEWER / SURFACE:** ——— SWS ——— SWS ———
- SEWER / COMBINED:** ——— SCS ——— SCS ———
- CATV:** ——— CATV ——— CATV ———
- BT:** ——— BT (G) ——— BT (G) ———
- COMMS:** ——— COMMS ——— COMMS ———
- GAS:** ——— GAS ——— GAS ———
- UNKNOWN GPR:** ——— UG ——— UG ———
- UNKNOWN SERVICE:** ——— US ——— US ———
- TRAFFIC SIGNAL:** ——— TSC ——— TSC ———
- TAKEN FROM RECORDS = QL-D**
- SEWER / FOUL TFR:** ——— FWA ——— FWA ———
- SEWER / COMBINED TFR:** ——— SCS ——— SCS ———
- WATER MAIN TFR:** ——— WATER MAIN ———
- GAS TFR:** ——— GAS ——— GAS ———
- ELEC TFR:** ——— ELEC ——— ELEC ———
- QUALITY LEVELS**
- WATER=QL-B1
 ELECTRICITY=QL-B1
 FOUL WATER=QL-B1
 SURFACE WATER=QL-B1
- BT=QL-B1
 COMMUNICATIONS=QL-B2
 GAS=QL-B2
 GPR=QL-B2
 UNIDENTIFIED=QL-B2
 TRAFFIC SIGNAL CABLE=QL-B2
 QL-D=DESKTOP UTILITY RECORD SEARCH

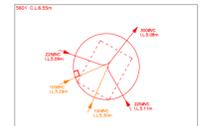
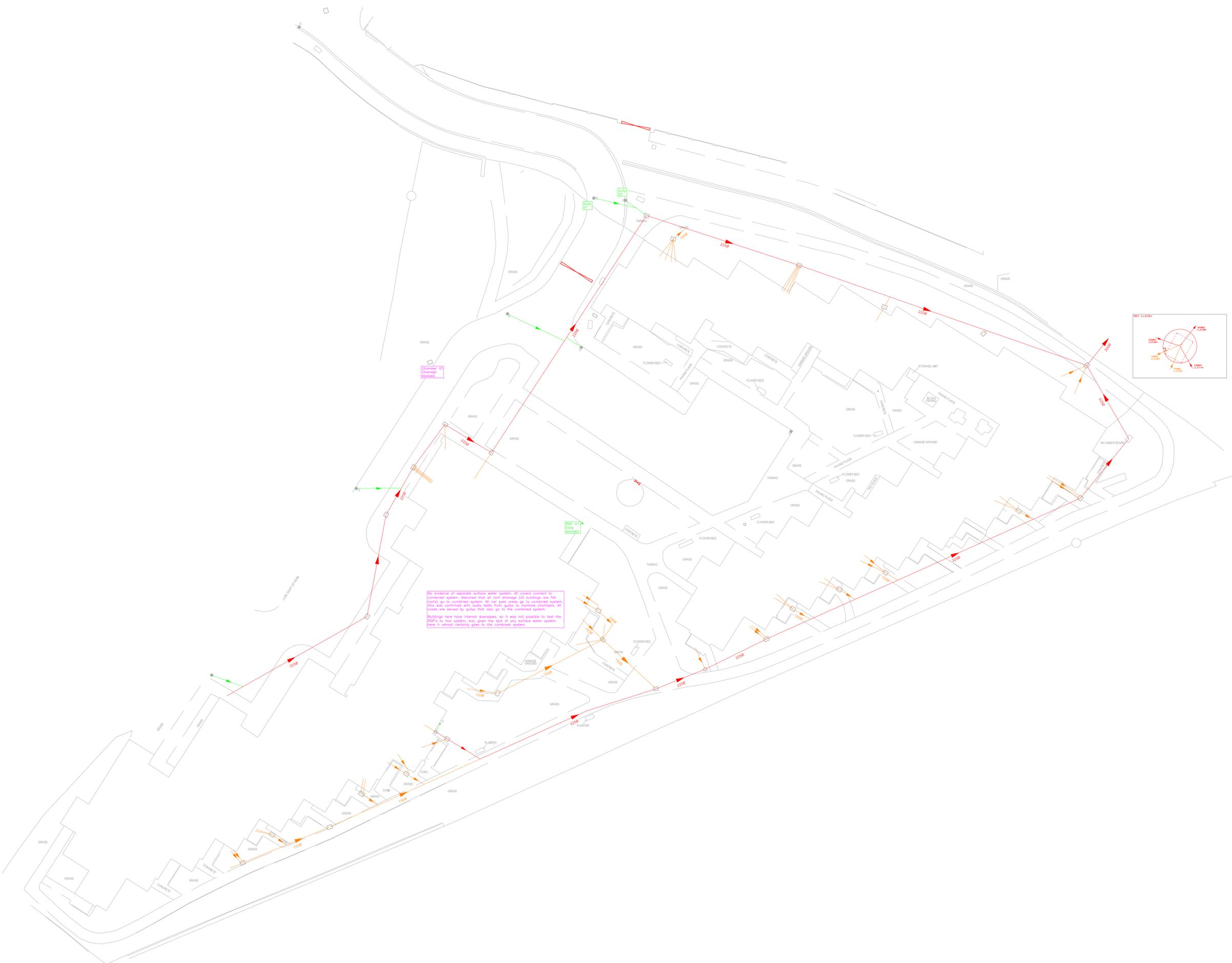
NOTE:
 The position and depths of underground apparatus as indicated on this plan are approximate and are intended for guidance only. The onus of locating the apparatus precisely before commencing any excavations or other works in the immediate vicinity therefore rests entirely upon the person undertaking or responsible for those works.

Appendix G Invek Surveys Drainage Layout



Legend/Notes:

- Combined Sewer
- Foul Sewer
- SW Sewer
- Assumed Sewer (Not Proven)
- Rising Main
- Highway Drainage
- Culvert Sewer
- Open Water Course
- Overflow Line
- Treated Line
- Rain Water Down Pipe
- Foul Down Pipe
- Combined Down Pipe
- Grey Water Down Pipe



No evidence of separate surface water system. All covers connect to combined system. Assumed that all roof drainage (all buildings are flat roofs) go to combined system. All car park areas go to combined system. This was confirmed with audio tests from gully to manhole chambers. All roads are served by gully that also go to the combined system.

Buildings here have internal downpipes, so it was not possible to test the RDP's to foul system, but, given the lack of any surface water system here it almost certainly goes to the combined system.

INVEK SURVEYS LTD.

Warrington Business Park, Long Lane, Warrington, Cheshire, WA2 8TX
 Tel: 01925 244376 Fax: 01925 241517
 Email: kevin@invek.com - www.invek.com

Client
Waterco

Drawing Title
**Maes Emlyn, Rhy1
Drainage Layout**

Scale(s)	N.T.S	Drawn	PW
Date	12.06.23	Checked	RD
Job Number	2109	Approved	KN

Sheet Size, Drawing Number & Revision
A1_2109/01_Rev_00

Appendix H Proposed Development Plan



1. Contractor to verify all dimensions and check level datums on site.
 2. All of the designs are the sole property of TACP Architects Ltd and may not be used without their written agreement.
 3. All prints, specifications and their copyright are the property of TACP Architects Ltd.
 4. Do not scale off drawings.
 5. All dimensions shall be checked on site before commencement of shop drawings, manufacture and all discrepancies must be reported to TACP Architects Ltd.

Unit Key:

- 1 Bedroom - 2 Person Apartment
Quantity = 18no.
(GFLR units to be Part M Cat 3 wheelchair accessible)
- 2 Bedroom - 4 Person Apartment
Quantity = 3no.
- 2 Bedroom - 4 person House (2 Storey)
Quantity = 10no.
- 3 Bedroom - 5 Person House (2 Storey)
Quantity = 4no.

Site Key:

- Parking Bay - Tarmacadam surface
- 1 no. space per bedroom (up to 3no. for 3 bed where possible) + 1 no. visitor space per 5 units
Quantity = 55 + 7 = 62 spaces
- Spaces to be 4.8m x 2.6m wide as standard.
- Future possibility to widen 1 space per accessible adaptable unit (house types) to 3.6m and lengthen to 6m.
- All ground floor apartments to have accessible parking bay as standard.
- EV charging
1 charging point per house type.
Future provision for 1 point per apartment and per visitor bay - ducting to be installed.
- Existing tree with RPA based on Arboricultural Survey
- Existing tree to be removed
- Proposed trees - please refer to landscape proposal plans
- Proposed hedge - please refer to landscape proposal plans
- Proposed amenity grass areas - please refer to landscape proposal plans
- Proposed ornamental planting - please refer to landscape proposal plans

External surfaces shown indicatively only - subject to detailed design and agreement of materials - refer to Landscape Proposal for materials.

Risk Assessments

DRAFT FOR INFORMATION ONLY

Rev	Date	Description	By	Check
B	10/01/23	Further development in line with unit layouts and design team input.	KM	MG
C	17/01/23	Aperture positions at ground floor indicated as per unit type development. Alterations to rear garden surfacing and bike shed positions to suit window / door positions.	KM	MG
D	08/02/23	Updates in line with landscape proposals received and client comments regarding apartment block roof forms. Apartments also amended to suit M&E plant room requirements.	KM	MG
E	20/02/23	Site plan updated to suit apartment design approved by client team.	KM	MG

Consultants

Client
Denbighshire County Council

Project Title
Maes Emlyn Housing, Rhyll

Drawing Title
Site layout

Scale	Date	Drawn By	Checked By	Office
As indicated@A0	07/11/22	KM	MG	Wrexham

Job Number Project*Originator*Zone*Level*Type*Role*Number Revision
 22038 MEH-TACP-PS-ST-DR-A-701 E

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 E. admin@tacparchitects.co.uk
 www.tacparchitects.co.uk



Appendix I SAB Consultation Response

Adam McCulloch

From: Daniel Jones <Daniel.Jones@denbighshire.gov.uk>
Sent: 10 January 2023 14:33
To: Adam McCulloch
Cc: Land Drainage Consultations
Subject: RE: 14973-SAB Pre-Application-Maes Emlyn [Filed 10 Jan 2023 14:53]

Categories: Filed by Mail Manager

Good Afternoon Adam,

Thank you for the information below regarding proposals at Maes Emlyn, Rhyl.

We would have no objections in principle to your intention of discharging the surface water from the site into the public combined sewer, providing the following conditions are met:

1. Evidence that the hierarchy has been followed and that you have explored and exhausted alternative surface water drainage options.
2. Confirmation from Welsh Water that they are happy to accept flows from the site.

Kind regards,

Daniel Jones BSc (Hons)
Swyddog Perygl Llifogydd / Flood Risk Officer
Cyngor Sir Ddinbych / Denbighshire County Council
Priffyrdd a Gwasanaethau Amgylcheddol / Highways & Environmental Services
Ffon/Phone: 01824 706822 / 07824 409601
Gwefan/Website: www.sirddinbych.gov.uk / www.denbighshire.gov.uk

From: Adam McCulloch [mailto:adam.mcculloch@waterco.co.uk]
Sent: 23 December 2022 13:16
To: Land Drainage Consultations <landdrainage.consultations@denbighshire.gov.uk>
Subject: RE: 14973-SAB Pre-Application-Maes Emlyn

Proposed residential development at Maes Emlyn, Rhyl, Denbighshire, LL18 4AB. Grid Reference: 301448, 381587.

Dear Sir/Madam,

We are currently undertaking a Drainage Strategy at the above address. The proposed development is for the demolition of 59No. existing residential dwellings and erection of 38No. residential dwellings with associated access roads and parking. Please find attached the completed SuDS pre-application form and supporting documentation.

If you require any further information to process my request, please do not hesitate to contact me.

Kind Regards,

Adam McCulloch
Environmental Consultant

Teams: adam.mcculloch@waterco.co.uk

We're recruiting! For more information, please take a look at our [website](#).

 Please consider the environment before printing this email.

Dilyn ni ar Twitter: <http://twitter.com/cyngorsDd> - Follow us on Twitter:
<http://twitter.com/DenbighshireCC>
Ymwelwch a ni ar-lein ar <http://www.sirddinbych.gov.uk> - Visit us online at
<http://www.denbighshire.gov.uk>

Mae'r wybodaeth a gynhwysir yn yr e-bost hwn ac unrhyw ffeiliau a drosglwyddir gydag o wedi eu bwriadu yn unig ar gyfer pwy bynnag y cyfeirir ef ato neu atynt. Os ydych wedi derbyn yr e-bost hwn drwy gamgymeriad, hysbyswch yr anfonwr ar unwaith os gwelwch yn dda. Mae cynnwys yr e-bost yn cynrychioli barn yr unigolyn(ion) a enwir uchod ac nid yw o angenrheidrwydd yn cynrychioli barn Cyngor Sir Ddinbych. Serch hynny, fel Corff Cyhoeddus, efallai y bydd angen i Gyngor Sir Ddinbych ddatgelu'r e-bost hwn [neu unrhyw ymateb iddo] dan ddarpariaethau deddfwriaethol.

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Appendix J Soakaway Test Results

Appendix K ReFH2 Greenfield Runoff Rates

DOCUMENT VERIFICATION RECORD	
Project:	14973 – Maes Emlyn, Rhyl
Client:	TACP Architects Ltd
Report Title:	14973-Drainage Strategy-01
Date:	01/02/23

DOCUMENT REVIEW & APPROVAL	
Author:	Adam McCulloch
Checker:	Aled Williams BSc (Hons) MCIWEM C.WEM
Approver:	Nigel Jones BEng (Hons) CEng MICE

ReFH2 RUNOFF RATES*	
Return Period (Years)	As-rural Peak Flow (l/s)
1	0.58
2	0.67
5	1.00
10	1.27
30	1.84
50	2.19
75	2.51
100	2.76
200	3.43
1000	5.21

*Runoff Rates printed from the ReFH Flood Modelling software package

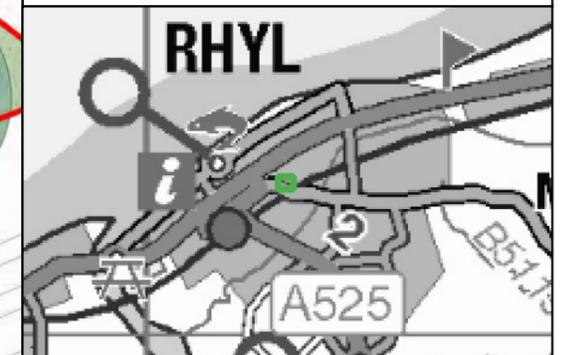
Appendix L Drainage Areas Plan



Notes:
 1) This sketch has not been subject to formal checks and approvals. Its validity and use must therefore be limited to discussion and information purposes only.
 2) This drawing is an amendment of the 'Site Layout' by 'TACP Architects Ltd'. This drawing provides a concept only and is not intended for detailed design.

LEGEND

- Site Boundary
- Drainage Area Split



CLIENT:			
TACP Architects Ltd			
 www.waterco.co.uk			
SCHEME:			
Maes Emlyn, Rhyl			
PLOT TITLE:			
Drainage Area Plan			
PLOT STATUS:		DATE:	
FINAL		28-02-2023	
DRAWN:	CHECKED:	APPROVED:	PLOT SCALE AT A3:
AM	AW	NJ	1:500
PLOT NAME:			REVISION:
14973_Drainage_Area_Plan			-

Appendix M MicroDrainage Attenuation Storage Estimates

Waterco Ltd		Page 1
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 1	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	9.444	0.444	3.6	135.8	O K
30 min Summer	9.585	0.585	3.6	179.0	O K
60 min Summer	9.734	0.734	3.6	224.6	Flood Risk
120 min Summer	9.867	0.867	3.6	265.2	Flood Risk
180 min Summer	9.932	0.932	3.6	285.2	Flood Risk
240 min Summer	9.967	0.967	3.6	296.0	Flood Risk
360 min Summer	9.991	0.991	3.6	303.3	Flood Risk
480 min Summer	9.991	0.991	3.6	303.3	Flood Risk
600 min Summer	9.977	0.977	3.6	299.1	Flood Risk
720 min Summer	9.958	0.958	3.6	293.1	Flood Risk
960 min Summer	9.918	0.918	3.6	280.9	Flood Risk
1440 min Summer	9.840	0.840	3.6	257.0	Flood Risk
2160 min Summer	9.731	0.731	3.6	223.6	Flood Risk
2880 min Summer	9.627	0.627	3.6	191.8	O K
4320 min Summer	9.434	0.434	3.6	132.8	O K
5760 min Summer	9.308	0.308	3.6	94.2	O K
7200 min Summer	9.230	0.230	3.6	70.4	O K
8640 min Summer	9.181	0.181	3.5	55.3	O K
10080 min Summer	9.149	0.149	3.3	45.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	156.101	0.0	136.6	16
30 min Summer	103.795	0.0	181.1	31
60 min Summer	66.103	0.0	233.9	62
120 min Summer	40.250	0.0	284.7	122
180 min Summer	29.726	0.0	315.2	182
240 min Summer	23.809	0.0	336.5	242
360 min Summer	17.216	0.0	364.7	360
480 min Summer	13.656	0.0	385.5	480
600 min Summer	11.385	0.0	401.5	600
720 min Summer	9.798	0.0	414.4	656
960 min Summer	7.701	0.0	433.6	768
1440 min Summer	5.446	0.0	457.8	1024
2160 min Summer	3.819	0.0	486.6	1448
2880 min Summer	2.961	0.0	503.0	1848
4320 min Summer	2.058	0.0	524.4	2552
5760 min Summer	1.598	0.0	542.8	3240
7200 min Summer	1.330	0.0	564.8	3960
8640 min Summer	1.155	0.0	588.6	4592
10080 min Summer	1.034	0.0	614.8	5256

Waterco Ltd		Page 2
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 1	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Winter	9.444	0.444	3.6	135.7	O K
30 min Winter	9.585	0.585	3.6	179.0	O K
60 min Winter	9.734	0.734	3.6	224.5	Flood Risk
120 min Winter	9.867	0.867	3.6	265.4	Flood Risk
180 min Winter	9.934	0.934	3.6	285.7	Flood Risk
240 min Winter	9.970	0.970	3.6	296.7	Flood Risk
360 min Winter	9.995	0.995	3.6	304.6	Flood Risk
480 min Winter	9.998	0.998	3.6	305.3	Flood Risk
600 min Winter	9.986	0.986	3.6	301.9	Flood Risk
720 min Winter	9.967	0.967	3.6	295.9	Flood Risk
960 min Winter	9.917	0.917	3.6	280.7	Flood Risk
1440 min Winter	9.824	0.824	3.6	252.2	Flood Risk
2160 min Winter	9.678	0.678	3.6	207.3	O K
2880 min Winter	9.516	0.516	3.6	157.8	O K
4320 min Winter	9.289	0.289	3.6	88.4	O K
5760 min Winter	9.169	0.169	3.4	51.6	O K
7200 min Winter	9.114	0.114	3.1	34.8	O K
8640 min Winter	9.095	0.095	2.8	29.2	O K
10080 min Winter	9.085	0.085	2.5	26.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Winter	156.101	0.0	136.6	16
30 min Winter	103.795	0.0	181.1	31
60 min Winter	66.103	0.0	233.9	62
120 min Winter	40.250	0.0	284.7	120
180 min Winter	29.726	0.0	315.2	178
240 min Winter	23.809	0.0	336.5	236
360 min Winter	17.216	0.0	364.7	352
480 min Winter	13.656	0.0	385.5	464
600 min Winter	11.385	0.0	401.5	576
720 min Winter	9.798	0.0	414.4	678
960 min Winter	7.701	0.0	433.6	788
1440 min Winter	5.446	0.0	458.0	1082
2160 min Winter	3.819	0.0	486.6	1556
2880 min Winter	2.961	0.0	503.0	1932
4320 min Winter	2.058	0.0	524.5	2632
5760 min Winter	1.598	0.0	542.8	3232
7200 min Winter	1.330	0.0	564.8	3824
8640 min Winter	1.155	0.0	588.6	4496
10080 min Winter	1.034	0.0	614.8	5152

Waterco Ltd		Page 3
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 1	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 301481 381595 SJ 01481 81595
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.354

Time (mins)		Area
From:	To:	(ha)
0	1	0.354

Waterco Ltd		Page 4
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 1	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	306.0	1.000	306.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0090-3600-1000-3600
Design Head (m)	1.000
Design Flow (l/s)	3.6
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

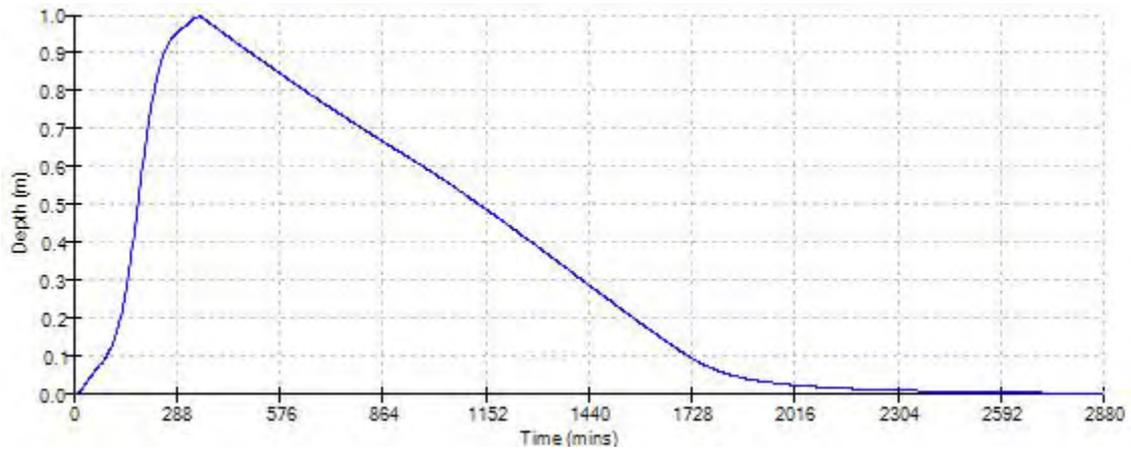
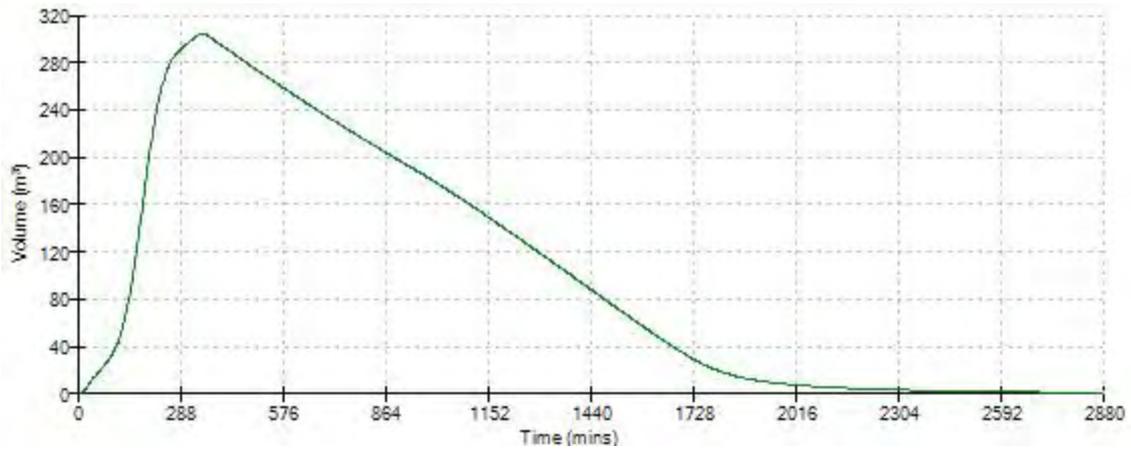
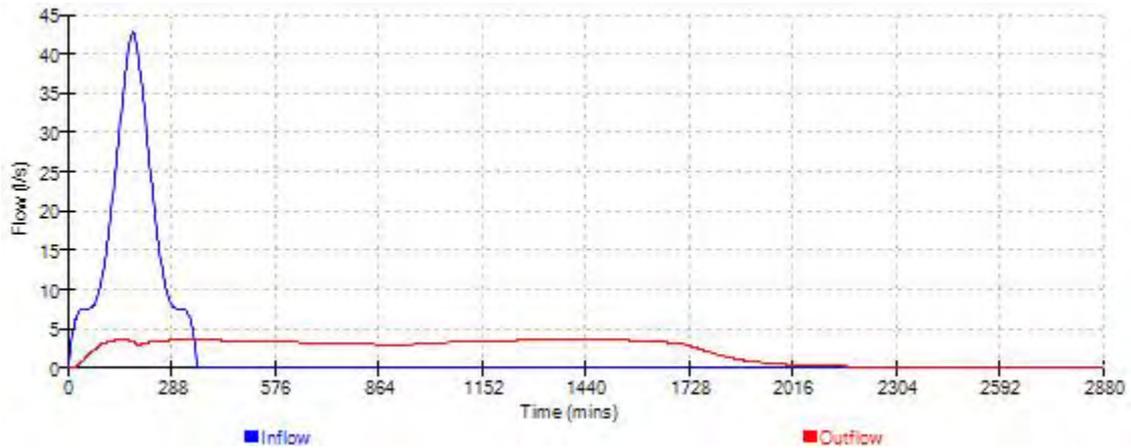
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	3.6
Flush-Flo™	0.300	3.6
Kick-Flo®	0.631	2.9
Mean Flow over Head Range	-	3.1

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	1.600	4.5	5.000	7.6
0.200	3.5	1.800	4.7	5.500	8.0
0.300	3.6	2.000	5.0	6.000	8.3
0.400	3.5	2.200	5.2	6.500	8.6
0.500	3.4	2.400	5.4	7.000	9.0
0.600	3.1	2.600	5.6	7.500	9.3
0.800	3.2	3.000	6.0	8.000	9.5
1.000	3.6	3.500	6.5	8.500	9.8
1.200	3.9	4.000	6.9	9.000	10.1
1.400	4.2	4.500	7.3	9.500	10.4



Event: 360 min Winter



Eden Court
Lon Parcwr Business Park
Denbighshire LL15 1NJ

Maes Emlyn
Rhyl
Drainage Area 1



Date 30/08/2023

Designed by AM

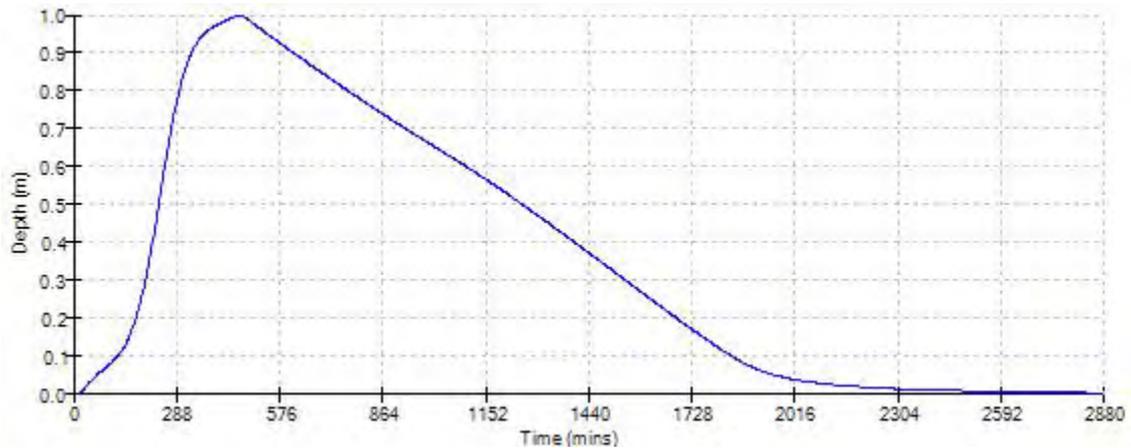
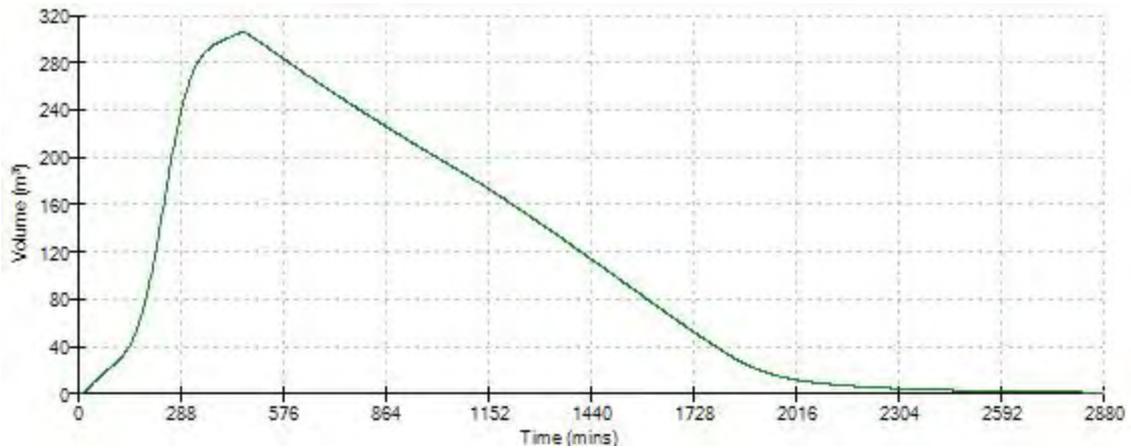
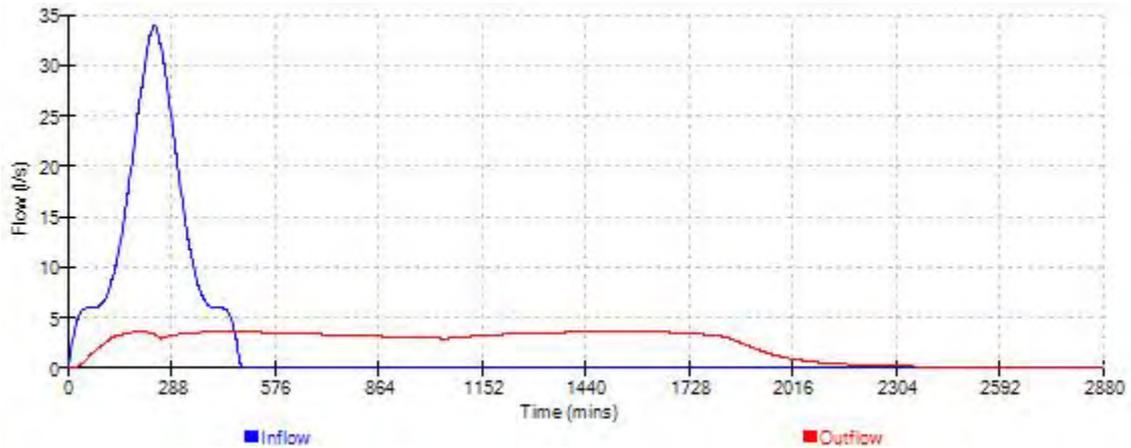
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XP Solutions

Source Control 2020.1.3

Event: 480 min Winter



Eden Court
Lon Parcwr Business Park
Denbighshire LL15 1NJ

Maes Emlyn
Rhyl
Drainage Area 1



Date 30/08/2023

Designed by AM

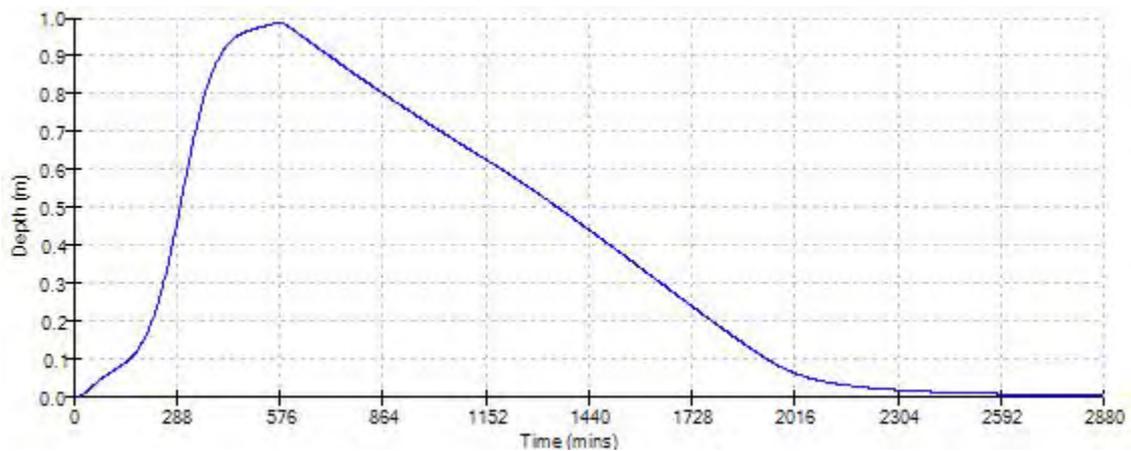
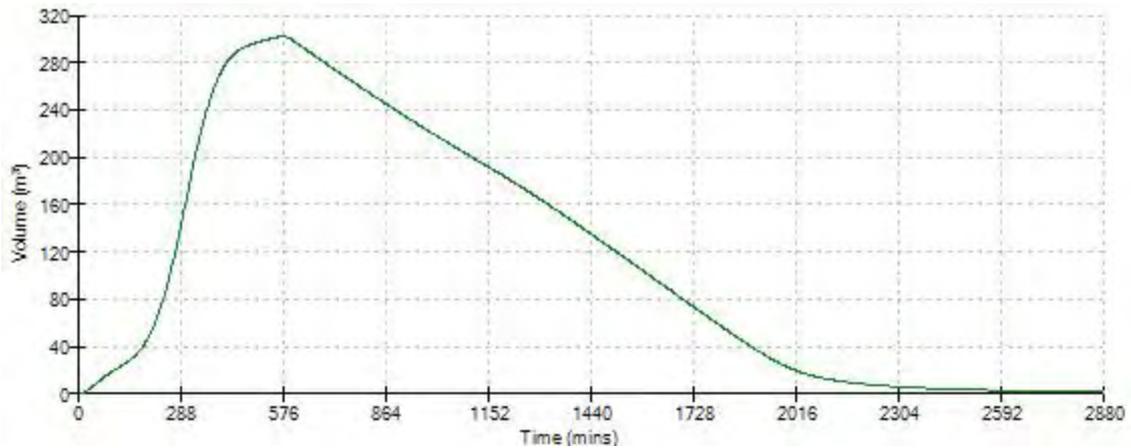
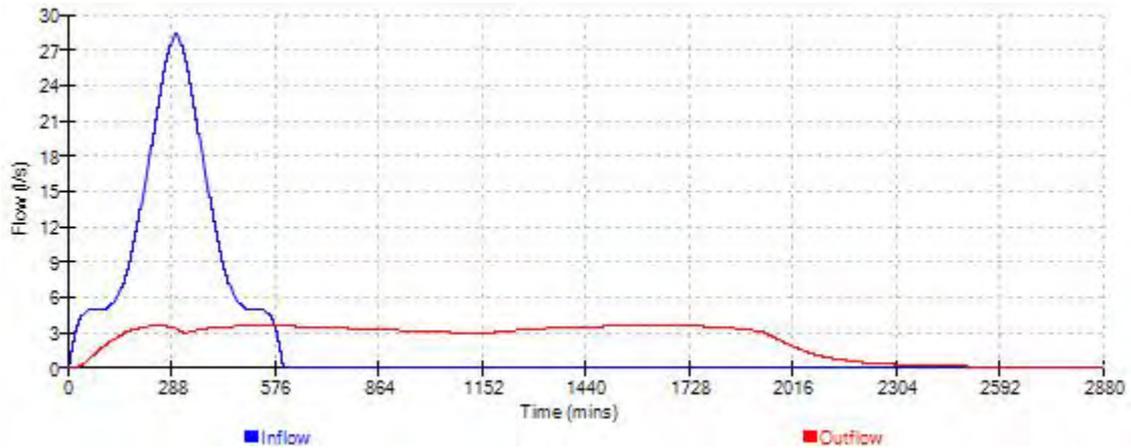
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Source Control 2020.1.3

Event: 600 min Winter



Waterco Ltd		Page 1
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 2	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	9.441	0.441	1.3	53.4	O K
30 min Summer	9.582	0.582	1.3	70.4	O K
60 min Summer	9.729	0.729	1.3	88.2	Flood Risk
120 min Summer	9.861	0.861	1.3	104.2	Flood Risk
180 min Summer	9.927	0.927	1.4	112.2	Flood Risk
240 min Summer	9.962	0.962	1.4	116.5	Flood Risk
360 min Summer	9.987	0.987	1.4	119.5	Flood Risk
480 min Summer	9.989	0.989	1.4	119.6	Flood Risk
600 min Summer	9.976	0.976	1.4	118.1	Flood Risk
720 min Summer	9.957	0.957	1.4	115.8	Flood Risk
960 min Summer	9.919	0.919	1.4	111.2	Flood Risk
1440 min Summer	9.844	0.844	1.3	102.1	Flood Risk
2160 min Summer	9.743	0.743	1.3	89.9	Flood Risk
2880 min Summer	9.657	0.657	1.3	79.4	O K
4320 min Summer	9.495	0.495	1.3	59.9	O K
5760 min Summer	9.348	0.348	1.3	42.1	O K
7200 min Summer	9.258	0.258	1.3	31.3	O K
8640 min Summer	9.200	0.200	1.2	24.2	O K
10080 min Summer	9.161	0.161	1.2	19.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	156.101	0.0	54.1	16
30 min Summer	103.795	0.0	71.6	31
60 min Summer	66.103	0.0	91.8	62
120 min Summer	40.250	0.0	111.8	122
180 min Summer	29.726	0.0	123.9	182
240 min Summer	23.809	0.0	132.3	242
360 min Summer	17.216	0.0	143.5	360
480 min Summer	13.656	0.0	151.8	480
600 min Summer	11.385	0.0	158.1	600
720 min Summer	9.798	0.0	163.1	656
960 min Summer	7.701	0.0	170.7	770
1440 min Summer	5.446	0.0	179.9	1024
2160 min Summer	3.819	0.0	191.0	1448
2880 min Summer	2.961	0.0	197.5	1848
4320 min Summer	2.058	0.0	205.9	2680
5760 min Summer	1.598	0.0	213.1	3344
7200 min Summer	1.330	0.0	221.8	4032
8640 min Summer	1.155	0.0	231.1	4672
10080 min Summer	1.034	0.0	241.4	5352

Waterco Ltd		Page 2
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 2	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions		Source Control 2020.1.3

Summary of Results for 100 year Return Period (+40%)

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Winter	9.441	0.441	1.3	53.4	O K
30 min Winter	9.582	0.582	1.3	70.4	O K
60 min Winter	9.729	0.729	1.3	88.3	Flood Risk
120 min Winter	9.863	0.863	1.3	104.4	Flood Risk
180 min Winter	9.929	0.929	1.4	112.5	Flood Risk
240 min Winter	9.966	0.966	1.4	116.9	Flood Risk
360 min Winter	9.993	0.993	1.4	120.2	Flood Risk
480 min Winter	9.997	0.997	1.4	120.6	Flood Risk
600 min Winter	9.987	0.987	1.4	119.5	Flood Risk
720 min Winter	9.970	0.970	1.4	117.3	Flood Risk
960 min Winter	9.922	0.922	1.4	111.6	Flood Risk
1440 min Winter	9.836	0.836	1.3	101.2	Flood Risk
2160 min Winter	9.708	0.708	1.3	85.7	Flood Risk
2880 min Winter	9.589	0.589	1.3	71.3	O K
4320 min Winter	9.340	0.340	1.3	41.2	O K
5760 min Winter	9.194	0.194	1.2	23.5	O K
7200 min Winter	9.123	0.123	1.2	14.8	O K
8640 min Winter	9.086	0.086	1.1	10.4	O K
10080 min Winter	9.071	0.071	1.0	8.6	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Winter	156.101	0.0	54.1	16
30 min Winter	103.795	0.0	71.6	31
60 min Winter	66.103	0.0	91.8	62
120 min Winter	40.250	0.0	111.8	120
180 min Winter	29.726	0.0	123.9	178
240 min Winter	23.809	0.0	132.3	236
360 min Winter	17.216	0.0	143.5	352
480 min Winter	13.656	0.0	151.8	464
600 min Winter	11.385	0.0	158.1	576
720 min Winter	9.798	0.0	163.1	680
960 min Winter	7.701	0.0	170.7	788
1440 min Winter	5.446	0.0	179.9	1082
2160 min Winter	3.819	0.0	191.0	1540
2880 min Winter	2.961	0.0	197.5	1992
4320 min Winter	2.058	0.0	206.0	2724
5760 min Winter	1.598	0.0	213.1	3344
7200 min Winter	1.330	0.0	221.8	3968
8640 min Winter	1.155	0.0	231.1	4584
10080 min Winter	1.034	0.0	241.4	5192

Waterco Ltd		Page 3
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 2	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions	Source Control 2020.1.3	

Rainfall Details

Rainfall Model	FEH
Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 301481 381595 SJ 01481 81595
Data Type	Point
Summer Storms	Yes
Winter Storms	Yes
Cv (Summer)	1.000
Cv (Winter)	1.000
Shortest Storm (mins)	15
Longest Storm (mins)	10080
Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.139

Time (mins)		Area
From:	To:	(ha)
0	1	0.139

Waterco Ltd		Page 4
Eden Court Lon Parcwr Business Park Denbighshire LL15 1NJ	Maes Emlyn Rhyl Drainage Area 2	
Date 30/08/2023 File	Designed by AM Checked by AW	
XP Solutions	Source Control 2020.1.3	

Model Details

Storage is Online Cover Level (m) 10.000

Tank or Pond Structure

Invert Level (m) 9.000

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	121.0	1.000	121.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0056-1400-1000-1400
Design Head (m)	1.000
Design Flow (l/s)	1.4
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	56
Invert Level (m)	8.995
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

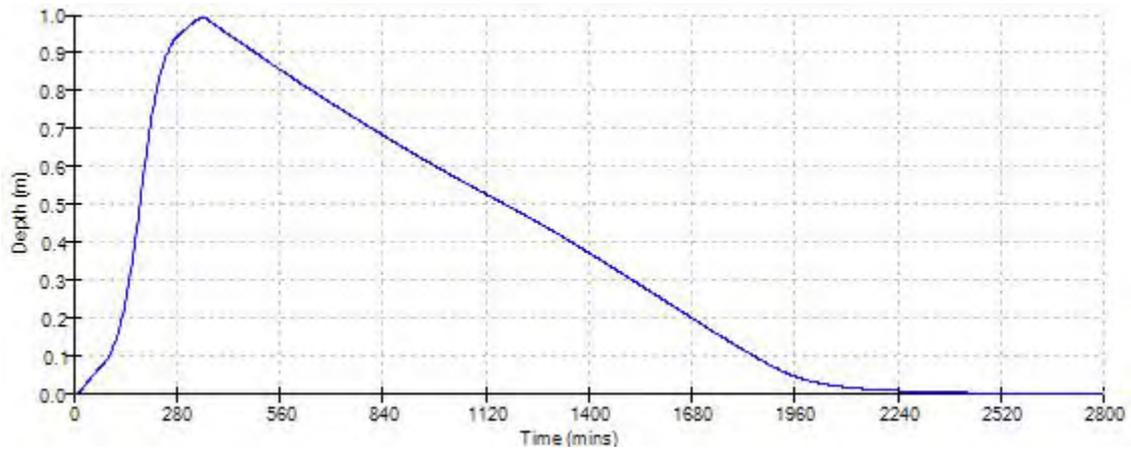
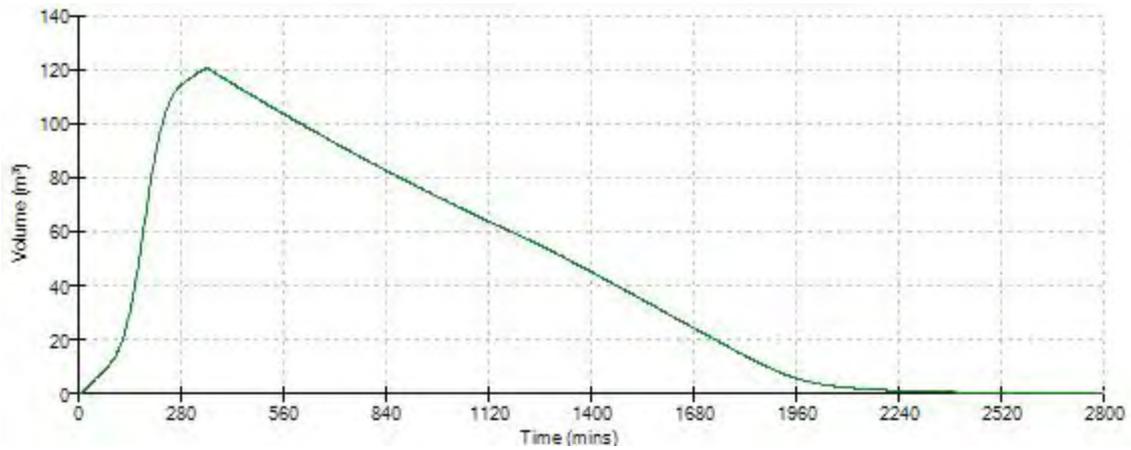
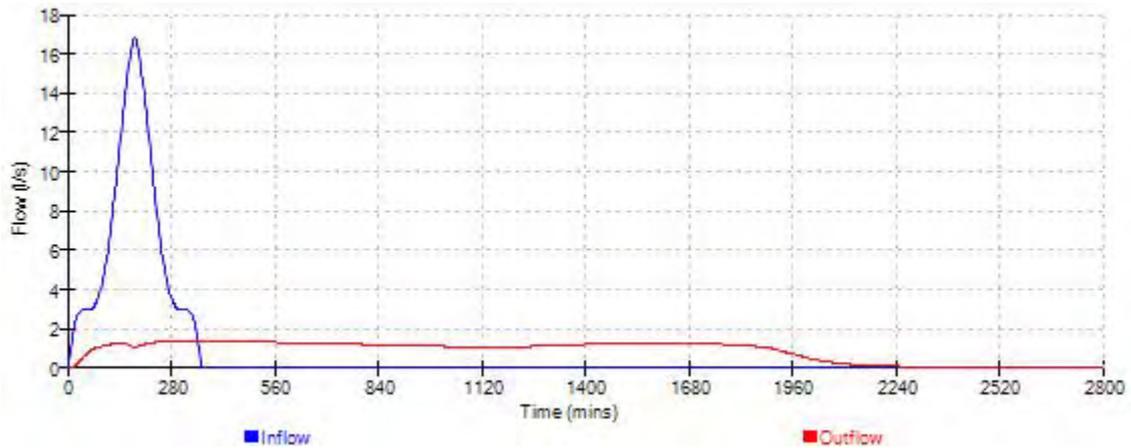
Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	1.4
Flush-Flo™	0.245	1.3
Kick-Flo®	0.497	1.0
Mean Flow over Head Range	-	1.2

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.1	1.600	1.7	5.000	2.9
0.200	1.2	1.800	1.8	5.500	3.1
0.300	1.2	2.000	1.9	6.000	3.2
0.400	1.2	2.200	2.0	6.500	3.3
0.500	1.0	2.400	2.1	7.000	3.4
0.600	1.1	2.600	2.2	7.500	3.5
0.800	1.3	3.000	2.3	8.000	3.6
1.000	1.4	3.500	2.5	8.500	3.7
1.200	1.5	4.000	2.6	9.000	3.8
1.400	1.6	4.500	2.8	9.500	3.9



Event: 360 min Winter



Eden Court
Lon Parcwr Business Park
Denbighshire LL15 1NJ

Maes Emlyn
Rhyl
Drainage Area 2



Date 30/08/2023

Designed by AM

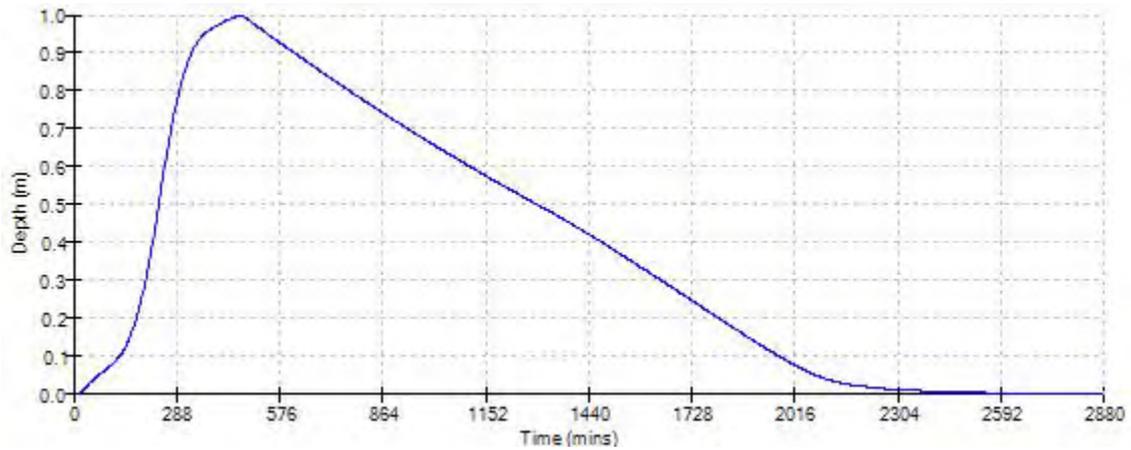
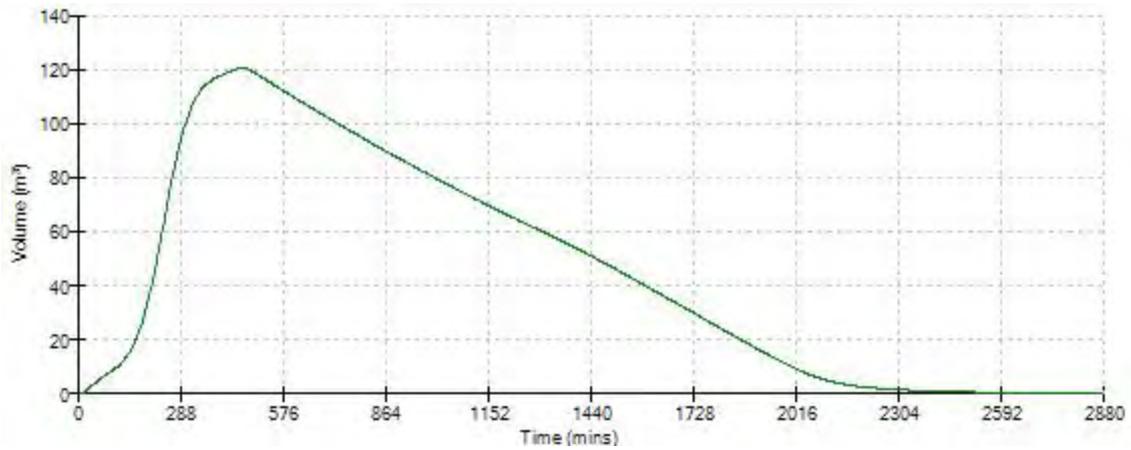
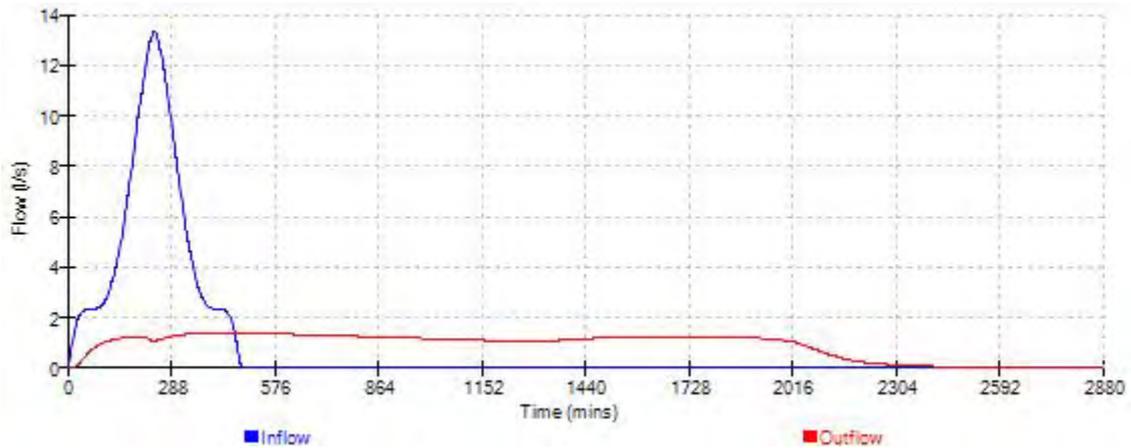
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Checked by AW

XP Solutions

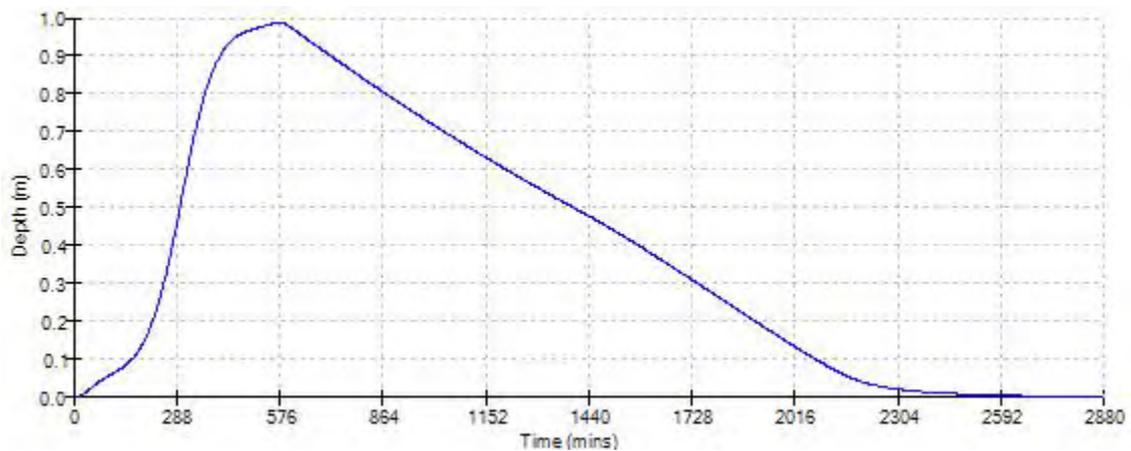
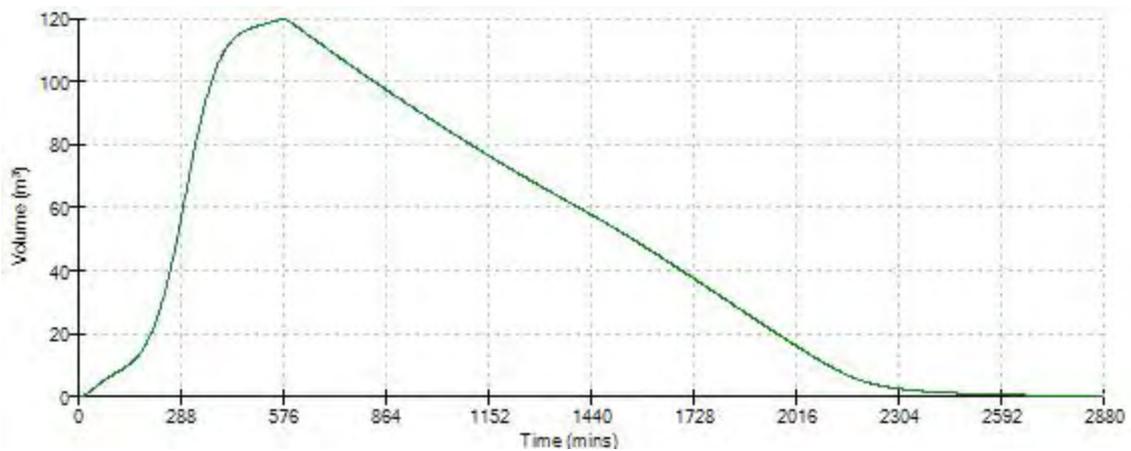
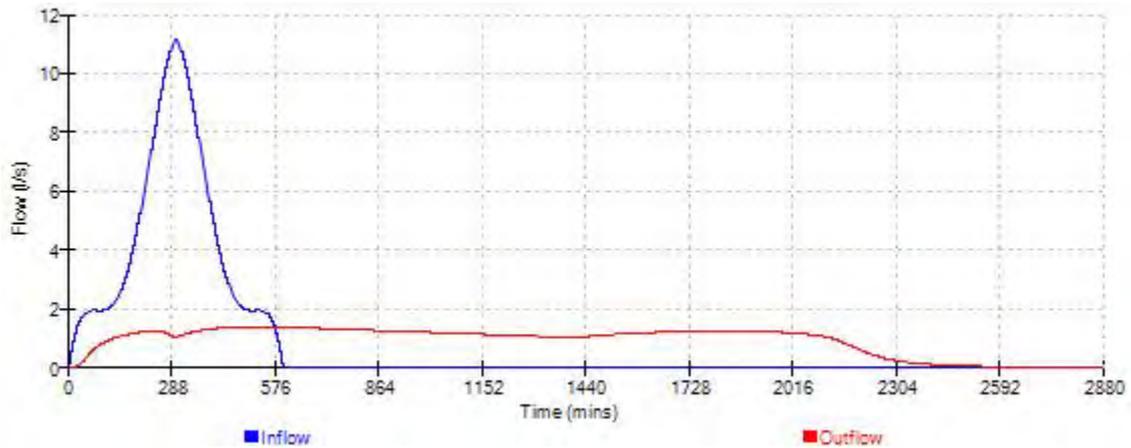
Source Control 2020.1.3

Event: 480 min Winter





Event: 600 min Winter



Appendix N Concept Drainage Sketch



Notes:
 1) This sketch has not been subject to formal checks or approvals. Its validity and use must therefore be limited to discussion and information purposes only.
 2) Unless otherwise noted the risks associated with this proposal are not considered to be extra ordinary and within the remit of an experienced and competent contractor.
 3) All dimensions in millimetres and all levels in metres above ordnance datum unless shown otherwise.
 4) This drawing is an amendment of the 'Site Layout Plan' by 'TACP Architects Ltd (Job Number: 22038)'. This drawing provides a concept only and is not intended for detailed design.

LEGEND

- Site Boundary
- Drainage Area Split
- Surface Water Drain
- Permeable Surfacing
- Rain Gardens
- Surface Water Inspection Chamber
- Existing Public Combined Sewer Manhole
- Flow Control Chamber

CLIENT:		TACP Architects Ltd	
		 www.waterco.co.uk	
SCHEME:		Maes Emlyn, Rhyl	
PLOT TITLE:		Concept Drainage Sketch	
PLOT STATUS:	SKETCH	DATE:	18-09-2023
DRAWN:	AM	CHECKED:	AW
APPROVED:	NJ	PLOT SCALE AT A3:	1:500
PLOT NAME:		14973_Concept_Drainage_Sketch	
REVISION:		-	

Appendix O Maintenance Schedules

Operation and Maintenance Requirements for Permeable Paving

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface)	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturer’s recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional maintenance	Stabilise and move contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level or the paving	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required (if infiltration performance is reduced due to significant clogging)
Monitoring	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48hr after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually
	Monitor inspection chambers	Annually

Ref. Table 20.15, CIRIA C753 ‘The SuDS Manual’

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Operation and Maintenance Requirements for Attenuation Storage Tanks

Maintenance Schedule	Required Action	Typical Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance)	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays	Annually, or as required
Remedial actions	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Ref. Table 21.3, CIRIA C753 'The SuDS Manual'

The maintenance requirements detailed above are to be undertaken by the site owner.

Name :

Position :

Date :

Signed on behalf of the site owner :

Appendix P Concept Designers Risk Assessment (cDRA)

Project: Maes Emlyn, Rhyl
 Client: TACP Architects Ltd
 Report Reference: 14973

Project No: 14973

Prepared by: Adam McCulloch Date: 28/02/2023
 Checked by: Aled Williams Date: 28/02/2023
 Reviewed by: Nigel Jones Date: 28/02/2023

Requirement:

The Construction (Design and Management) Regulations 2015 (CDM 2015) place an obligation on the Designer to take all reasonable steps to provide, with the design, sufficient information about the design, construction or maintenance of the structure, to adequately assist the client, other designers and contractors to comply with their duties under CDM. The Designer has undertaken this assessment to identify any extra-ordinary risks, or those that would not be expected on this particular project by an experienced and competent Contractor. The aim is to avoid needless paperwork and bureaucracy and ensure the assessment is project specific, relevant and proportionate to the risk.

DRA Summary

Each of the following risk areas has been considered using the question below. Is a risk present which is considered to be **extra-ordinary or unexpected** in this instance?

If **YES** - A detailed risk assessment is required at design stage

If **UNKNOWN** - Insufficient information has been provided at concept design stage and the risks are unknown. Further consideration must be given at design stage(s)

If **NO** - No further action is required.

Hazard Ref.	Risk Areas	YES, UNKNOWN or NO	Comments
1	Ground Conditions	Unknown	
2	Hazardous Environment	Unknown	
3	Existing Working Environment	Unknown	
4	Existing Services	Yes	Existing services in place - See GPR Survey
5	Proximity to Other Structure(s)	Yes	Railway line to south
6	Near Waterbody / flood risk	No	Low flood risk, see FCA reference: 14973-FCA-01
7	Proximity to Other Activities	Unknown	Railway line to south
8	Sequence of Construction	Unknown	
9	Access	Unknown	Provided off Churton Road
10	Interfaces	Unknown	
11	Confined Space Working	Unknown	
12	Maintenance Considerations	Unknown	
13	Working at Height	Unknown	
14	Steep Slopes	No	The site is generally flat with levels ranging from 7.08m AOD to 6.45m AOD
15	Demolition / Refurbishment / Repair	Yes	Demolition of existing residential properties
16	Welfare	Unknown	
17	Occupational Health	Unknown	
18	Environmental Issues	Unknown	
19	Other Significant Hazards not Identified Above	Unknown	
20	Residual Risk to Future Users	Unknown	