LAND OFF MAES MEURIG, MELIDEN, PRESTATYN, LL19 8LG

FLOOD CONSEQUENCES ASSESSMENT AND DRAINAGE STATEMENT

Final Report v1.0
May 2023

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Report Title	**Land Off Maes Meurig, Meliden, Prestatyn, LL19 8LG** Flood Consequences Assessment and Drainage Statement Final Report v1.0
Client	Kingscrown Land & Commercial Ltd
Date of issue	25 May 2023

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1 INTRODUCTION

1.1 Purpose of Report

Weetwood Services Ltd ('Weetwood') has been instructed by Kingscrown Land & Commercial Ltd to prepare a Flood Consequences Assessment and Drainage Statement (FCADS) report to accompany a planning application for the proposed development of land off Maes Meurig, Meliden ("the site") for residential use.

The assessment has been undertaken in accordance with the requirements of Technical Advice Note 15 (TAN15) dated July 2004.

1.2 Structure of the Report

The report is structured as follows:

Section 1 Introduction and report structure
Section 2 Provides background information relating to the development site
Section 3 Presents national and local flood risk and drainage planning policy
Section 4 Assesses the potential risk of flooding to the development site
Section 5 Presents an illustrative surface water drainage scheme
Section 6 Presents an illustrative foul water drainage scheme
Section 7 Presents a summary of key findings and the recommendations

1.3 Relevant Documents

The assessment has been informed by the following documents:

- Strategic Flood Consequences Assessment, Denbighshire County Council, January 2018
- Preliminary Flood Risk Assessment, Denbighshire County Council, June 2011
- Denbighshire County Council Local Development Plan 2006 - 2021, June 2013

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 Site Location

The approximately 0.87 ha site is located north-west of Maes Meurig, Meliden, at Ordnance Survey (OS) National Grid Reference SJ 057 810, as shown in **Figure 1**.

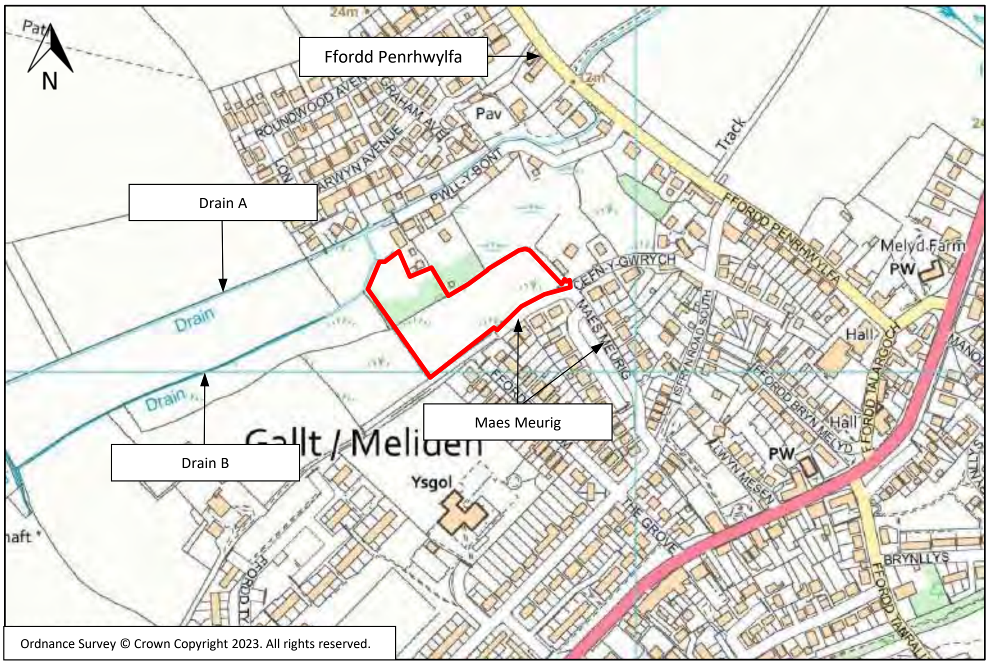


Figure 1: Site Location and Location of Surface Waterbodies

2.2 Existing and Proposed Development

The site is currently undeveloped.

The proposals are for the development of 35 residential dwellings with associated infrastructure and amenity space, with vehicular access provided off Maes Meurig. The proposed site plan is provided in **Appendix A**.

TAN15 classifies residential development as Highly Vulnerable to flood risk.

2.3 Surface Waterbodies in the Vicinity of the Site

The locations of waterbodies in the vicinity of the site are illustrated in **Figure 1**. Drain A is located approximately 25 m north of the site and flows in a north-easterly direction. Drain B flows along the north-western boundary of the site before outfalling into Drain A.

Both Drain A and Drain B are classified as ordinary watercourses.

2.4 Topographic Levels

A topographic survey of the site has been undertaken by Survey Solutions (**Appendix B**) and LiDAR data has been used to develop a digital terrain model of the site and surrounding area as illustrated in **Figure 2**.

Ground levels are shown to fall from 21.43 m AOD in the south-western corner of the site to 11.61 m AOD in the north-western corner, adjacent to Drain B. Ground levels in the residential development area, across the southern portion of the site, are a minimum of 12.38 m AOD.

Ground levels on Maes Meurig adjacent to the site entrance generally range from 17.51 to 20.61 m AOD.

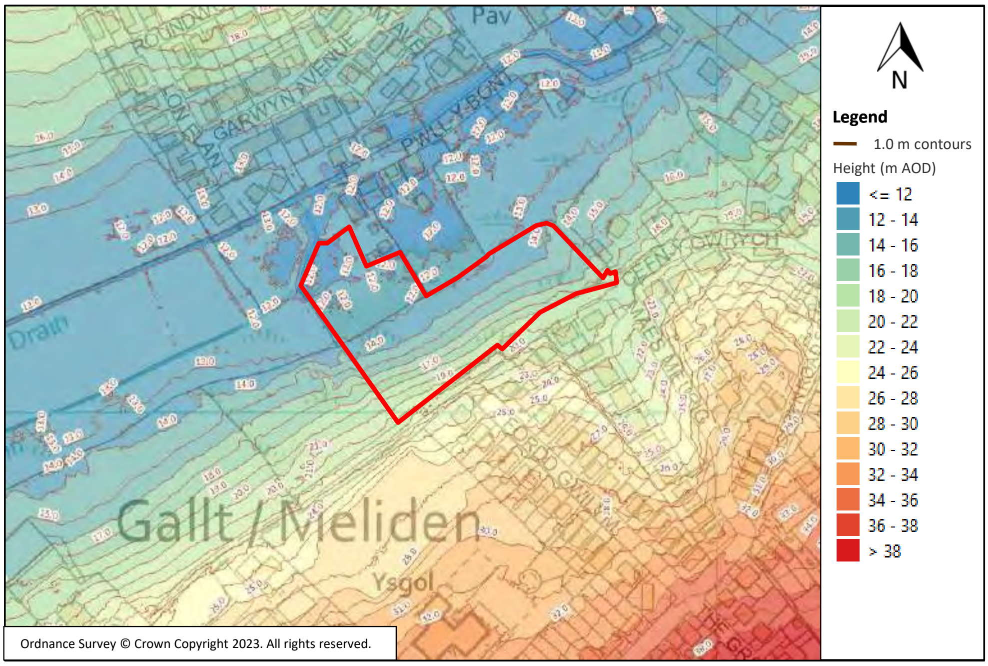


Figure 2: Digital Terrain Model from LiDAR Data

2.5 Ground Conditions

According to the Soilscapes soils dataset produced by the Cranfield Soil and AgriFood Institute[1], soil conditions at the site and within the surrounding area are described as slowly permeable seasonally wet loamy and clayey soils.

British Geological Survey mapping of surface geology[2] indicates the underlying bedrock formation comprises siltstone and sandstone with subordinate mudstone (Warwickshire Group), overlain by Till.

According to the British Geological Survey and Natural Resources Wales aquifer designation dataset[3] the superficial deposits and underlying bedrock at the site are classified as a Secondary A.

The site is not shown to be located within a designated groundwater source protection zone[4].

1 www.landis.org.uk/soilscapes/
2 https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
3 https://www.bgs.ac.uk/map-viewers/geoindex-onshore/
4 https://lle.gov.wales/catalogue/item/SourceProtectionZonesSPZMerged/?lang=en

3 PLANNING POLICY AND GUIDANCE

3.1 National Planning Policy and Policy Guidance

Future Wales - the national Plan 2040 sets out the national development framework for Wales with a strategy for addressing key national priorities through the planning system, including sustaining and developing a vibrant economy, achieving decarbonisation and climate-resilience, developing strong ecosystems and improving the health and well-being of our communities.

Policy 8 - Flooding states that *"flood risk management that enables and supports sustainable strategic growth and regeneration in National and Regional Growth Areas will be supported. The Welsh Government will work with Flood Risk Management Authorities and developers to plan and invest in new and improved infrastructure, promoting nature-based solutions as a priority. Opportunities for multiple social, economic and environmental benefits must be maximised when investing in flood risk management infrastructure. It must be ensured that projects do not have adverse impacts on international and national statutory designated sites for nature conservation and the features for which they have been designated"*.

Planning Policy Wales (PPW) sets out government's planning policies for Wales and how these are expected to be applied. TAN15 provides technical guidance which supplements the policy within PPW and seeks to ensure that flood risk is taken into account at all stages in the planning process and is appropriately addressed.

The general approach of TAN15 is to set out a precautionary framework to guide planning decisions in areas at high risk of flooding. The overarching aim of the framework is, in order of preference, to:

- Direct new development away from those areas which are at a high risk of flooding.
- Where development has to be considered in high risk areas (i.e. zone C) only those developments which can be justified should be located in such areas.

In accordance with paragraph 6 of TAN15, development will only be justified if it can be demonstrated that:

i. Its location in zone C is necessary to assist, or be part of, a local authority regeneration initiative or a local authority strategy required to sustain an existing settlement; **or**,
ii. Its location in zone C is necessary to contribute to key employment objectives supported by the local authority, and other key partners, to sustain an existing settlement or region;

and,

iii. It concurs with the aims of PPW and meets the definition of previously developed land (PPW Figure 2.1); and,
iv. The potential consequences of a flooding event for the particular type of development have been considered, and in terms of the criteria contained in sections 5 and 7 and appendix 1 found to be acceptable.

National policy requires that planning applications for new development proposals should incorporate sustainable drainage systems (SuDS) to appropriate operational standards and with maintenance arrangements in place unless there is clear evidence that this would be inappropriate.

Statutory standards for sustainable drainage were published by Welsh Government in October 2018[5] in relation to the design, construction, operation and maintenance of sustainable drainage systems serving new developments of more than one house or where the construction area is equal to or greater than 100 square metres (m^2). These standards set out how surface water runoff generated during the present day 1 in 1, 1 in 30 and 1 in 100 annual exceedance probability (AEP) rainfall events and for events exceeding the present day 1 in 100 AEP event should be managed, how peak runoff rates should be restricted and how runoff volumes should be controlled. Approval is subsequently required from the SuDS Approval Body (SAB) before construction can commence.

[5] Statutory Standards for Sustainable Drainage Systems – designing, constructing, operating and maintaining surface water drainage systems (https://gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf)

3.2 Local Planning Policy

The Denbighshire County Council Local Development Plan 2006 – 2021 was adopted by Denbighshire County Council in June 2013. The following policies are relevant in respect of flood risk and drainage:

Policy RD1; Sustainable Development and Good Standard Design

Development proposals will be supported within development boundaries provided that all the following criteria are met:

- Does not unacceptably affect the amenity of local residents, other land and property users or characteristics of the locality by virtue of increased activity, distribution, noise, dust, fumes, litter, drainage, light pollution etc., and provides satisfactory amenity standards itself; and
- Satisfies physical or natural environmental considerations relating to land stability, drainage and liability to flooding, water supply and water abstraction from natural watercourses.

Policy VOE 6; Water Management

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.

3.3 Water Framework Directive

The Water Framework Directive (WFD) provides a legal framework for the protection, improvement and sustainable use of inland surface waters, groundwater, transitional waters, and coastal waters across England, and seeks to:

- Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters
- Achieve at least 'good' status for all waterbodies by 2015
- Promote the sustainable use of water as a natural resource
- Conserve habitats and species that depend directly on water
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment
- Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants; and
- Contribute to mitigating the effects of floods and droughts.

The WFD applies to any proposed development which has the potential to impact on a waterbody. Where this is the case, the Natural Resources Wales may require evidence demonstrating that the proposed development does not compromise the aims of the WFD.

3.4 Environmental Permitting and Land Drainage Consent

Under the Environmental Permitting (England and Wales) Regulations 2016 an Environmental Permit for Flood Risk Activities[6] is required from the Natural Resources Wales for any permanent or temporary works, including works:

- In, over or under a designated main river
- Within 8 m of the top of bank of a designated main river or of the landward toe of a flood defence (16 m if it is a tidal main river or a sea defence).

In addition, any permanent or temporary works within the floodplain of a designated main river may also require an Environmental Permit for Flood Risk Activities. A permit is separate to and in addition to any planning permission granted.

If the location of an activity is on an ordinary watercourse that lies within an Internal Drainage District, land drainage consent may be required from Natural Resources Wales.

Undertaking activities controlled by local byelaws also requires the relevant consent.

6 https://naturalresources.wales/permits-and-permissions/environmental-permits/?lang=en

4 REVIEW OF FLOOD RISK

4.1 Historical Records of Flooding

The Flood Map for Planning - Recorded Flood Extents and associated database[7], and Appendix A of the 2018 Strategic Flood Consequences Assessment ("SFCA Settlement Maps") indicate that there are no records of flooding at or within the immediate vicinity of the site.

4.2 Flood Risk from Rivers (Fluvial)

Figure 1 of TAN15 defines three development advice zones as follows:

- Zone A: Considered to be at little or no risk of fluvial or tidal/coastal flooding
- Zone B: Areas known to have been flooded in the past evidenced by sedimentary deposits
- Zone C: Based on the Natural Resources Wales flood outline, equal to or greater than 0.1% (river, tidal or coastal). Zone C is subdivided into the following two zones:
    - Zone C1: Areas of the floodplain which are developed and served by significant infrastructure, including flood defences
    - Zone C2: Areas of the floodplain without significant flood defence infrastructure

The development advice zones are shown on the Development Advice Map[8] and are defined by the predicted extent of the 1 in 1,000 (sea and rivers) AEP event (zone C) and British Geological Survey drift data (zone B). The zones do not take account of the possible impacts of climate change and consequent changes in the future probability of flooding.

The Development Advice Map (**Figure 3**) indicates that the residential development area is primarily located in zone A, with zone B located along its northern edge. The northern portion of the site is located in zone B and zone C2. This is reiterated on Appendix A of the 2018 Strategic Flood Consequences Assessment ("SFCA Settlement Maps").

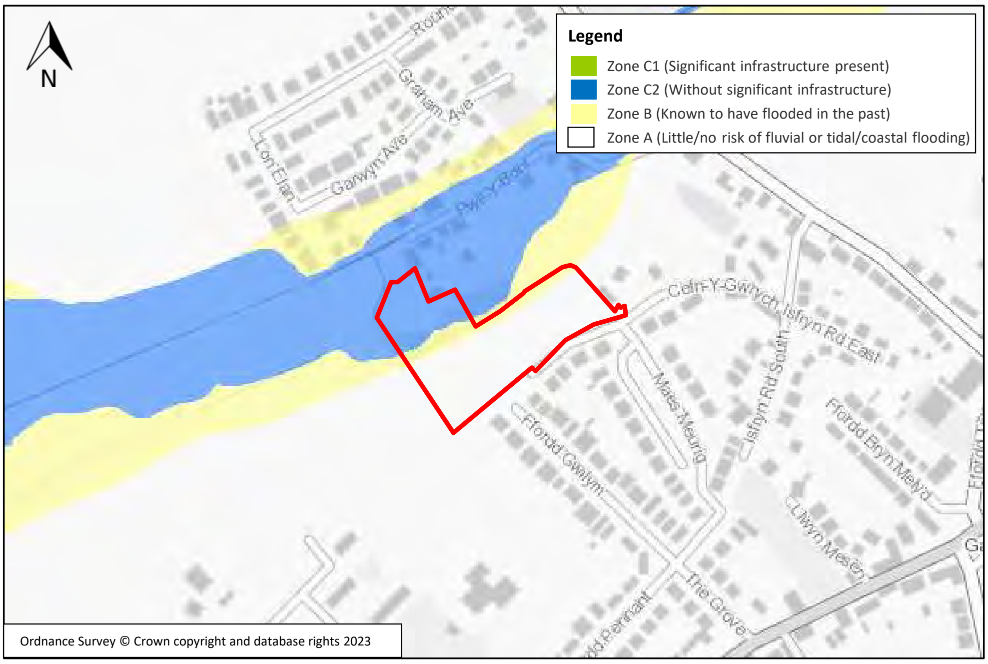


Figure 3: Development Advice Map
Source: Natural Resources Wales website; Accessed: May 2023

[7] http://lle.gov.wales/catalogue/item/HistoricFl/?lang=en
[8] https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

The Flood Map for Planning – Rivers and Seas (**Figure 4**) confirms that the residential development area in the south of the site is located entirely in flood zone 1, with the northern portion of the site located in flood zone 2 and 3.

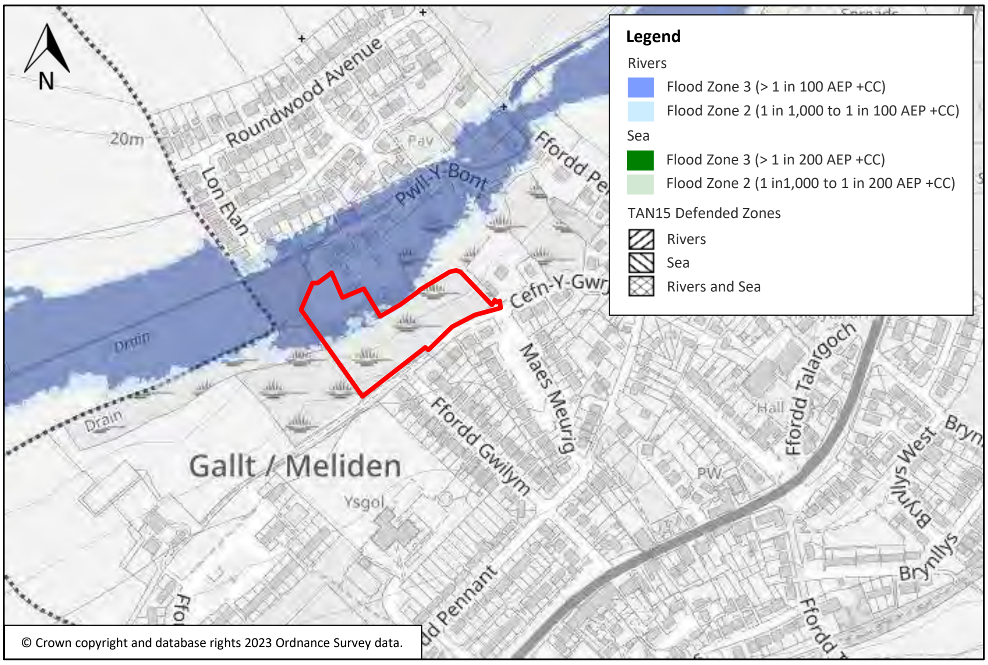


Figure 4: Flood Map for Planning – Rivers and Seas
Source: Natural Resources Wales website; Accessed: May 2023

A 1D-2D Flood Modeller-TUFLOW hydraulic model of Drain A was developed by Wallingford HydroSolutions Limited as part of Rhyl Cut & Prestatyn Gutter Hydraulic Modelling Study (April 2019, updated January 2021). This assesses the risk of flooding from Drain A for the present day 1 in 30, 1 in 100 and 1 in 1,000 annual exceedance probability (AEP) events and the 1 in 100 and 1 in 1,000 AEP events +30% climate change.

The modelled flood extents are shown in **Figure 5** and indicate that the residential development area is located outside the flood extent in up to the 1 in 1,000 AEP event +30% climate change.

As detailed in **Section 2.3**, Drain B flows along the north-western boundary of the site. No modelled channel was included in Rhyl Cut & Prestatyn Gutter Hydraulic Modelling Study for Drain B. However, the Drain B catchment has been included in the flows for Drain A. Therefore, the flood risk from Drain B is considered within the Rhyl Cut & Prestatyn Gutter Hydraulic Modelling Study and is likely driven by the water level in Drain A.

It is concluded that the residential development area is at a very low risk of flooding from rivers (fluvial).

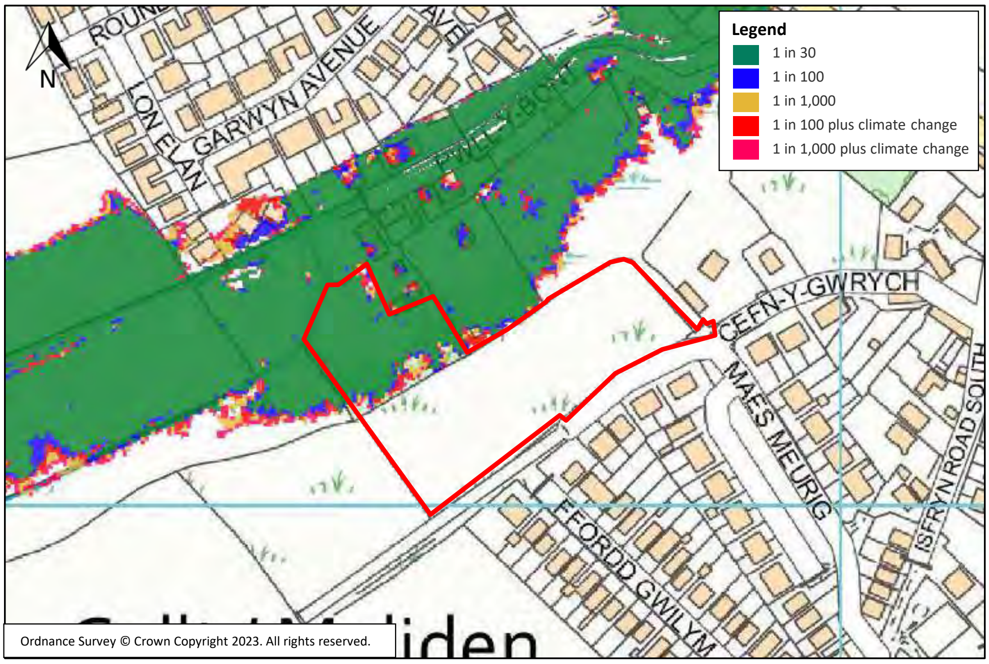


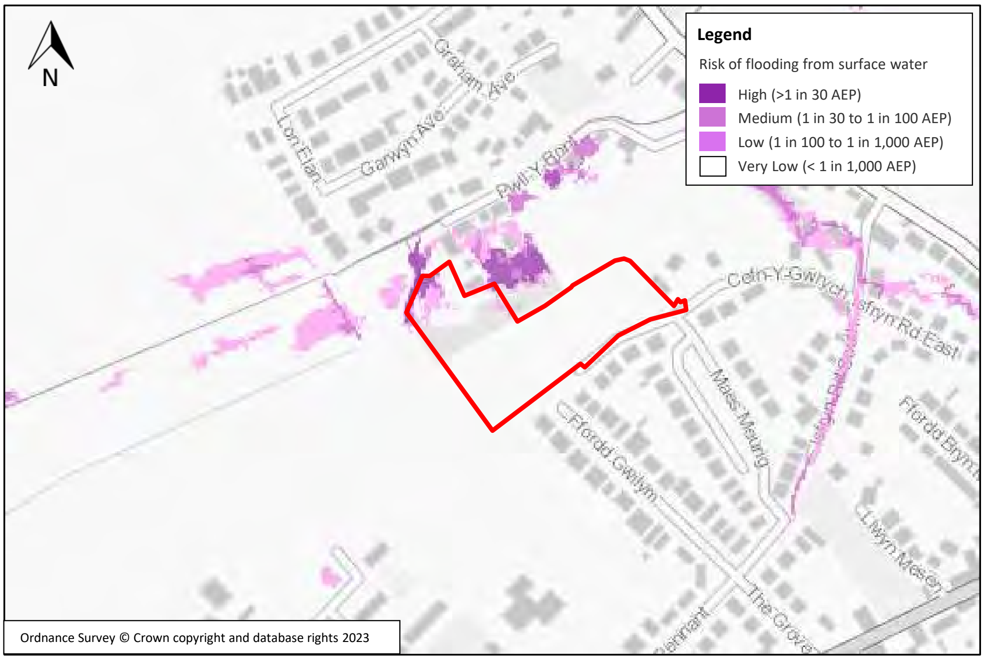
Figure 5: Drain A Modelled Flood Extents
Source: Rhyl Cut & Prestatyn Gutter Hydraulic Modelling Study, Wallingford HydroSolutions Limited, April 2019

4.3 Flood Risk from Surface Water (Pluvial)

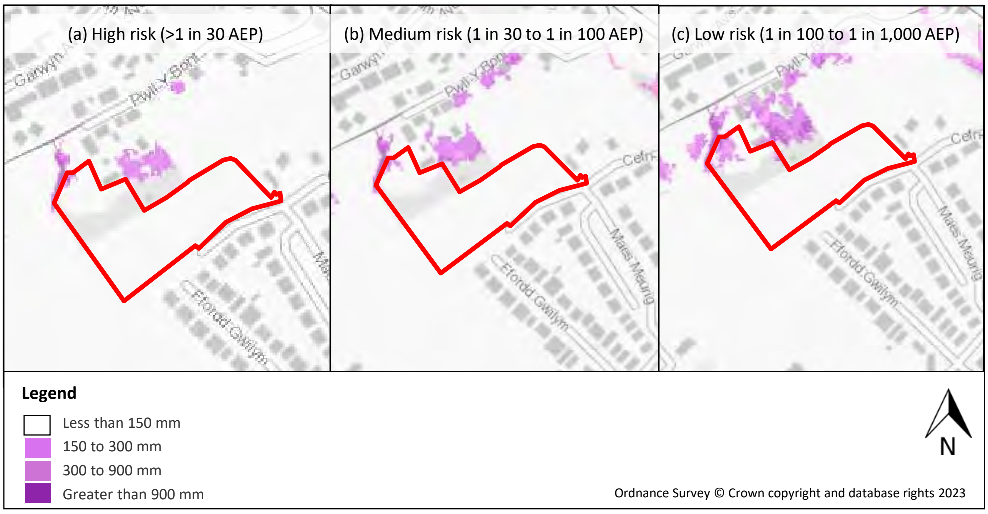
The Flood Map for Planning - Surface Water and Small Watercourses (**Figure 6**) indicates that the northern portion of the site is located at a very low to high risk of flooding from surface water, with the residential development area located at a very low risk of flooding.

The Flood Risk Assessment Wales Map - Flood Risk from Surface Water and Small Watercourses (**Figure 7**) accounts for climate change and continues to show that the residential development area is located at a very low risk of flooding from surface water.

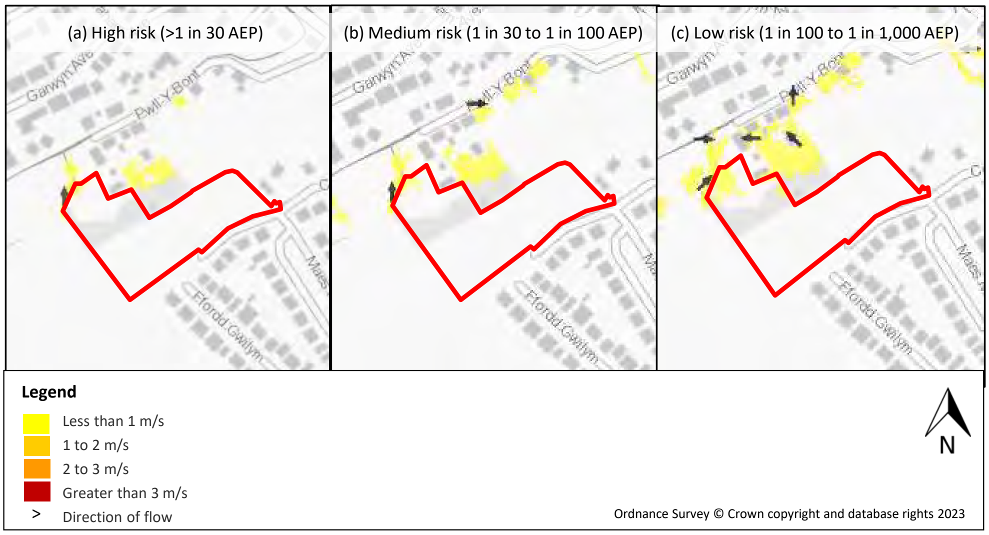
It is concluded that the residential development area is at very low risk of flooding from surface water.



(a) Extent



(b) Depth



(c) Velocity

Figure 6: Flood Risk Assessment Wales Map - Flood Risk from Surface Water and Small Watercourses

Source: Natural Resources Wales website; Accessed: May 2023

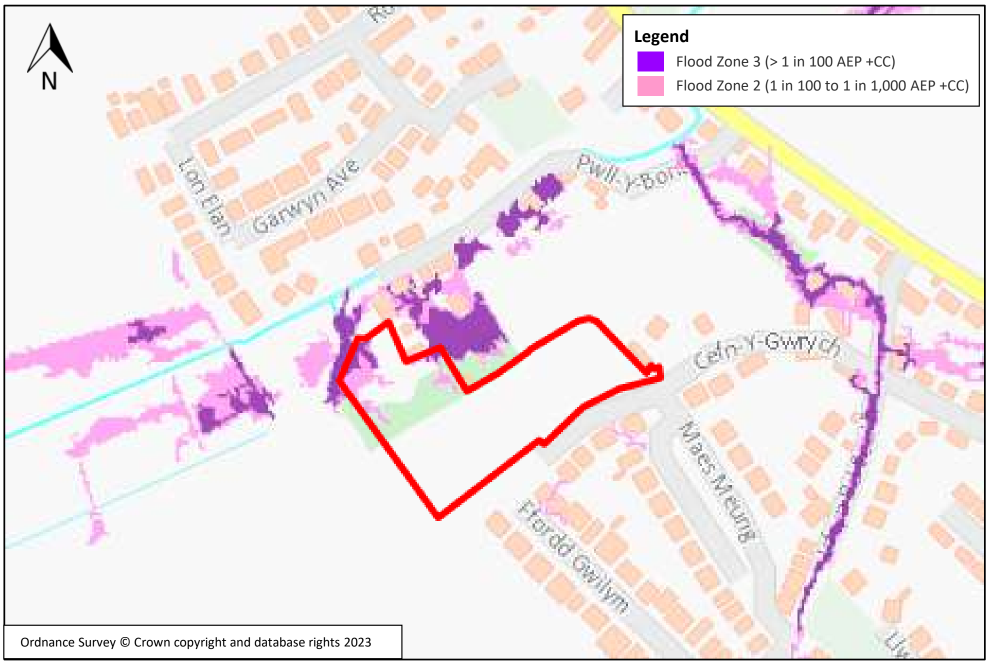


Figure 7: Flood Map for Planning - Surface Water and Small Watercourses
Source: Natural Resources Wales website; Accessed: May 2023

4.4 Flood Risk from Reservoirs, Canals and Other Water Impounding Structures

There are no canals or other impounded waterbodies located within the immediate vicinity of the site. The Flood Map for Planning - Flood Risk from Reservoirs (not shown) indicates that the site is not at risk of flooding from such sources.

It is concluded that the site is not at risk of flooding from reservoirs, canals or other water impounding structures.

4.5 Flood Risk from Groundwater

The JBA Groundwater Flood Risk Indicator map (**Figure 8**) indicates that the site is at a Negligible risk during a 1 in 100 AEP groundwater flood event.

Given the site topography, in the unlikely event that groundwater emergence occurs, flood water is expected to flow in a southerly direction towards Drain A and B and is not expected to pond on site.

It is concluded that the site is at a very low risk of flooding from groundwater.

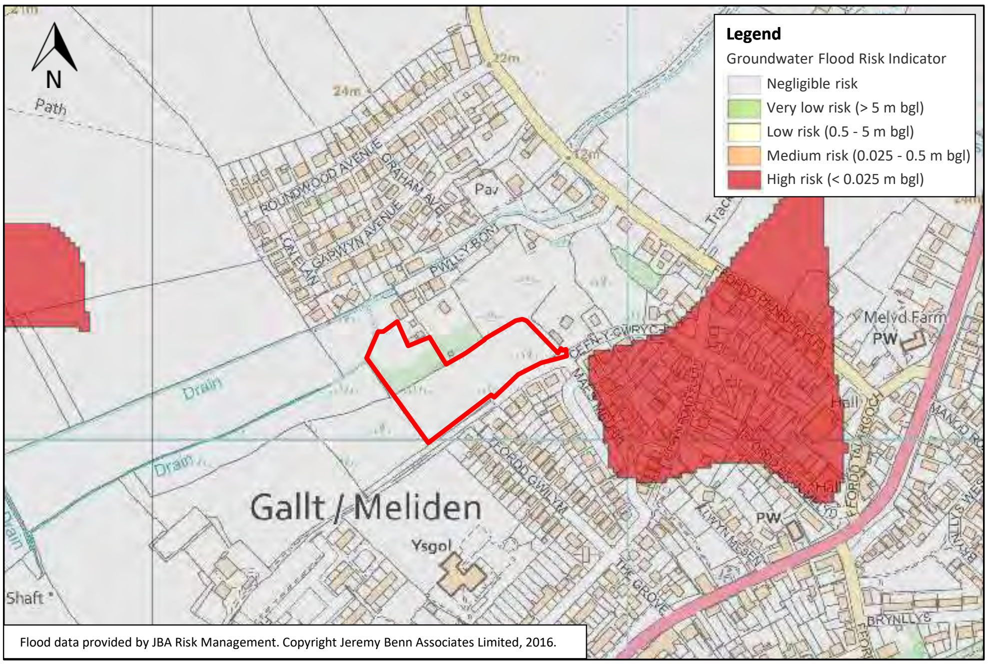


Figure 8: JBA Groundwater Flood Risk Indicator Map
Source: Blue Sky Maps; Accessed: May 2023

4.6 Flood Risk Mitigation

Finished ground and first floor levels should be set a minimum of 0.15 m above adjacent external ground levels following reprofiling of the site, with ground levels sloping down from the dwellings.

This measure will, subject to the implementation of an appropriately designed surface water drainage scheme (**Section 5**), enable any potential overland flows to be conveyed safely across the site without affecting property.

It is noted that the finished ground floor levels of the residential dwellings to the south of the internal site access are significantly below proposed ground levels within the rear gardens of these properties. As such, the external walls below ground level should be tanked and cavity drainage systems installed as appropriate.

4.7 Flood Risk Elsewhere

In accordance with A1.2 of TAN15 developers must ensure there will be no loss of flood flow or flood storage capacity for floods up to the severity of the 1 in 1,000 AEP event. Whilst not specified by TAN15, Natural Resources Wales generally recommends that this should be the case over the lifetime of development (i.e. should take into account climate change) and should consider breach and blockage where necessary.

The site is not at risk of flooding in up to a 1 in 1,000 AEP fluvial event including an allowance for climate change (+30%). As such, the proposals would not be expected to impact flood risk elsewhere and compensatory flood storage is not required.

4.7.1 Additional Rainfall-Runoff Modelling

Denbighshire County Council raised concerns in its pre-planning enquiry response dated 12 October 2022 (ref: 43/2022/0627) relating to a recent planning appeal at an adjacent site. The planning appeal was dismissed because the proposed development had not been shown to prevent increases in flood risk elsewhere as a result of changes in ground levels and land cover affecting surface water runoff / infiltration.

Based upon the above, Weetwood has developed a 2D TUFLOW direct rainfall-runoff model to assess the impact of the proposed development on surface water runoff / infiltration regimes.

The 2D domain topography is based upon filtered LiDAR data, and OS mapping and aerial photography have been used to define the different land uses within the model domain.

Rainfall hyetographs have been derived using the ReFH2 hydrological model for the southern catchment upstream of the site and the site itself. The southern catchment extent is shown in **Figure 9** and the ReFH2 hyetographs are provided in **Appendix C**.

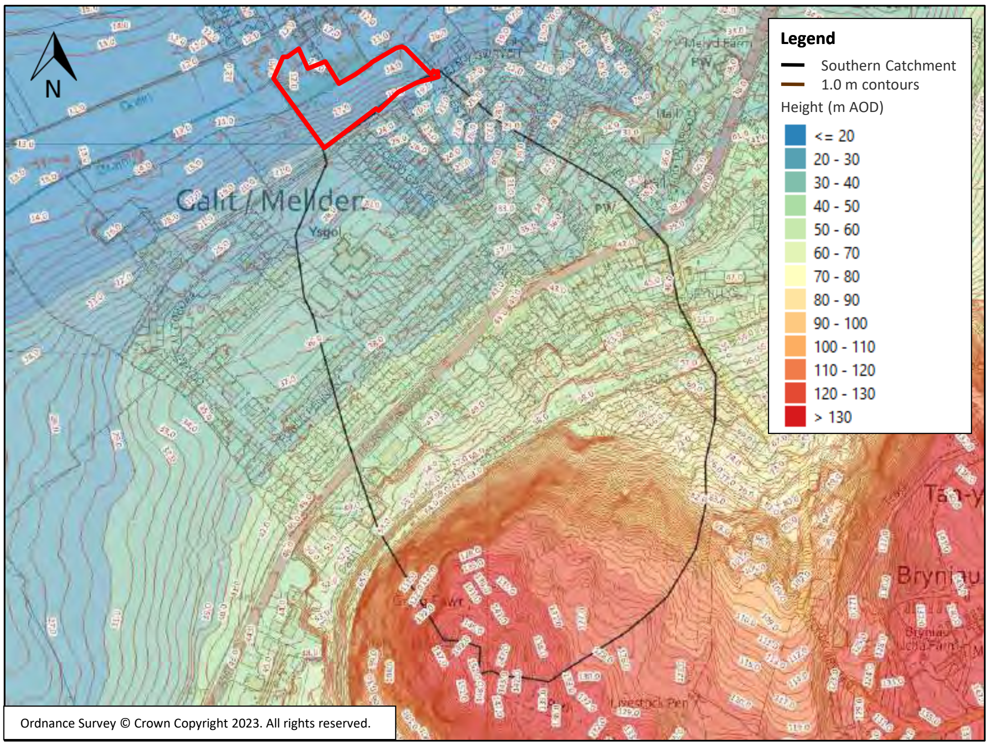


Figure 9: Catchment Delineation

The net rainfall output from ReFH2 has been applied to the southern catchment to take account of the losses associated with soil storage and the urban drainage network.

The total rainfall output from ReFH2 has been applied to the site, and the losses associated with soil storage have been accounted for by applying an average infiltration rate that has been calculated based on the difference between the total and net rainfall (excluding the impact of the urban drainage network).

The average infiltration rate calculated for each storm event are outlined within **Table 1**.

Table 1: Site Infiltration Rate

AEP Event	ReFH2 Loss (mm/hr)
Present day 1 in 20	3.53
Present day 1 in 100	5.02
Present day 1 in 1,000	7.20
1 in 100 +40% climate change	6.64

The rainfall-runoff model has been used to assess the 6-hour duration rainfall event for the present day 1 in 20, 1 in 100 and 1 in 1,000 AEP events and the 1 in 100 AEP event +40% climate change.

The modelled outputs for the aforementioned events are provided in **Appendix D**. These indicate that there is no defined flow route through the existing site and that floodwater is not shown to accumulate on site to significant depths.

The rainfall-runoff model has subsequently been updated to demonstrate that the proposed development does not have a negative impact on flood risk downstream of the site.

The proposed scenario model includes the proposed residential dwellings, proposed site levels and the proposed changes in land use. In addition, rainfall has not been applied to the proposed impermeable areas because runoff from these areas will be managed by the proposed surface water drainage system, and similarly, infiltration is no longer permitted through the proposed impermeable areas.

The model has been rerun for the present day 1 in 20, 1 in 100 and 1 in 1,000 AEP event and the 1 in 100 AEP event +40% climate change.

The modelled outputs are provided in **Appendix E**. These indicate that flood depth are shown to be less than 150 mm adjacent to the proposed dwellings to ensure they remain flood free.

4.7.2 Comparison of Flows Leaving the Site

Flows passing through the northern edge of the proposed residential development area have been assessed for the existing and proposed scenarios. The discharge hydrograph from the proposed surface water drainage system have been accounted for separately based on the proposed surface water discharge rate of 2 l/s (refer **Section 5.2.3**).

A comparison of the proposed surface water flows are provided in **Table 2**. These indicate that the proposed development reduces the rate at which surface water leaves the site. This is because the proposed surface water discharge rate from the proposed impermeable areas is less than greenfield runoff rates.

Table 2: Surface Water Flow Comparison

AEP Event	Existing (l/s)	Proposed (l/s)		Difference in Flow (l/s)
		Runoff	Site Drainage	
Present day 1 in 20	75	67	2	-8
Present day 1 in 100	153	130		-23
Present day 1 in 1,000	284	247		-37
1 in 100 +20% climate change	200	172		-28
1 in 100 +40% climate change	247	214		-33

4.8 Justification Test

The Development Advice Map indicates that the proposed residential development area is primarily located in zone A, with zone B located along its northern edge. The Flood Map for Planning – Rivers and Seas located the development platform entirely in flood zone 1. Therefore, it is concluded that the Justification Test need not be applied in this instance.

5 SURFACE WATER MANAGEMENT

5.1 Surface Water Drainage at the Existing Site

No formal surface water drainage system is present at the site and given the sites topography, surface water runoff would be expected to flow overland in a northerly direction towards Drain B.

The site has a total area of 1.19 ha; however, for the purposes of this assessment the proposed developable area is taken as approximately 0.48 ha. This excludes areas of open space, which are expected to continue to drain as existing.

The greenfield surface water runoff rates for the site, calculated using the HR Wallingford Greenfield runoff tool, are presented in **Table 3**. Details of the input parameters and the output results are provided in **Appendix F**.

Table 3: Greenfield Runoff Rate

AEP of Rainfall Event	Greenfield Runoff Rate (l/s/ha)	Greenfield Runoff Rate for 0.48 ha Site (l/s)
1 in 1	1.6	0.8
QBAR	1.8	0.9
1 in 30	3.3	1.6
1 in 100	4.1	2.0

5.2 Surface Water Drainage at the Developed Site

5.2.1 Disposal of Surface Water (Standard S1)

In accordance with Welsh Government guidance[9], surface water runoff should be disposed of according to the following hierarchy: Rainwater collected for use; Into the ground (infiltration); To a surface water body; To a surface water sewer or highway drain; To a combined sewer.

As part of the drainage strategy on site, a rainwater harvesting system could be considered to collect non-potable water for reuse where possible. This could include the installation of water butts at individual dwellings, which would reduce demand on potable water supplies. However, the incorporation of rainwater harvesting systems within the dwelling will require pumped systems. In accordance with the principles of the Statutory Standards for SuDS, the use of pumping should be avoided where possible. Therefore, Priority Level 1 has been discounted as the primary method for disposal of surface water.

As detailed in **Section 2.4**, the site is underlain by soils with impeded drainage. As such, the disposal of surface water via infiltration is unlikely to be feasible; however, infiltration tests have not been undertaken at this stage. Such tests may be undertaken at the detailed design stage in accordance with the guidelines in BRE365[10].

In the event that infiltration is not a practicable method for the disposal of surface water (Priority Level 2), it is subsequently proposed to direct all runoff from the developed site to Drain B in accordance with Priority Level 3. It should be noted that in order to utilise Drain B, a surface water pumping station may be required.

5.2.2 Post Development Impermeable Area

The area of impermeable surfaces within the proposed development has been calculated to be 0.48 ha, based on **Appendix A**.

[9] Footnote 5
[10] BRE Digest 365 Soakaway Design, Building Research Establishment, 2016

5.2.3 Peak Flow Control (Standard S2)

The runoff rates outlined in **Table 3** are considered to be unachievable because a flow control with a diameter of less than 75 mm may pose a risk of blockage to the drainage system. As such, a discharge rate of 2.2 l/s has been utilised, assuming a gravity connection is utilised.

5.2.4 Volume Control (Standard S2)

Where reasonably practicable, for greenfield sites, the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1 in 100 AEP, 6 hour rainfall event should not exceed the greenfield runoff volume for the same event.

As outlined within the CIRIA SuDS Manual 2015 extra runoff volumes in extreme events may be managed by releasing all runoff (above the 1 in 1 AEP event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value.

Reducing the proposed surface water discharge rate to less than 2.2 l/s is not considered to be achievable, recognising that proposed discharge rate is dictated by a minimum flow control diameter of 75 mm, assuming a gravity connection is utilised.

5.2.5 Attenuation Storage

It is proposed to attenuate surface water runoff generated by the proposed roofs and hardstanding within an attenuation basin.

The proposed surface water drainage system has been modelled using Causeway Flow (**Appendix H**) and has been sized to store the 1 in 100 AEP rainfall event including a 40% increase in rainfall intensity to allow for climate change in accordance with Welsh Government guidance[11].

Assuming a peak discharge rate of 2.2 l/s, a total storage volume of 623 m^3 would be required. The storage volume could be accommodated within an attenuation basin with an area of 874 m^2.

A preliminary surface water drainage layout is provided in **Appendix I**.

5.2.6 Urban Creep

A uniform allowance of 10% additional impermeable area has been made to account for urban creep.

5.2.7 Exceedance Routes

Flows resulting from rainfall in excess of the 1 in 100 AEP rainfall event including an allowance for climate change will be managed in exceedance routes. It is assumed that as the development proposals progress, the design of the site would ensure flood flows are directed towards carriageways, with the site being profiled to ensure that flood flows are directed away from built development.

5.2.8 Water Quality and Pollution Control (Standard S3)

The CIRIA SuDS Manual[12] and Table G3.1 of the Statutory Standards for SuDS identifies individual property driveways, roofs and low traffic roads as having a low pollution hazard level. Table 26.2 of the CIRIA SuDS Manual 2015 indicates that the pollution hazard indices associated with such uses for total suspended solids, hydrocarbons and metals are 0.50, 0.40 and 0.40 respectively.

Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for attenuation basins and permeable paving for total suspended solids, hydrocarbons and metals are 0.50, 0.50 and 0.60 and 0.7, 0.6 and 0.7 respectively. As such, the proposed drainage system includes adequate water quality treatment.

[11] Flood Consequences Assessments: Climate Change Allowances - https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf

[12] Table 26.2

In addition, catchpit manholes and silt traps in gullies/channels drains, will help prevent contaminants discharging into the downstream receptor.

5.2.9 Amenity and Biodiversity (Standard S4 and Standard S5)

The proposed layout includes landscaped areas/trees which will provide aesthetic benefits and interception of rainfall, thus helping with volume control (via evapotranspiration).

Vegetated detection basins can include a variety of diverse planting that will help make a positive contribution to urban biodiversity – providing habitat and food for insects and birds. Some plans and animals specifically require ephemeral water bodies as part of their life cycle, and suitable wildflower mixes can provide important nectar sources for insects.

It is generally recommended that native vegetation is used to maximise the biodiversity value of these areas. However, it may be valuable to include some non-native vegetation to support pollinators, such as butterflies and bees.

The implementation of soft landscaping will also help provide users of the site with health and wellbeing benefits.

5.2.10 Adoption and Maintenance of SuDS (Standard S6)

SuDS elements which serve one property will be the responsibility of the owner of the property.

SuDS elements which serve more than one property will be adopted and maintained by the SAB, in accordance with the Statutory Standards for SuDS.

If a surface water Pumping Station is required it will need to be maintained in accordance with manufacturers recommendations and given that it serves multiples properties will presumably be adopted and maintained by the SAB.

An indicative maintenance schedule is presented in **Table 4**.

Table 4: Maintenance Requirements

Schedule	Required action	Frequency
Attenuation Basin		
Regular maintenance	Remove litter and debris	Monthly
	Cut grass	Monthly during grow season Or as required)
	Manage other vegetation and remove nuisance plants	Monthly at start, then as required
	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies	Monthly for first year, then annually or as required
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets/outlets	Annually (or as required)
Occasional maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every two years, or as required
	Remove sediments from inlets/outlets and main basin when required	
Remedial actions	Repair erosion or other damage by reseeding or re-turfing	As required
	Realignment of rip-rap	
	Repair/rehabilitation of inlets/outlets	
	Relevel uneven surface and reinstate design levels	
Permeable Paving		

Schedule	Required action	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.
Occasional maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosphate 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 of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for three months after installation
	Inspect for evidence of poor operation and/or weed growth- if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies accumulation rates and establish appropriate removal frequencies	Annually
	Monitor inspection chambers	

6 FOUL WATER MANAGEMENT

6.1 Existing Assets

An extract of the public sewer records obtained from Dŵr Cymru Welsh Water (DCWW) is provided in **Appendix J** and a drainage survey undertaken by Invek Surveys is provided in **Appendix G**. This indicates that the following wastewater assets are present within the site boundary:

- 225 mm diameter public combined sewer flowing east
- 225 mm / 375 mm diameter public combined sewer flowing north

6.2 New Connections

The anticipated domestic foul loading from the site has been calculated in accordance with Design and Construction Guidance[13]. The expected total peak flow rate from the development is 1.6 l/s.

DCWW has advised, by way of a pre-planning sewerage enquiry response (**Appendix K**), that there is capacity in the local foul sewerage network to receive and treat domestic foul water from the proposed development, and that foul water can discharge without restriction into the 225 mm/ 300 mm diameter combined sewer located at the site.

A preliminary foul water drainage layout is provided in **Appendix I**.

6.3 Easements, Diversions and Disconnections

To ensure that DCWW has adequate access to the existing combined sewers for future repairs and maintenance, DCWW will require a 3 m easement to be provided either side of the centreline of the sewers. It should be noted that it is anticipated that diversion works will be required to facilitate the development as shown on the preliminary foul water drainage layout provided in **Appendix I**.

[13] Sewerage Sector Guidance Appendix C, Water UK, Approved Version 2.0, March 2020

7 SUMMARY AND RECOMMENDATIONS

This report has been prepared on behalf of Kingscrown Land & Commercial Ltd and relates to the proposed development of the land rear of Maes Meurig, Meliden for residential use.

The Development Advice Map indicates the residential development area is primarily located in zone A, with zone B located along its northern edge. The northern portion of the site is located in zone B and zone C2.

The risk of flooding to the proposed development from all identified sources is assessed to be low.

The proposed development platform is located in zone A and therefore the justification test need not apply.

Based on the assessment of flood risk, finished floor levels should be at least 0.15 m above adjacent ground levels following any reprofiling of the site, with ground levels sloping down from the dwellings, in accordance with best practice.

Any impact on flood risk elsewhere is expected to be minimal.

A 2D TUFLOW direct rainfall-runoff model to assess the impact of the proposed development on surface water runoff / infiltration regimes. A comparison of the proposed surface water flows indicate that the proposed development reduces the rate at which surface water leaves the site

Surface water runoff from the redeveloped site can be sustainably managed in accordance with planning policy. Surface water drainage is proposed to connect to Meliden Mine Drain at a rate of 2.2 l/s in order to utilise a 75mm orifice. The detailed drainage design should be submitted to and approved by the SAB prior to the commencement of development

Foul water is proposed to connect to the existing combined sewer within the site boundary.

In conclusion, this report demonstrates that the proposed development may be completed in accordance with the requirements of planning policy.

APPENDIX A

Proposed Site Plan

WIP

REV	DESCRIPTION	DATE	BY
F	PLOTS 5-12 REVISED	28/04/23	OR
E	PLOTS 1-2 AMENDED	25/04/23	OR
D	WILDLIFE CORRIDOR ADDED + SITE LAYOUT AMENDED	24/04/23	OR
C	AMENDMENTS DUE TO CCTV SURVEY + AMENITY SPACE CALCULATED	20/04/23	OR
B	ROAD AMENDED TO SUIT FOCUS COMMENTS + PLOTS 3-11 MOVED FORWARD A METRE TO AVOID TREES RPA	11/04/23	OR
A	ROAD RE-MODELLED TO SUIT SITE CONTOURS + PLOT LEVELS ADJUSTED	05/04/23	OR

PROJECT
LAND OFF MAES MEURIG, MELIDEN
for KINGSCROWN PROPERTIES

DRAWING TITLE
INDICATIVE SITE LAYOUT FROM MAES MEURIG OPT 3

SCALE	DATE	DRAWN	CHECKED
1 : 500 @A3	21/03/23	OR	SV

DRAWING STATUS: PRELIMINARY

JOB No	DRAWING No	REVISION
C1109	009	F

AG | AINSLEY GOMMON ARCHITECTS
THE OLD POLICE STATION, 15 GLYNNE WAY, HAWARDEN, CH5 3NS
Tel: 01244 537 100 | wales@agarchitects.co.uk | www.agarchitects.co.uk
Ainsley Gommon Architects Ltd. Registered in England & Wales No.4187948
Registered Office: 1 Price Street, Hamilton Square, Birkenhead CH41 6JN

PRINTED: 02/05/2023 08:46:55

A3

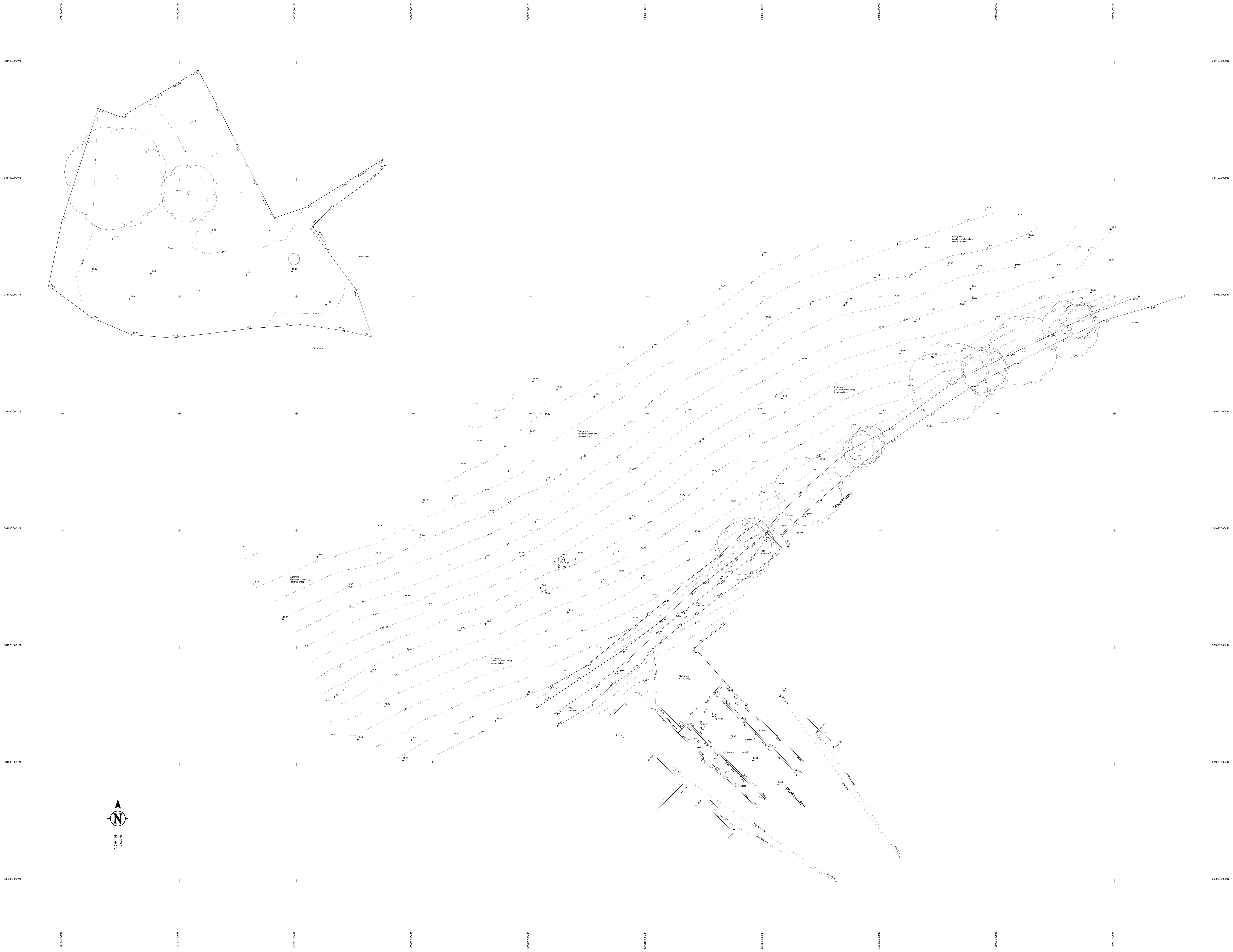
HOUSING KEY

		PLOT NO.
8 No.	4P2B HOUSE	26, 27, 28, 29, 30, 31, 32, 33, 34.
6 No.	4P2B SPLIT LEVEL HOUSE	7, 8, 9, 10, 11, 12.
2 No.	5P3B SIDE ENTRY HOUSE	25, 35.
4 No.	5P3B WIDE HOUSE SPLIT LEVEL	3, 4, 5, 6.
4 No.	5P3B SPLIT LEVEL HOUSE	13, 14, 15, 16.
10 No.	2P1B WALK UP APARTMENT	1, 2 , 17-24.

TOTAL:
35no. UNITS

APPENDIX B

Topographic Survey



TOPOGRAPHICAL & MEASURED BUILDING SURVEYS

ABBREVIATIONS & SYMBOLS

AH	Arch Head Height	ER	Earth Rod	RSD	Roller Shutter Door
A/B	Air Brick	ET	EP+Transformer	RSJ	Rolled Steel Joist
AR	Assumed Route	FB	Flower Bed	SI	Sign Post
AV	Air Valve	FBD	Floor Board Direction	SP	Arch Spring Point Height
BB	Belisha Beacon	FH	Fire Hydrant	SV	Stop Valve
BH	Bore Hole	FL	Floor Level	SW	Surface Water
BL	Bed Level	FP	Flag Pole	SY	Cable Stay
BO	Bollard	FW	Foul Water	Tac	Tactile Paving
BrP	Brace Post	GG	Gully Grate	TC	Telecom Cover
BS	Bus Stop	GV	Gas Valve	TH	Trial Pit
BU	Bush	HH	Head Height	THL	Threshold Level
B/W	Barbed Wire Fence	IC	Inspection Cover	TL	Traffic Light
BX	Box (Utilities)	IL	Invert Level	ToW	Top of Wall
C/B	Close Board Fence	I/R	Iron Railings	TP	Telegraph Pole
CH	Cill Height	KO	Kerb Outlet	TS	Traffic Signal Cover
CL	Cover Level	LP	Lamp Post	TV	Cable TV Cover
C/L	Chain Link Fence	MH	Manhole	UB	Universal Beam
C-Lev	Ceiling Level	MP	Marker Post	UC	Unknown Cover
Col	Column	NB	Name Board	UK	Unknown Tree
C/P	Chestnut Paling Fence	OHL	Overhead Line (approx)	UMG	Unmade Ground
CR	Cable Riser	Pan	Panel Fence	USB	Under Side Beam
C/W	Chicken Wire	PB	Post Box	UTL	Unable To Lift
DC	Drainage Channel	PM	Parking Meter	UTS	Unable To Survey
DH	Door Head Height	PO	Post	VP	Vent Pipe
Dil.	Dilapidated	P/R	Post & Rail Fence	WB	Waste Bin
DP	Down Pipe	P/W	Post & Wire Fence	WH	Weep Hole
DR	Drain	P/Wall	Partition Wall	WL	Water Level
EBx	Electric Box	RE	Rodding Eye	WM	Water Meter
EC	Electric Supply Cover	RL	Ridge Level	WO	Wash Out
EL	Eaves Level	RP	Reflector Post	X.XX	Floor to Ceiling Height
EP	Electric Pole	RS	Road Sign	X.XX F/C	Floor to False Ceiling Ht
					Survey Control Station

DRAWING NOTES

Topographical Surveys

Trees are drawn to scale showing the average canopy spread. Descriptions and heights should be used as a guide only.

All building names, descriptions, number of storeys, construction type including roof line details are indicative only and taken externally from ground level.

All below ground details including drainage, voids and services have been identified from above ground and therefore all details relating to these features including; sizes, depth, description etc will be approximate only. All critical dimensions and connections should be checked and verified prior to starting work.

Detail, services and features may not have been surveyed if obstructed or not reasonably visible at the time of the survey.

Surveyed physical features may not necessarily represent the legal boundary line.

Measured Building Surveys

Measurements to internal walls are taken to the wall finishes at approx 1m above the floor level and the wall assumed to be vertical.

Cill heights are measured as floor to the cill and head heights are measured from cill to the top of window.

General

The contractor must check and verify all site and building dimensions, levels, utilities and drainage details and connections prior to commencing work. Any errors or discrepancies must be notified to Survey Solutions immediately.

The accuracy of the digital data is the same as the plotting scale implies. All dimensions are in metres unless otherwise stated.

The survey control listed is only to be used for topographical surveys at the stated scale. All control must be checked and verified prior to use.

Do not scale from this drawing.

SURVEY CONTROL CO-ORDINATES

STATIONS	EASTINGS	NORTHINGS	LEVEL	DESCRIPTION
ST01	305855.382	380996.435	25.080	
ST02	305834.868	381015.508	21.331	
ST03	305866.842	381042.373	19.509	
ST2A	305845.313	381025.470	20.865	

SURVEY GRID AND LEVEL DATUM

The coordinate system established for this survey is related to Ordnance Survey (OS) national grid at a single point using Smartnet, then orientated to grid north with a scale factor of 1.000.

The level datum established for this survey is related to Ordnance Survey (OS) using GPS Smartnet.

To avoid discrepancies any coordinated data used in conjunction with this survey must be derived directly from this control data.

REV	DESCRIPTION	DRAWN	APPR	DATE

SURVEY SOLUTIONS

LAND SURVEYING
BUILDING SURVEYING
UNDERGROUND SURVEYING
SITE ENGINEERING
MONITORING

0845 040 5969
survey-solutions.co.uk

IPSWICH BEDFORD COVENTRY GLASGOW LONDON MANCHESTER NORWICH NOTTINGHAM YEOVIL

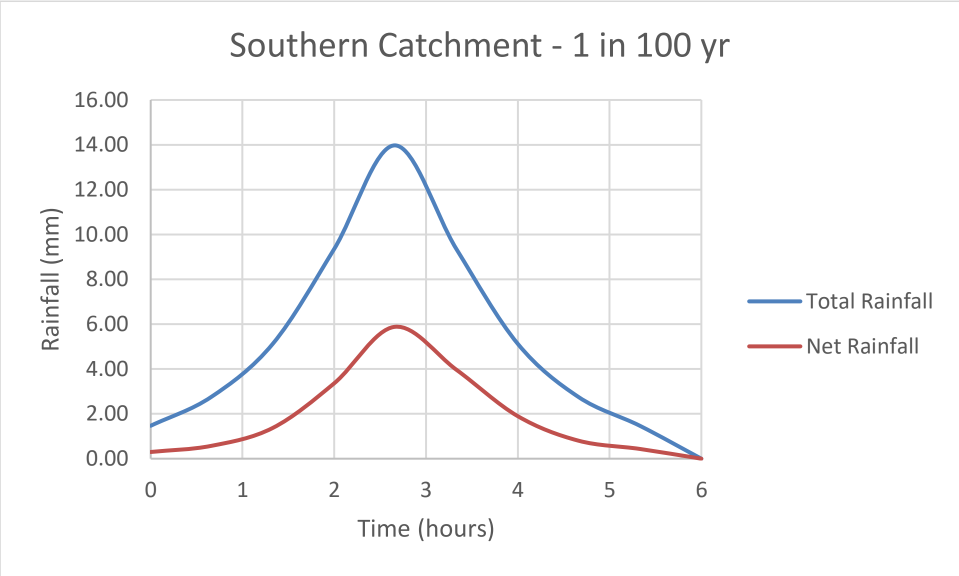
PROJECT TITLE Maes Meurig Meliden Prestatyn LL19 8LG				
DRAWING DETAIL TOPOGRAPHICAL SURVEY Sheet 1 of 1				
CLIENT Premier Builders Ltd				SCALE 1:200
SURVEYOR SO	SURVEY DATE 23/12/2022	CHECKED BY SO	APPROVED BY	DWG STATUS FINAL
DRAWING NUMBER 44377MCLS-01			REVISION	ISSUE DATE 04/01/2023

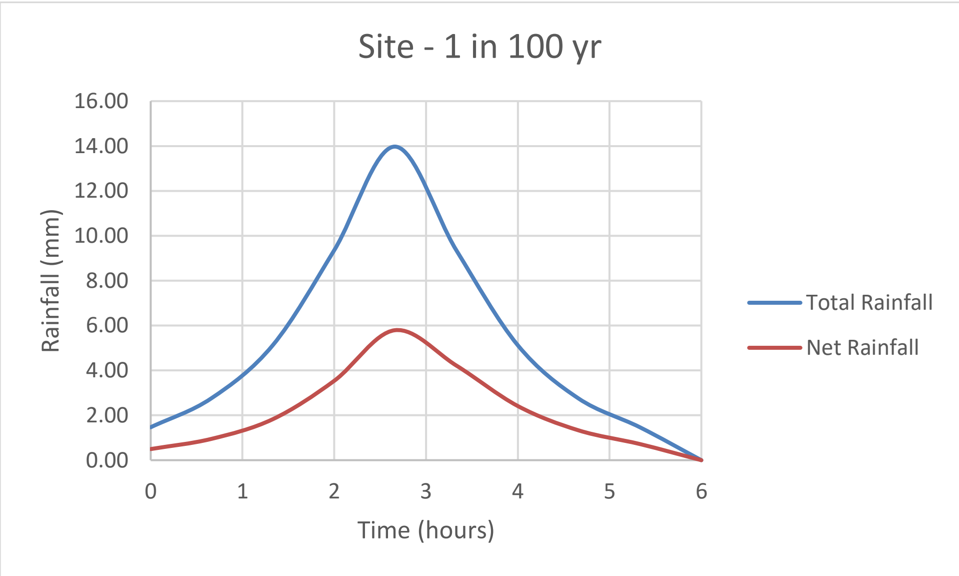
RICS
chartered ices
THE SURVEY ASSOCIATION
ISO 9001 REGISTERED FIRM
QMS ISO 14001 : 2015 REGISTERED

Original Sheet Size A0H

APPENDIX C

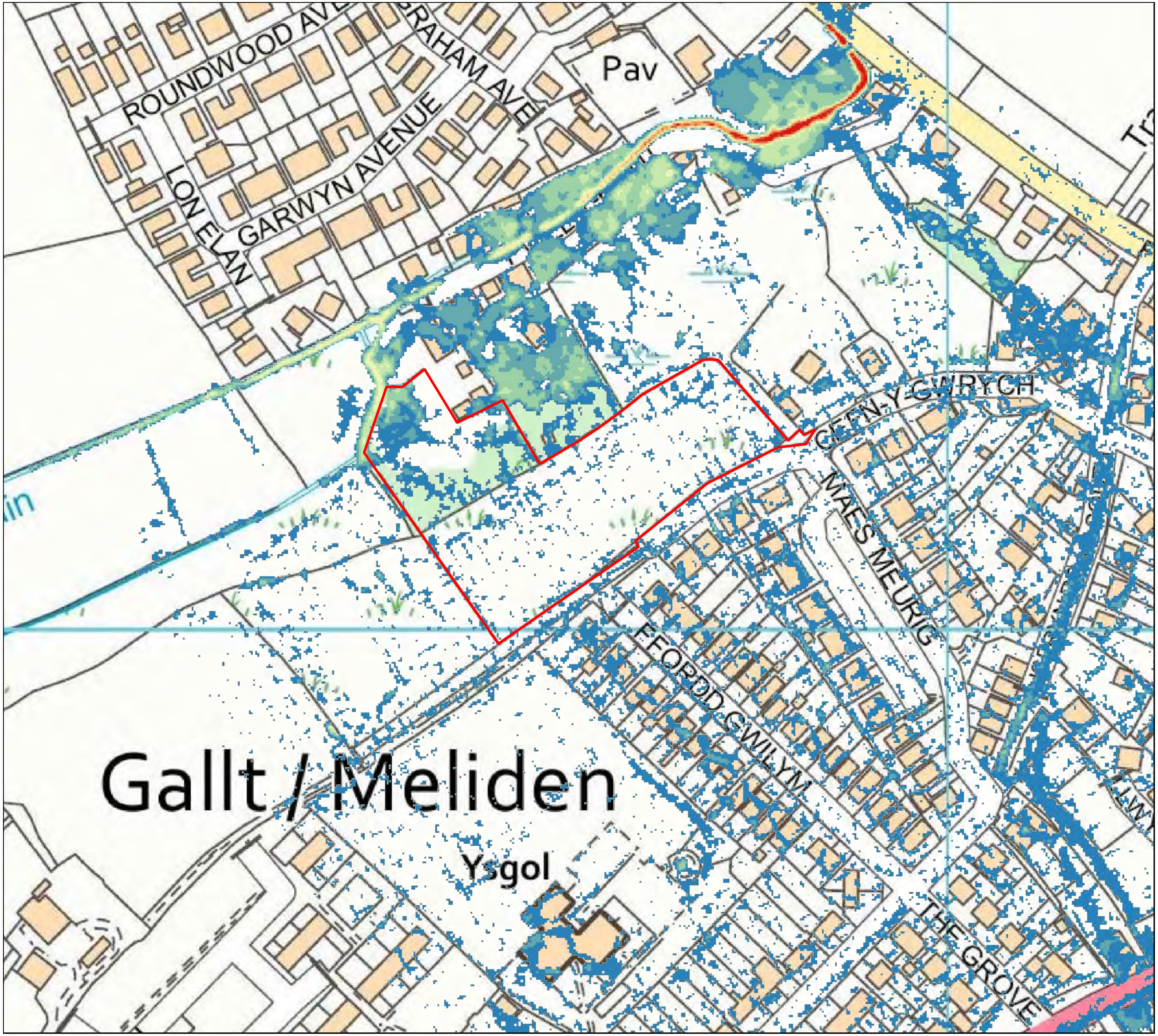
ReFH2 Hyetographs





APPENDIX D

Baseline Model Outputs



Notes:

1. Do not scale from this drawing.
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Legend

Site Location

Depth (m)

- < 0.02
- 0.1
- 0.2
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- 0.4
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- 0.7
- 0.8
- 0.9
- > 1.0

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Mold
CH7 1FQ
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E: info@weetwood.net
W: www.weetwood.net

Client: **Kingscrown Land & Commercial Ltd**

Project Title: **Land rear of Maes Meurig, Meliden, Prestatyn. LL19 8LG**

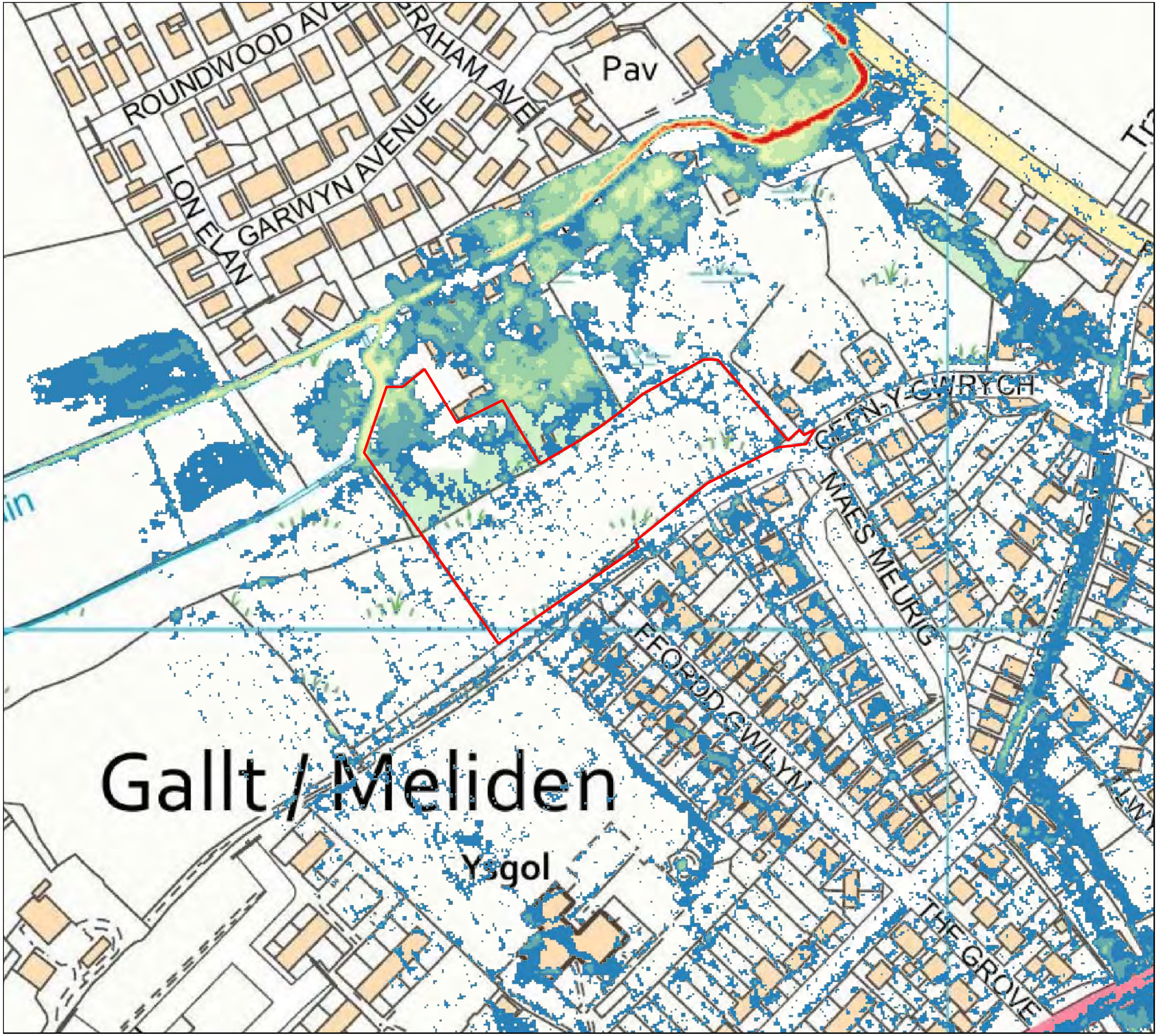
Drawing Title: **Pluvial Baseline Scenario - Maximum Flood Depth; 1 in 20 AEP event**

Map Orientation:

Scale: 0 8 16 24 32 40 m

Drawn:	Checked:	Date:
FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
5698	5698_003_Q0020_d	A



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Project Title: **Land rear of Maes Meurig, Meliden, Prestatyn. LL19 8LG**

Drawing Title: **Pluvial Baseline Scenario - Maximum Flood Depth; 1 in 100 AEP event**

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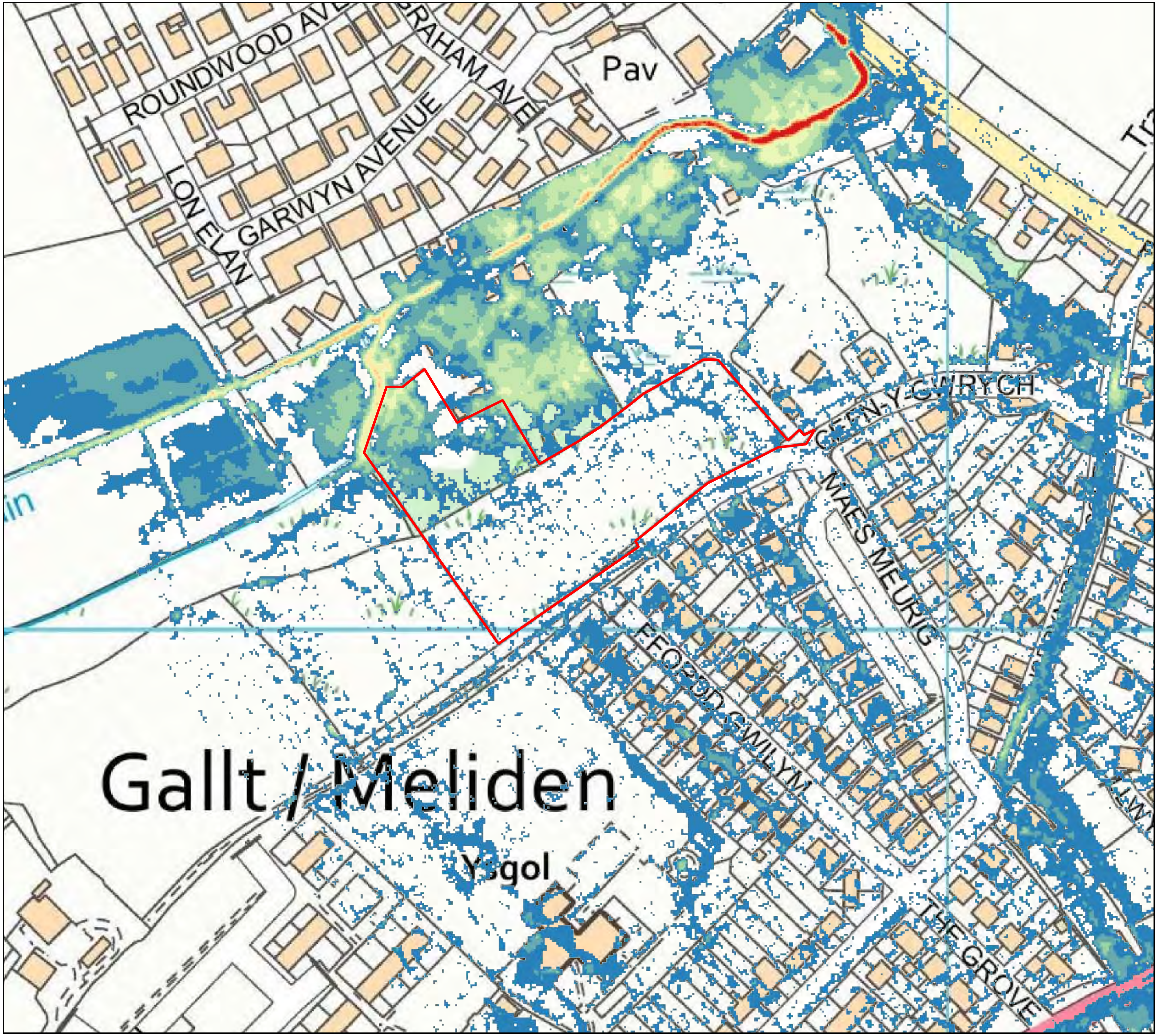
Drawn: FL	Checked: JA	Date: 23 May 2023
Project No: 5698	Drawing No: 5698_003_Q0100_d	Rev: A



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Project Title: **Land rear of Maes Meurig, Meliden, Prestatyn. LL19 8LG**

Drawing Title: **Pluvial Baseline Scenario - Maximum Flood Depth; 1 in 100 plus climate change (40%) AEP event**

Map Orientation:

Scale: 0 8 16 24 32 40 m

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FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
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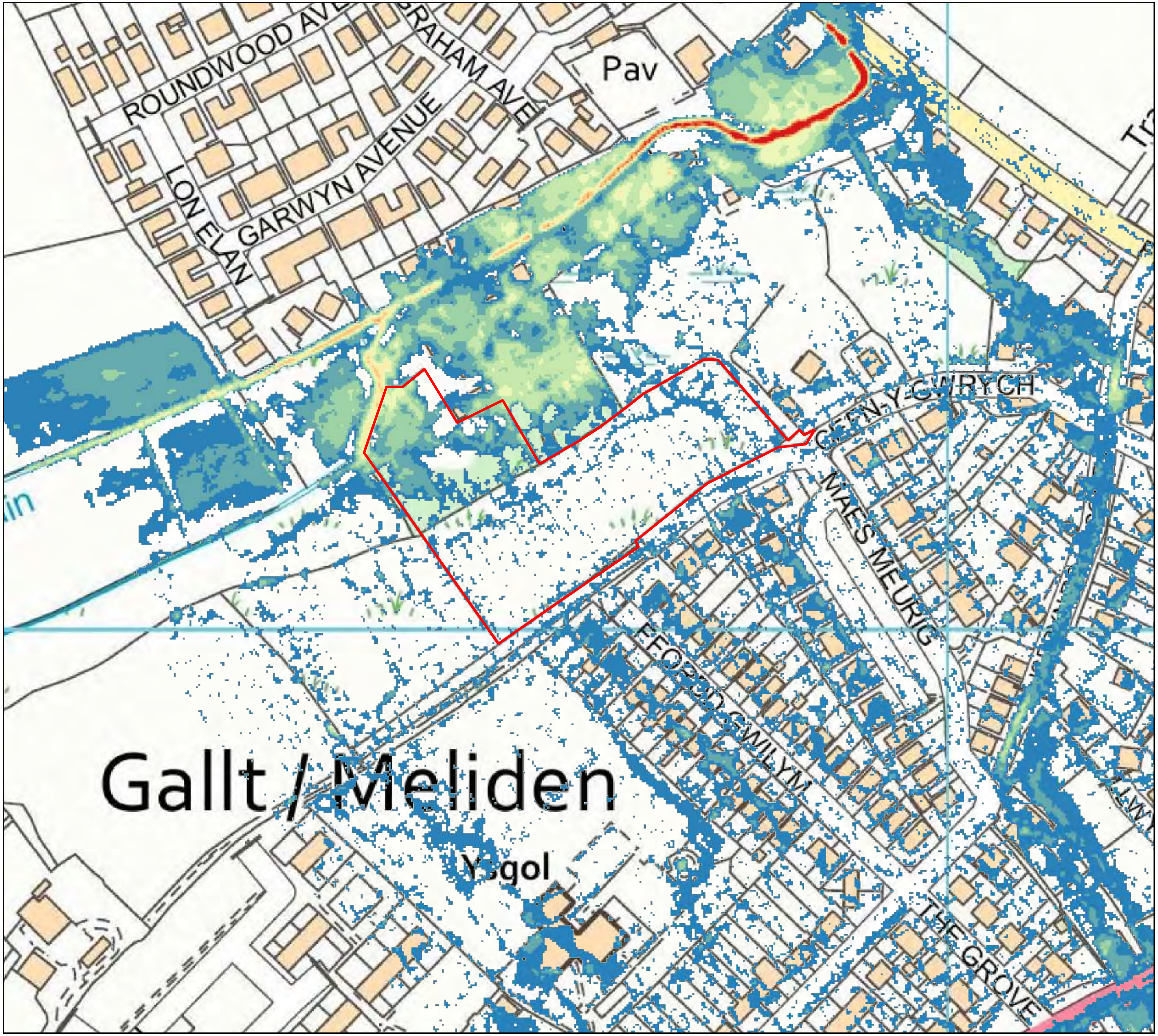

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Site Location

Depth (m)

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Client:
Kingscrown Land & Commercial Ltd

Project Title:
Land rear of Maes Meurig, Meliden, Prestatyn. LL19 8LG

Drawing Title:
Pluvial Baseline Scenario - Maximum Flood Depth; 1 in 1,000 AEP event

Map Orientation:

Scale: 0 8 16 24 32 40 m

Drawn:	Checked:	Date:
FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
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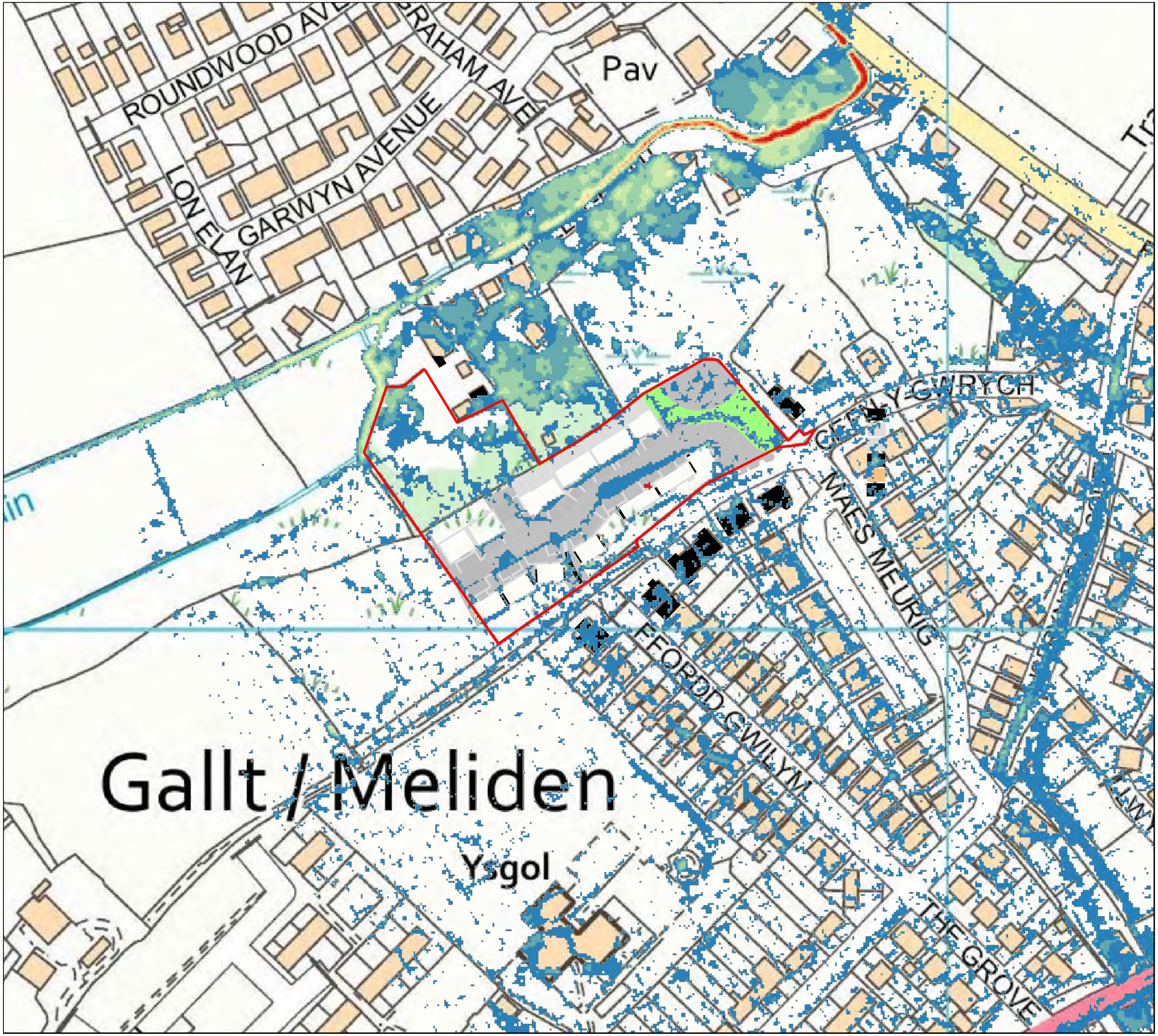
APPENDIX E

Proposed Model Outputs



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Project Title: **Land Off Maes Meurig, Meliden, Prestatyn. LL19 8LG**

Drawing Title: **Pluvial Proposed Scenario - Maximum Flood Depth; 1 in 20 AEP event**

Map Orientation:

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FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
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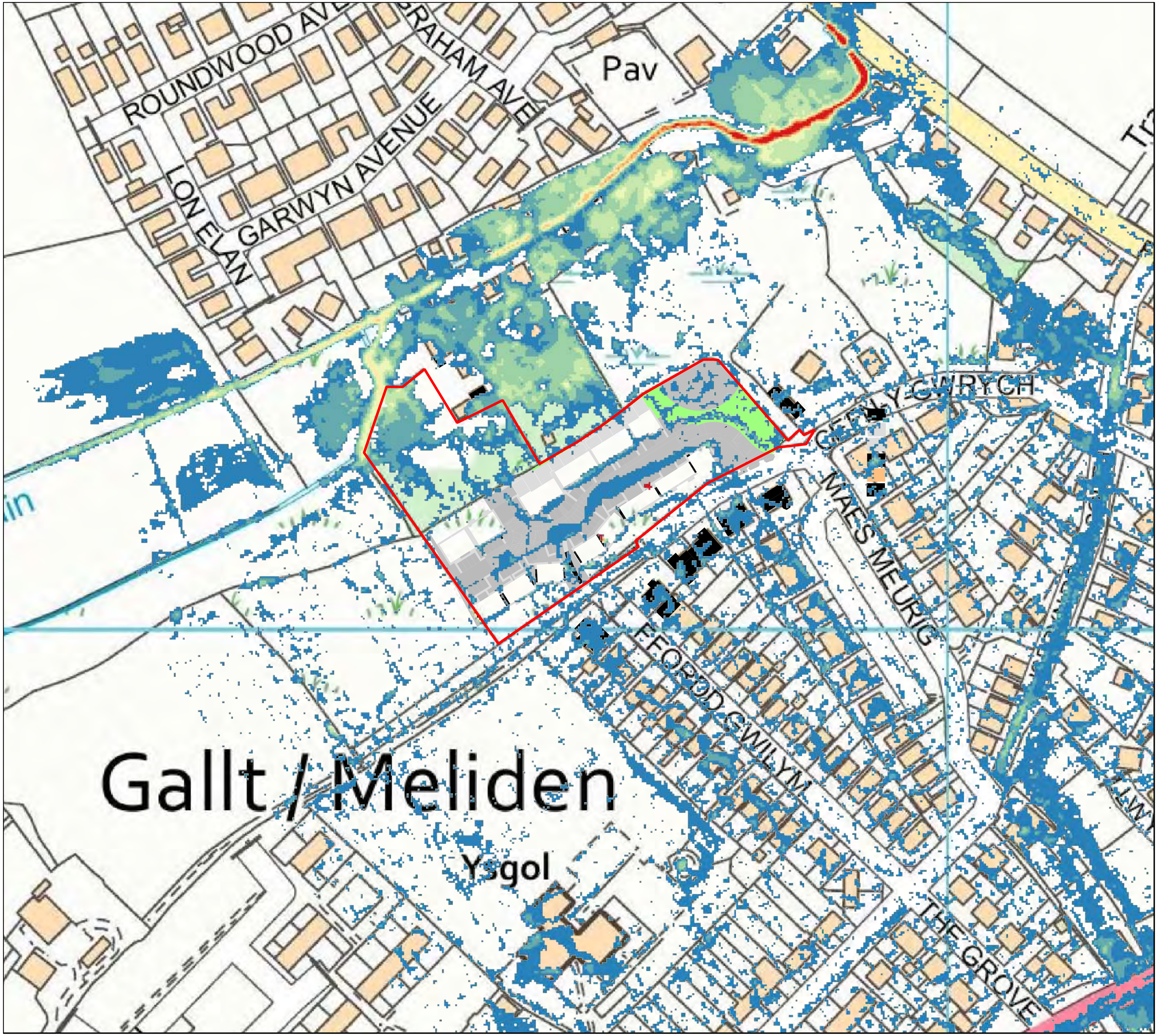

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Client:	**Kingscrown Land & Commercial Ltd**
Project Title:	**Land Off Maes Meurig, Meliden, Prestatvn. LL19 8LG**
Drawing Title:	**Pluvial Proposed Scenario - Maximum Flood Depth; 1 in 100 AEP event**
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Checked:	JA
Date:	23 May 2023
Project No:	5698
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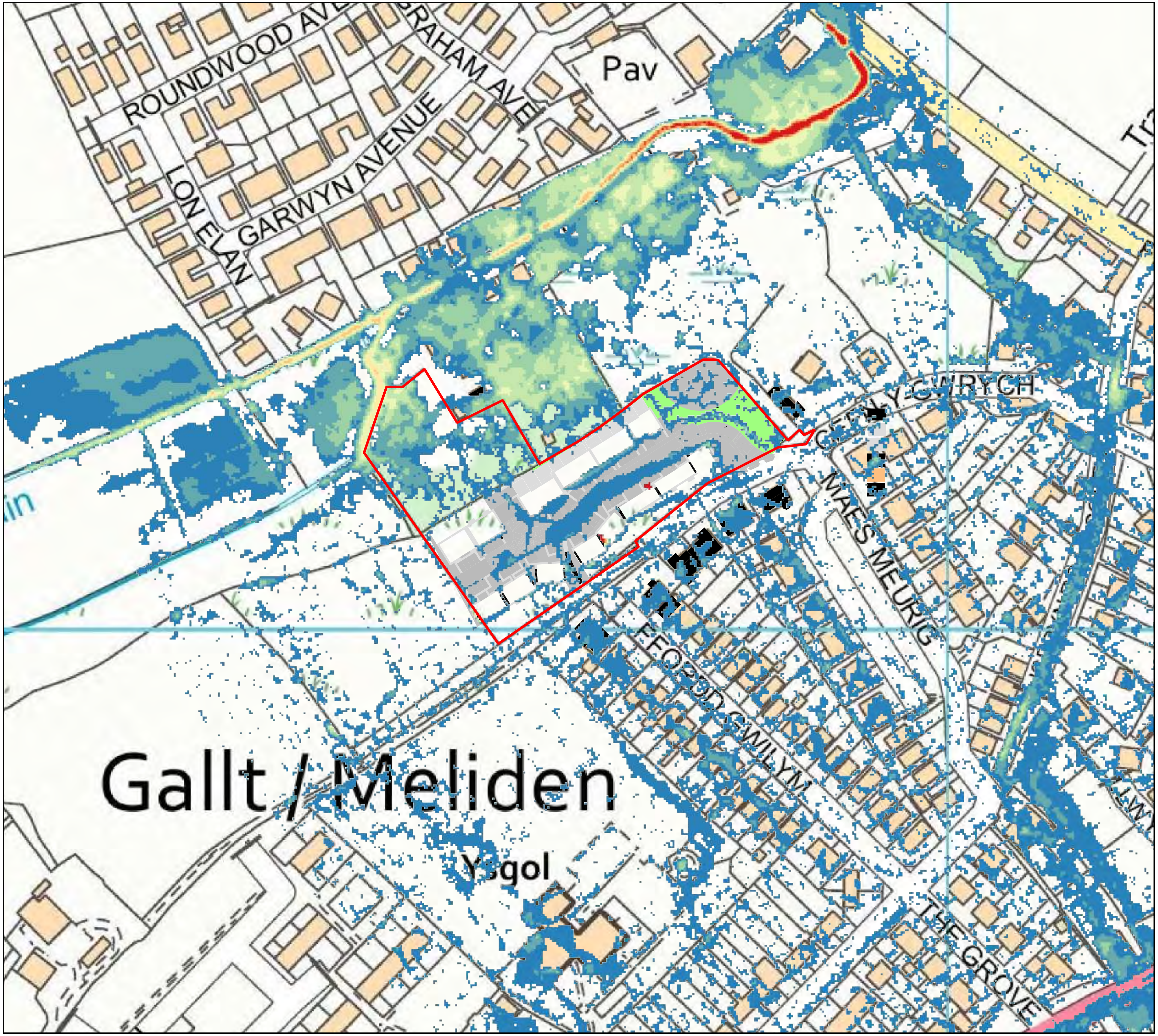
Rev:	A



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Project Title:

Land Off Maes Meurig, Meliden, Prestatyn. LL19 8LG

Drawing Title:

Pluvial Proposed Scenario - Maximum Flood Depth; 1 in 100 plus climate change (40%) AEP event

Map Orientation:

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Drawn:	Checked:	Date:
FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
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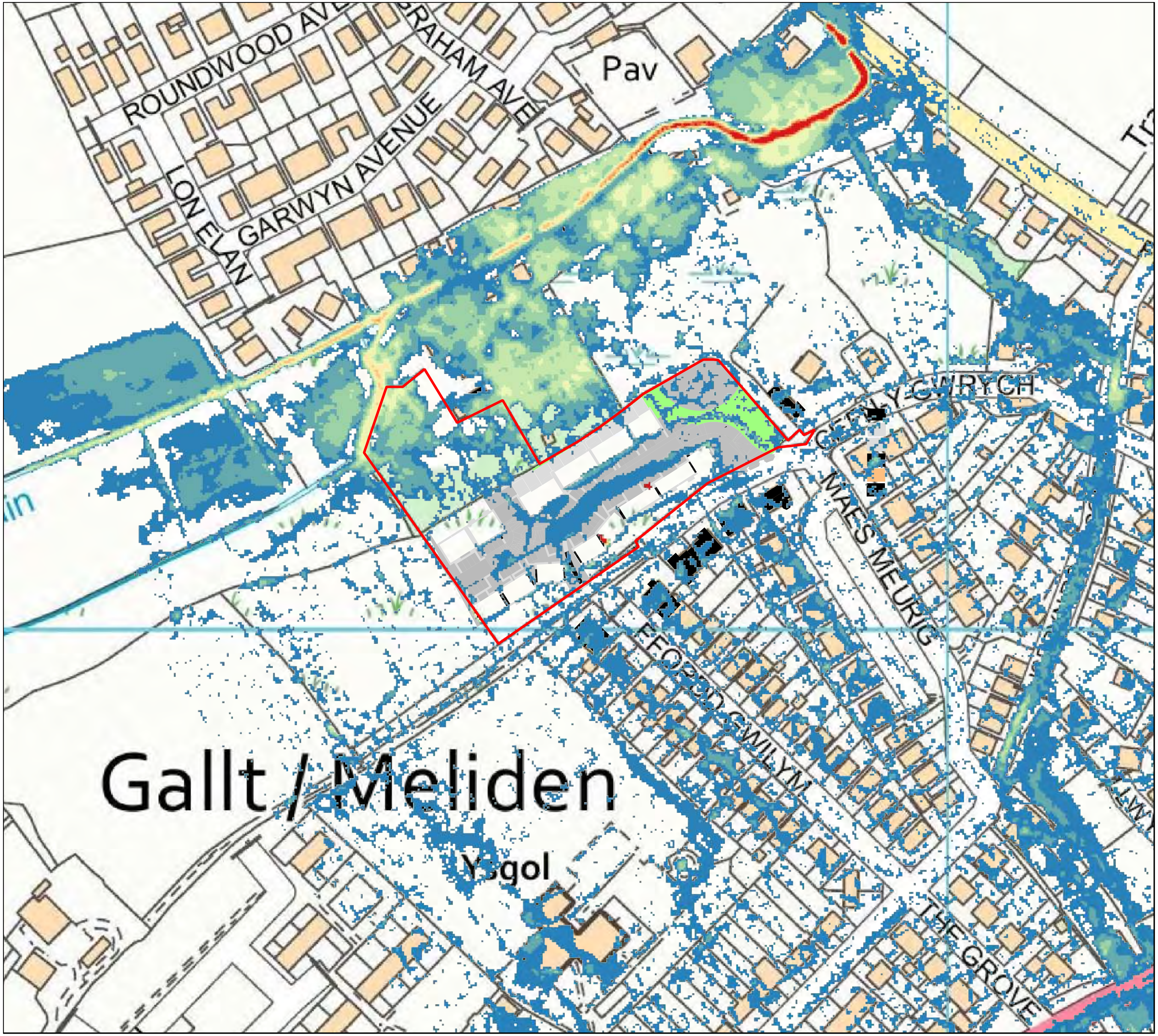

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Client: **Kingscrown Land & Commercial Ltd**

Project Title: **Land Off Maes Meurig, Meliden, Prestatyn. LL19 8LG**

Drawing Title: **Pluvial Proposed Scenario - Maximum Flood Depth; 1 in 1,000 AEP event**

Map Orientation:

Scale: 0 8 16 24 32 40 m

Drawn:	Checked:	Date:
FL	JA	23 May 2023

Project No:	Drawing No:	Rev:
5698	5698_004_Q1000_d	A

APPENDIX F

Greenfield Runoff Calculations

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	dan hodson
Site name:	Maes Meurig
Site location:	LL19 8LE

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	53.31804° N
Longitude:	3.41502° W
Reference:	2126726840
Date:	Mar 21 2023 16:50

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 1

Methodology

Q_{BAR} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	715	715
Hydrological region:	9	9
Growth curve factor 1 year:	0.88	0.88
Growth curve factor 30 years:	1.78	1.78
Growth curve factor 100 years:	2.18	2.18
Growth curve factor 200 years:	2.46	2.46

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

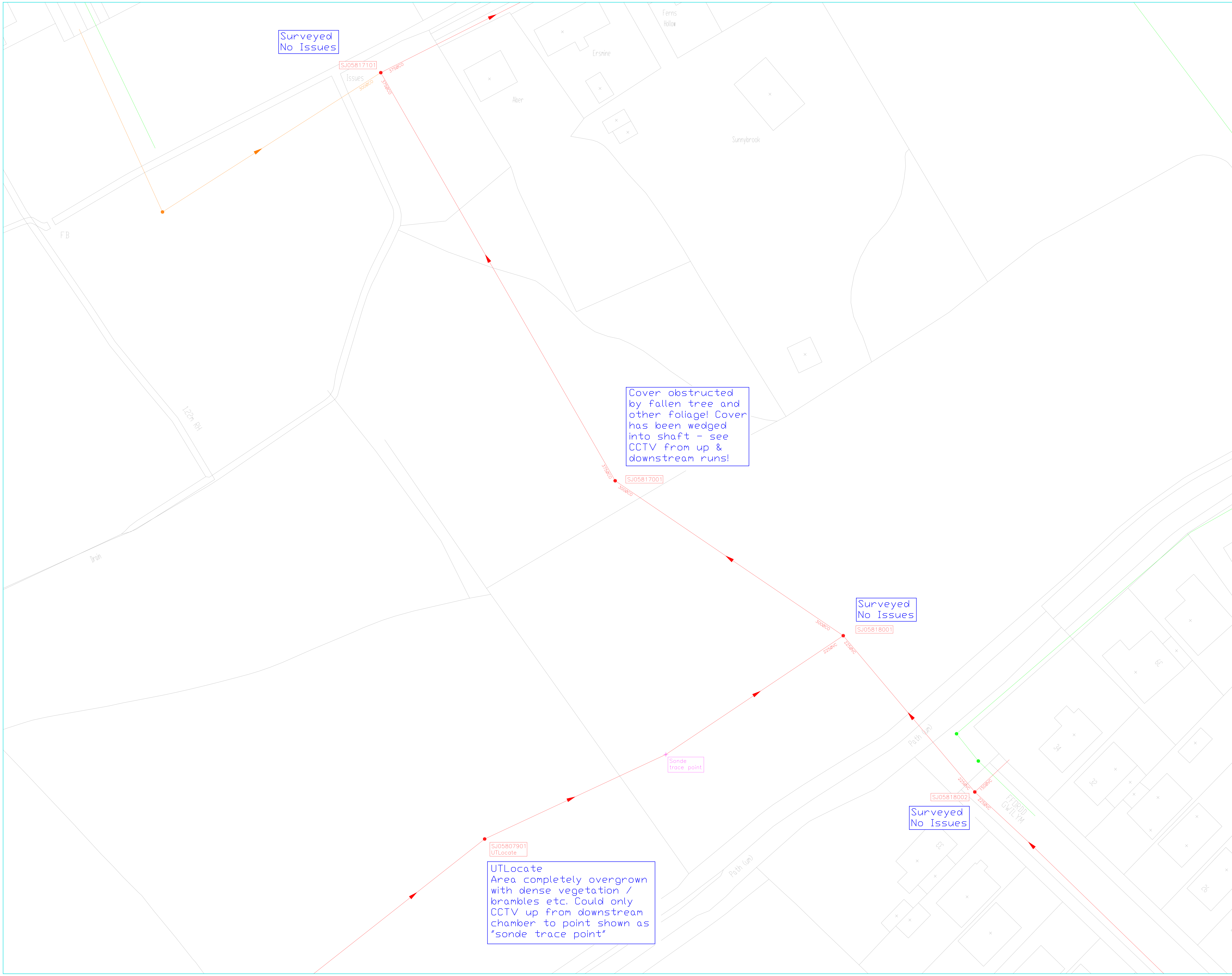
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q_{BAR} (l/s):	1.87	1.87
1 in 1 year (l/s):	1.64	1.64
1 in 30 years (l/s):	3.33	3.33
1 in 100 year (l/s):	4.07	4.07
1 in 200 years (l/s):	4.6	4.6

APPENDIX G

Invek Drainage Survey



N

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
- Highway Gully
- Septic Tanks
- Direction of overland flows
- Spot levels

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Client
Kingscrown Group

Drawing Title
Maes Meurig, Meliden
Drainage Layout

Scale(s)	N.T.S	Drawn	PW
Date	14.04.23	Checked	RD
Job Number	2090	Approved	KN

Sheet Size, Drawing Number & Revision
A1_2090/01_Rev_00

APPENDIX H

Surface Water Attenuation - Storage Volume Calculation

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

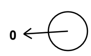
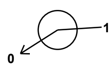
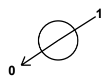
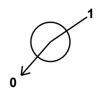
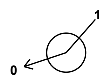
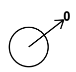
Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.021	5.00	16.950	1200	305899.268	381091.062	1.500
2	0.074	5.00	15.800	1200	305883.815	381090.079	1.500
3	0.044	5.00	15.000	1200	305858.503	381073.934	1.600
4	0.069	5.00	15.000	1200	305836.744	381059.243	1.800
5	0.070	5.00	15.000	1200	305826.745	381047.864	2.000
60	0.117	5.00	15.500	1200	305798.418	381034.486	2.900
6	0.044	5.00	15.000	1200	305807.619	381041.517	2.500
7	0.042	5.00	14.000	1200	305798.302	381062.539	1.600
HW1			12.000		305773.163	381060.373	1.000
HW2		5.00	12.000		305748.134	381090.245	1.000
8			12.000	1200	305743.381	381092.084	1.050
HW3			12.000		305738.672	381096.813	0.400

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.484	13.5	300	Circular	16.950	15.450	1.200	15.800	14.300	1.200
1.001	30.023	33.4	300	Circular	15.800	14.300	1.200	15.000	13.400	1.300
1.002	26.254	131.3	300	Circular	15.000	13.400	1.300	15.000	13.200	1.500
1.003	15.148	75.7	300	Circular	15.000	13.200	1.500	15.000	13.000	1.700
1.004	20.152	40.3	300	Circular	15.000	13.000	1.700	15.000	12.500	2.200
2.000	11.580	115.8	300	Circular	15.500	12.600	2.600	15.000	12.500	2.200
1.005	22.994	229.9	300	Circular	15.000	12.500	2.200	14.000	12.400	1.300
1.006	25.232	18.0	300	Circular	14.000	12.400	1.300	12.000	11.000	0.700
1.007	5.096	101.9	300	Circular	12.000	11.000	0.700	12.000	10.950	0.750
1.008	6.674	-10.3	150	Circular	12.000	10.950	0.900	12.000	11.600	0.250

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	60	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	HW1		Junction	
1.007	HW2		Junction		8	1200	Manhole	Adoptable
1.008	8	1200	Manhole	Adoptable	HW3		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	305899.268	381091.062	16.950	1.500	1200		0	1.000	15.450	300
2	305883.815	381090.079	15.800	1.500	1200		1	1.000	14.300	300
							0	1.001	14.300	300
3	305858.503	381073.934	15.000	1.600	1200		1	1.001	13.400	300
							0	1.002	13.400	300
4	305836.744	381059.243	15.000	1.800	1200		1	1.002	13.200	300
							0	1.003	13.200	300
5	305826.745	381047.864	15.000	2.000	1200		1	1.003	13.000	300
							0	1.004	13.000	300
60	305798.418	381034.486	15.500	2.900	1200		0	2.000	12.600	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
6	305807.619	381041.517	15.000	2.500	1200	1	2.000	12.500	300
						2	1.004	12.500	300
						0	1.005	12.500	300
7	305798.302	381062.539	14.000	1.600	1200	1	1.005	12.400	300
						0	1.006	12.400	300
HW1	305773.163	381060.373	12.000	1.000		1	1.006	11.000	300
HW2	305748.134	381090.245	12.000	1.000		0	1.007	11.000	300
8	305743.381	381092.084	12.000	1.050	1200	1	1.007	10.950	300
						0	1.008	10.950	150
HW3	305738.672	381096.813	12.000	0.400		1	1.008	11.600	150

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	10	0
30	0	10	0
100	40	10	0

Node 8 Online Pump Control

Flap Valve	x	Design Depth (m)	0.700	Switch off depth (m)	0.000
Replaces Downstream Link	✓	Design Flow (l/s)	2.2		
Invert Level (m)	10.950	Switch on depth (m)	0.100		

Depth (m)	Flow (l/s)
0.700	2.200

Node HW2 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	40.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.000	Main Channel Slope (1:X)	500.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.020

Inlets
HW1

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	536.0	0.0	1.000	853.0	0.0

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	24.000		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	54.600		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	20.200	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node 60 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.100	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	41.400	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	7.000		

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.472	0.022	3.2	0.0312	0.0000	OK
15 minute winter	2	10	14.355	0.055	14.4	0.1211	0.0000	OK
15 minute winter	3	10	13.496	0.096	20.8	0.1660	0.0000	OK
15 minute winter	4	11	13.307	0.107	30.5	0.2103	0.0000	OK
15 minute winter	5	11	13.097	0.097	40.5	0.1851	0.0000	OK
15 minute winter	60	11	12.710	0.110	17.7	0.2227	0.0000	OK
15 minute winter	6	11	12.712	0.212	63.7	0.3217	0.0000	OK
15 minute winter	7	11	12.507	0.107	70.1	0.1834	0.0000	OK
1440 minute winter	HW1	1140	11.241	0.241	4.6	0.0000	0.0000	OK
1440 minute winter	HW2	1140	11.241	0.241	3.0	0.0000	0.0000	OK
1440 minute winter	8	1140	11.241	0.291	1.9	0.3286	0.0000	SURCHARGED
15 minute summer	HW3	1	11.600	0.000	0.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	3.2	0.611	0.010	0.0851	
15 minute winter	2	1.001	3	14.2	1.027	0.073	0.4211	
15 minute winter	3	1.002	4	20.4	0.981	0.211	0.5465	
15 minute winter	4	1.003	5	30.5	1.448	0.239	0.3195	
15 minute winter	5	1.004	6	40.6	1.113	0.231	0.7355	
15 minute winter	60	2.000	6	16.8	0.513	0.163	0.4440	
15 minute winter	6	1.005	7	64.1	1.683	0.878	0.8719	
15 minute winter	7	1.006	HW1	70.1	3.077	0.267	0.5748	
15 minute winter	HW1	Flow through pond	HW2	78.5	0.205	0.004	32.3567	
15 minute winter	HW2	1.007	8	4.9	0.455	0.045	0.1479	
1440 minute winter	8	Pump	HW3	0.9				59.3

Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.484	0.034	8.5	0.0494	0.0000	OK
15 minute winter	2	10	14.389	0.089	38.2	0.1981	0.0000	OK
15 minute winter	3	12	13.596	0.196	55.5	0.3410	0.0000	OK
15 minute winter	4	11	13.556	0.356	83.3	0.7036	0.0000	SURCHARGED
15 minute winter	5	11	13.469	0.469	97.0	0.8920	0.0000	SURCHARGED
15 minute winter	60	11	13.293	0.693	47.1	1.3988	0.0000	SURCHARGED
15 minute winter	6	11	13.262	0.762	157.3	1.1571	0.0000	SURCHARGED
15 minute winter	7	11	12.594	0.194	172.1	0.3313	0.0000	OK
960 minute winter	HW1	930	11.455	0.455	13.4	0.0000	0.0000	OK
960 minute winter	HW2	930	11.455	0.455	7.3	0.0000	0.0000	SURCHARGED
960 minute winter	8	930	11.455	0.505	1.9	0.5706	0.0000	SURCHARGED
15 minute summer	HW3	1	11.600	0.000	0.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	8.5	0.809	0.028	0.1705	
15 minute winter	2	1.001	3	37.9	1.279	0.196	0.9629	
15 minute winter	3	1.002	4	55.5	1.150	0.573	1.5659	
15 minute summer	4	1.003	5	78.8	1.580	0.617	1.0667	
15 minute winter	5	1.004	6	98.3	1.395	0.560	1.4191	
15 minute winter	60	2.000	6	42.9	0.635	0.416	0.8155	
15 minute winter	6	1.005	7	156.2	2.393	2.140	1.3635	
15 minute winter	7	1.006	HW1	171.5	4.528	0.652	0.9873	
15 minute winter	HW1	Flow through pond	HW2	163.7	0.249	0.008	87.1586	
15 minute summer	HW2	1.007	8	8.0	0.459	0.073	0.2653	
960 minute winter	8	Pump	HW3	1.6				75.2

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m^3)	Flood (m^3)	Status
15 minute winter	1	10	15.497	0.047	16.5	0.0678	0.0000	OK
15 minute winter	2	12	14.896	0.596	74.4	1.3211	0.0000	SURCHARGED
15 minute winter	3	13	14.820	1.420	97.7	9.5384	0.0000	FLOOD RISK
15 minute winter	4	13	14.703	1.503	124.5	6.9688	0.0000	FLOOD RISK
15 minute winter	5	11	14.595	1.595	151.7	3.0320	0.0000	SURCHARGED
15 minute winter	60	11	14.423	1.823	91.7	3.6811	0.0000	SURCHARGED
15 minute winter	6	11	14.313	1.813	238.6	2.7516	0.0000	SURCHARGED
15 minute winter	7	11	13.000	0.600	263.0	1.0256	0.0000	SURCHARGED
960 minute winter	HW1	945	11.765	0.765	24.2	0.0000	0.0000	OK
960 minute winter	HW2	945	11.765	0.765	13.0	0.0000	0.0000	FLOOD RISK
960 minute winter	8	945	11.765	0.815	2.2	0.9217	0.0000	FLOOD RISK
15 minute summer	HW3	1	11.600	0.000	1.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m^3)	Discharge Vol (m^3)
15 minute winter	1	1.000	2	16.4	0.906	0.054	0.5998	
15 minute summer	2	1.001	3	66.7	1.400	0.345	2.1142	
15 minute winter	3	1.002	4	115.1	1.634	1.188	1.8488	
15 minute winter	4	1.003	5	130.6	1.855	1.022	1.0667	
15 minute winter	5	1.004	6	157.7	2.239	0.898	1.4191	
15 minute winter	60	2.000	6	86.3	1.225	0.836	0.8155	
30 minute summer	6	1.005	7	231.1	3.283	3.167	1.6192	
15 minute winter	7	1.006	HW1	262.4	4.844	0.998	1.5953	
15 minute summer	HW1	Flow through pond	HW2	227.0	0.262	0.011	151.1642	
15 minute winter	HW2	1.007	8	-8.1	0.513	-0.074	0.3589	
240 minute winter	8	Pump	HW3	2.2				49.1

Design Settings

Rainfall Methodology	FEH-13	Minimum Velocity (m/s)	1.00
Return Period (years)	2	Connection Type	Level Soffits
Additional Flow (%)	0	Minimum Backdrop Height (m)	0.200
CV	0.750	Preferred Cover Depth (m)	1.200
Time of Entry (mins)	5.00	Include Intermediate Ground	✓
Maximum Time of Concentration (mins)	30.00	Enforce best practice design rules	x
Maximum Rainfall (mm/hr)	50.0		

Adoptable Manhole Type

Max Width (mm)	Diameter (mm)	Max Width (mm)	Diameter (mm)
374	1200	749	1500
499	1350	900	1800

>900 Link+900 mm

Max Depth (m)	Diameter (mm)	Max Depth (m)	Diameter (mm)
1.500	1050	99.999	1200

Circular Link Type

Shape	Circular	Auto Increment (mm)	75
Barrels	1	Follow Ground	x

Available Diameters (mm)

100	150

Nodes

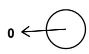
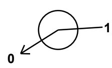
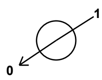
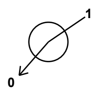
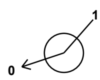
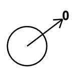
Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
1	0.021	5.00	16.950	1200	305899.268	381091.062	1.500
2	0.074	5.00	15.800	1200	305883.815	381090.079	1.500
3	0.044	5.00	15.000	1200	305858.503	381073.934	1.600
4	0.069	5.00	15.000	1200	305836.744	381059.243	1.800
5	0.070	5.00	15.000	1200	305826.745	381047.864	2.000
60	0.117	5.00	15.500	1200	305798.418	381034.486	2.900
6	0.044	5.00	15.000	1200	305807.619	381041.517	2.500
7	0.042	5.00	14.000	1200	305798.302	381062.539	1.600
HW1			12.000		305773.163	381060.373	1.000
HW2		5.00	12.000		305748.134	381090.245	1.000
8			12.000	1200	305743.381	381092.084	1.050
HW3			12.000		305738.672	381096.813	0.400

Pipeline Schedule

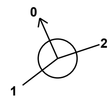
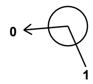
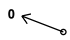
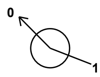
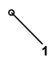
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	15.484	13.5	300	Circular	16.950	15.450	1.200	15.800	14.300	1.200
1.001	30.023	33.4	300	Circular	15.800	14.300	1.200	15.000	13.400	1.300
1.002	26.254	131.3	300	Circular	15.000	13.400	1.300	15.000	13.200	1.500
1.003	15.148	75.7	300	Circular	15.000	13.200	1.500	15.000	13.000	1.700
1.004	20.152	40.3	300	Circular	15.000	13.000	1.700	15.000	12.500	2.200
2.000	11.580	115.8	300	Circular	15.500	12.600	2.600	15.000	12.500	2.200
1.005	22.994	229.9	300	Circular	15.000	12.500	2.200	14.000	12.400	1.300
1.006	25.232	18.0	300	Circular	14.000	12.400	1.300	12.000	11.000	0.700
1.007	5.096	101.9	300	Circular	12.000	11.000	0.700	12.000	10.950	0.750
1.008	6.674	-10.3	150	Circular	12.000	10.950	0.900	12.000	11.600	0.250

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1200	Manhole	Adoptable
1.001	2	1200	Manhole	Adoptable	3	1200	Manhole	Adoptable
1.002	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.003	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.004	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
2.000	60	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.005	6	1200	Manhole	Adoptable	7	1200	Manhole	Adoptable
1.006	7	1200	Manhole	Adoptable	HW1		Junction	
1.007	HW2		Junction		8	1200	Manhole	Adoptable
1.008	8	1200	Manhole	Adoptable	HW3		Junction	

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
1	305899.268	381091.062	16.950	1.500	1200					
							0	1.000	15.450	300
2	305883.815	381090.079	15.800	1.500	1200		1	1.000	14.300	300
							0	1.001	14.300	300
3	305858.503	381073.934	15.000	1.600	1200		1	1.001	13.400	300
							0	1.002	13.400	300
4	305836.744	381059.243	15.000	1.800	1200		1	1.002	13.200	300
							0	1.003	13.200	300
5	305826.745	381047.864	15.000	2.000	1200		1	1.003	13.000	300
							0	1.004	13.000	300
60	305798.418	381034.486	15.500	2.900	1200					
							0	2.000	12.600	300

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections		Link	IL (m)	Dia (mm)
6	305807.619	381041.517	15.000	2.500	1200		1	2.000	12.500	300
							2	1.004	12.500	300
							0	1.005	12.500	300
7	305798.302	381062.539	14.000	1.600	1200		1	1.005	12.400	300
							0	1.006	12.400	300
HW1	305773.163	381060.373	12.000	1.000			1	1.006	11.000	300
HW2	305748.134	381090.245	12.000	1.000			0	1.007	11.000	300
8	305743.381	381092.084	12.000	1.050	1200		1	1.007	10.950	300
							0	1.008	10.950	150
HW3	305738.672	381096.813	12.000	0.400			1	1.008	11.600	150

Simulation Settings

Rainfall Methodology	FEH-13	Analysis Speed	Detailed	Additional Storage (m^3/ha)	20.0
Summer CV	0.750	Skip Steady State	x	Check Discharge Rate(s)	x
Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Volume	x

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
2	0	10	0
30	0	10	0
100	40	10	0

Node 8 Online Pump Control

Flap Valve	x	Design Depth (m)	0.700	Switch off depth (m)	0.000
Replaces Downstream Link	✓	Design Flow (l/s)	2.2		
Invert Level (m)	10.950	Switch on depth (m)	0.100		

Depth (m)	Flow (l/s)
0.700	2.200

Node HW2 Flow through Pond Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Main Channel Length (m)	40.000
Side Inf Coefficient (m/hr)	0.00000	Invert Level (m)	11.000	Main Channel Slope (1:X)	500.0
Safety Factor	2.0	Time to half empty (mins)		Main Channel n	0.020

Inlets
HW1

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	536.0	0.0	1.000	853.0	0.0

Node 3 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	3	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	24.000		

Node 4 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	2	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	54.600		

Node 5 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	14.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	20.200	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node 60 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	15.100	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	41.400	Inf Depth (m)	
Porosity	0.30	Length (m)	5.000		

Node 7 Carpark Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Invert Level (m)	13.600	Slope (1:X)	500.0
Side Inf Coefficient (m/hr)	0.00000	Time to half empty (mins)	0	Depth (m)	
Safety Factor	2.0	Width (m)	5.000	Inf Depth (m)	
Porosity	0.30	Length (m)	7.000		

Results for 2 year +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.472	0.022	3.2	0.0312	0.0000	OK
15 minute winter	2	10	14.355	0.055	14.4	0.1211	0.0000	OK
15 minute winter	3	10	13.496	0.096	20.8	0.1660	0.0000	OK
15 minute winter	4	11	13.307	0.107	30.5	0.2103	0.0000	OK
15 minute winter	5	11	13.097	0.097	40.5	0.1851	0.0000	OK
15 minute winter	60	11	12.710	0.110	17.7	0.2227	0.0000	OK
15 minute winter	6	11	12.712	0.212	63.7	0.3217	0.0000	OK
15 minute winter	7	11	12.507	0.107	70.1	0.1834	0.0000	OK
1440 minute winter	HW1	1140	11.241	0.241	4.6	0.0000	0.0000	OK
1440 minute winter	HW2	1140	11.241	0.241	3.0	0.0000	0.0000	OK
1440 minute winter	8	1140	11.241	0.291	1.9	0.3286	0.0000	SURCHARGED
15 minute summer	HW3	1	12.000	0.400	0.5	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	3.2	0.611	0.010	0.0851	
15 minute winter	2	1.001	3	14.2	1.027	0.073	0.4211	
15 minute winter	3	1.002	4	20.4	0.981	0.211	0.5465	
15 minute winter	4	1.003	5	30.5	1.448	0.239	0.3195	
15 minute winter	5	1.004	6	40.6	1.113	0.231	0.7355	
15 minute winter	60	2.000	6	16.8	0.513	0.163	0.4440	
15 minute winter	6	1.005	7	64.1	1.683	0.878	0.8719	
15 minute winter	7	1.006	HW1	70.1	3.077	0.267	0.5748	
15 minute winter	HW1	Flow through pond	HW2	78.5	0.205	0.004	32.3567	
15 minute winter	HW2	1.007	8	4.9	0.455	0.045	0.1479	
1440 minute winter	8	Pump	HW3	0.9				59.3

Results for 30 year +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.484	0.034	8.5	0.0494	0.0000	OK
15 minute winter	2	10	14.389	0.089	38.2	0.1981	0.0000	OK
15 minute winter	3	12	13.596	0.196	55.5	0.3410	0.0000	OK
15 minute winter	4	11	13.556	0.356	83.3	0.7036	0.0000	SURCHARGED
15 minute winter	5	11	13.469	0.469	97.0	0.8920	0.0000	SURCHARGED
15 minute winter	60	11	13.293	0.693	47.1	1.3988	0.0000	SURCHARGED
15 minute winter	6	11	13.262	0.762	157.3	1.1571	0.0000	SURCHARGED
15 minute winter	7	11	12.594	0.194	172.1	0.3313	0.0000	OK
960 minute winter	HW1	930	11.455	0.455	13.4	0.0000	0.0000	OK
960 minute winter	HW2	930	11.455	0.455	7.3	0.0000	0.0000	SURCHARGED
960 minute winter	8	930	11.455	0.505	1.9	0.5706	0.0000	SURCHARGED
15 minute summer	HW3	1	12.000	0.400	0.7	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	8.5	0.809	0.028	0.1705	
15 minute winter	2	1.001	3	37.9	1.279	0.196	0.9629	
15 minute winter	3	1.002	4	55.5	1.150	0.573	1.5659	
15 minute summer	4	1.003	5	78.8	1.580	0.617	1.0667	
15 minute winter	5	1.004	6	98.3	1.395	0.560	1.4191	
15 minute winter	60	2.000	6	42.9	0.635	0.416	0.8155	
15 minute winter	6	1.005	7	156.2	2.393	2.140	1.3635	
15 minute winter	7	1.006	HW1	171.5	4.528	0.652	0.9873	
15 minute winter	HW1	Flow through pond	HW2	163.7	0.249	0.008	87.1586	
15 minute summer	HW2	1.007	8	8.0	0.459	0.073	0.2653	
960 minute winter	8	Pump	HW3	1.6				75.2

Results for 100 year +40% CC +10% A Critical Storm Duration. Lowest mass balance: 99.41%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	15.497	0.047	16.5	0.0678	0.0000	OK
15 minute winter	2	12	14.896	0.596	74.4	1.3211	0.0000	SURCHARGED
15 minute winter	3	13	14.820	1.420	97.7	9.5384	0.0000	FLOOD RISK
15 minute winter	4	13	14.703	1.503	124.5	6.9688	0.0000	FLOOD RISK
15 minute winter	5	11	14.595	1.595	151.7	3.0320	0.0000	SURCHARGED
15 minute winter	60	11	14.423	1.823	91.7	3.6811	0.0000	SURCHARGED
15 minute winter	6	11	14.313	1.813	238.6	2.7516	0.0000	SURCHARGED
15 minute winter	7	11	13.000	0.600	263.0	1.0256	0.0000	SURCHARGED
960 minute winter	HW1	945	11.765	0.765	24.2	0.0000	0.0000	OK
960 minute winter	HW2	945	11.765	0.765	13.0	0.0000	0.0000	FLOOD RISK
960 minute winter	8	945	11.765	0.815	2.2	0.9217	0.0000	FLOOD RISK
15 minute summer	HW3	1	12.000	0.400	1.1	0.0000	0.0000	OK

Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	16.4	0.906	0.054	0.5998	
15 minute summer	2	1.001	3	66.7	1.400	0.345	2.1142	
15 minute winter	3	1.002	4	115.1	1.634	1.188	1.8488	
15 minute winter	4	1.003	5	130.6	1.855	1.022	1.0667	
15 minute winter	5	1.004	6	157.7	2.239	0.898	1.4191	
15 minute winter	60	2.000	6	86.3	1.225	0.836	0.8155	
30 minute summer	6	1.005	7	231.1	3.283	3.167	1.6192	
15 minute winter	7	1.006	HW1	262.4	4.844	0.998	1.5953	
15 minute summer	HW1	Flow through pond	HW2	227.0	0.262	0.011	151.1642	
15 minute winter	HW2	1.007	8	-8.1	0.513	-0.074	0.3589	
240 minute winter	8	Pump	HW3	2.2				49.1

APPENDIX I

Preliminary Drainage Layout

THIS DRAWING MUST BE READ IN CONJUNCTION WITH THE SPECIFICATION AND ALL OTHER RELEVANT DRAWINGS. DO NOT SCALE FROM THIS DRAWING.

NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT AND PROPOSED EXTERNAL LEVELS TAKEN FROM AGA ARCHITECTS 'INDICATIVE SITE LAYOUT FROM MAES MEURIG OPTION 3' REVISION F DATED 28/04/23 DRAWING (REF: C1109-009-F).
3. EXISTING LEVEL INFORMATION TAKEN FROM SURVEY SOLUTIONS 'TOPOGRAPHIC SURVEY' (REF: 44377MCLS-01, 04/01/23).
4. EXISTING DRAINAGE INFORMATION TAKEN SURVEY COMPLETED BY INVEK SURVEYS DATED 14/04/23 REFERENCE 2090/01.

REV	DATE	DESCRIPTION	DRAWN	CHECK
P1	17.05.23	INITIAL ISSUE	DSH	TB

Weetwood
Development • Planning • Environment
Park House, Ffordd Byrnwr Gwair, Mold
CH7 1FQ
Tel 01352 700045
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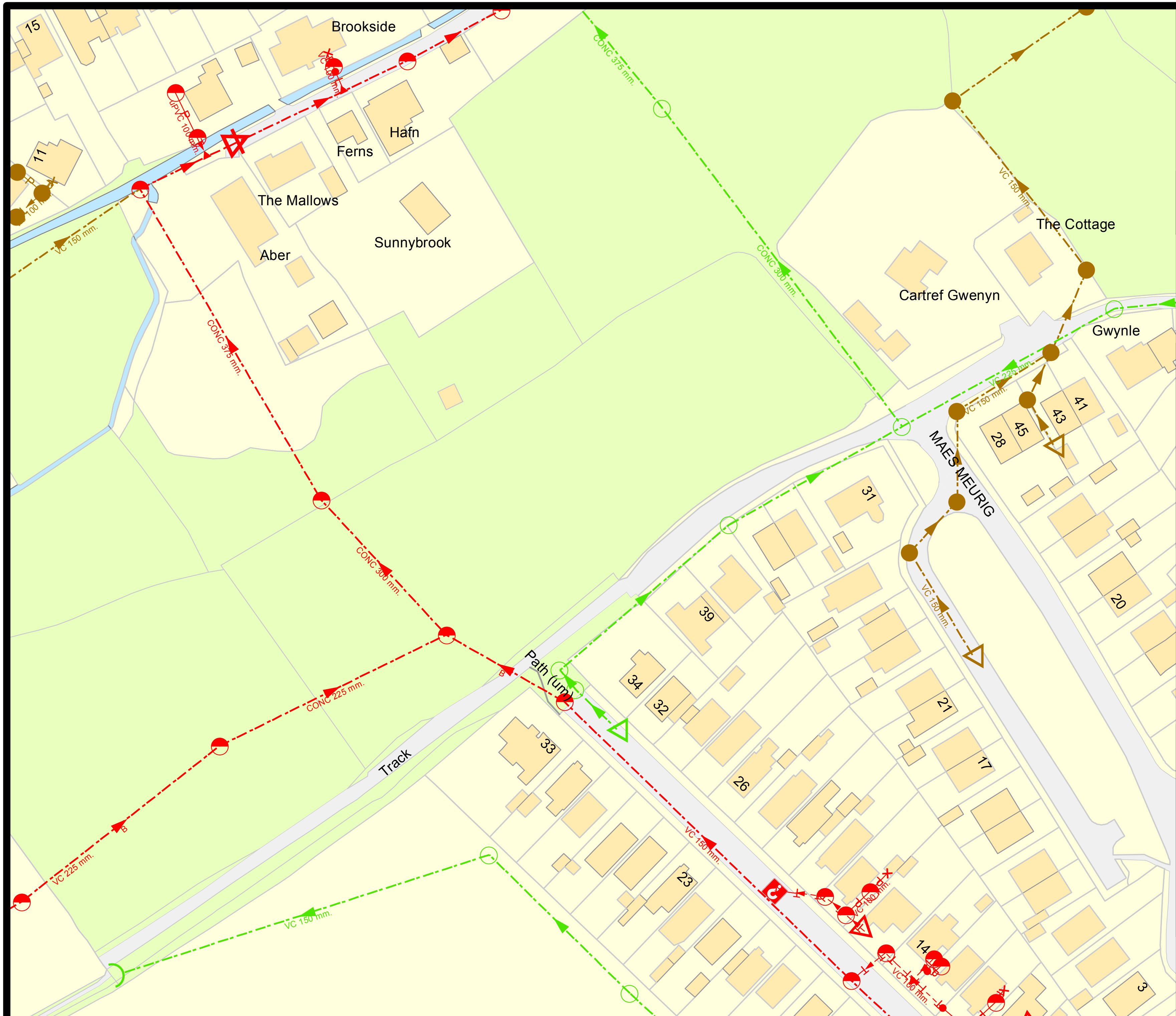
www.weetwood.net

Client
KINGSCROWN GROUP

Drawing Status: PRELIMINARY
Date: MAY 2023
Scale (A0): 1:200
Project: LAND OFF MAES MEURIG, MELIDEN
Drawn: DSH
Checked: TB
Project No: 5698
Title: PROPOSED PRELIMINARY DRAINAGE LAYOUT
Drawing No: 100
Revision: P1

APPENDIX J

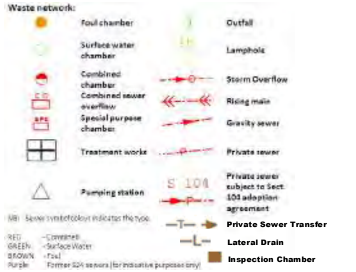
Dŵr Cymru Welsh Water Public Sewer Record



Dŵr Cymru
Welsh Water

PPA0007729 Public Sewer Record

LEGEND(Representative of most common features)



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

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

Map Ref:	305854,381057
Map scale:	1:1283
Printed by:	Jeremy Hackman
Printed on:	31 Mar 2023

APPENDIX K

Dŵr Cymru Welsh Water Pre-Planning Enquiry

Dŵr Cymru
Welsh Water

Developer Services
PO Box 3146
Cardiff
CF30 0EH

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

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

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

Mr Daniel Russell
Kingscrown Group
Suites 11
2nd Floor Prudential Buildings
61 St. Petersgate
Stockport
SK1 1DH

Date: 31/03/2023
Our Ref: PPA0007729

Dear Mr Russell,

Grid Ref: 305828 381062
Site Address: Land off Mares Meurig, Meliden
Development: Residential 35 dwellings

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

APPRAISAL

Firstly, we note that the proposal relates to 35 dwellings at land off Mares Meurig and acknowledge that the site is allocated within the Denbighshire LDP Housing Allocation (Rear of Maes Meurig 30 units) for 30 units. In reference to our representations during the LDP consultation process, namely the 'Statement of Common Ground', we can confirm that an assessment has been undertaken of the public sewerage and watermains systems to accommodate 30 units. Please note, however, this proposal comprises an increase to the LDP allocation and the following assessment takes account of an additional 5 units accordingly and informs our appraisal as follows.

Please note, notwithstanding the following assessment, we would advise there is also a mandatory requirement to undertake a pre-application consultation with all 'Specialist Consultees', including Dwr Cymru Welsh Water as the statutory water and sewerage undertaker, in accordance with Schedule 4 of Town & Country Planning (Development Management Procedure) (Wales) (Amendment) Order 2016. As a major development amounting to more than 10 units, you will be statutorily required to consult Welsh Water and a substantive response will be issued within 28 days from the date of the notice as per the requirements of Article 2E.

PUBLIC SEWERAGE NETWORK

The proposed development site is located in the immediate vicinity of a predominantly combined public sewerage system which drains to Llanana Wastewater Treatment Works (WwTW).

This site is crossed by public sewers with their approximate position being marked on the attached Statutory Public Sewer Record. In accordance with the Water Industry Act 1991, Dwr Cymru Welsh Water requires access to its apparatus at all times in order to carry out maintenance and repairs. However, having regard to the indicative site layout option 4 (C1009 007 B), it appears the proposed development would be situated within the protection zone of the public 225mm sewer measured 3 metres either side of the centreline. Our strong recommendation is that your site layout is amended to take 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. Alternatively, it may be possible to divert the sewer if the developer applies under Section 185 of the Water Industry Act albeit may prove unviable for the purposes of this development, given the size of the sewer, and therefore recommend the proposed development is repositioned to accommodate for the required protection zone.

In the first instance, it is recommended that the developer carry out a survey to ascertain the location of this sewer and establish its relationship to the proposed development. Further information regarding Asset Protection is provided in the attached Advice & Guidance note.

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

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. Please refer to further detailed advice relating to surface water management included in our attached Advice & Guidance note.

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

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 between manholes SJ05818001 and SJ05817001 located within the site boundary. Should a planning application be submitted for this development we will seek to control these points of communication via appropriate planning conditions and therefore recommend that any drainage layout or strategy submitted as part of your application takes this into account. However, should you wish for an alternative connection point to be considered please provide further information to us in the form of a drainage strategy, preferably in advance of a planning application being submitted.

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

SEWAGE TREATMENT

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

POTABLE WATER SUPPLY

The water supply system in the immediate vicinity has insufficient capacity to serve the development and will also cause detriment to existing customers' water supply. A hydraulic modelling assessment is required to establish the scope of any reinforcement works to be completed at the same time as the provision of new water mains to serve the new development under Section 41 and Section 51 of the Water Industry Act (1991).

Information relating to our Hydraulic Modelling Assessment process is available on our website and within our guidance notes. The area planning officer will also be able to provide you within information relating to this process.

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

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

Please quote our reference number in all communications and correspondence.

Yours faithfully,

Owain George
Planning Liaison Manager
Developer Services

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

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