

PROPOSED DEVELOPMENT

DRAINAGE STRATEGY REPORT & FLOOD STATEMENT

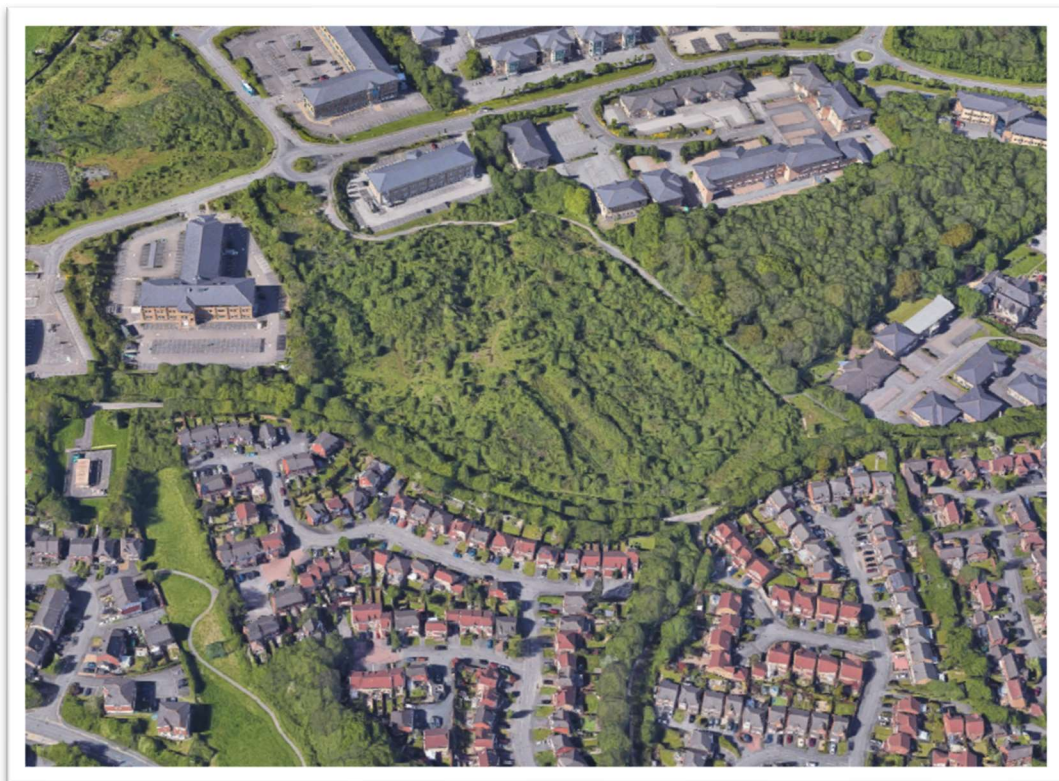
PLOT 12 - CARDIFF GATE BUSINESS PARK

LAND SOUTH OF MALTHOUSE AVENUE

PONTPRENNAU

CARDIFF

CF23 8BA



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Issue	Prepared by	Checked by	Date
D100	TDJ	DK	13/08/2021

1.0 Introduction

Shear Design Ltd has been instructed to prepare a sustainable drainage strategy report in respect of a potential mixed development at:

Plot 12 – Cardiff Gate Business Park

Land South of Malthouse Avenue

Pontprennau

Cardiff

CF23 8BA

This report has been prepared on behalf of Cardiff Gate Business Ltd and is intended to accompany a planning application for the development of circa 120 dwellings and 1,200m² commercial unit/s on the site and all associated infrastructure.

Schedule 3 to the Flood and Water Management Act 2010 & The Sustainable Drainage (Approval and Adoption Procedure) (Wales) Regulations 2018 require all proposed developments greater than 100m² or more than one unit to be approved by the local SuDS Approving Body (SAB) prior to construction. This report is also intended to supplement the formal SAB approval application for SABs officers, planning officers and other consultees to review.

This report will also consider the flood risk to the site in accordance with the requirements of Technical Advice Note 15 (TAN 15).

The site is located at National Grid Reference ST 21285 82770. A site location plan is included in [Appendix A](#).

2.0 Site Description & Topography

The development site is situated off Malthouse Avenue in an area of Cardiff Business Park, adjacent to Junction 30 of the M4 motorway. The site is bounded by Malthouse Avenue and Raglan House to the north, an embankment up to Peterson House to the west, St Mellon's Road to the south and the stream of Nant Pontprennau to the east. The site is highest in the north-western corner at a level of approximately 70.1mAOD, with the sites low point of 57.5mAOD 350m away in the south-eastern corner. This gives an approximate fall of 1in28 across the site. An historic topographical survey, dated 2010 is included in Appendix B.

The site has been recently cleared of overgrowth (circa winter 2019/2020) to allow for the reprofiling of the site to commence as well as further survey works. Historical mapping for the site has been reviewed from 1885 to 1953; the site is continuously a rural, non-developed setting with only a dwelling (possible farm house) labelled 'Pont-prennau'. The adjacent area was developed in the 1980's & 1990's providing both housing to the south as well as multiple office buildings & car dealerships, the latter, known as Cardiff Gate Business Park, opened circa 1998.

There are a series of manholes within the site, visible following the reprofiling works. Dŵr Cymru Welsh Water (DCWW) asset records show public sewers within the site boundary. It is understood these chambers are for a foul water sewer and the partial culverting of Nant Pontprennau (refer to sections 3.0, 4.1 & 4.3).

The total site area is approximately 4.40ha hectares of which circa 2.83ha is to be developed.

The proposed development will comprise of a new access formed off Malthouse Avenue, with a proposed 1200m² commercial unit to front onto Malthouse Avenue with a small car parking area to the rear. 120 residential units with associated drainage and other infrastructure.

Refer to [Appendix C](#) for an illustrative architectural layout Plan.

3.0 Flood Risk

The site is identified by NRW (Natural Resources Wales) within their development advice mapping as being entirely with Flood Zone A, an area not known to have flooded in the past and ‘*considered to be at little or no risk of fluvial or tidal/coastal flooding*’. A copy of the development advice map is included within [Appendix D](#). More detail mapping regarding specific flood sources has also been reviewed. Small segments of low to high-risk surface water flooding have been identified along the culverted course of the Nant Pontprennau; it is proposed that this section of culvert is removed, restoring the stream to the more natural state of an open watercourse to increase the streams capacity and reduce possible impacts of surface water flooding.

3.1 Flood and Water Management Act (2010) and Flood Risk Regulations (2009)

The Flood and Water Management Act of 2010 sets out what should be included in the National flood and coastal erosion risk management strategies for England and Wales as well as local flood risk management strategies. It responds to recent pressure to introduce legislation to address the threat of flooding and water scarcity, both of which are predicted to increase with climate change. The Flood Risk Regulations of 2009 set out the duties regarding producing preliminary flood risk assessments, flood hazard maps and flood risk maps and flood risk management plans. Both Act and Regulation place responsibility on the local authority as Lead Local Flood Authority (LLFA) to manage and lead local flooding issues.

3.2 Schedule 3 to the Flood and Water Management Act 2010 & The Sustainable Drainage (Approval and Adoption Procedure) (Wales) Regulations 2018

As part of the advancement in Sustainable Drainage Systems (SuDS) design, legislature was implemented on 7th January 2019 in Wales to enforce Schedule 3 of the Flood and Water Management Act 2010. This led to the establishment of SuDS Approval Bodies (SABs) for each LLFA. In the case of this development and under requirements of the above legislature, Cardiff Council would look to review and approve any surface water drainage design proposed for the development. Any SuDS proposed would need to conform to CIRA C753, ‘The SuDS Manual’ and any additional guidance or information provided by the LLFA. Any drainage design previously proposed to connect to a surface water Dŵr Cymru Welsh Water or Highway asset would now be

subject to a detailed application & formal approval process, prior to construction and/or communication of drainage flows from the development.

3.3 Technical Advice Note (TAN) 15

Planning Policy Wales sets out the land use planning policies of the Welsh Government and is supplemented by a series of Technical Advice Notes. Technical Advice Note (TAN) 15: Development and Flood Risk (2004) advises on development and flood risk, providing a framework within which risks arising from both river and coastal flooding, and from additional run-off from development in any location can be assessed. TAN 15 provides an indicative guidance as to what the frequency threshold could be for different types of development described in terms of annual probability of occurrence:

Table 1: Indicative Guidance of TAN15 Section A1.14 (*Targets for no flooding*)

Type of Development	Threshold Frequency (Years)	
	Fluvial	Tide
Residential	1%	0.5%
Commercial/Retail	1%	0.5%

3.4 Flood Mitigation Measures

Though the proposed site may not be inundated during a flood event, access to the property via local roads could be restricted. All future occupants of the property are recommended to follow all guidance provided by both NRW and the Environment Agency (EA). During extreme flood events the wider area surrounding the site may be affected by flooding. The flood water will rise at a relatively slow rate, and it is considered that the predicted flood scenario and peak flood conditions can be appropriately managed by the implementation of a number of mitigation measures which are identified as follows:

- Met Office Flood Warnings
- Residents/occupiers of the property are to sign up to Floodline (tel: 03459881188) and complete a NRW Personal Flood Plan (refer to Appendix F)
- With the time afforded by advance warning, an evacuation of the property to a safe egress point and the removal any valuables from the building can be implemented
- The predicted depths, rise, speed of inundation and velocities are likely to satisfy the TAN 15 suggested tolerable conditions for more extreme events.

- However, a well-walked means of safe access and egress from the site is likely to be afforded at all times prior to even partial flooding of the surrounding areas. It is crucial to that all occupants of the site be aware of this inherent risk, and the planned egress route.

3.5 Flood Warnings

Though the site is not predicted to be impacted by flooding the occupiers of the site are encouraged to sign up to the 'Floodline Warnings Direct' scheme so that they receive advanced warning of potential flooding and possible travel / access implications for the site. This can be done by telephoning the NRW/EA on 0845 988 1188. Current flood warnings enforced can also be viewed online on NRW's home page at <https://naturalresources.wales/>. Current Flood Warnings enforced by the EA can also be viewed on the EA web site (<https://flood-warning-information.service.gov.uk/warnings>). Both NRW & EA issue flood warnings using a four-stage system:-

1. Flood Alert
2. Flood Warning
3. Severe Flood Warning
4. Warnings No Longer in Force

Current meanings of these warnings refer to NRW online advice at <https://naturalresources.wales/flooding/flood-codes/?lang=en> (Ref [Appendix F](#)).

4.0 Drainage Strategy

4.1 Existing Foul Drainage

The Dŵr Cymru Welsh Water (DCWW) sewer records indicate that there are public foul sewers running north-south along the site's eastern boundary, parallel to Nant Pontprennau; a copy of the DCWW sewer record is included in [Appendix D](#).

4.2 Proposed Foul Drainage

Depending on final architectural layouts, it is assumed that a single foul connection to FHM16, ST21824702 be constructed for the whole development site, under a Section 106 of the Water Industry Act 1991 (WIA 1991) submitted to DCWW. Similarly depending on final quantity and size of dwelling units, the peak flow rates will be calculated allowing for a suitable sized and designed gravity fed foul water drainage system (to be adopted under a Section 104 Agreement of WIA 1991) to be constructed.

4.3 Existing Surface Water Drainage

There are no surface water sewers shown on DCWW's records within the site's redline planning boundary, but the watercourse of Nant Pontprennau is clearly shown and identified within the topographical survey provided and headwalls providing surface water drainage from other areas of Cardiff Gate are shown. Following a review of historic map tiles for the area, the watercourse appears to have been moved eastwards by approx. 100m and artificially straightened. Near to the south east corner of the site at a confluence point with another stream, the watercourse becomes culverted for approximately 75m before outfalling and continuing on as open watercourse south of Old St Mellon's Road.

4.4 Proposed Surface Water Drainage

In line with Statutory standards for SuDS Wales, 2018 discharging of surface water runoff should conform to the following hierarchy as detailed in Standard 1 (S1):

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

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

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

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

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

4.4.1 Assessment of Proposed Discharge Location:

Priority Level 1: Surface water runoff is collected for use; Due to the small roof areas proposed for residential dwellings, the reuse of water through rain water harvesting as a potable source (flushing of toilets etc) is not deemed appropriate. However, elements regarding the use of SuDS planters and/or water butts will allow for the reuse of rainwater and should enable natural irrigation of green landscaping.

Priority Level 2: Surface water runoff is infiltrated to ground; Based upon previous ground investigation works and local area knowledge, it is anticipated that the soils within the site will not be accepting of infiltration flows. The adjacent watercourse also indicates a possible high-water table. Testing to BRE Digest 365 is recommended to confirm the assumption that the site is impervious.

Priority Level 3: Surface water runoff is discharged to a surface water body; It is proposed to form a new headwall into the adjacent Nant Pontprennau and discharge any surface water flows at an attenuated rate into the stream.

Priority Level 4: Surface water runoff is discharged to a surface water sewer, highway drain, or another drainage system; No Dŵr Cymru Welsh Water surface water sewers or highway culverts (other than the partial culverted Nant Pontprennau watercourse) are known to exist on the development site.

Priority Level 5: Surface water runoff is discharged to a combined sewer; No combined water sewers are known to exist within the development site.

4.4.2 Proposed Surface Water Strategy

It is proposed that surface water runoff from proposed carriageways and footways is to be collected and conveyed into a swale/ditch running north-south near to the eastern boundary. It is intended that this will discharge into a detention basin, providing the majority of attenuation for the site. The swale is proposed along the eastern boundary to provide both shallow conveyance of runoff and as a cutoff drain to the site boundary. To aid future maintenance arrangements and conveyancing, a private geocellular attenuation tank will be proposed beneath the small car park of the commercial unit with a flow control limiting discharge to the swale and basin to <2.0l/s. Treatment of runoff from the commercial unit will be achieved by feeding into the SuDS features downstream. A series of rain-gardens are also proposed to the back of footways and intended to be included within areas of highway to be offered for adoption by Cardiff Council. Larger forebays are proposed near outlets and at the assumed low points to provide further treatment and access for maintenance. Runoff from proposed highways will be achieved through a combination of kerb drainage units with pop-outs placed at suitable points and castellated kerbs. The inclusion of rain-gardens and a large swale to receive the majority of all highway runoff, significantly improves water quality through a reduction of pollutants; refer to Section 4.5.

Surface water discharge from the development will be limited to 4.31l/s/ha as agreed with Cardiff Council SAB on adjacent development sites within the Business Park. This results in a peak flow rate of 12.2l/s (restricted via a vortex flow control) for all critical storm events up to (and including) the 1 in 100 year + 40% climate change provision. A drawing illustrating our proposal is included in [Appendix E](#) which will be presented to Cardiff Council under a SABS pre-application process and will

be suitably amended following any future discussions or receipt of formal comments. Under Cardiff Council’s role as SAB and LLFA, SuDS features such as the rain-gardens, swale and basin proposed will be offered for adoption and future maintenance completed by Cardiff Council.

4.5 Pollution Prevention

4.5.1 Water Quality Management Criteria

The surface water drainage network serving the proposed development consists of various SuDS features to ensure that where possible, all impermeable catchments are drained via SuDS features that improve the water quality of the run-off and mitigate the risk of polluting the downstream network. The criteria noted in this technical note is based on the requirements set out in Chapter 4 and 26 of CIRIA Report 753, *The SuDS Manual*.

Table 1 below sets out the minimum water quality management requirements for discharges to receiving surface waters.

Table 1: Minimum water quality management

Land Use	Pollution Hazard Levels	Requirements for discharge to surface waters
Residential roofs	Low	Simple index approach
Individual driveway, cul de sacs & access road	Low	Simple index approach

Based on the site-specific land use noted in Table 1, Table 2 sets out the pollution hazard indices for the different land uses. The indices range from 0 (no pollution hazard for this contaminant type) to 1 (high pollution hazard for this contaminant type).

Table 2: Pollution hazard indices for different land use classifications

Land Use	Pollution Hazard Levels	Total suspended solids (TSS)	Metals	Hydrocarbons
Other roofs (typically commercial/industrial roofs)	Low	0.3	0.2	0.05
Residential roofs	Low	0.2	0.2	0.05
Individual driveway, cul de sacs & access road	Low	0.5	0.4	0.4

4.5.2 Water Quality Treatment Strategy

The water quality treatment strategy is based on the simple index approach noted in The SuDS Manual. To ensure that the SuDS features deliver adequate treatment, features should have a total pollution mitigation index for each contaminant type that equals or exceeds the pollution hazard index for that contaminant type. The site-specific SuDS features for this development include:

- Bio-retention system (rain-garden)
- Swale / Conveyance ditch
- Detention Basin

Table 3: Mitigation indices for each SuDS feature against the pollution hazard indices.

Residential Development					
	Pollution Hazard Indices (minimum)	Mitigation indices			Total Index
		Rain-garden (bio-retention system)	Swales	Detention Basin	= $x_1 + 0.5(x_2)$
Residential Roof:					
Total suspended solids (TSS)	0.2	0.8	0.5	0.5	1.30
Metals	0.2	0.8	0.6	0.5	1.35
Hydrocarbons	0.05	0.8	0.6	0.6	1.40
Other roofs (typically commercial/industrial roofs):					
Total suspended solids (TSS)	0.3	0.8	0.5	0.5	1.30
Metals	0.2	0.8	0.6	0.5	1.35
Hydrocarbons	0.05	0.8	0.6	0.6	1.40
Individual property driveways, cul de sacs & general access roads:					
Total suspended solids (TSS)	0.5	0.8	0.5	0.5	1.30
Metals	0.4	0.8	0.6	0.5	1.35
Hydrocarbons	0.4	0.8	0.6	0.6	1.40

The indices in Table 3 above illustrate that the proposed SuDS features exceed the minimum requirements noted in Table 2 to improve the water quality of the run-off and to mitigate the risk of polluting the downstream network.

4.5.3 Surface Water & SuDS Operation and Maintenance Strategy

4.5.3.1 Drainage Features

The following table describes the proposed drainage features that form part of the wider drainage network and the maintenance requirements for each feature.

Drainage Feature	Purpose and function	Maintenance
Private drains	Convey run-off	Inspection via CCTV survey to check for blockages
Linear drainage and gullies	Convey run-off and intercept run-off	Inspection of sump sediment level via grating
Geocellular Attenuation Tank i. Storage Crates ii. Catchpit & inlet iii. Vent pipe iv. Overflow pipe Outlet (see Flow Control Chamber below)	Storage of peak flows (where discharge rates are restricted) during a critical storm event	1. Inspection for blockages/debris 2. Inspection for build-up of sediments and debris around inlets, outlets vents and overflows to ensure that they are in good condition and operating as designed 3. Removal of debris from the catchment surface 4. Removal of silt & debris from catchpit sump Survey of inside of tank for sediment build-up and remove if necessary.
Swale	Convey and intercept run-off	Visual inspection for blockages/debris, vegetation condition and inlet/outlet pipe blockages
Detention Basin	Covey and attenuate runoff from upstream sources	Inspection for litter/debris, sediment build-up, vegetation condition and inlet/outlet pipe blockages.
Bio-retention system (including rain gardens and tree pits)	Convey and intercept run-off from roofs and paved areas	Inspection for litter/sediment build-up, adequate infiltration, vegetation condition and inlet/outlet pipe blockages.
Flow control chamber	Restrict the peak surface water discharge to a managed rate	Visual inspection of inlet sump for sediment build-up, flow control device (keep bypass gate closed) and opening clear, downstream pipework clear.

In addition to the ongoing maintenance of the drainage features, structural inspection will also be required to monitor the structural integrity of the chambers, whilst also ensuring that, where used, any step irons and safety features are firmly fixed.

4.5.3.2 Operation and Maintenance Strategy for the drainage network and associated features

The following table sets out the maintenance schedule, actions and frequency for the maintenance of the drainage features noted in Section 4.5.3.1.

Maintenance Schedule	Action Required	Frequency (typical)
Regular inspections & monitoring	Inspect bioretention system infiltration surfaces for silting and ponding, record de-watering time of the facility and assess standing water levels in underdrain (if appropriate) to determine maintenance is necessary.	Quarterly
	Check operation of underdrains on bioretention systems by inspection of flows after rain	Annually
	Assess plants for disease infection, poor growth, invasive species etc and replace as necessary	Quarterly
	Inspect bioretention system inlets and outlets for blockage	Quarterly
	Inspect/check all inlets, outlet, pipes, and vents to ensure that they are in good condition and operating as designed	As required
	Carry out remote survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required
	Inspect silt accumulation rates and establish appropriate maintenance frequencies	Annually
	Monitor inspection chambers, manholes and catchpits	Annually
Regular Maintenance	Remove litter, debris and weeds from catchment surface	Monthly
	Cleaning – Brush regularly and remove sweepings from hard surfaces.	Monthly
	Inspect inlet catchpits and assess general condition and possible build-up of silt, litter or debris and remove where required	Monthly for 3 months, then annually
	Check mechanical devices (flow control device and non-return valve)	Half yearly
	Removal of silt, litter or debris from catchpit sump and flow control chamber	Annually, or as required
	Removal of silt, litter or debris build-up from bioretention system inlets or forebays	Quarterly to biannually
	Check and clear sediments from reverse action interceptor via rodding arm.	Annually, or as required
	Cut grass to retain height within swale and manage other vegetation and remove nuisance plants. Inspect vegetation coverage.	Monthly (during growing season) or as required
	Inspect swale inlets and outlets for blockages and clear if required	Monthly
Occasional Maintenance	Replace any plants to maintain planting density in bioretention system	As required
	Infill any holes or scour in bioretention system filter medium, improve erosion protection if required	As required
	Repair minor accumulations of silt in bioretention system by raking away surface mulch, scarifying surface of medium and replacing mulch	As required
	Reseed areas of poor vegetation growth and alter plant types to better suit conditions, if required, for swale.	As required or if bare soil is exposed over 10% or more of the

		treatment area
Remedial actions	Repair/jet/rehabilitate inlet, outlets, overflows, reverse action interceptor, flow control chamber and vents	As required
	Repair swale erosion or other damage by re-turning or reseeded	As required
	Relevel uneven surfaces and reinstate design levels	As required
	Remove build-up of sediment from base and remove and dispose of oils or petrol residues using safe standard practices	As required
	Remove and replace bioretention system filter medium and vegetation above	As required but likely to be > 20 years

Maintenance and inspection of all drainage apparatus should be conducted in accordance with the manufacturer’s guidance. On completion of the construction phase, the relevant operation and maintenance information should be provided in the relevant Health and Safety File and Operation and Maintenance manual. Operation, maintenance and inspections should be carried out by suitably qualified operatives.

5.0 Summary

The proposed developed site is in Flood Zone A and is considered to be at low risk of flooding from tidal and fluvial sources. Based upon a review of flooding from other sources and the following the anticipated restoration of Nant Pontprennau as an open watercourse, the site will not be adversely at risk of flooding and the development could proceed in full compliance with the requirements of TAN 15.

Proposed foul water shall connect to the foul sewer in the development site, with peak flows and capacity to be confirmed and agreed with DCWW following finalising of architectural concept plans.

Historic surface water infiltration information and results shown poor acceptance and it is recommended that site testing to BRE digest 365 be undertaken to confirm this. On site, the design includes use of rain-gardens, an engineered swale and detention basin to ensure the surface water design standards meet the SAB requirements for water re-use, water discharge control, interception for retention and water quality requirements in line with CIRIA Report 753, *The SUDS Manual* and Welsh Government Statutory Standards for Sustainable Drainage Design. Total site surface water discharge to the Nant Pontprennau and will be restricted to an agreed rate with Cardiff Council SAB as well as any works to the existing culverted watercourse; subject to Ordinary Watercourse Land Drainage Consent.

Report prepared by: -
ON BEHALF OF SHEAR DESIGN LTD



**THOMAS JAYNE
CIVIL ENGINEER**

Approved by: -
ON BEHALF OF SHEAR DESIGN LTD



**DAMEON KILGOUR
ASSOCIATE
CIVIL ENGINEER**

APPENDIX

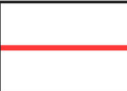


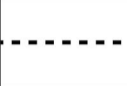
A) SITE LOCATION PLAN

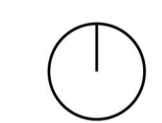
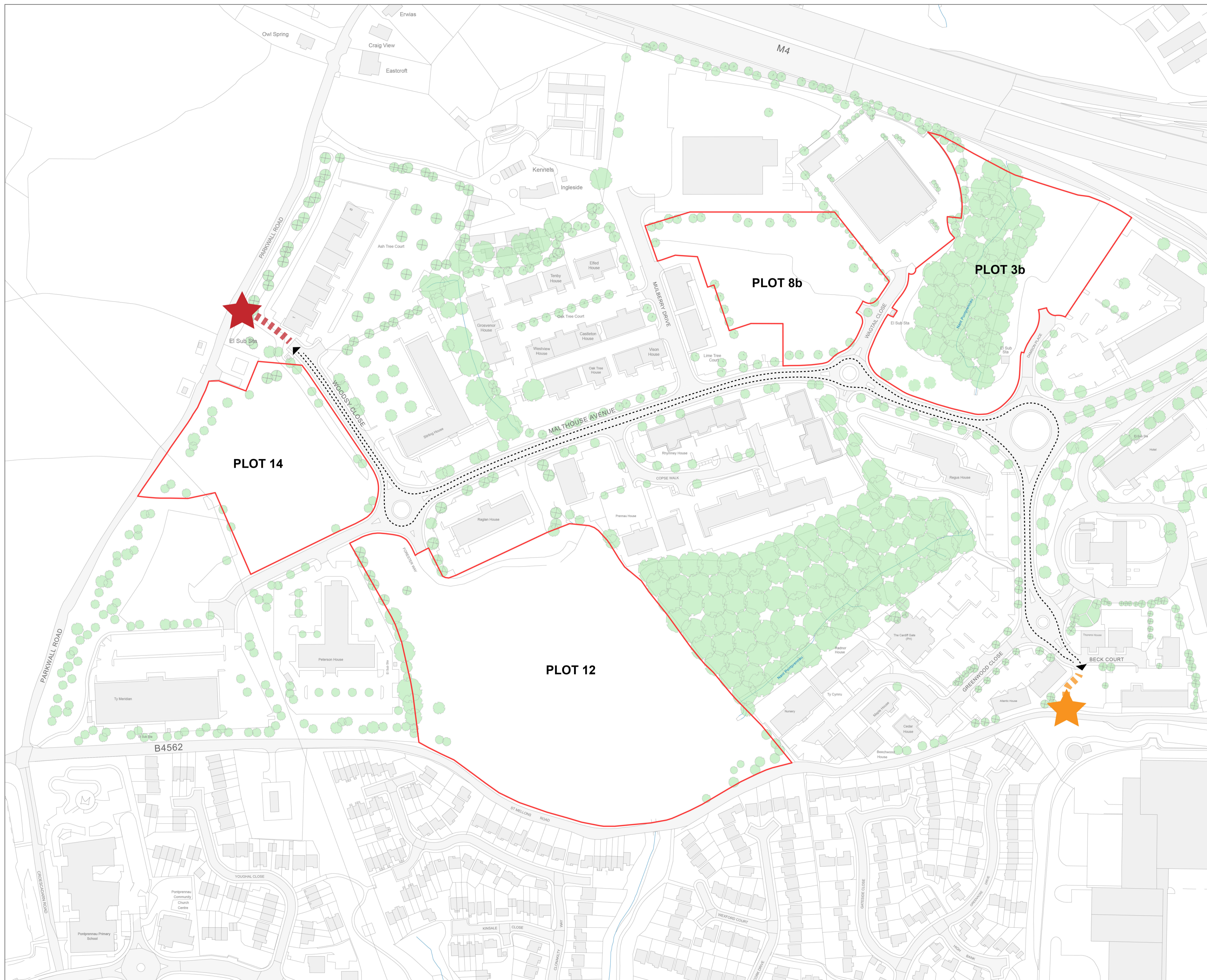


CARDIFF GATE PLOT 12 LOCATION PLAN – NEAREST POSTCODE = CF23 8XH

The scaling of this drawing cannot be assured

Revision	Date	Drn	Ckd
B - Site boundary updated	26.05.20	GR	GR

-  **Site Boundary**
- Plot 8b: Full proposal for a car showroom.**
- Plot 12: Outline proposal for residential development. Approximately 150 dwellings.**
- Plot 14: Full proposal for a Welsh Ambulance Service Facility (pink area); and Outline proposal for mixed-use development.**
-  **Full proposal for a bus connection.**
-  **Full proposal for bus egress through Becks Court.**
- Plot 3b: Rationalisation of unmanaged woodland area to enable development and secure landscape management**
-  **Bus route connecting proposed new accesses**



PROJECT
Cardiff Gate

DRAWING TITLE
Site Plan

DATE 30.04.20	SCALE 1:1250@A1	DRAWN BY GR	CHECK BY GR
PROJECT NO 21674	DRAWING NO 9020	REVISION B	

DRAFT

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 Heritage • Graphic Communication •
 Communications & Engagement • Development Economics

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APPENDIX

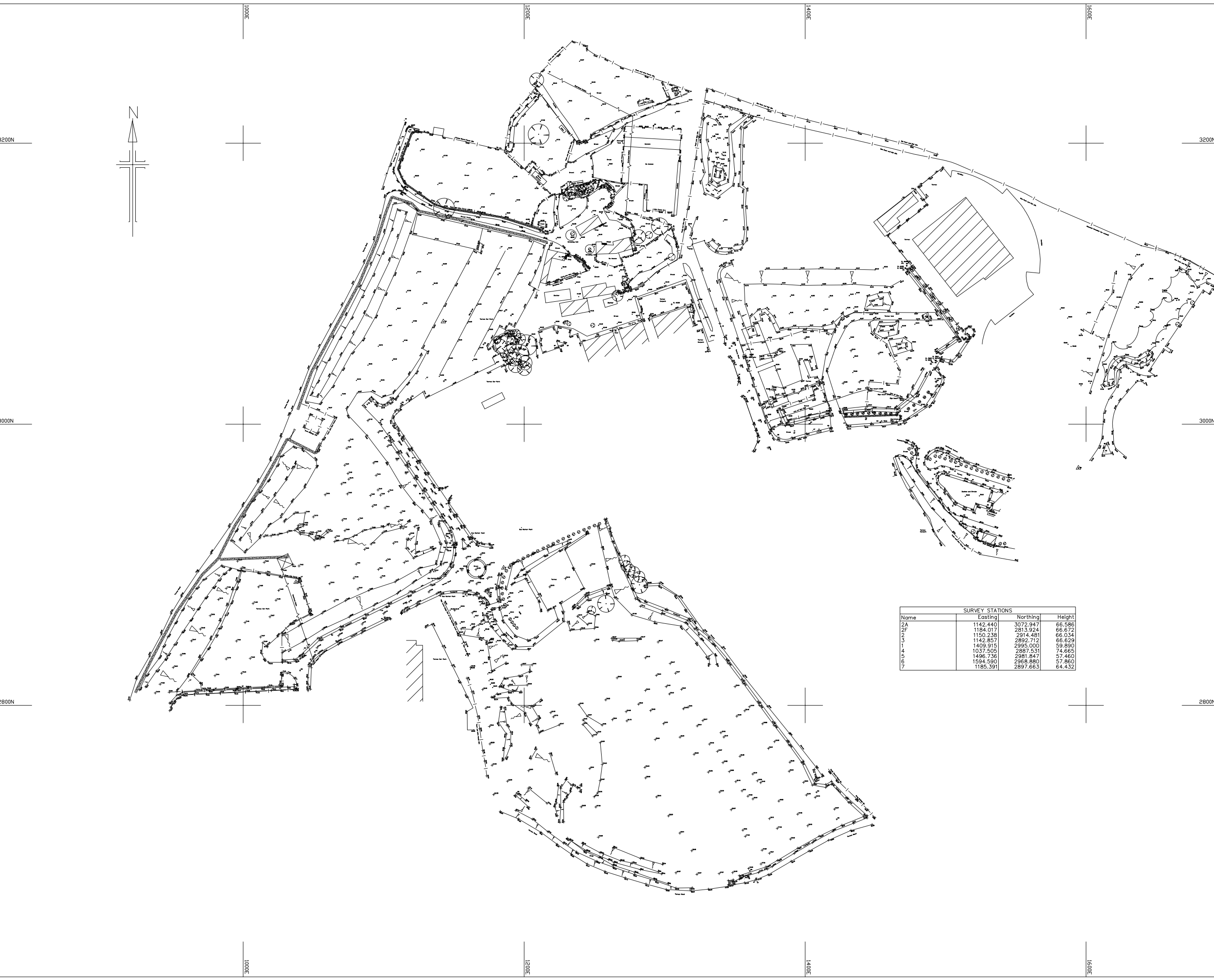
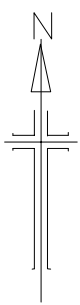
B) TOPOGRAPHICAL SURVEY

Survey by:
 Hywel John Surveys
 Enterprise House
 126/7 Bute Street
 Cardiff CF10 5LE
 Tel: 02920 488006
 Fax: 02920 480195
 email: Hywel@hyweljohnsurveys.co.uk
 www.hyweljohnsurveys.co.uk

ABBREVIATIONS

MH: Manhole	IC: Inspection Cover
GY: Road Gully	ST: Stop Tap
FH: Fire Hydrant	TP: Telephone Pole
LP: Lamp Post	SV: Stop Valve
RW: Retaining Wall	PW: Post & Wire Fence
BW: Barbed Wire Fence	MR: Marker
PR: Post & Rail Fence	LF: Lap Fence
BT: British Telecom	WM: Water Meter
EP: Electricity Pole	GV: Gas Valve
BD: Bollard	RS: Road Sign
SP: Sign Post	IR: Iron Railings
FL: Floor Level	RL: Ridge Level
	EL: Eaves Level

TOPOGRAPHICAL SURVEY
 LEVELS RELATED TO SIR ROBERT MCALPINE SURV



SURVEY STATIONS			
Name	Easting	Northing	Height
2A	1142.440	3072.947	66.586
2F	1184.017	2813.924	66.672
2	1150.238	2914.481	66.034
3	1142.857	2892.712	66.629
1	1409.915	2995.000	59.890
4	1037.505	2887.531	74.665
5	1496.736	2981.847	57.460
6	1594.590	2968.880	57.860
7	1185.391	2897.663	64.432

N	05/12/10	Survey detail added next to HBD site	
M	29/09/10	Spot levels on top of heap next to Mercedes	
L	16/08/10	Fence/Building added around Lloyds Building	
K	15/06/10	Kerb/Building added to Allt site	JRV
J	07/05/10	Boundary updated to North	JRV
I	25/01/10	Plot 8 resurveyed	JRV
H	23/02/07	Trial pit survey at Boyes Rees office	JRV
G	20/02/07	Added survey of Regents House to East	JRV
F	06/02/07	Added survey of Kennels to North	JRV
E	05/01/07	Spot Levels added on Plot 12 using Stations 2, 2A & 2F	JRV
D	09/12/06	Location of underground gas pipe	JRV
C	08/12/06	Gas marker posts added	JRV
A	27/10/06	Updated Southern levels	JRV

Issue	Date	Remarks	Checked

Client
 SHEAR DESIGN
 Cedar House
 Greenwood Close
 Cardiff Gate
 CF23 8RD

Project
 Cardiff Gate Business Park

Title
 TOPOGRAPHICAL SURVEY

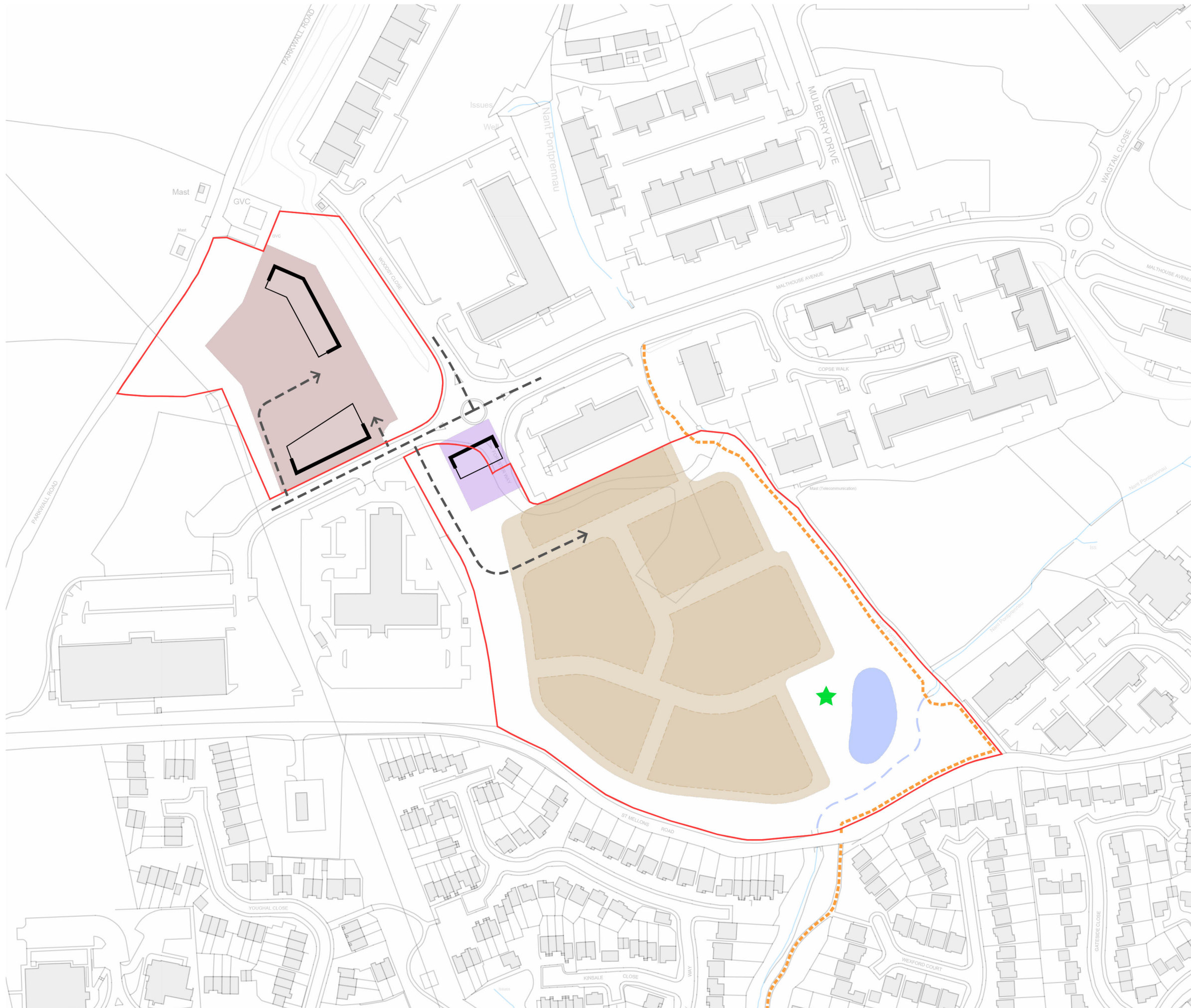
Drawn	Date	Checked	Date
HJ	13/05/06		

Scale
 1:1250

Drawing Number
 37/06/HJ

APPENDIX

C) PROPOSED SITE LAYOUT



The scaling of this drawing cannot be assured

Revision	Date	Drn	Ckd
B - Areas Update	09/06/21	GR	-



- Site Boundary
- Mixed Area = ~0.71ha
- Commercial Area = ~0.12ha
- Residential Area = ~2.36ha

Project
Cardiff Gate

Drawing Title
Plot-12 Plot-14 Concept Plan

Date 05.06.20	Scale 1:2000@A3	Drawn by GR	Check by -
Project No 21047	Drawing No 9300	Revision B	

DRAFT WILLMORE
 Town Planning • Master Planning & Urban Design • Architecture •
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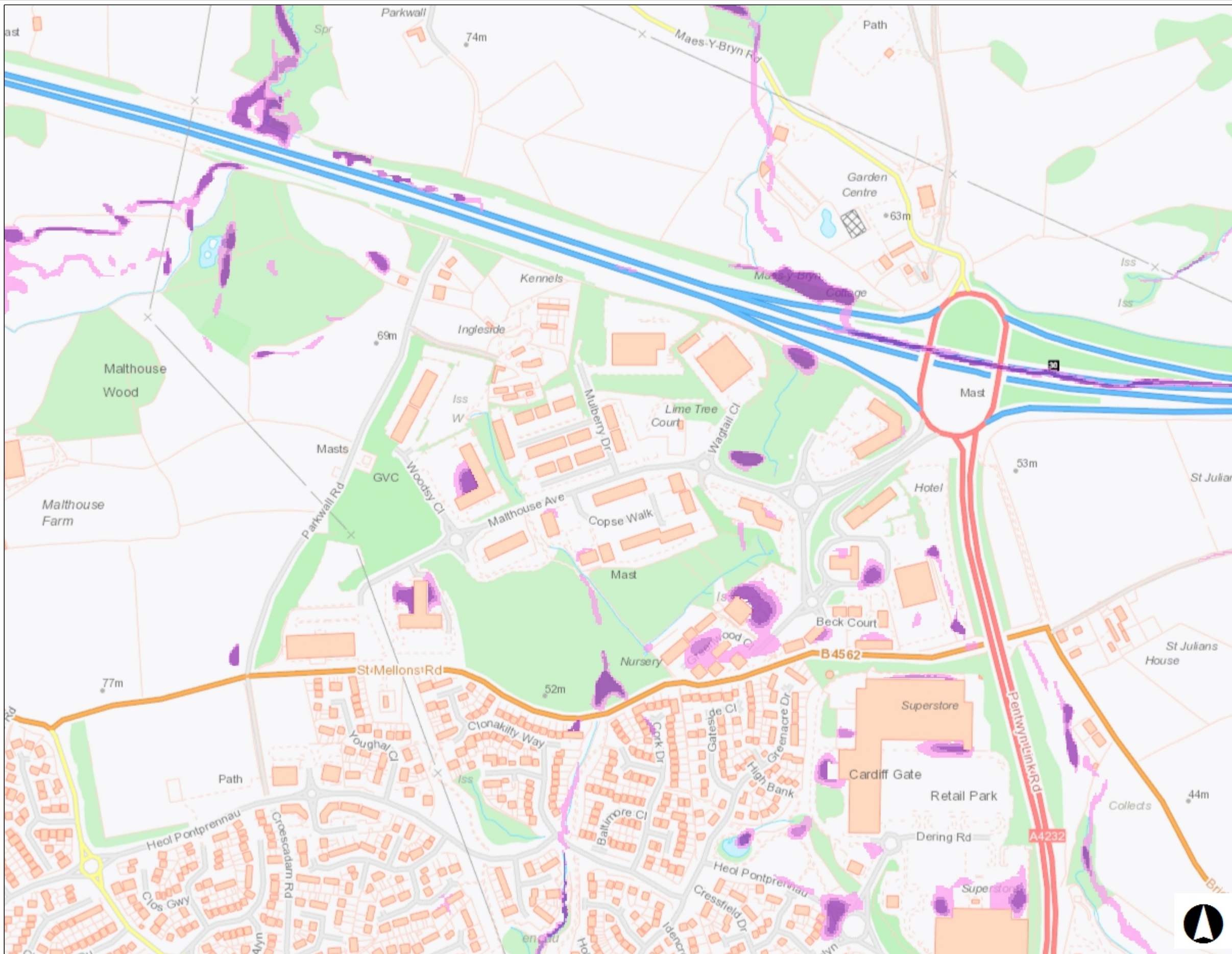
APPENDIX

D) NRW FLOOD MAPPING AND DCWW SEWER RECORDS

**Map Perygl Llifogydd / Flood Risk Map -
Plot 12 Cardiff Gate Business Park**

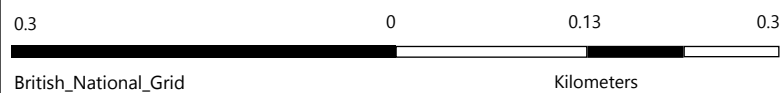
Allwedd / Map Key

- Risk Level Under Review
- Flood Risk from Rivers - Extent
 - High
 - Medium
 - Low
- Flood Risk from the Sea
 - High
 - Medium
 - Low
- Flood Risk from Surface Water & Small Watercourses - Extent
 - High
 - Medium
 - Low



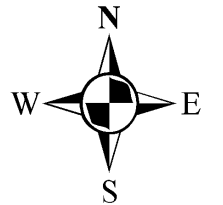
Graddfa / Scale at A3 1:5,000

Dyddiad / Date
03/08/2021






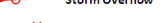

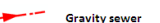



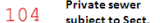

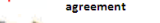











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PPA0000870



LEGEND(Representative of most common features)

	Foul chamber		Outfall
	Surface water chamber		Lamphole
	Combined chamber		Storm Overflow
	Combined sewer overflow		Rising main
	Special purpose chamber		Gravity sewer
	Treatment works		Private sewer
	Pumping station		Private sewer subject to Sect. 104 adoption agreement
	NB: Sewer symbol colour indicates the type.		S 104
	RED - Combined		Private Sewer Transfer
	GREEN - Surface Water		Lateral Drain
	BROWN - Foul		Inspection Chamber
	Purple - Former S24 sewers (for indicative purposes only)		

Notes:

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

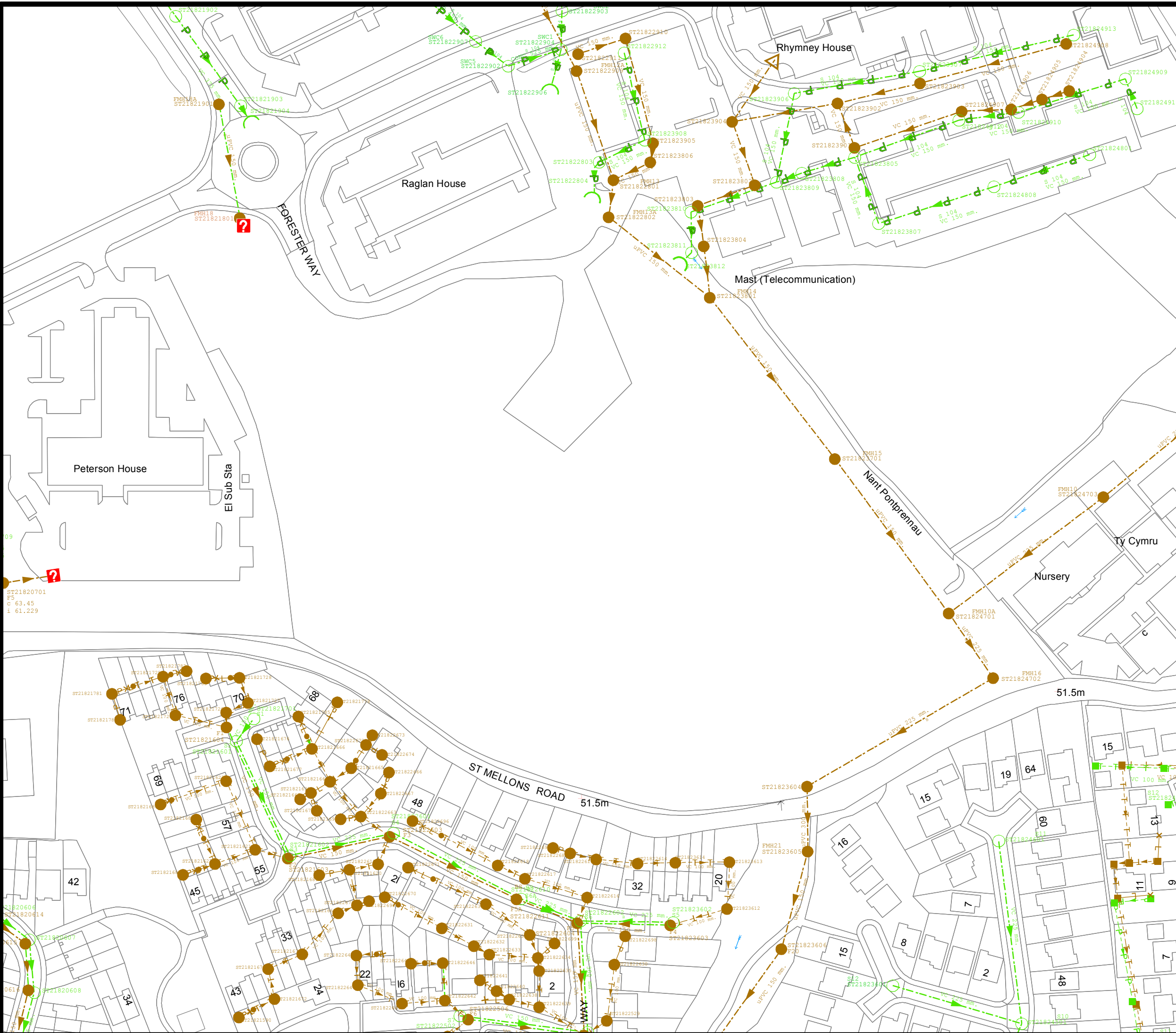
Dŵr Cymru Cyf gives this information as to the position of its underground apparatus by way of general guidance only on the strict understanding that it is based on the best information available and no warranty as to its correctness is relied upon in the event of excavations or other works made in the vicinity of the Company's apparatus and any onus of locating the apparatus before carrying out any excavations rests entirely on you. It must be understood that the furnishing of the information is entirely without prejudice to the provision of the New Roads and Streetworks Act 1991 and of the Company's right to be compensated for any damage to its apparatus.

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

EXACT LOCATIONS OF ALL APPARATUS TO BE DETERMINED ON SITE.

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Map Ref: 321283 182771
 Map scale: 1:1,250
 Printed by: bg
 Printed on: 12th March 2015



APPENDIX

E) ILLUSTRATIVE DRAINAGE LAYOUT AND CALCULATIONS

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
15 min Summer	46.279	0.579	12.2	684.4	O K
30 min Summer	46.468	0.768	12.2	962.5	O K
60 min Summer	46.668	0.968	12.2	1287.6	O K
120 min Summer	46.865	1.165	12.2	1642.6	O K
180 min Summer	46.969	1.269	12.2	1842.8	O K
240 min Summer	47.037	1.337	12.3	1979.2	O K
360 min Summer	47.129	1.429	12.7	2172.4	O K
480 min Summer	47.188	1.488	12.9	2298.8	O K
600 min Summer	47.227	1.527	13.0	2386.3	Flood Risk
720 min Summer	47.255	1.555	13.1	2447.7	Flood Risk
960 min Summer	47.288	1.588	13.3	2518.8	Flood Risk
1440 min Summer	47.298	1.598	13.3	2542.3	Flood Risk
2160 min Summer	47.271	1.571	13.2	2481.0	Flood Risk
2880 min Summer	47.244	1.544	13.1	2423.0	Flood Risk
4320 min Summer	47.202	1.502	13.0	2329.2	Flood Risk
5760 min Summer	47.157	1.457	12.8	2231.8	O K
7200 min Summer	47.110	1.410	12.6	2131.4	O K
8640 min Summer	47.062	1.362	12.4	2031.5	O K
10080 min Summer	47.014	1.314	12.3	1932.7	O K
15 min Winter	46.279	0.579	12.2	684.4	O K
30 min Winter	46.468	0.768	12.2	963.0	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
15 min Summer	113.212	0.0	701.3	25
30 min Summer	79.743	0.0	988.1	39
60 min Summer	53.779	0.0	1331.9	68
120 min Summer	34.885	0.0	1729.4	128
180 min Summer	26.524	0.0	1950.5	188
240 min Summer	21.706	0.0	1955.2	248
360 min Summer	16.359	0.0	1961.9	366
480 min Summer	13.354	0.0	1976.9	486
600 min Summer	11.395	0.0	1999.3	606
720 min Summer	10.002	0.0	2029.1	726
960 min Summer	8.130	0.0	2077.2	964
1440 min Summer	6.053	0.0	2121.2	1440
2160 min Summer	4.491	0.0	4006.8	1796
2880 min Summer	3.628	0.0	3996.2	2168
4320 min Summer	2.693	0.0	3810.9	2988
5760 min Summer	2.181	0.0	5189.3	3808
7200 min Summer	1.853	0.0	5514.2	4680
8640 min Summer	1.624	0.0	5795.2	5456
10080 min Summer	1.453	0.0	6052.0	6344
15 min Winter	113.212	0.0	701.2	24
30 min Winter	79.743	0.0	987.7	38

7 Ashtree Court
 Woodsy Close
 Cardiff Gate Business Park



Date 13/08/2021 09:30
 File BASIN SIZE - 1.546M AT ...

Designed by TDJth
 Checked by


Innovyze

Source Control 2020.1

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

Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m ³)	Status
60 min Winter	46.669	0.969	12.2	1288.8	O K
120 min Winter	46.866	1.166	12.2	1644.8	O K
180 min Winter	46.971	1.271	12.2	1846.5	O K
240 min Winter	47.039	1.339	12.3	1984.0	O K
360 min Winter	47.132	1.432	12.7	2179.5	O K
480 min Winter	47.192	1.492	12.9	2308.9	O K
600 min Winter	47.233	1.533	13.1	2399.5	Flood Risk
720 min Winter	47.263	1.563	13.2	2464.2	Flood Risk
960 min Winter	47.299	1.599	13.3	2543.2	Flood Risk
1440 min Winter	47.318	1.618	13.4	2586.3	Flood Risk
2160 min Winter	47.288	1.588	13.3	2520.0	Flood Risk
2880 min Winter	47.248	1.548	13.1	2432.4	Flood Risk
4320 min Winter	47.184	1.484	12.9	2291.3	O K
5760 min Winter	47.109	1.409	12.6	2130.5	O K
7200 min Winter	47.029	1.329	12.3	1964.3	O K
8640 min Winter	46.947	1.247	12.2	1800.7	O K
10080 min Winter	46.865	1.165	12.2	1641.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m ³)	Discharge Volume (m ³)	Time-Peak (mins)
60 min Winter	53.779	0.0	1332.6	68
120 min Winter	34.885	0.0	1729.4	126
180 min Winter	26.524	0.0	1948.5	184
240 min Winter	21.706	0.0	1952.5	244
360 min Winter	16.359	0.0	1958.0	360
480 min Winter	13.354	0.0	1971.9	478
600 min Winter	11.395	0.0	1993.4	594
720 min Winter	10.002	0.0	2022.2	710
960 min Winter	8.130	0.0	2067.1	938
1440 min Winter	6.053	0.0	2103.4	1384
2160 min Winter	4.491	0.0	4006.4	1988
2880 min Winter	3.628	0.0	3985.2	2252
4320 min Winter	2.693	0.0	3813.4	3200
5760 min Winter	2.181	0.0	5190.8	4096
7200 min Winter	1.853	0.0	5510.2	4976
8640 min Winter	1.624	0.0	5795.6	5880
10080 min Winter	1.453	0.0	6055.4	6760

Shear Design Ltd		Page 3
7 Ashtree Court Woodsy Close Cardiff Gate Business Park		
Date 13/08/2021 09:30 File BASIN SIZE - 1.546M AT ...	Designed by TDJth Checked by	
Innovyze		Source Control 2020.1


Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	19.000	Shortest Storm (mins)	15
Ratio R	0.266	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 2.479

Time (mins) Area			Time (mins) Area			Time (mins) Area		
From:	To:	(ha)	From:	To:	(ha)	From:	To:	(ha)
0	4	0.290	4	8	2.030	8	12	0.159

Shear Design Ltd		Page 4
7 Ashtree Court Woodsy Close Cardiff Gate Business Park		
Date 13/08/2021 09:30 File BASIN SIZE - 1.546M AT ...	Designed by TDJth Checked by	
Innovyze	Source Control 2020.1	

Model Details

Storage is Online Cover Level (m) 47.500

Tank or Pond Structure

Invert Level (m) 45.700

Depth (m)	Area (m ²)	Depth (m)	Area (m ²)
0.000	982.0	1.500	2200.0

Hydro-Brake® Optimum Outflow Control

Unit Reference	MD-SHE-0152-1220-1500-1220
Design Head (m)	1.500
Design Flow (l/s)	12.2
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	152
Invert Level (m)	45.500
Minimum Outlet Pipe Diameter (mm)	225
Suggested Manhole Diameter (mm)	1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.500	12.2
Flush-Flo™	0.440	12.2
Kick-Flo®	0.944	9.8
Mean Flow over Head Range	-	10.6

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

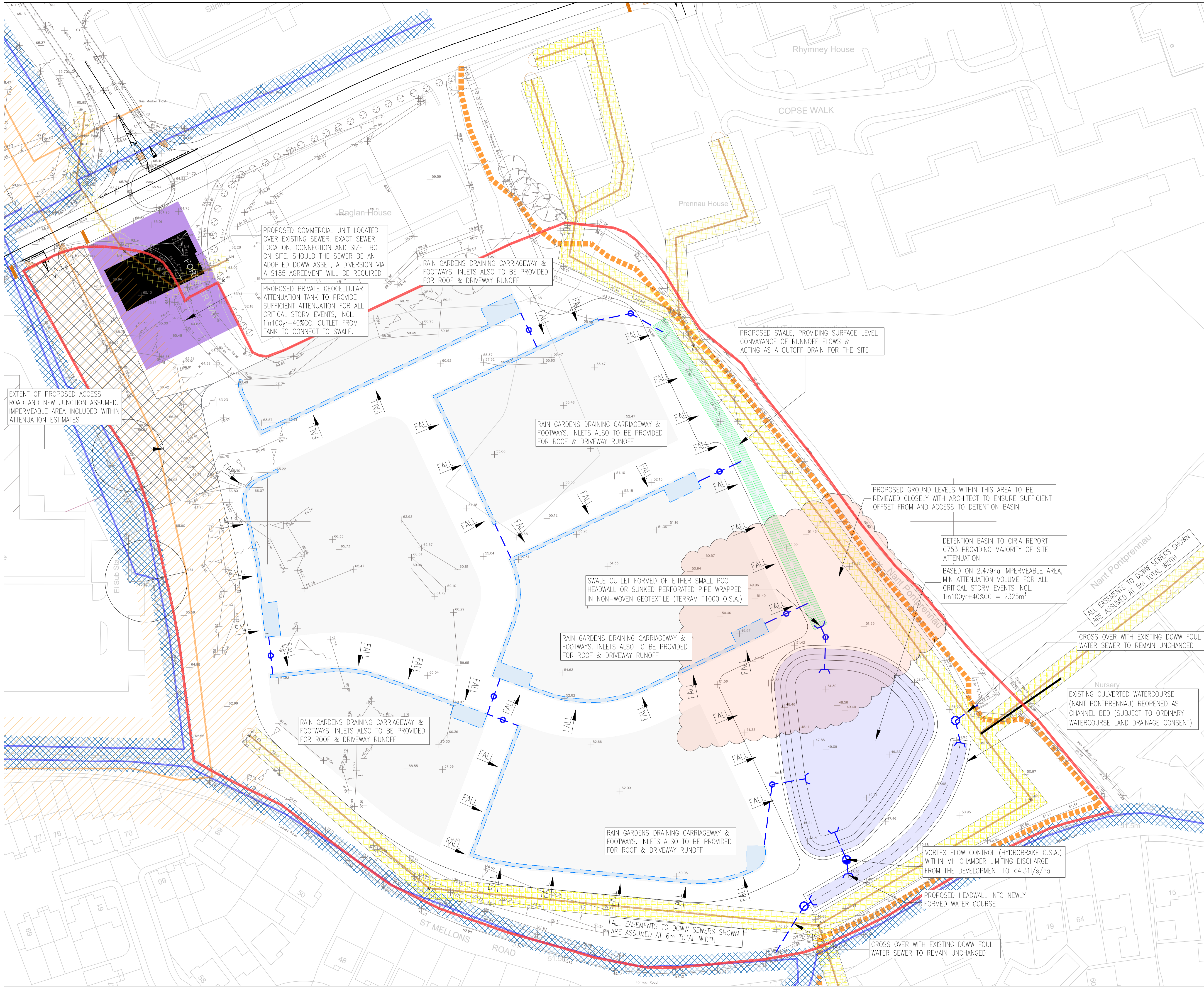
Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	5.5	1.200	11.0	3.000	17.0	7.000	25.4
0.200	11.0	1.400	11.8	3.500	18.2	7.500	26.3
0.300	11.9	1.600	12.6	4.000	19.5	8.000	27.1
0.400	12.2	1.800	13.3	4.500	20.6	8.500	27.9
0.500	12.2	2.000	14.0	5.000	21.6	9.000	28.7
0.600	12.0	2.200	14.6	5.500	22.7	9.500	29.5
0.800	11.2	2.400	15.2	6.000	23.6		
1.000	10.1	2.600	15.8	6.500	24.6		

NOTES

- GENERAL**
1. ALL DIMENSIONS ARE IN MILLIMETRES UNLESS NOTED OTHERWISE. ALL LEVELS ARE IN METRES UNLESS NOTED OTHERWISE.
 2. ALL LEVELS RELATE TO ORDNANCE DATUM UNLESS NOTED OTHERWISE.
 3. DO NOT SCALE FROM THIS DRAWING. USE FIGURED DIMENSIONS ONLY.
 4. ANY DISCREPANCIES TO BE REPORTED IMMEDIATELY TO THE ENGINEER.
 5. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT ARCHITECTS, SUBCONTRACTORS AND SPECIALISTS DRAWINGS AND SPECIFICATIONS.
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LEGEND

- High pressure gas main with 15m easement exclusion zone either side of line of pipe in residential areas
- High pressure gas main with 6m easement exclusion zone either side of line of pipe in commercial areas
- Foul sewer with 3m easement either side of line of pipe
- Water main with 3m easement either side of line of pipe
- Development boundary
- Proposed surface water detention basins and reopened watercourse (part of a proposed SuDS drainage system)



PROPOSED COMMERCIAL UNIT LOCATED OVER EXISTING SEWER. EXACT SEWER LOCATION, CONNECTION AND SIZE TBC ON SITE. SHOULD THE SEWER BE AN ADOPTED DCWW ASSET, A DIVERSION VIA A S185 AGREEMENT WILL BE REQUIRED

PROPOSED PRIVATE GEOCELLULAR ATTENUATION TANK TO PROVIDE SUFFICIENT ATTENUATION FOR ALL CRITICAL STORM EVENTS, INCL. 1in100yr+40%CC. OUTLET FROM TANK TO CONNECT TO SWALE.

RAIN GARDENS DRAINING CARRIAGEWAY & FOOTWAYS. INLETS ALSO TO BE PROVIDED FOR ROOF & DRIVEWAY RUNOFF

PROPOSED SWALE, PROVIDING SURFACE LEVEL CONVOYANCE OF RUNOFF FLOWS & ACTING AS A CUTOFF DRAIN FOR THE SITE

EXTENT OF PROPOSED ACCESS ROAD AND NEW JUNCTION ASSUMED. IMPERMEABLE AREA INCLUDED WITHIN ATTENUATION ESTIMATES

RAIN GARDENS DRAINING CARRIAGEWAY & FOOTWAYS. INLETS ALSO TO BE PROVIDED FOR ROOF & DRIVEWAY RUNOFF

PROPOSED GROUND LEVELS WITHIN THIS AREA TO BE REVIEWED CLOSELY WITH ARCHITECT TO ENSURE SUFFICIENT OFFSET FROM AND ACCESS TO DETENTION BASIN

SWALE OUTLET FORMED OF EITHER SMALL PCC HEADWALL OR SUNKED PERFORATED PIPE WRAPPED IN NON-WOVEN GEOTEXTILE (TERRAM T1000 O.S.A.)

DETENTION BASIN TO CIRIA REPORT C753 PROVIDING MAJORITY OF SITE ATTENUATION
BASED ON 2.479ha IMPERMEABLE AREA, MIN ATTENUATION VOLUME FOR ALL CRITICAL STORM EVENTS INCL. 1in100yr+40%CC = 2325m³

ALL EASEMENTS TO DCWW SEWERS SHOWN ARE ASSUMED AT 6m TOTAL WIDTH

CROSS OVER WITH EXISTING DCWW FOUL WATER SEWER TO REMAIN UNCHANGED

EXISTING CULVERTED WATERCOURSE (NANT PONTPRENNAU) REOPENED AS CHANNEL BED (SUBJECT TO ORDINARY WATERCOURSE LAND DRAINAGE CONSENT)

RAIN GARDENS DRAINING CARRIAGEWAY & FOOTWAYS. INLETS ALSO TO BE PROVIDED FOR ROOF & DRIVEWAY RUNOFF

RAIN GARDENS DRAINING CARRIAGEWAY & FOOTWAYS. INLETS ALSO TO BE PROVIDED FOR ROOF & DRIVEWAY RUNOFF

RAIN GARDENS DRAINING CARRIAGEWAY & FOOTWAYS. INLETS ALSO TO BE PROVIDED FOR ROOF & DRIVEWAY RUNOFF

VORTEX FLOW CONTROL (HYDROBRAKE O.S.A.) WITHIN MH CHAMBER LIMITING DISCHARGE FROM THE DEVELOPMENT TO <4.31l/s/ha

PROPOSED HEADWALL INTO NEWLY FORMED WATER COURSE

ALL EASEMENTS TO DCWW SEWERS SHOWN ARE ASSUMED AT 6m TOTAL WIDTH

CROSS OVER WITH EXISTING DCWW FOUL WATER SEWER TO REMAIN UNCHANGED

REV	DATE	DESCRIPTION	BY	CHK
		AMENDMENTS		

CLIENT: CARDIFF GATE BUSINESS PARK

PROJECT: PROPOSED SuDS DRAINAGE PLAN

SHEAR design
Consulting Civil and Structural Engineers

7 Ashree Court - Woody Close - Cardiff Gate Business Park - Cardiff - CF23 8RW
Tel: 029 2054 7000 - Fax: 029 2054 7001 - www.shear-design.com - enquiries@shear-design.com

DRAWN: TDJ	CHECKED: DK	DATE: AUG 2021	SCALE: 1:500 @ A1
STATUS KEY: I = INFORMATION P = PRELIMINARY A = APPROVAL CO = CONTRACT		1 = TENDER C = CONSTRUCTION AB = AS-BUILT	
STATUS: P	DRAWING NUMBER: 20033-SK500	REVISION: --	

APPENDIX

F) NRW PERSONAL FLOOD PLAN & FLOOD WARNING DEFINITIONS

FLOOD ALERT

What it means

- Flooding is possible. Be prepared.

When is it used?

- Between two hours and two days in advance of flooding.

What to do

- Be prepared to act on your flood plan.
- Prepare a flood kit of essential items.
- Monitor local water levels and the flood forecast on our website.



FLOOD WARNING

What it means

- Flooding is expected. Immediate action required.

When is it used?

- Between half an hour and one day in advance of flooding.

What to do

- Move family, pets and valuables to a safe place.
- Turn off gas, electricity and water supplies if it is safe to do so.
- Put flood protection equipment in place.



SEVERE FLOOD WARNING

What it means

- Severe flooding. Danger to life.

When is it used?

- When flooding poses a significant threat to life.

What to do

- Stay in a safe place with a means of escape.
- Be ready to leave your home.
- Cooperate with the emergency services.
- Call 999 if you are in immediate danger.





Name:

Useful numbers:

General contact list	Company name	Contact name	Telephone
Floodline	Natural Resources Wales		0345 988 1188
Electricity provider			
Gas provider			
Water company			
Telephone provider			
Insurance company & policy number			
Local council			
Local radio station			
Travel / weather info			

Key locations:

Service cut-off	Description of location
Electricity	
Gas	
Water	

Who can help / who can you help?

Relationship	Name	Contact details	How can they / you help?
Relative			
Friend or neighbour			

What can you do if a flood is expected in your area?

Actions	Location
Home Move furniture and electrical items to safety	
Put flood boards, polythene and sandbags in place	
Make a list now of what you can move away from the risk	
Turn off electricity, water and gas supplies	
Roll up carpets and rugs	
Unless you have time to remove them hang curtains over the rods	
Move sentimental items to safety	
Put important documents in polythene bags and move to safety	
Garden and outside Move your car out of the flood risk area	
Move any large or loose items or weigh them down	
Business Move important documents, computers and stock	
Alert staff and request their help	
Farmers move animals and livestock to safety	
Evacuation – prepare a flood kit in advance Inform your family or friends that you may need to leave your home	
Get your flood kit together and include a torch, warm and waterproof clothing, water, food, medication, toys for children and pets, rubber gloves and wellingtons	

What can I do now?

Put important documents out of flood risk and protect in polythene <input type="checkbox"/>	Look at the best way of stopping floodwater entering your property <input type="checkbox"/>
Check your insurance covers you for flooding <input type="checkbox"/>	Make a flood plan and prepare a flood kit <input type="checkbox"/>
Find out where you can get sandbags <input type="checkbox"/>	Identify what you would need to take with you if you had to leave your home <input type="checkbox"/>
Identify who can help you / who you can help <input type="checkbox"/>	Understand the flood warning codes <input type="checkbox"/>

Are you signed up to receive flood warnings?

If not call Floodline on 0345 988 1188 to see if your area receives free flood warnings.

Let us know when you've completed your flood plan by calling Floodline on 0345 988 1188. This will help us learn more about how people are preparing for flooding.

There are a range of flood protection products on the market to help you protect your property from flood damage. A directory of these is available from the National Flood Forum at www.bluepages.org.uk