ANTELOPE INDUSTRIAL PARK, RHYDYMWYN, MOLD

FLOOD CONSEQUENCES ASSESSMENT AND DRAINAGE STATEMENT

Final Report v1.0
November 2024

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Report Title	**Antelope Industrial Park, Rhydymwyn, Mold** Flood Consequences Assessment and Drainage Statement Final Report v1.0
Client	Whitley Estates Ltd
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List of Abbreviations

AEP	Annual Exceedance Probability	IDD	Internal Drainage Districts
AOD	Above Ordnance Datum	km	Kilometres
ASGWF	Areas Susceptible to Groundwater Flooding	LFRMS	Local Flood Risk Management Strategy
bgl	Below Ground Level	LiDAR	Light Detection and Ranging
BGS	British Geological Survey	LLFA	Lead Local Flood Authority
BRE	Building Research Establishment	LPA	Local Planning Authority
BSI	British Standards Institute	l/s	Litres per Second
CC	Climate Change	m	Metres
CCMA	Coastal Change Management Area	m^2	Square Metres
CFMP	Catchment Flood Management Plan	m^3	Cubic Metres
CIRIA	Construction Industry Research and Information Association	NFM	Natural Flood Management
		NGR	National Grid Reference
CRT	Canal and River Trust	NRW	Natural Resources Wales
DCWW	Dŵr Cymru Welsh Water	NVZ	Nitrate Vulnerable Zone
DEFRA	Department for Environment, Food and Rural Affairs	OS	Ordnance Survey
		PFRA	Preliminary Flood Risk Assessment
DS	Drainage Statement	PPW	Planning Policy Wales
EA	Environment Agency	RBD	River Basin District
FCA	Flood Consequences Assessment	RBMP	River Basin Management Plan
FCADS	Flood Consequences Assessment and Drainage Statement	RFI	Request for Information (to NRW)
		RMA	Risk Management Authority
FCERM	Flood and Coastal Erosion Risk Management	RoFSW	Risk of Flooding from Surface Water
		SFCA	Strategic Flood Consequences Assessment
FFL	Finished Floor Level		
FMP	Flood Management Plan	SMP	Shoreline Management Plan
FRMP	Flood Risk Management Plan	SoP	Standard of Protection
FWA	Flood Warning Area	SSSI	Site of Special Scientific Interest
FWEP	Flood Warning and Evacuation Plan	SAB	SuDS Approving Body
FWMA	Flood and Water Management Act	SuDS	Sustainable Drainage System
FWS	Flood Warning System	SWMP	Surface Water Management Plan
GSPZ	Groundwater Source Protection Zone	TAN15	Technical Advice Note 15
ha	Hectare	WFD	Water Framework Directive

1 INTRODUCTION

1.1 Purpose of Report

Weetwood Services Ltd ('Weetwood') has been instructed by Whitley Estates Ltd to prepare a FCADS report to accompany a full planning application for the proposed redevelopment of Antelope Industrial Park, Rhydymwyn, Mold ("the site") for industrial use.

The assessment has been undertaken in accordance with the requirements of TAN15 dated July 2004 and taking into account the revised (draft) version of TAN15 (January 2023).

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 and Planning Policy

The assessment has been informed by the following documents, policy and information:

- Technical Advice Note 15: Development, Flooding and Coastal Erosion, Welsh Government, January 2023 (Consultation Version)
- Flood Consequences Assessments: Climate Change Allowances, Welsh Government, September 2021, https://gov.wales/sites/default/files/publications/2021-09/climate-change-allowances-and-flood-consequence-assessments_0.pdf
- Design and Construction Guidance: Sewerage Sector Guidance Appendix C, Water UK, Approved Version 2.0, March 2020;
- Statutory Standards for Sustainable Drainage Systems - Designing, Constructing, Operating and Maintaining Surface Water Drainage Systems, Welsh Government, October 2018, https://gov.wales/sites/default/files/publications/2019-06/statutory-national-standards-for-sustainable-drainage-systems.pdf
- BRE Digest 365 Soakaway Design, BRE, February 2016
- The SuDS Manual (C753), CIRIA, December 2015;
- Dee Preliminary Flood Consequences Assessment, Natural Resources Wales, December 2018;
- Strategic Flood Consequences Assessment, Flintshire County Council (LPA), July 2018;
- Preliminary Flood Risk Assessment, Flintshire County Council, June 2011;
- Flintshire Local Plan 2015 - 2030, Flintshire County Council, January 2023;
- Flintshire Local Flood Risk Assessment, Strategy Document, Flintshire County Council, December 2013;
- Technical Advice Note 15: Development and Flood Risk, Welsh Government, July 2004;
- HR Wallingford Greenfield Runoff Tool, www.uksuds.com;
- Soilscapes, Soil and AgriFood Institute, Cranfield University, www.landis.org.uk/soilscapes;
- National Geoscience Data Centre's Single Onshore Borehole Index, https://www.bgs.ac.uk/products/onshore/SOBI.html;
- BGS Mapping of Surface Geology, https://www.bgs.ac.uk/map-viewers/geoindex-onshore/.

1.4 Third Party Surveys, Drawings and Assessments

The assessment has been informed by the following third party surveys, drawings and assessments:

- Topographic Survey (**Appendix B**);

1.5 Explanatory Note on Flood Probability

This report refers to the likelihood of a flood event occurring in terms of an AEP expressed as a percentage. This terminology is consistent with the definition of the development advice zones presented in Figure 1 of TAN15 (2004) and the flood zones on the Flood Map for Planning (refer to **Section 4.2** of this report).

The AEP is the reciprocal of the return period which describes the rarity of an event in terms of its statistical reoccurrence interval in years. For example, a '1 in 30 year flood' has a 1/30 = 0.033 (3.3%) probability of occurring or being exceeded in any one year, whilst a '1 in 100 year flood' has a 1/100 = 0.010 (1.0%) probability of occurring or being exceeded in any one year.

AEP	AEP (expressed as a %)	Return Period (years)	Alternative Expression
1.000	100.0%	1	1 in 1
0.500	50.0%	2	1 in 2
0.435	43.5%	2.3	1 in 2.3 (QBAR)
0.100	10.0%	10	1 in 10
0.050	5.0%	20	1 in 20
0.033	3.3%	30	1 in 30
0.020	2.0%	50	1 in 50
0.010	1.0%	100	1 in 100
0.005	0.5%	200	1 in 200
0.001	0.1%	1,000	1 in 1,000

2 SITE DETAILS AND PROPOSED DEVELOPMENT

2.1 Site Location

The site is located south of Denbigh Road (A541) at OS NGR SJ 208 665, as shown in **Figure 1**. The land ownership area (blue-line boundary) is approximately 5.0 ha whilst the proposed development site area (red-line boundary) is approximately 1.4 ha.

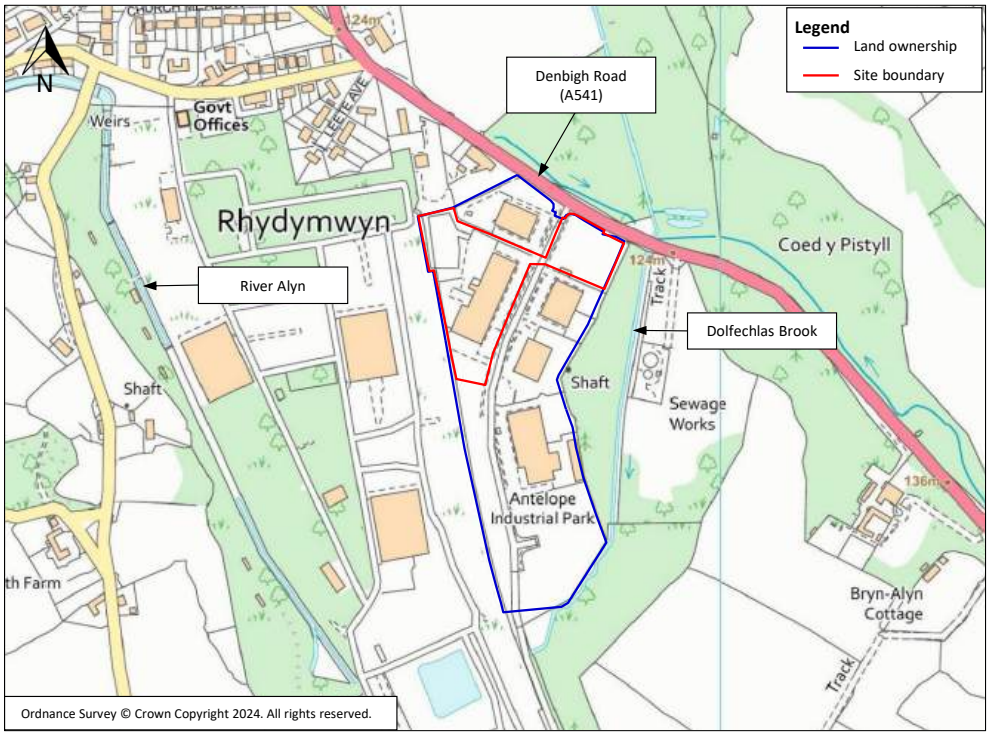


Figure 1: Site Location and Location of Surface Waterbodies

2.2 Existing and Proposed Development

The site currently comprises of 5 industrial buildings accommodating 6 units.

Proposals are for the demolition of the existing Unit 3 building which previously experienced fire damage and the reconstruction of a replacement building. Construction also includes a new building, Unit 2, to be located in the east of the application site.

Vehicular access to the site will continue to be via Denbigh Road (A541) north of the site. The proposed site plan is provided in **Appendix A**.

TAN15 classifies general industry development as Less Vulnerable to flood risk.

2.3 Surface Waterbodies in the Vicinity of the Site

The locations of waterbodies within the vicinity of the site are shown in **Figure 1**.

Dolfechlas Brook is located 15 m to the east of the site and flows in a southerly direction.

The River Alyn is located approximately 165 m west of the site and flows in a southerly direction.

It is assumed Dolfechlas Brook outfalls into the River Alyn approximately 180 m south-east of the site within a culverted section of the watercourses.

The River Alyn and Dolfechlas Brook are classified as main rivers.

2.4 Topographic Levels

A topographic survey of the site has been undertaken (**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**.

Site levels at the site are in the region of 121.6 – 125.0 m AOD, with levels generally falling to the east.

Ground levels on Denbigh Road are in the region of 123.3 – 123.5 m AOD.

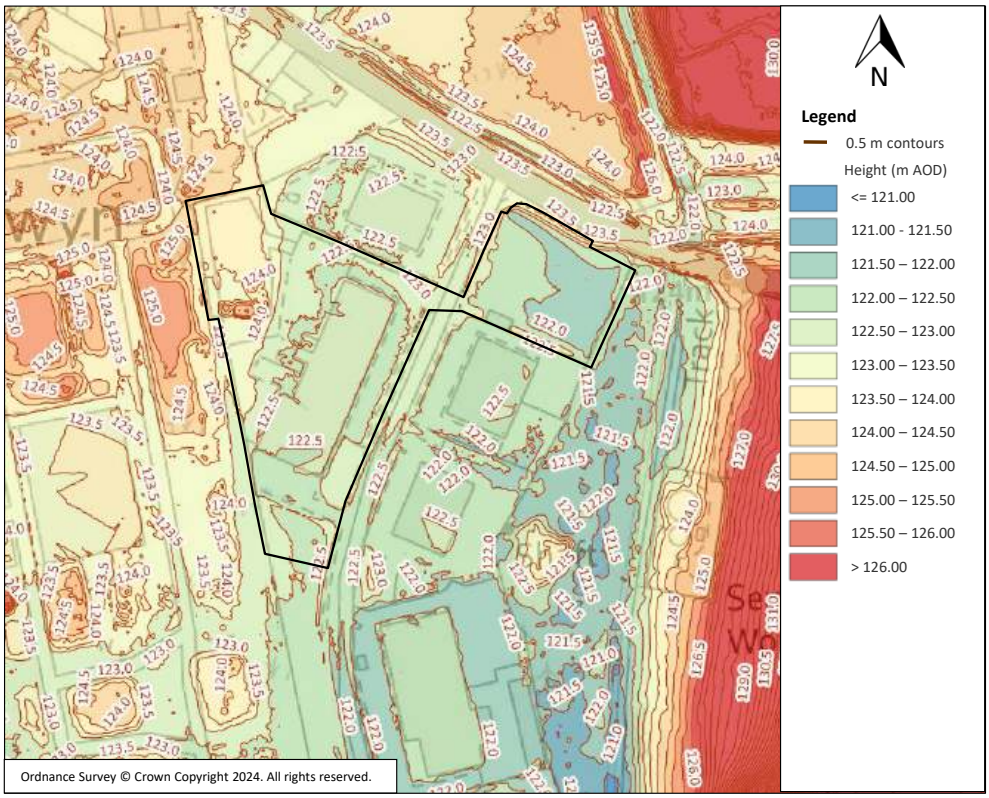


Figure 2: Digital Terrain Model from LiDAR Data

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 loamy and clayey floodplain soils with naturally high groundwater.

BGS mapping of surface geology[2] indicates the underlying bedrock formation comprises Bowland Shale formation – Mudstone in the west of the site and Gwespyr Sandstone – Sandstone and argillaceous in the east, overlain by Alluvium – Clay, silt, sand and gravel superficial deposits.

According to the BGS and NRW aquifer designation dataset[3] the superficial deposits at the site are classified as a Secondary A aquifer whilst the underlying bedrock is classified as a Secondary A.

The site is not shown to be located within a designated GSPZ[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://datamap.gov.wales/layers/inspire-nrw:NRW_Source_Protection_Zones

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"*.

PPW sets out government's planning policies for Wales and how these are expected to be applied. TAN15 (2004) 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 (2004) 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 (2004), 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.

A revised version of TAN15 and updated Flood Map for Planning are due to be published in the near future (albeit the timing is yet to be confirmed by Welsh Government). The Flood Map for Planning currently holds no formal weight as it is not yet national policy, but Welsh Government advise that this best available information may be regarded as a material consideration.

National policy requires that planning applications for new development proposals should incorporate 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 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 m^2. These standards set out how surface water runoff generated during the 100%, 3.3% and 1% AEP rainfall events and for events exceeding the 1% 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 SAB before construction can commence.

3.2 Local Planning Policy

The Unitary Development Plan was adopted by Flintshire County Council in September 2011 and was the development plan for the 15 year period running from 2000 to 2015. Although the adopted Unitary Development Plan expired at the end of 2015, it remained the adopted development plan for the county until the Flintshire Local Development Plan was adopted in January 2023.

The following policies from the 2023 Local Development Plan are relevant in respect of flood risk and drainage:

Policy PC2: General Requirements for Development

This policy states, in part, that all development should not result in or be susceptible to problems related to foul and surface water drainage or flooding either on or off site.

Policy PC3: Design

This policy states, in part, that all new development should incorporate Sustainable Urban Drainage Schemes to bring about multiple benefits as an integral part of the development.

Policy EN14; Flood Risk

In order to avoid the risk of flooding, development will not be permitted:

a) in areas at risk of fluvial, pluvial, coastal and reservoir flooding, unless it can be demonstrated that the development can be justified in line with national guidance and is supported by a technical assessment that verifies that the new development is designed to alleviate the threat and consequences of flooding;
b) where it would lead to an increase in the risk of flooding on the site or elsewhere from fluvial, pluvial, coastal or increased surface water run-off from the site;
c) where it would have a detrimental effect on the integrity of existing flood risk management assets: or
d) where it would impede access to existing and proposed flood risk management assets for maintenance and emergency purposes.

Policy EN15; Water Resources

Development affecting water resources will only be permitted if:

a) it would not have a significant adverse impact on the capacity and flow of groundwater, surface water, or coastal water systems;
b) it would not pose an unacceptable risk to the quality of groundwater, surface water, or coastal water; and

it would have access to adequate water supply, sewerage and sewage treatment facilities which either already exist, or will be provided in time to serve the development, without detriment to existing abstractions, water quality, fisheries, amenity or nature conservation.

3.3 Water Framework Directive

The 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 surface water and groundwater bodies;
- Protect, enhance and restore surface water and groundwater bodies (except artificial or heavily modified water bodies) with the aim of achieving good ecological, chemical and groundwater quantitative status by December 2021;
- Protect and enhance artificial and heavily modified water bodies with the aim of achieving good ecological potential and good chemical status by December 2021;
- Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment and progressively reduce pollution of groundwater.

The WFD applies to any proposed development which has the potential to impact on a waterbody. Where this is the case, the EA 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[5] is required from NRW 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 IDD, land drainage consent may be required from NRW.

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

5 https://www.gov.uk/guidance/flood-risk-activities-environmental-permits

4 REVIEW OF FLOOD RISK

4.1 Historical Records of Flooding

The Flood Map for Planning - Recorded Flood Extents and associated database[6] (refer to extract in **Figure 3**) indicate that flooding of the site and its surrounding area occurred in November 2000 as a result of overtopping of the River Alyn. It is understood that flood alleviation works have since been completed to protect Rhydymwyn.

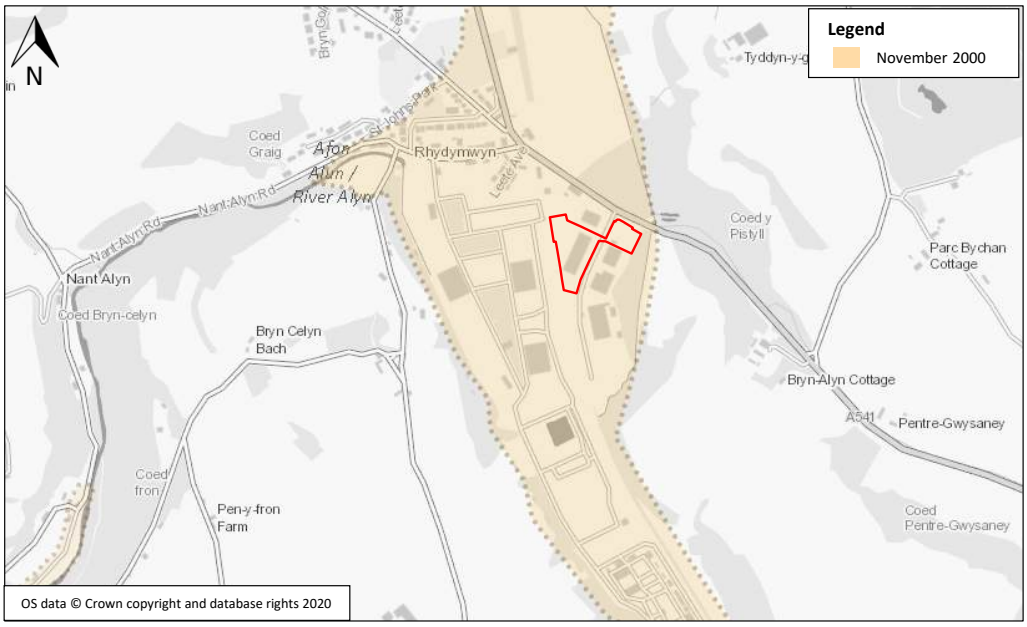


Figure 3: Flood Map for Planning - Recorded Flood Extents
Source: NRW website; Accessed: August 2024

4.2 Flood Risk from Rivers (Fluvial)

Figure 1 of TAN15 (2004) 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 NRW 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[7] and are defined by the predicted extent of the 0.1% (sea and rivers) AEP event (zone C) and BGS 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 4**) indicates the site to be located in zone C2.

The Flood Map for Planning - Rivers and Sea (**Figure 5**) indicates that flooding within the general vicinity of the site is less extensive than what is indicated on the Development Advice Map. At the site the Flood Map for Planning - Rivers and Sea shows a combination of flood zone 2 (rivers), with a flow route through the site located in flood zone 3 (rivers).

The flood zones are defined as follows and include the effects of climate change:

6 https://datamap.gov.wales/layers/inspire-nrw:NRW_HISTORIC_FLOODMAP
7 https://naturalresources.wales/evidence-and-data/maps/long-term-flood-risk/?lang=en

- Flood zone 1 (Rivers and Sea): Less than a 0.1% chance of flooding from rivers and the sea in a given year
- Flood Zone 2 (Rivers): Areas with a 0.1% to 1.0% chance of flooding from rivers in a given year
- Flood Zone 3 (Rivers): Areas with more than a 1.0% chance of flooding from rivers in a given year
- Flood Zone 2 (Sea): Areas with a 0.1% to 0.5% chance of flooding from the sea in a given year
- Flood Zone 3 (Sea): Areas with more than a 0.5% chance of flooding from the sea in a given year
- TAN15 Defended Zones: Areas that benefit from RMA flood defences with a present day 1.0% AEP and 0.5% AEP SoP for rivers and the sea respectively

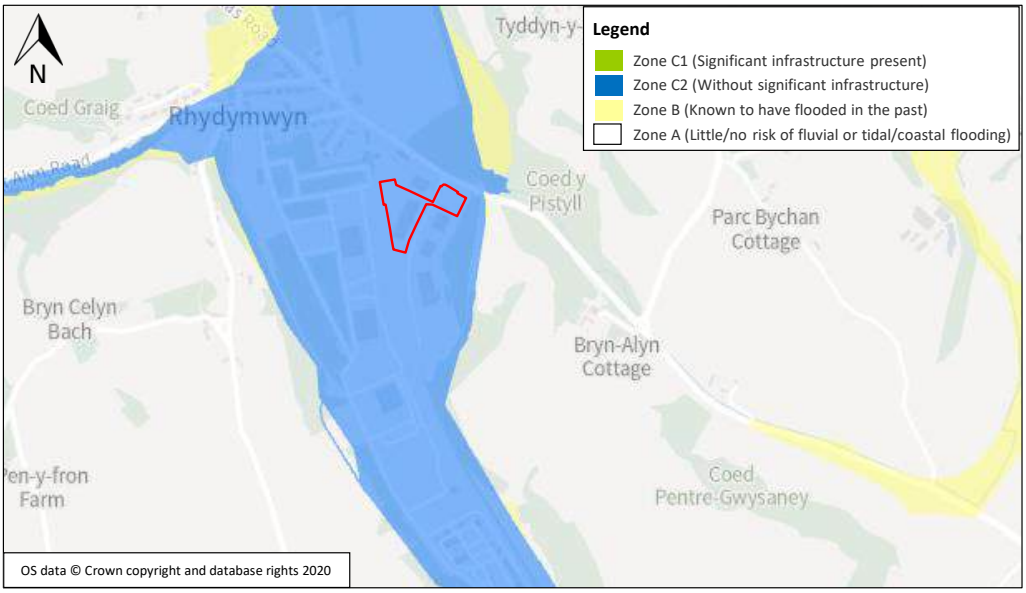


Figure 4: Development Advice Map
Source: NRW website; Accessed: August 2024

Figure 5: Flood Map for Planning - Rivers and Sea
Source: NRW website; Accessed: August 2024

Flood defences are present along the River Alyn and as indicated on the DataMapWales[8] (**Figure 6**) comprise a NRW maintained flood wall. No other information is available.

[8] https://datamap.gov.wales/layergroups/geonode:nrw_flood_defence_structures

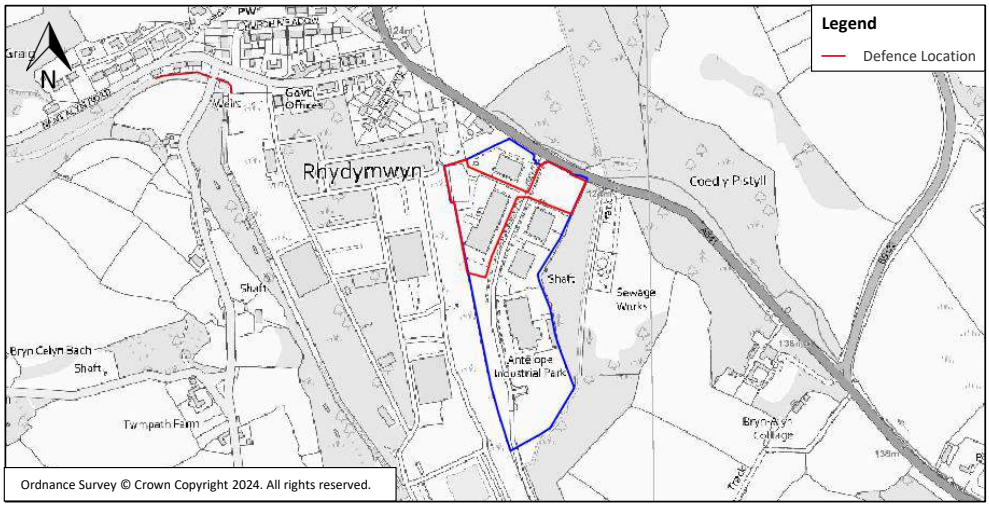


Figure 6: Existing Flood Defences

A 1D-2D ISIS-TUFLOW hydraulic model of the watercourses within the vicinity of the site was developed as part of the Rhydymwyn Flood Risk Mapping study (February 2011). The model has been obtained and recognising the age of the model, it was considered appropriate to update this to account for the latest climate change allowances and LiDAR data to make use of currently best available information and guidance. The updates made are detailed in the hydraulic modelling study report (**Appendix C**).

The amended Rhydymwyn model has subsequently been run for the 1.0% and 0.1% AEP events and the 1.0% AEP event +20% and +45% CC.

There is an upstream bridge structure located underneath Denbigh Road (A541) approximately 25 m north-east of the site, which may be susceptible to blockage that could impact flood risk at the site. Weetwood has modelled a 5%, 25% and 80% blockage of this structure in accordance with NRW requirements for the present day 0.1% AEP event and the 1.0% AEP event +20% and +45% CC.

No flooding of the site is indicated during the free-flowing 1.0% AEP event. In all other modelled events/scenarios floodwater is shown to overtop the channel upstream of the site and flow overland towards the site, flowing across Denbigh Road and southwards through the site. The flooding that occurs within the site is relatively shallow sheet flow as water is conveyed across the site (and not static floodwater with ponding).

Table 1 and **Table 2** summarises the maximum level, depth and velocity of floodwaters expected at the site and access route (Denbigh Road adjacent to the site entrance) respectively during the aforementioned AEP events and scenarios where the site is expected to flood. The corresponding model output plots presenting maximum flood depths are provided within Annex 1 of the hydraulic modelling study technical note (**Appendix C**).

It is concluded that the site is at a High risk of flooding from rivers (fluvial).

Table 1: Site Flood Information (Baseline)

Scenario		AEP Event	Max Level (m AOD)	Max Depth (m)		Max Velocity (m/s)	
				Highest	Mean	Highest	Mean
Unit 2 Area (East)							
Free-flowing		1.0% +20% CC	-	-	-	-	-
		1.0% +45% CC	122.93	0.45	0.18	0.41	0.09
		0.1%	122.95	0.51	0.21	0.39	0.13
Bridge Blockage	5%	1.0% +20% CC	122.92	0.412	0.16	0.34	0.07
		1.0% +45% CC	122.94	0.50	0.21	0.35	0.12
		0.1%	122.96	0.55	0.23	0.52	0.16
	25%	1.0% +20% CC	122.93	0.48	0.20	0.49	0.11
		1.0% +45% CC	122.95	0.52	0.21	0.38	0.13
		0.1%	122.97	0.57	0.25	0.64	0.18
	80%	1.0% +20% CC	122.97	0.57	0.25	0.48	0.17
		1.0% +45% CC	122.98	0.60	0.27	0.71	0.20
		0.1%	122.99	0.64	0.30	0.89	0.25
Unit 3 Area (West)							
Free-flowing		1.0% +20% CC	122.76	0.54	0.1891	0.62	0.09
		1.0% +45% CC	124.05	0.63	0.2656	1.08	0.15
		0.1%	124.08	0.66	0.31	1.21	0.21
Bridge Blockage	5%	1.0% +20% CC	122.87	0.61	0.27	0.95	0.14
		1.0% +45% CC	124.05	0.65	0.30	1.28	0.18
		0.1%	124.08	0.67	0.34	1.38	0.22
	25%	1.0% +20% CC	122.92	0.63	0.30	1.10	0.17
		1.0% +45% CC	124.05	0.66	0.28	1.37	0.19
		0.1%	124.08	0.68	0.34	1.39	0.23
	80%	1.0% +20% CC	123.05	0.67	0.36	1.38	0.23
		1.0% +45% CC	124.05	0.68	0.37	1.41	0.24
		0.1%	124.08	0.69	0.38	1.44	0.26

Table 2: Access Flood Information (Baseline)

Scenario		AEP Event	Max Level (m AOD)	Max Depth (m)		Max Velocity (m/s)	
				Highest	Mean	Highest	Mean
Free-flowing		1.0% +20% CC	123.43	0.64	0.12	0.43	0.18
		1.0% +45% CC	123.52	0.71	0.11	0.56	0.22
		0.1%	123.60	0.74	0.16	0.95	0.35
Bridge Blockage	5%	1.0% +20% CC	123.51	0.69	0.10	0.53	0.22
		1.0% +45% CC	123.58	0.72	0.13	0.94	0.32
		0.1%	123.64	0.75	0.15	0.97	0.41
	25%	1.0% +20% CC	123.55	0.71	0.12	0.79	0.27
		1.0% +45% CC	123.62	0.74	0.14	0.97	0.36
		0.1%	123.66	0.76	0.16	0.98	0.44
	80%	1.0% +20% CC	123.66	0.75	0.16	0.99	0.44
		1.0% +45% CC	123.69	0.77	0.17	1.07	0.49
		0.1%	123.71	0.78	0.22	1.34	0.55

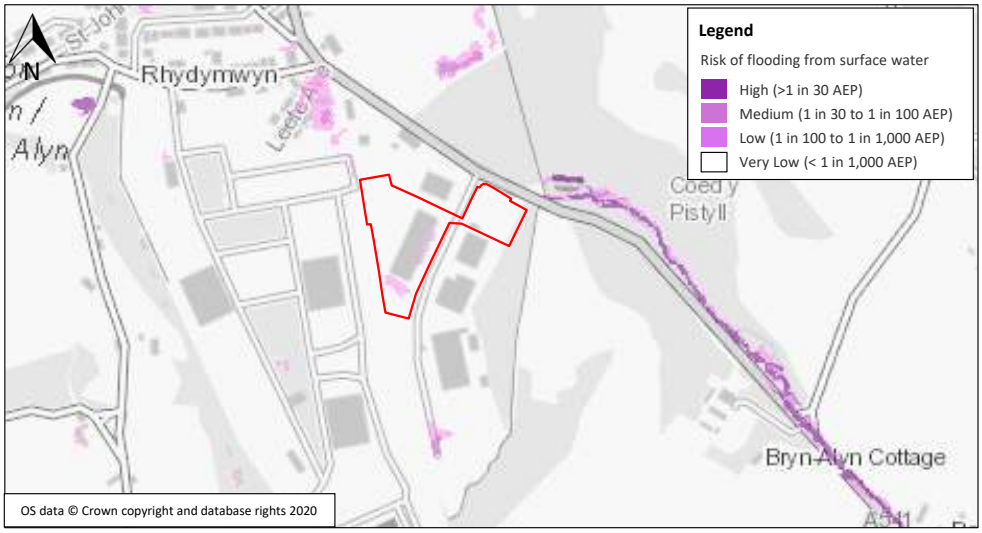
4.3 Flood Risk from Small Watercourses and Surface Water (Pluvial)

There are no small watercourses located within the vicinity of the site.

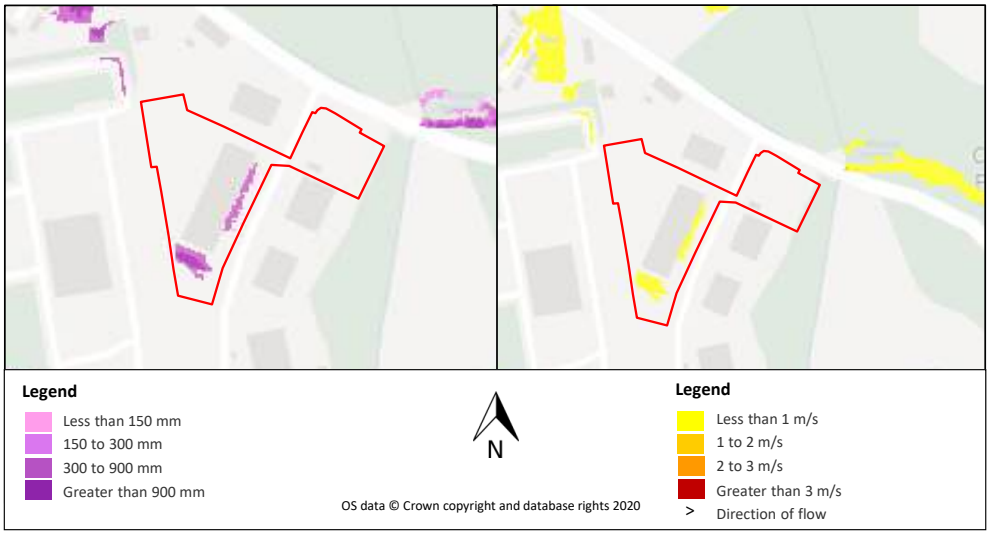
The Flood Risk Assessment Wales Map - Flood Risk from Surface Water and Small Watercourses (**Figure 7**) indicates that the majority of the site is located at a very low risk of surface water flooding, with patches of low risk to the south and east of unit 3 associated with depressions in local topography (as shown in **Figure 2**). Depths of flood water in these areas are shown to be up to 0.3 m, with a small area to the south of unit 3 being within the '0.3 to 0.9 m' band. Flood velocities are shown to remain below 1 m/s.

The Flood Map for Planning - Surface Water and Small Watercourses (**Figure 8**) accounts for climate change and indicates that the flood extents are generally the same as the present-day scenario, with the addition of a small patch of flood zone 3 located to the west of unit 3.

It is concluded that the site is not at risk of flooding from small watercourses and is at a Low of pluvial surface water flooding.



(a) Extent



(b) Low Risk Scenario

Figure 7: Flood Risk Assessment Wales Map - Flood Risk from Surface Water and Small Watercourses
Source: NRW website; Accessed: November 2024

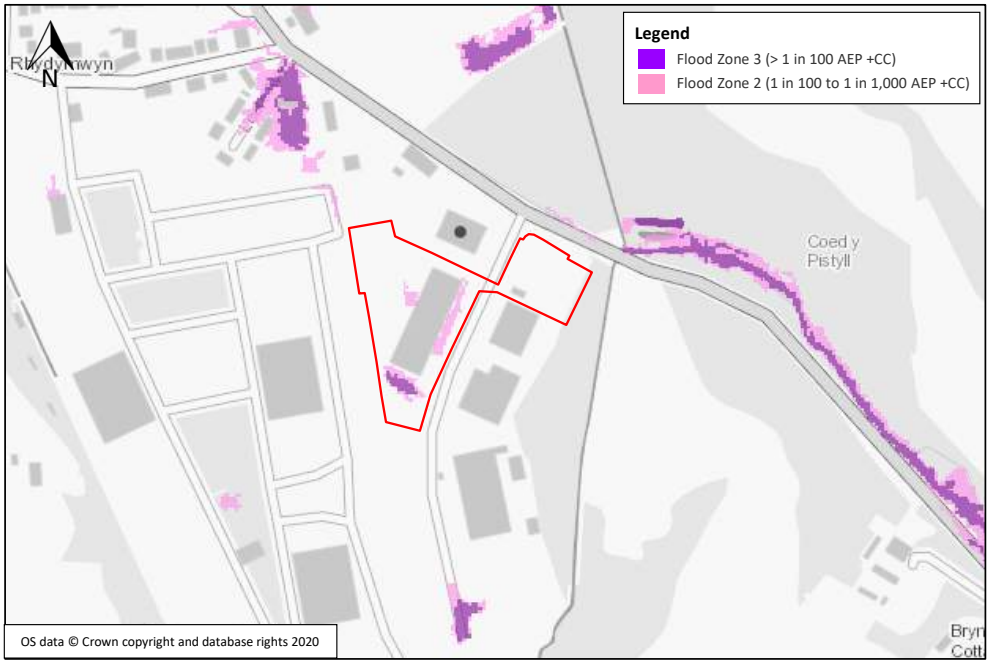


Figure 8: Flood Map for Planning - Surface Water and Small Watercourses
Source: NRW website; Accessed: November 2024

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

The Flood Map for Planning - Flood Risk from Reservoirs (**Figure 9**) indicates that the site is at risk of flooding from reservoir Cilcain No. 4. However, all large reservoirs are regularly inspected by reservoir panel engineers with essential safety work carried out as required. As such, reservoir flooding is extremely unlikely to occur.

It is concluded that the site is at a Low risk of flooding from reservoirs, canals or other water impounding structures.

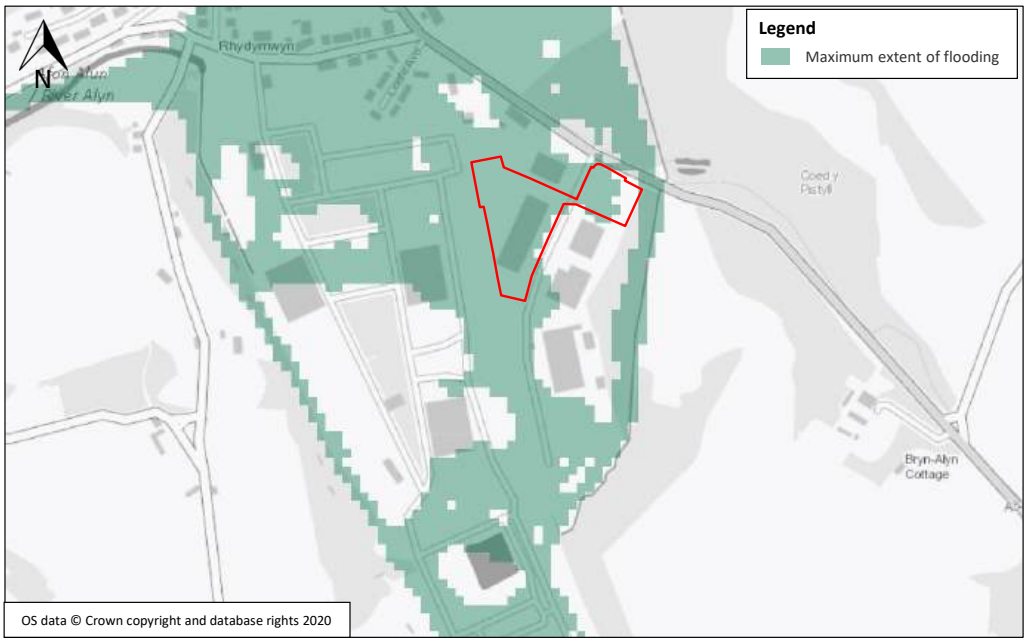


Figure 9: Flood Map for Planning - Flood Risk from Reservoirs
Source: NRW website; Accessed: August 2024

4.5 Flood Risk from Groundwater

The JBA Groundwater Flood Risk Indicator map (**Figure 10**) indicates that the site is at a Negligible risk during a 1.0% AEP groundwater flood event.

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

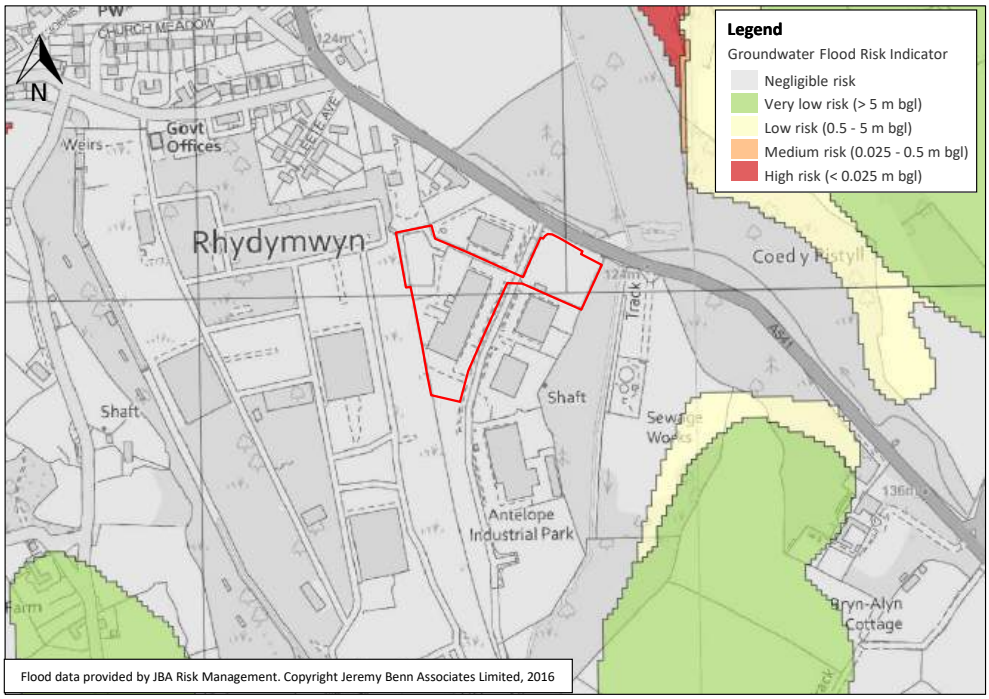


Figure 10: JBA Groundwater Flood Risk Indicator Map
Source: Blue Sky Maps; Accessed: August 2024

4.6 Flood Risk Mitigation

The risk of flooding to the proposed development from all identified sources is assessed to be low, with the exception of fluvial which presents a high risk. The risk of flooding to the proposed development will be mitigated through the implementation of the following measures:

- Unit 3 is a replacement of the existing building and therefore FFLs should be set no lower than existing.
- Ground levels in the western portion of the site, around unit 3, should be retained as existing.
- FFLs of unit 2 should be set at a minimum of 123.06 m AOD, which is the flood level expected in the vicinity of the new unit 2 in a 1.0% AEP 80% blockage event +45% CC proposed scenario and would be 30 mm above the flood level expected at the site in a 1.0% AEP 80% blockage event +20% CC. In addition, the FFL should be at least 0.15 m above adjacent ground levels following any reprofiling of the site, with ground levels sloping down from the buildings.
- In accordance with NRW's Operational Guidance Note – Flooding to ancillary areas, January 2018, ground levels of all ancillary areas within the vicinity of unit 2 (eastern portion of the site) should be set a minimum of 122.85 m AOD. This will allow the unit 2 car parking area to flood with maximum depths not exceeding 0.3 m. In addition, the hazard rating of the ancillary area around unit 2 is shown to be 'very low' during the proposed scenario, as illustrated in **Appendix D**, which presents the worst-case scenario (0.1% AEP 80% bridge blockage event). Flood risk elsewhere would not be increased as discussed further below.
- Within the northern extent of the eastern portion of the site (near to unit 2), ground levels along the strip of land adjacent to the northern boundary should be retained as existing in order to continue to allow surface water that may outfall from an existing pipe outlet to runoff eastwards towards the watercourse as per existing conditions (refer to **Appendix B**).
- It is recommended that a FWEP is prepared in consultation with Flintshire County Council emergency planning team. The site is included in a NRW flood alert and warning area. This provides the opportunity

for the relevant response procedures set out in the plan to be invoked in response to receipt of a flood warning from NRW.

These measures 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.

4.7 Flood Risk Elsewhere

In accordance with A1.2 of TAN15 (2004) developers must ensure there will be no loss of flood flow or flood storage capacity for floods up to the severity of the 0.1% AEP event. Whilst not specified by TAN15 (2004), NRW 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.

In order to assess the impact of the proposed development on flood risk elsewhere, the proposed development platform and the new unit 2 have been incorporated into the hydraulic model and run for the free flowing present day 0.1% AEP event and 1.0% AEP +20% and +45% CC events, and the corresponding bridge blockage (5%, 25% and 80%) scenarios for the same AEP events.

The modelled flood risk comparison plots are provided in **Appendix E**, which present changes in flood depths between baseline and proposed scenarios.

The results indicate that there is no material impact on flood risk elsewhere. It is noted that there are some increases within the ownership boundary, which should be regarded as acceptable. There are also some relatively small areas showing increased flood depths to the east of the site; however, this is within a woodland adjacent to Dolfechlas Brook and the increases identified up to a maximum of 0.11 m in those areas are not considered to be of material concern given the land use and given that those areas would already flood during such events.

4.8 Justification Test

The proposals will help to sustain the existing settlement and the site meets the definition of ‘previously developed land’. Part i and iii of the justification test are therefore considered to have been addressed.

This report addresses part iv of the justification test.

5 SURFACE WATER MANAGEMENT

5.1 Surface Water Drainage at the Existing Site

The drainage survey drawing (**Appendix E**) indicates that a private surface water drainage network, of varying pipe sizes, conveys the majority of flows from across the site in a southerly direction. It is assumed that this network discharges surface water runoff into Dolfechlas Brook to the south of the site. Areas to the west of Unit 3 appear to drain into the ground via infiltration manholes.

5.1.1 Existing Runoff Rates

The site has a total area of 1.42 ha; however, for the purposes of this assessment the proposed developable area is taken as approximately 0.68 ha. This excludes areas of open space, and parts of the site which are to be remain as existing and 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[9] are presented in **Table 3**. Details of the input parameters and the output results are provided in **Appendix G**.

Table 3: Greenfield Runoff Rate

AEP of Rainfall Event	Greenfield Runoff Rate (l/s/ha)	Greenfield Runoff Rate for 0.68 ha Site (l/s)
100.0%	2.1	1.4
QBAR	2.4	1.6
3.3%	4.3	2.9
1.0%	5.2	3.5

5.2 Surface Water Drainage at the Developed Site

5.2.1 Disposal of Surface Water

In accordance with Welsh Government guidance, 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 units, which would reduce demand on potable water supplies. However, the incorporation of rainwater harvesting systems within the units 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 2.5**, the site is underlain by soils with impeded drainage and shallow groundwater levels. As such the disposal of surface water via infiltration, Priority Level 2, is unlikely to be feasible; however, infiltration tests have not been undertaken at this stage. Such tests should be undertaken at the detailed design stage in accordance with the guidelines in BRE365.

A new direct connection to Dolfechlas Brook (Priority Level 3) has been considered but due to the densely vegetated woodland surrounding it, this is not considered practicable.

it is subsequently proposed to direct all runoff from the developed site to the existing surface water drainage network in accordance with Priority Level 4. It should be noted that this surface water drainage network is assumed to discharge runoff into Dolfechlas Brook.

9 www.uksuds.com

5.2.2 Post Development Impermeable Area

The area of impermeable surfaces within the proposed development has been calculated to be 0.68 ha, based on **Appendix A**.

5.2.3 Peak Flow Control (Standard S2)

It is proposed to restrict surface water runoff to the greenfield QBAR rate of 1.6 l/s post development, as outlined in **Table 3**. However, due to site constraints, a new connection from each unit will be required, resulting in a discharge rate of 0.8 l/s per unit.

It is recognised that a flow control with a flow rate of less than 1 l/s may pose a risk of blockage to the drainage system. As such a minimum discharge rate of 1.0 l/s applied to each unit has been used, therefore providing a total discharge rate of 2 l/s. This provides a betterment of 31% and 43% during the 3.3% and 1.0% AEP rainfall events respectively.

5.2.4 Volume Control (Standard S2)

Where reasonably practicable, for sites which have been previously developed, the runoff volume from the proposed development to any highway drain, sewer or surface water body in the 1.0% AEP, 6 hour rainfall event must be constrained to a value as close as is reasonably practicable to the greenfield runoff volume for the same event, but should never exceed the runoff volume from the development site prior to redevelopment for that event.

As outlined within The SuDS Manual extra runoff volumes in extreme events may be managed by releasing all runoff (above the 100.0% AEP event) from the site at a maximum rate of 2 l/s/ha or QBAR, whichever is the higher value.

It is therefore proposed to restrict peak discharge rates to the greenfield QBAR rate recognising a minimum flow rate of 1.0 l/s per unit would apply in up to the 1.0% AEP event, including an allowance for climate change.

5.2.5 Attenuation Storage

Attenuation storage will be provided to store surface water runoff generated across roofs and hardstanding.

The attenuation storage facility has been modelled using Causeway Flow (**Appendix G**). The required storage volume has been sized to store the 1.0% AEP rainfall event including a 30% increase in rainfall intensity to allow for climate change in accordance with local guidance[10].

Unit 2

Assuming a peak discharge rate of 1.0 l/s, a total storage volume of 258.3 m^3 would be required.

The storage volume could be accommodated within the pipe network and a geo-cellular storage tank, with an area of 315 m^2 and a depth of 0.8 m.

Unit 3

Assuming a peak discharge rate of 1.0 l/s, a total storage volume of 376.0 m^3 would be required.

The storage volume could be accommodated within the pipe network and an attenuation basin, with an area of 644.8 m^2 and a depth of 1.5 m.

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

5.2.6 Exceedance Routes

Flows resulting from rainfall in excess of the 1.0% 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

10 Flintshire Hydraulic Calcs Proforma Document

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.

5.2.7 Water Quality and Pollution Control (Standard S3)

Table 26.2 of The SuDS Manual and Table G3.1 of the Statutory Standards for SuDS identifies commercial roofs and delivery areas as having a low to medium pollution hazard level respectively. Table 26.2 of The CIRIA SuDS Manual indicates that the pollution hazard indices associated with such uses for total suspended solids, hydrocarbons and metals are 0.30, 0.20 and 0.05, and 0.7, 0.6 and 0.7, respectively.

Attenuation basins can provide water quality benefits via the settlement of pollutants in still or slow moving water, adsorption by the soil, and biological activity. Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for attenuation basins for total suspended solids, hydrocarbons and metals are 0.50, 0.50 and 0.60 respectively.

It is proposed to utilise filter drains to capture and convey runoff from hardstanding areas. Filter drains can help reduce pollutant levels in runoff by filtering out fine sediments, metals, hydrocarbons and other pollutants. They can also encourage adsorption and biodegradation processes. Table 26.3 of the CIRIA SuDS Manual 2015 indicates that the SuDS mitigation indices for filter drains for total suspended solids, hydrocarbons and metals are 0.40, 0.40 and 0.40 respectively.

It is proposed to utilise permeable paving within parking bays which would be expected to: (i) provide enhanced water quality treatment within the surface structure, including filtration, adsorption, biodegradation and sedimentation, and (ii) potentially enable the use of a smaller diameter outlet control device (by virtue of acting as a runoff pre-filter and hence blockage mitigation measure) and hence facilitate delivery of a lower pass-forward discharge rate. Table 26.3 of the CIRIA SuDS Manual indicates that the SuDS mitigation indices for permeable pavements for total suspended solids, hydrocarbons and metals are 0.70, 0.60 and 0.70 respectively.

As such, the proposed drainage system would incorporate adequate water quality treatment.

5.2.8 Amenity and Biodiversity (Standard S4 and Standard S5)

The proposed layout includes landscaped areas/trees in a number of locations which will provide aesthetic benefits and interception of water surface, thus helping with volume control (via evapotranspiration).

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.

5.2.9 Adoption and Maintenance of SuDS

SuDS elements will be maintained by the site owner, or an appointed management company.

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

Schedule	Required action	Frequency
	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		
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	
Geo-cellular attenuation storage tank		
Regular maintenance	Inspect and identify any areas that are not operating correctly	Monthly for 3 months, then annually
	Remove debris from the catchment surface	Monthly
	Remove sediment from internal forebays	Annually, or as required
Remedial action	Repair inlet/outlet and vents	As required
Monitoring	Inspect catchpit manholes and note rate of sediment accumulation	Monthly in the first year and then annually
	Inspect inlet/outlet and vents to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years, or as required
Filter Drain		
Regular maintenance	Remove litter including leaf litter and debris from filter drain surface, access chambers and pre-treatment devices	Monthly (or as required)

Schedule	Required action	Frequency
	Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly (or as required)
Occasional maintenance	Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly (or as required)
	Clear perforated pipework of blockages	As required
Flow Control Unit		
Routine maintenance	Remove litter and debris and inspect for sediment accumulation	Six Monthly
	Remove sediment from sump	As necessary – Indicated by system inspections
Remedial actions	Replace malfunctioning parts or structures	As required
Monitoring	Inspect for evidence of poor operation	Six Monthly
	Inspect flow control unit and establish appropriate replacement frequencies	Six Monthly
	Inspect sediment accumulation rates and establish appropriate removal frequencies	Monthly during first year of operation, then every six months

6 FOUL WATER MANAGEMENT

6.1 Existing Assets

An extract of the public sewer records obtained from DCWW is provided in **Appendix J**. This indicates that a 150 mm diameter public foul water sewer is located along both the northern and eastern boundaries of Unit 2.

The drainage survey (**Appendix F**) indicates that a private foul water drainage network conveys foul water from across the site, including Unit 3, into the 150 mm diameter public foul water sewer.

6.2 New Connections

The anticipated domestic foul loading from the site has been calculated in accordance with Design and Construction Guidance. The expected total peak flow rate from the development would be 0.6 l/s.

It is proposed to discharge foul flows for Unit 2 directly into the existing 150 mm diameter public foul water sewer to the north of site.

It is proposed to utilise the existing private foul water drainage network to discharge foul flows for Unit 3.

It is likely a Section 106 application will need to be made to DCWW for the new connection of the proposed network into the existing sewer, this will need to be made at the detailed design stage.

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

7 SUMMARY AND RECOMMENDATIONS

This report has been prepared on behalf of Whitley Estates Ltd and relates to the proposed redevelopment of Antelope Industrial Park for industrial use.

The Development Advice Map indicates the site to be located in zone C2.

The Flood Map for Planning - Rivers and Sea indicates the site to be located in flood zone 2 (rivers), with a flow route through the site located in flood zone 3 (rivers).

An assessment of flood risk from all identified potential sources of flooding has been undertaken using best available information. The risk of flooding to the proposed development is assessed to be negligible / low with the exception of flooding from fluvial, which is assessed to be high.

The assessment presented in this report demonstrates that the proposed development may be completed in accordance with the requirements of planning policy subject to the following:

- Unit 3 is a replacement of an existing building in the western portion of the site and therefore FFLs should be set no lower than the existing/previous building.
- Ground levels around unit 3 (eastern portion of the site) should remain as existing/previous.
- FFLs of unit 2 should be set at a minimum of 123.06 m AOD and at least 0.15 m above adjacent ground levels following any reprofiling of the site, with ground levels sloping down from the building.
- Ground levels for all ancillary areas within the vicinity of the new unit 2 should be set at a minimum of 122.85 m AOD.
- Within the northern extent of the eastern portion of the site (near to unit 2), ground levels along the strip of land adjacent to the northern boundary should be retained as existing in order to continue to allow surface water that may outfall from an existing pipe outlet to runoff eastwards towards the watercourse as per existing conditions.
- FWEP to be developed in consultation with Flintshire County Council.

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

Surface water runoff from the developed site can be sustainably managed in accordance with planning policy.

- An existing private surface water drainage network flows in a southerly direction and is assumed to discharge runoff into Dolfechlas Brook. Areas to the west of Unit 3 currently discharge runoff into the ground via infiltration manholes.
- Surface water runoff from Unit 2 and Unit 3 is to discharge into the existing private surface water drainage network serving the site.
- Surface water flows will be restricted to 1 l/s to each unit, providing a total combined discharge rate of 2 l/s. Attenuation storage will be provided by a geo-cellular storage tank to Unit 2 and an attenuation basin to Unit 3.
- The use of permeable paving, filter drains and an attenuation basin will provide adequate water quality treatment.

Foul water flows from Unit 2 are proposed to discharge directly into the 150 mm diameter public foul water sewer to the north of the site. Foul water flows from Unit 3 will utilise the existing private foul water drainage network which connects into the existing 150 mm diameter public foul water sewer.

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

Proposed Site Plan

Rev	Date	Notes	By	Che
B	07.10.24	Unit 2 layout altered	MD	

1 | **Proposed Site Plan - New Unit**
1 : 500

5 0 5 10 15 20 25
SCALE 1: 500 m

NORTH

NWD Architects

Cheshire Office
Old Coach Road, Kelsall, Tarporley,Cheshire, CW6 0QJ
T 01829 751555
E enquiries@nwdarchitects.co.uk

Client
FG Whitley and Sons Co Ltd

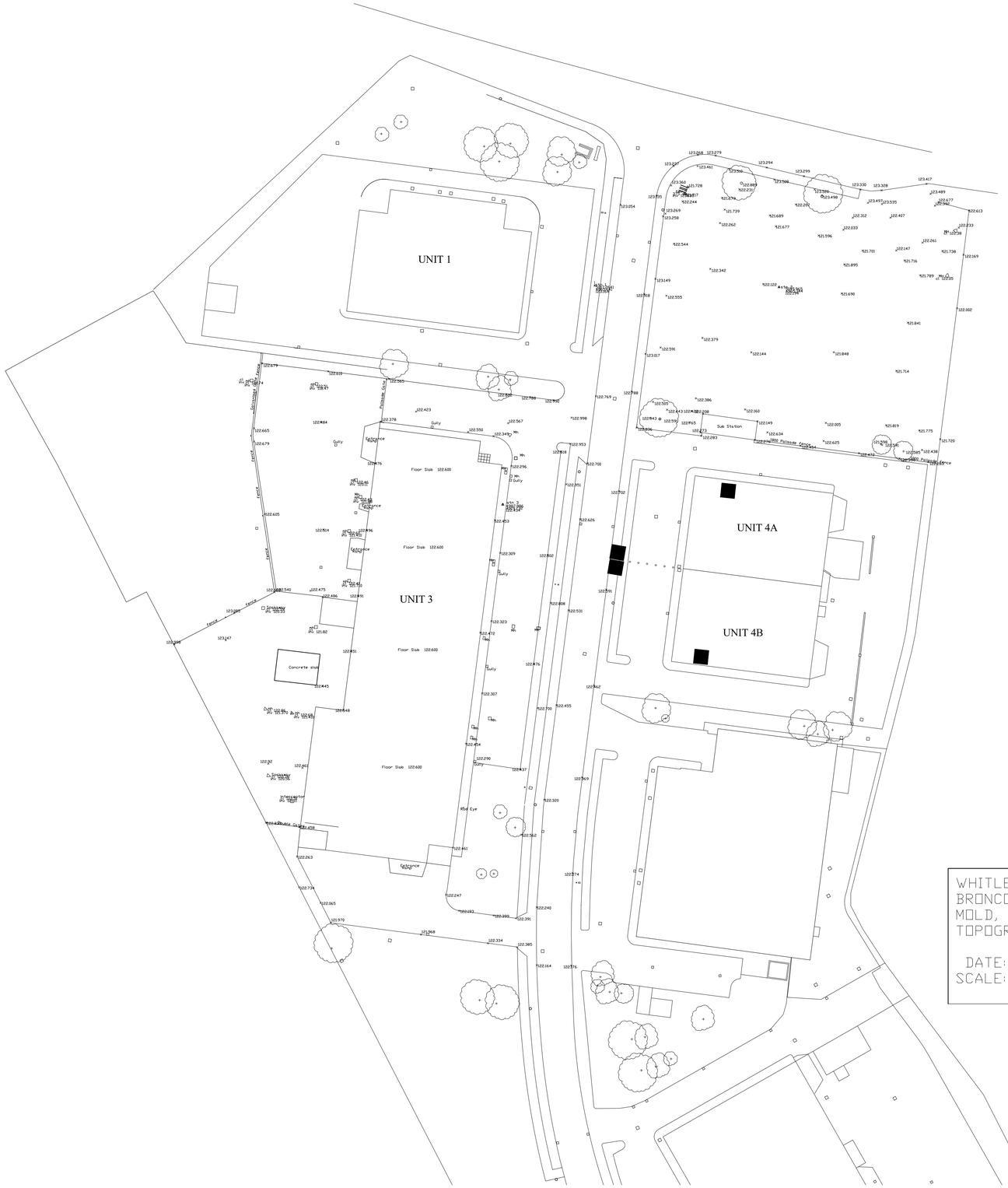
Project
Antelope business Park, Rhydymwyn, CH7 5JH

Title
Proposed Site Plan

Drawing No	Revision	Scale	Date
6977-04	B	1 : 500	27-03-24

APPENDIX B

Topographic Survey



WHITLEY ESTATES LTD
BRONCOED BUSINESS PARK
MOLD, CH7 1HP
TOPOGRAPHICAL SURVEY

DATE: January 2024
SCALE: 1:500

APPENDIX C

Hydraulic Modelling Study Technical Note, November 2024

Weetwood Services Ltd
info@weetwood.net

Antelope Industrial Park, Rhydymwyn, Mold

Hydraulic Modelling Study

Technical Note

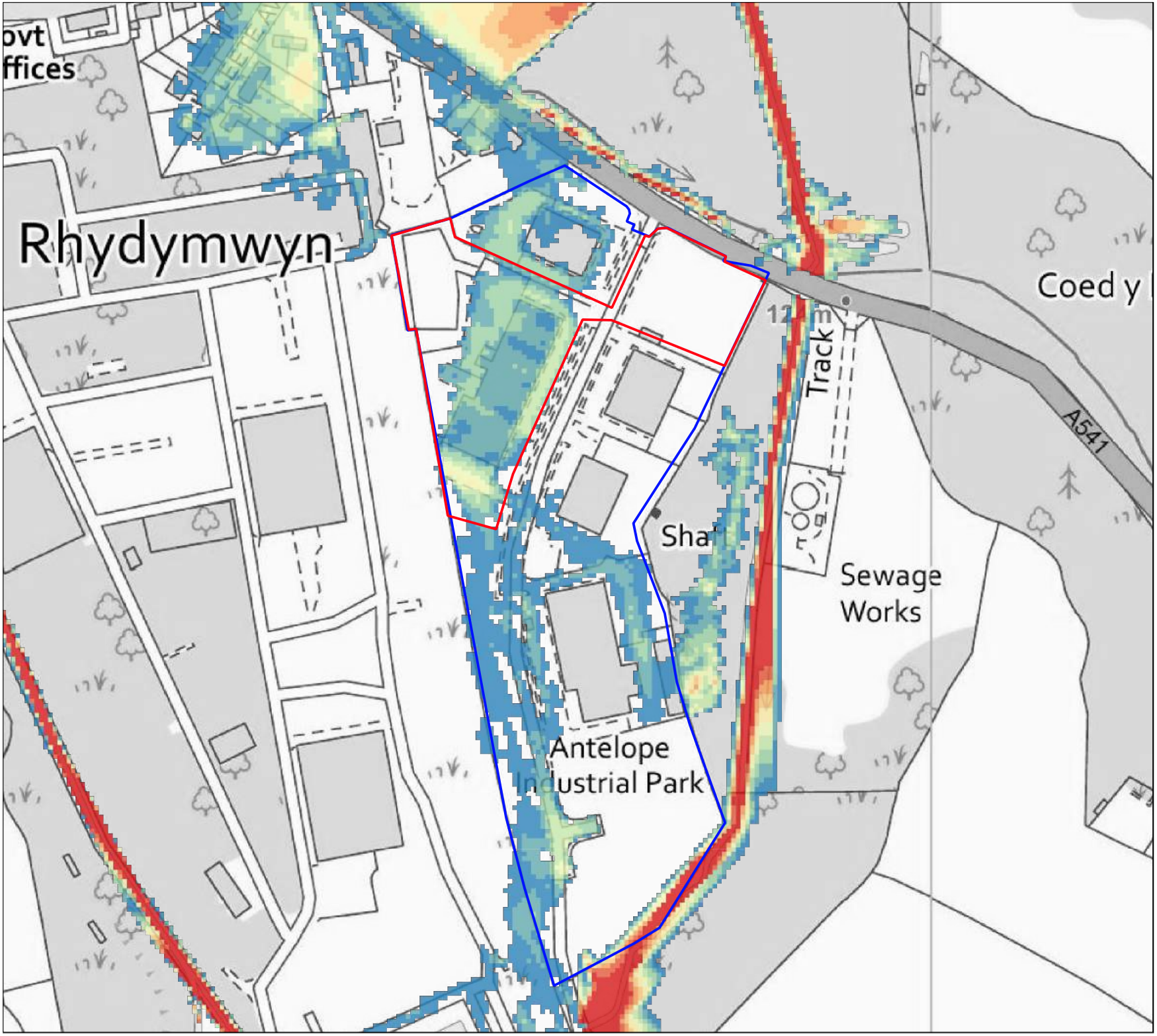
Project ref:	6262 – Antelope Industrial Park, Rhydymwyn, Mold
Prepared by:	Flora Lockey MEnvSci *Assistant Flood Risk Consultant*
Approved by:	Adam Edgerley BSc (Hons) *Director*
Date:	15 November 2024
Version:	Final v1.0

Summary of modelling study requirements	A modelling study has been undertaken to assess the existing fluvial flood risk to the development site, whether the proposed development will be safe and whether flood risk elsewhere will be increased as a result of the proposals. The development site is located south of Denbigh Road (A541) at Ordnance Survey National Grid Reference SJ 208 665. Further details regarding the proposed development and site location are provided within the Weetwood Flood Consequence Assessment (FCA) dated 15 November 2024.
Details of existing models	A copy of the Rhydymwyn Flood Risk Mapping study, February 2011, has been provided by Natural Resources Wales under licence (reference: ATI 27349a). The Rhydymwyn Flood Risk Mapping study model includes the site location and is herein referred to as the 'supplied model'. It is understood the supplied model has been approved for use by Natural Resources Wales. The supplied model files include the defended an undefended scenarios and have assessed the present day 1.0% and 0.1% and the 1.0% plus climate change (20%) AEP events. The 0.1% plus climate change (20%) AEP event was run as part of the subsequent Flood Map for Planning – Climate Change, August 2021, study.
Model extent and details of any truncations	The model extent has not been changed from the supplied model
Amendments to hydrology	To reflect the Natural Resources Wales September 2021 climate change guidance, the input hydrology has been updated to include 45% climate change allowance. This supplements the 20% allowance that was provided with the supplied model. No further amendments have been made to the supplied model hydrology.
Amendments to existing model	The 2D domain topography has been updated to be based upon filtered LiDAR data flown during February 2021 and is considered the most recent available data with a grid resolution of 1 m. Due to instabilities occurring in the 1D domain, a 0.5 m high top slot has been incorporated into the .dat file for some events/scenarios at the culvert located at the downstream extent of Dolfechlas Brook (node references: BL101IN, BL99, BL98 and BL101CULV2). No further amendments have been made to the supplied model.

Design runs	The amended 'baseline' model has been run for the present day 1.0% and 0.1% AEP events, and the 1.0% plus climate change (20% and 45%) climate change AEP events. The model run number for the free-flowing scenario is **6262_006_** (for the present day 1.0% AEP event and the 1.0% AEP plus climate change (20% and 45%) events) and **6262_022_** for the 0.1% AEP event. The model has been run in Flood Modeller v7.1 and TUFLOW version 2023-03-AF-iDP-w64. In addition to the free-flowing scenario, a 5%, 25% and 80% blockage of the Denbigh Road (A541) bridge has been assessed. The model run numbers are as follows: • **6262_010_** 5% blockage, 1.0% AEP plus climate change (20% and 45%) • **6262_011_** 25% blockage, 1.0% AEP plus climate change (20% and 45%) and 0.1% AEP • **6262_012_** 80% blockage, 1.0% AEP plus climate change (20% and 45%) • **6262_023_** 5% blockage, 0.1% AEP • **6262_024_** 80% blockage, 0.1% AEP The baseline model output plots are provided in **Annex 1**.
Suitability and accuracy of model for study site	The model has been reviewed, and with the amendments included in the model geometry, it is considered suitable for site-specific modelling. The model cell size is 5 m which enables sufficient detail of the floodplain and flow routes around buildings. The stability of the model is good for the site location. The final cumulative Mass Error (ME) is between -0.74% and -0.60%. There are no negative depths in the 1D or 2D domains. There are 2 warnings and 5 checks shown prior to the simulation during all model events. Most of these are legacy of the supplied model and are not thought to impact the maximum results at the site.
Sensitivity and calibration	The amendments undertaken to the supplied model are relatively minor. As such, additional sensitivity testing for this amended version of the model is not considered necessary.
Submitted files	To accompany this Technical Note, the following files can be provided to the Environment Agency: • The digital model files. • A modelling log detailing the model runs that have been undertaken. To submit the above files, we will require a "sharefile" link from the Environment Agency. Please can this be sent to Flora.Lockey@weetwood.net

ANNEX 1

Model Plots – Baseline Scenario



Notes:

1.Do not scale from this drawing.

2.Map background reproduced from Ordnance Survey digital map data. Crown Copyright under licence.

Legend

- Application Boundary
- Ownership Boundary

Depth (m)

- < 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- > 1.0

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E: info@weetwood.net
W: www.weetwood.net

Client:
Whitley Estate Co. Ltd

Project Title:
Antelope Industrial Park, Rhydymwyn, Mold

Drawing Title:
Fluvial Baseline Scenario - Maximum Flood Depth 1.0% plus climate change (20%) AEP event

Map Orientation:

Scale: 0 10 20 30 40 50 m

Drawn:	Checked:	Date:
FL	AE	4 November 2024

Project No:	Drawing No:	Rev:
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Legend

- Application Boundary
- Ownership Boundary

Depth (m)

- < 0.1
- 0.2
- 0.3
- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- > 1.0

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Client:
Whitley Estate Co. Ltd

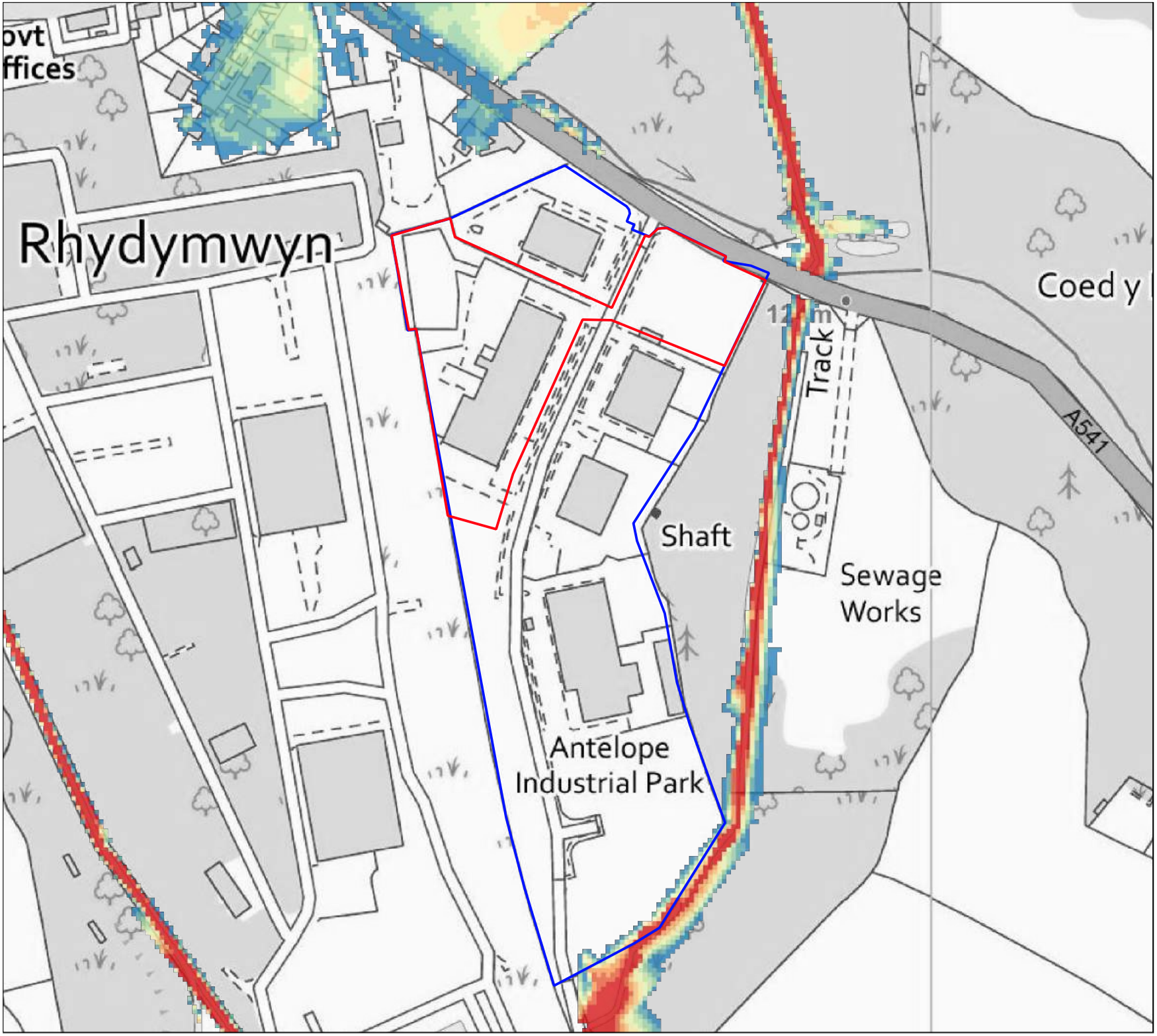
Project Title:
Antelope Industrial Park, Rhydymwyn, Mold

Drawing Title:
Fluvial Baseline Scenario - Maximum Flood Depth 1.0% plus climate change (45%) AEP event

Map Orientation:	Scale:
	0 10 20 30 40 50 m

Drawn:	Checked:	Date:
FL	AE	4 November 2024

Project No:	Drawing No:	Rev:
6262	6262_006_rhyd_100cc45_5m_def_006_d	A



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Depth (m)

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Project Title: **Antelope Industrial Park, Rhydymwyn, Mold**

Drawing Title: **Fluvial Baseline Scenario - Maximum Flood Depth 1.0% AEP event**

Map Orientation:

Scale: 0 10 20 30 40 50 m

Drawn:	Checked:	Date:
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Project No:	Drawing No:	Rev:
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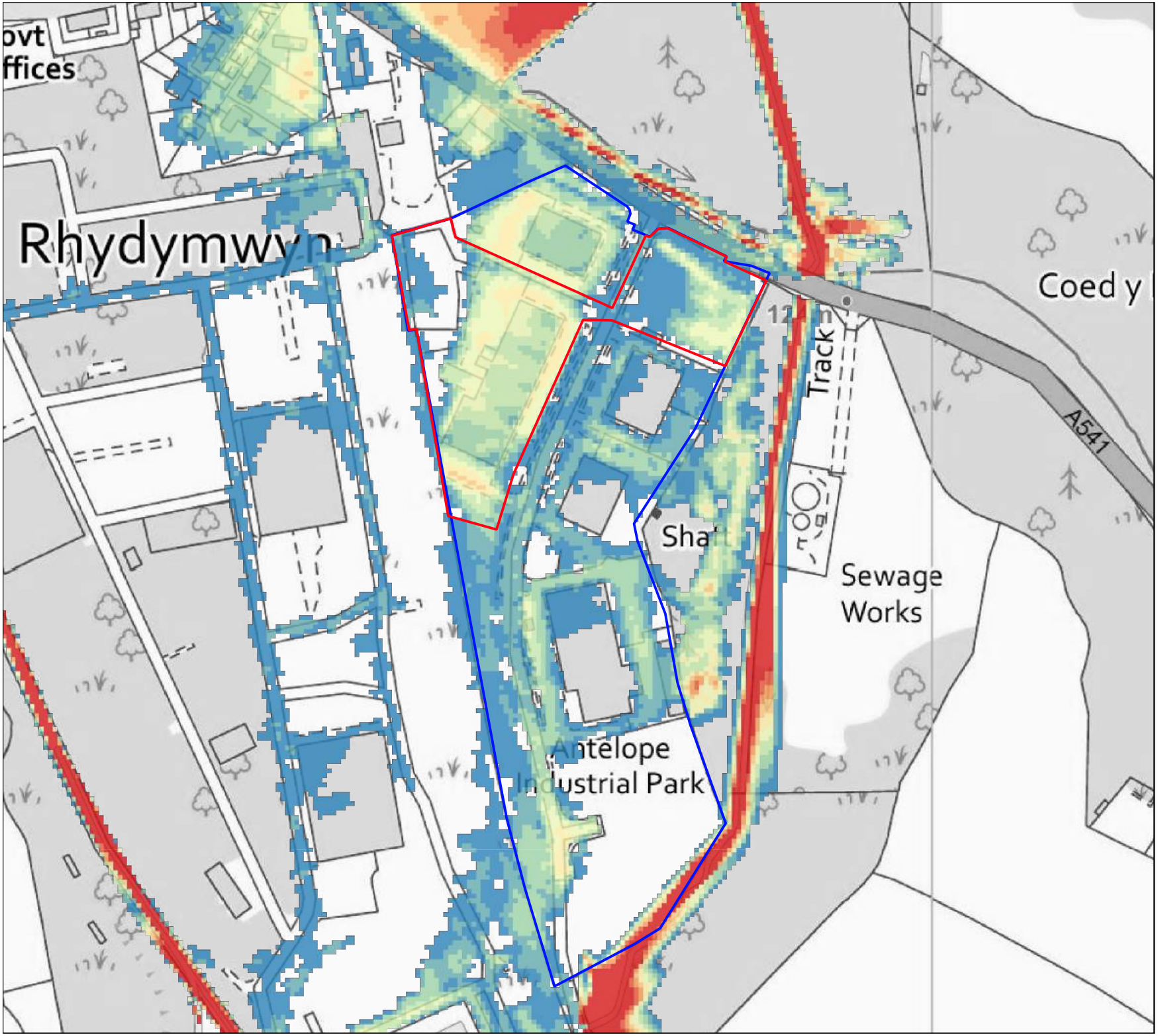

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Project Title: **Antelope Industrial Park, Rhydymwyn, Mold**

Drawing Title: **Fluvial Baseline Scenario - Maximum Flood Depth 0.1% AEP event**

Map Orientation:

Scale: 0 10 20 30 40 50 m

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Legend

- Application Boundary
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- Blockage Location

Depth (m)

- < 0.1
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- 0.9
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Project Title:
Antelope Industrial Park, Rhydymwyn, Mold

Drawing Title:
Fluvial 5% Blockage Scenario - Maximum Flood Depth 1.0% plus climate change (20%) AEP event

Map Orientation:

Scale: 0 10 20 30 40 50 m

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Drawing Title:
Fluvial 5% Blockage Scenario - Maximum Flood Depth 1.0% plus climate change (45%) AEP event

Map Orientation:

Scale: 0 10 20 30 40 50 m

Drawn:	Checked:	Date:
FL	AE	4 November 2024

Project No:	Drawing No:	Rev:
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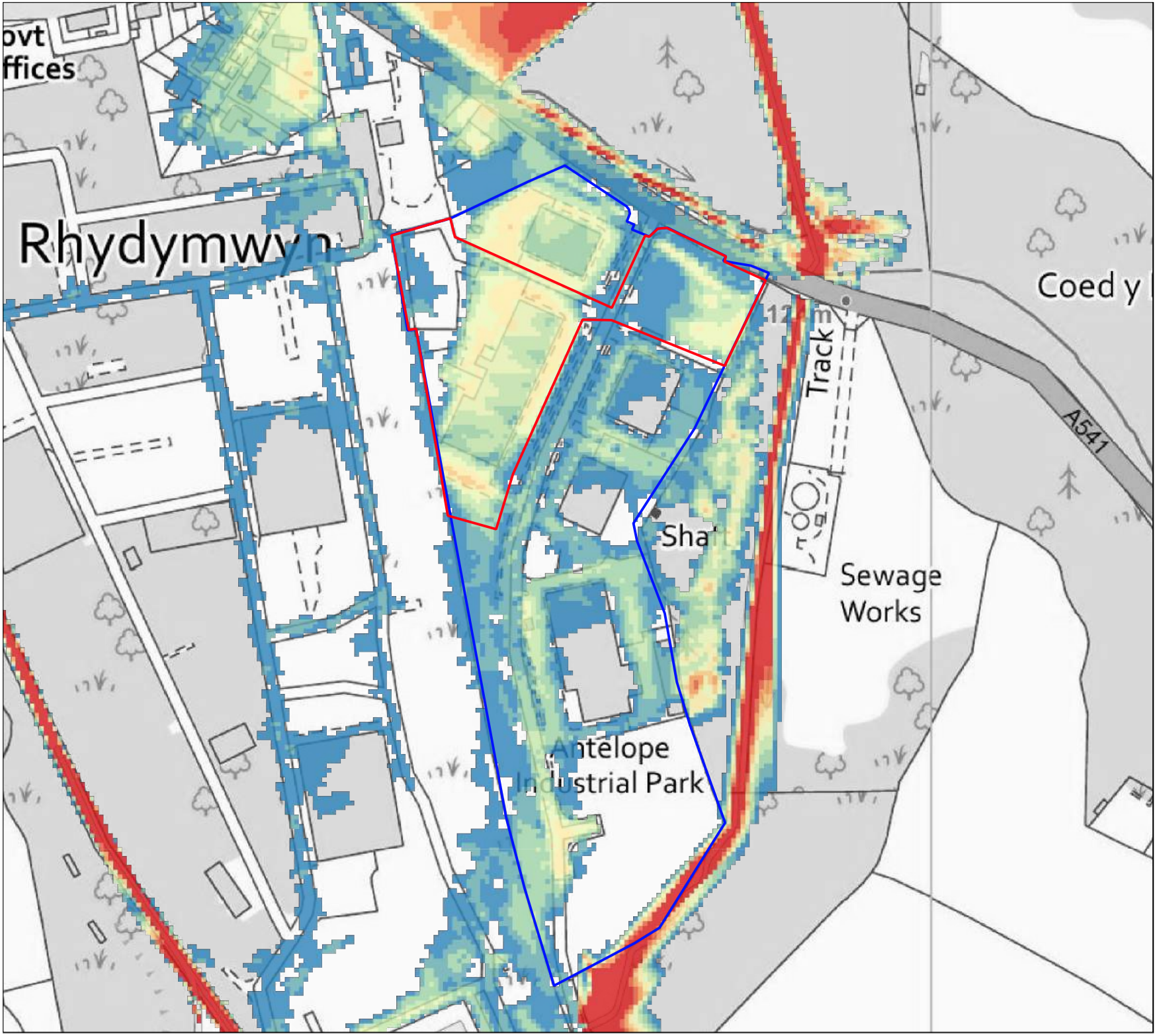

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Drawing Title: **Fluvial 25% Blockage Scenario - Maximum Flood Depth 1.0% plus climate change (20%) AEP event**

Map Orientation:

Scale: 0 10 20 30 40 50 m

Drawn:	Checked:	Date:
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Depth (m)

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Map Orientation:	Scale:
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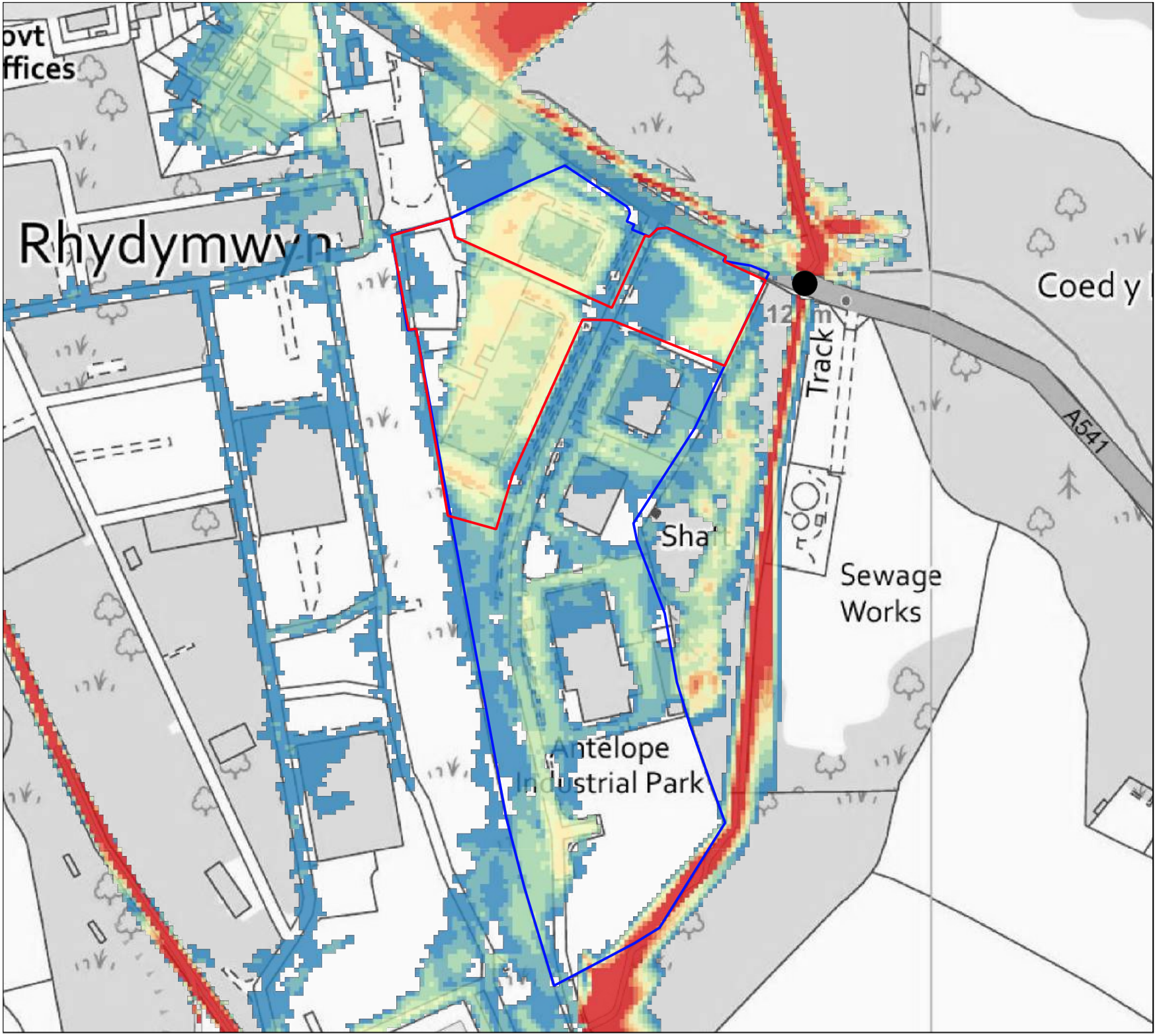

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Map Orientation:

Scale: 0 10 20 30 40 50 m

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- Application Boundary
- Ownership Boundary
- Blockage Location

Depth (m)

- < 0.1
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- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- > 1.0

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Drawing Title:
Fluvial 80% Blockage Scenario - Maximum Flood Depth 1.0% plus climate change (45%) AEP event

Map Orientation:	Scale: 0 10 20 30 40 50 m

Drawn:	Checked:	Date:
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Project No:	Drawing No:	Rev:
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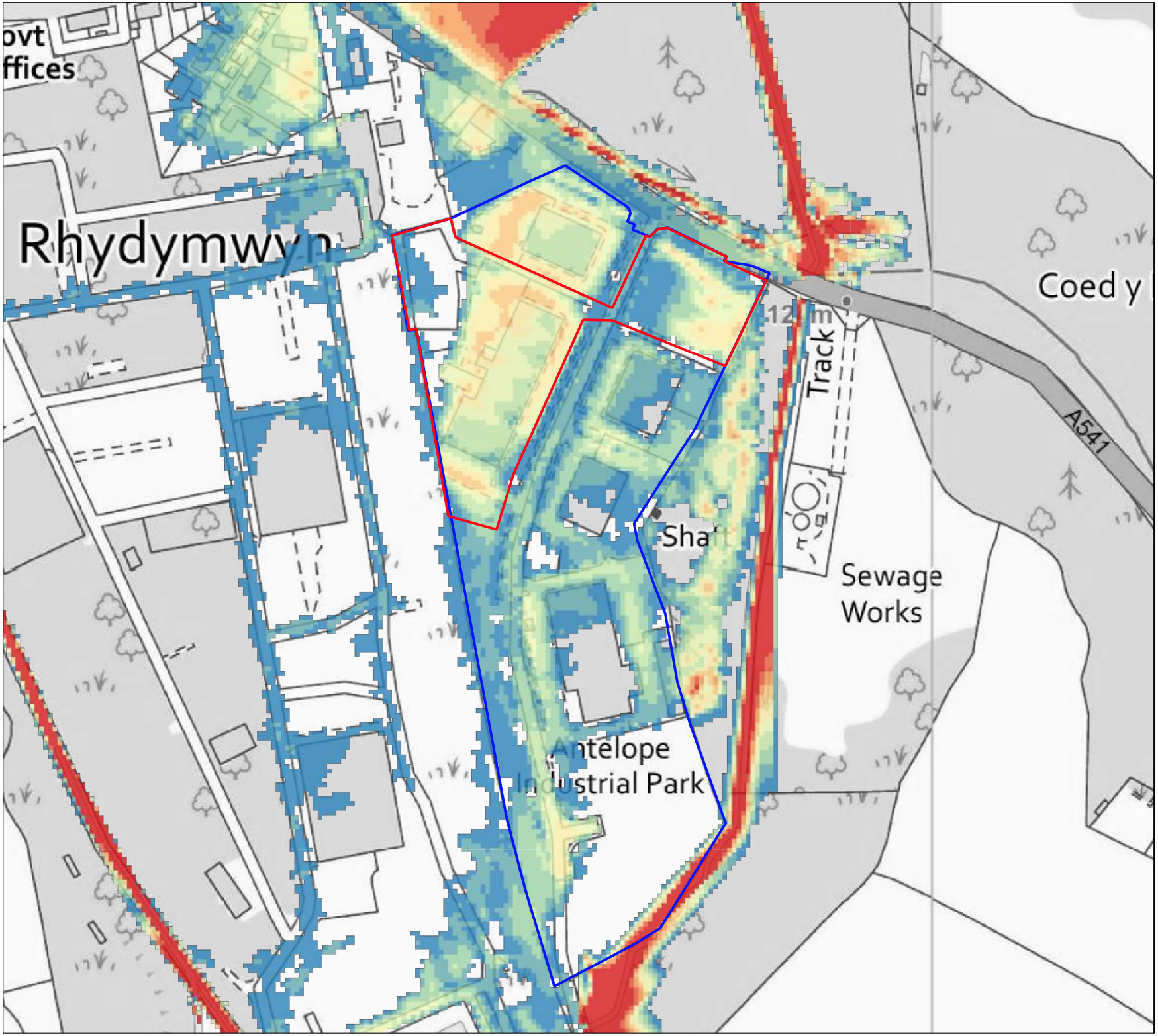

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- Ownership Boundary

Depth (m)

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- 0.4
- 0.5
- 0.6
- 0.7
- 0.8
- 0.9
- > 1.0

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Drawing Title:
Fluvial 80% Blockage Scenario - Maximum Flood Depth 0.1% AEP event

Map Orientation:

Scale: 0 10 20 30 40 50 m

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Flood Consequences Assessments
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Water Framework Directive Assessments
Environmental Permit and Land Drainage Applications
Sequential, Justification and Exception Tests
Utility Assessments
Expert Witness and Planning Appeals
Discharge of Planning Conditions

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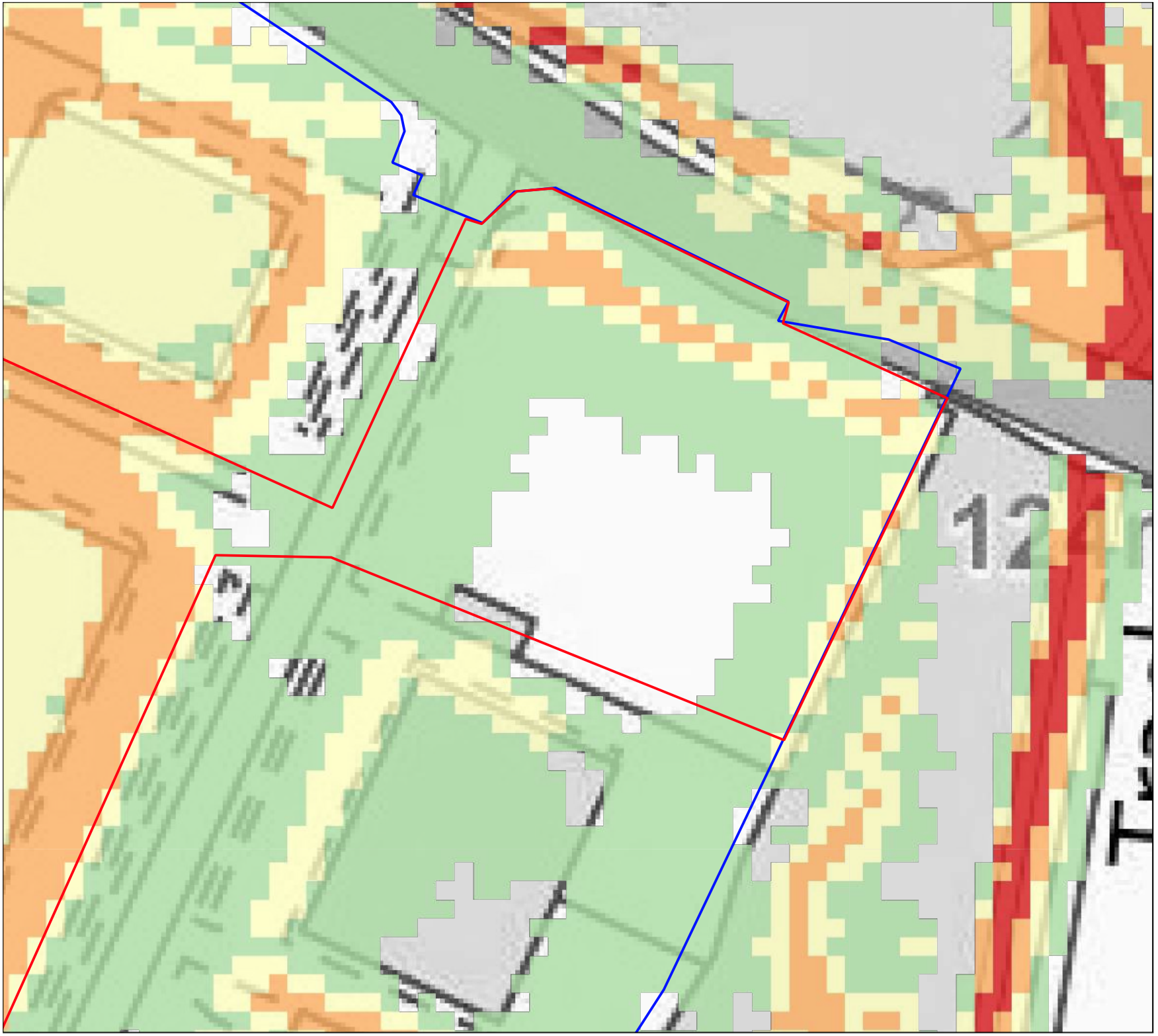
APPENDIX D

Flood Risk Hazard Plot



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Legend

- Application Boundary
- Ownership Boundary
- No Hazard
- Low Hazard
- Moderate Hazard
- Significant Hazard
- Extreme Hazard

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Drawing Title:
Fluvial 80% Blockage Scenario - Hazard Rating 0.1% AEP event

Map Orientation:

Scale: 0 3 6 9 12 m

Drawn:	Checked:	Date:
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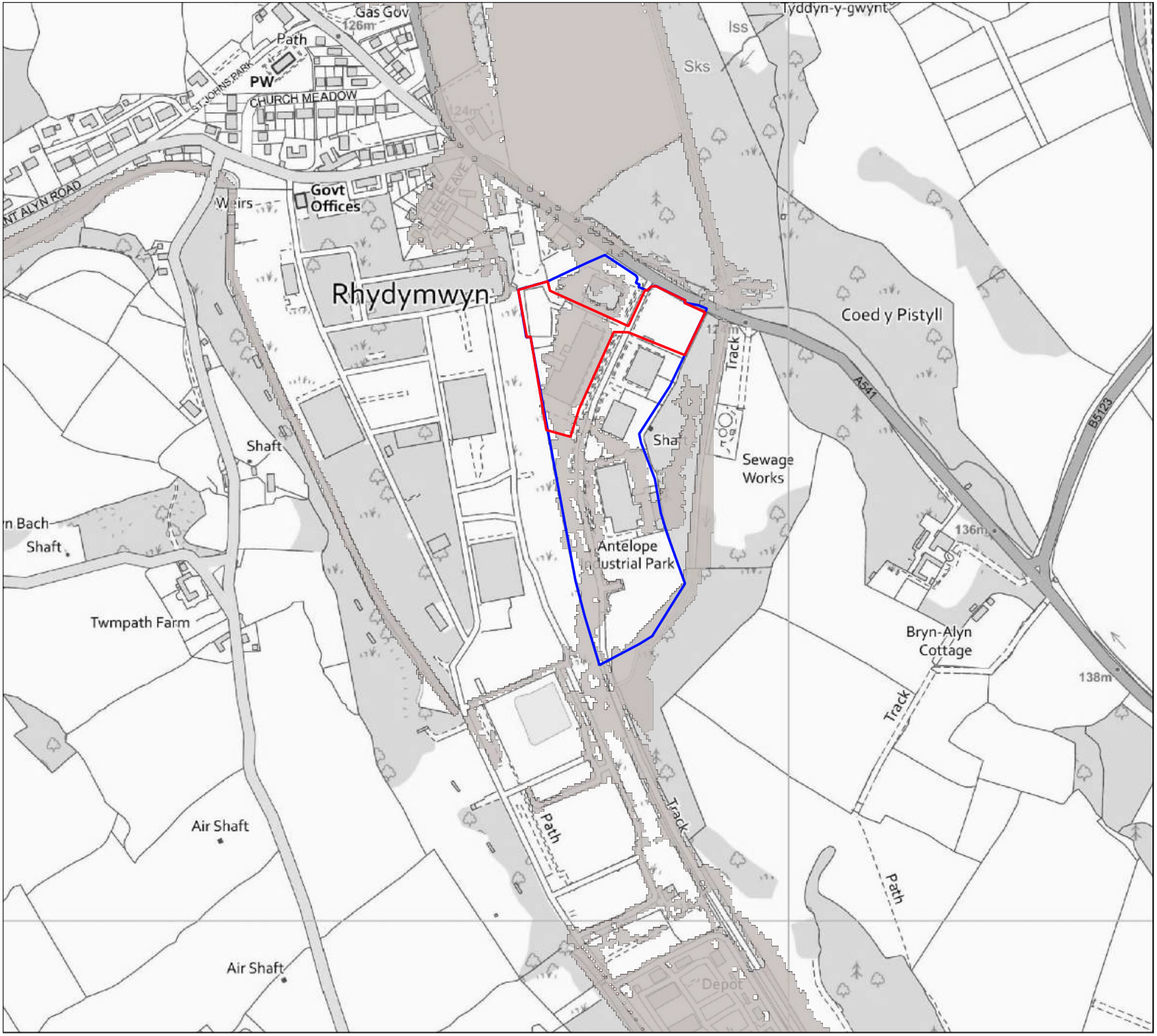
APPENDIX E

Flood Risk Comparison Plots



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Legend

- Application Boundary
- Ownership Boundary

Change in Depth (m)

- Reduction < 0.1
- Reduction 0.1 to 0.03
- Reduction 0.03 to 0.01
- No Change
- Increase 0.01 to 0.03
- Increase 0.03 to 0.1
- Increase > 0.1

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Project Title:
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Drawing Title:
Fluvial Proposed Scenario - Maximum Flood Depth 1.0% AEP plus climate change (20%) event

Map Orientation:

Scale: 0 20 40 60 80 100 m

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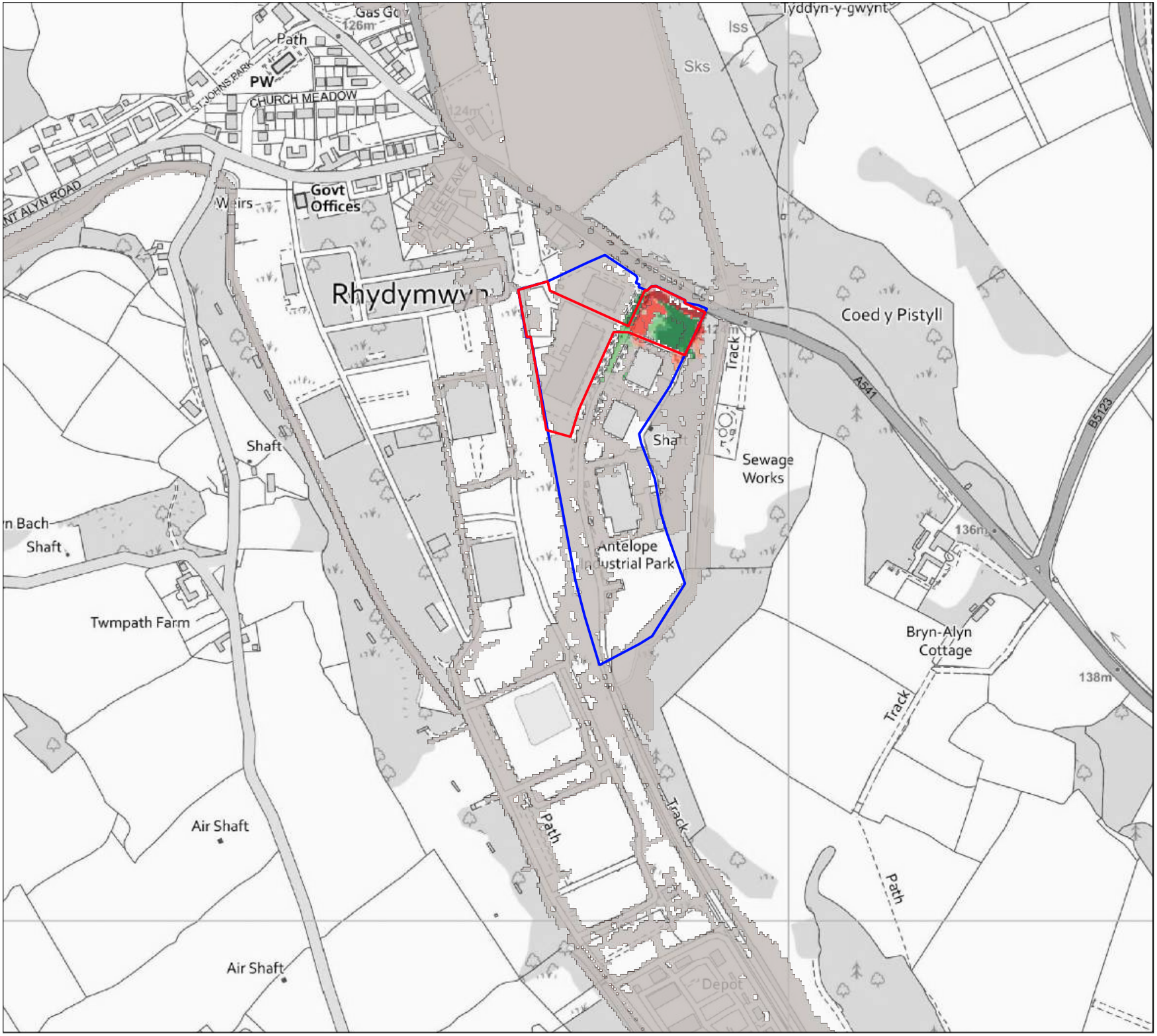

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Legend

- Application Boundary
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Change in Depth (m)

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- Reduction 0.03 to 0.01
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Map Orientation:	Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
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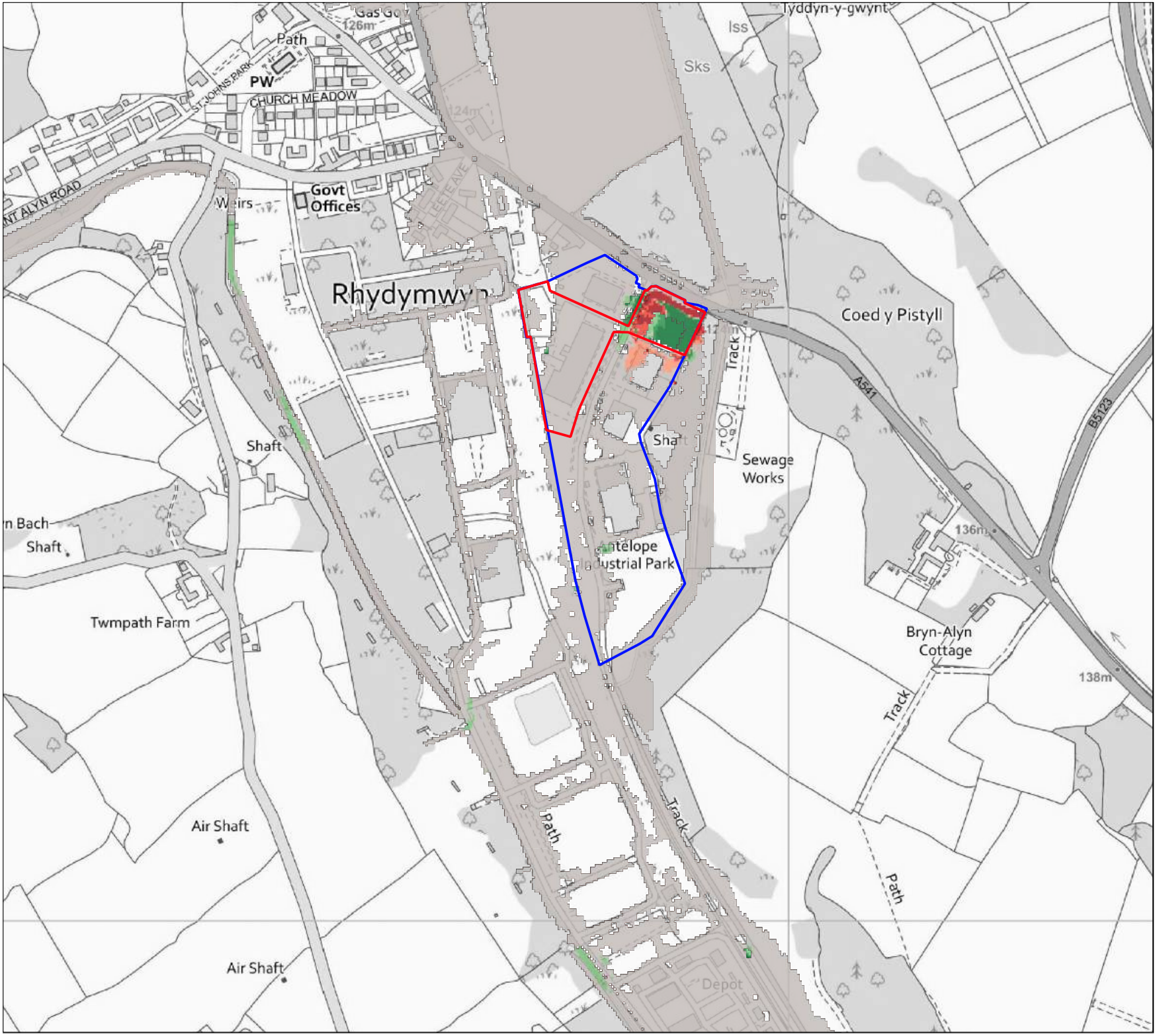

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Legend

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Map Orientation:

Scale: 0 20 40 60 80 100 m

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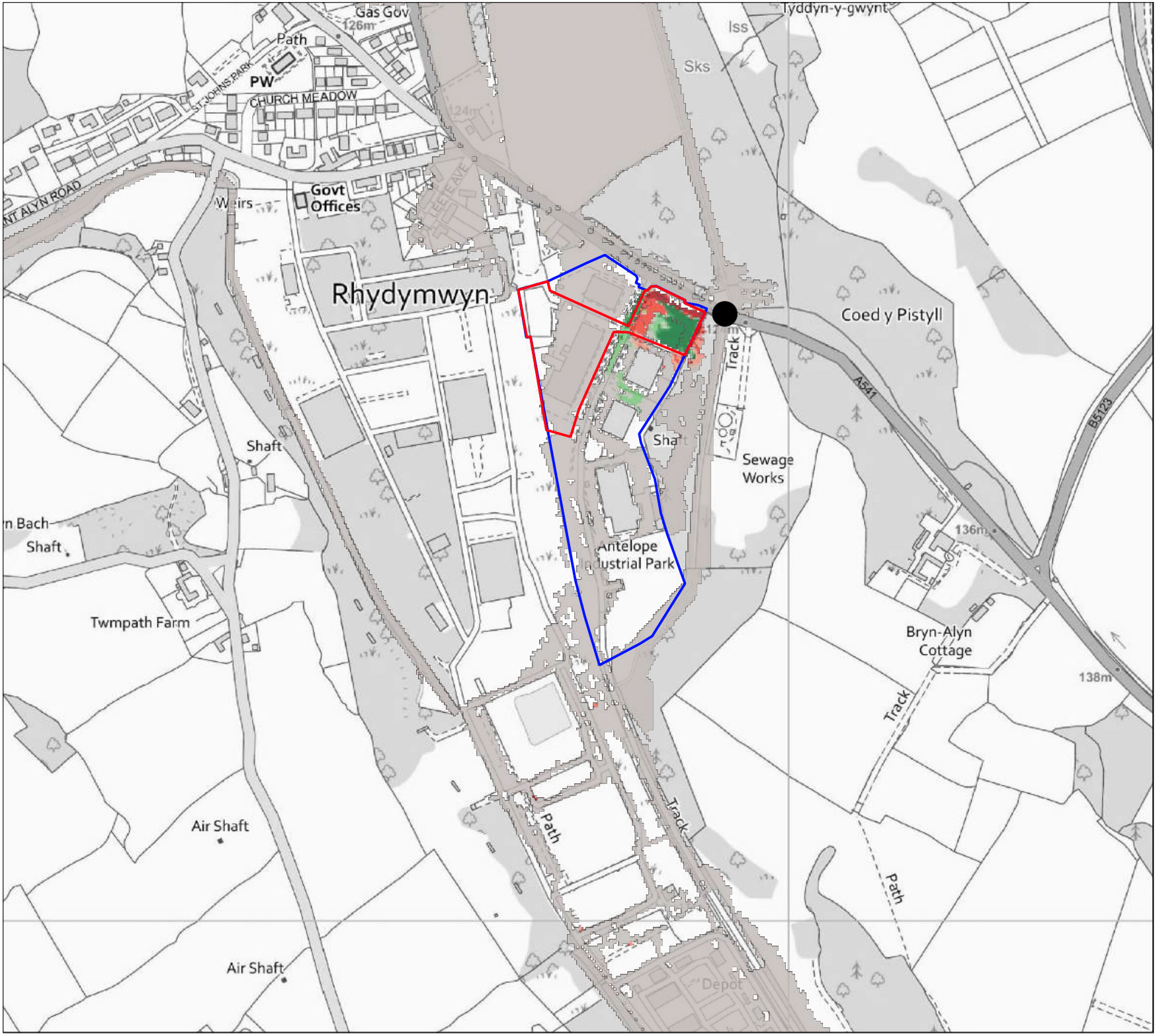

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1.0% AEP plus climate change (20%) event

Map Orientation:

Scale: 0 20 40 60 80 100 m

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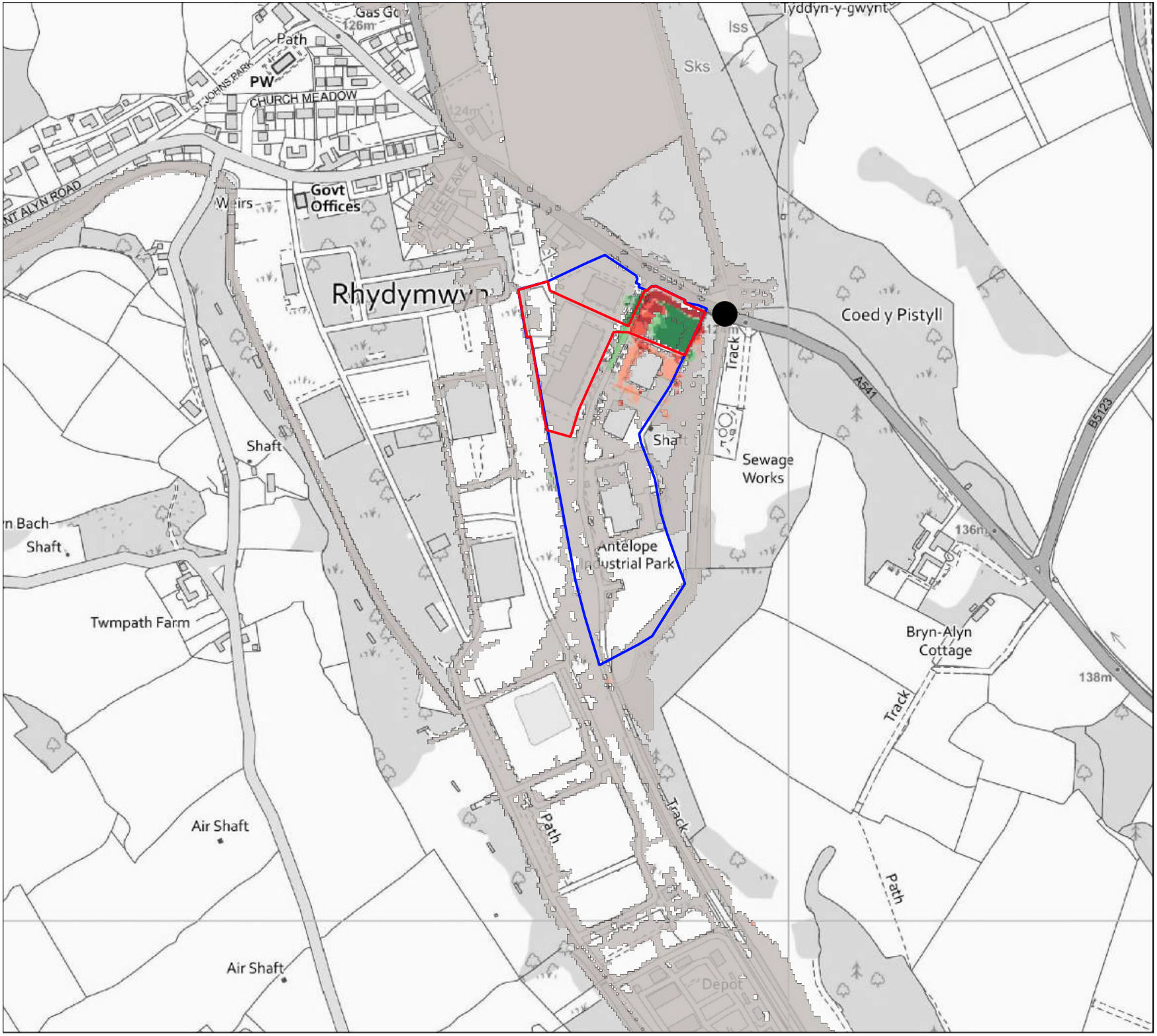

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Scale: 0 20 40 60 80 100 m

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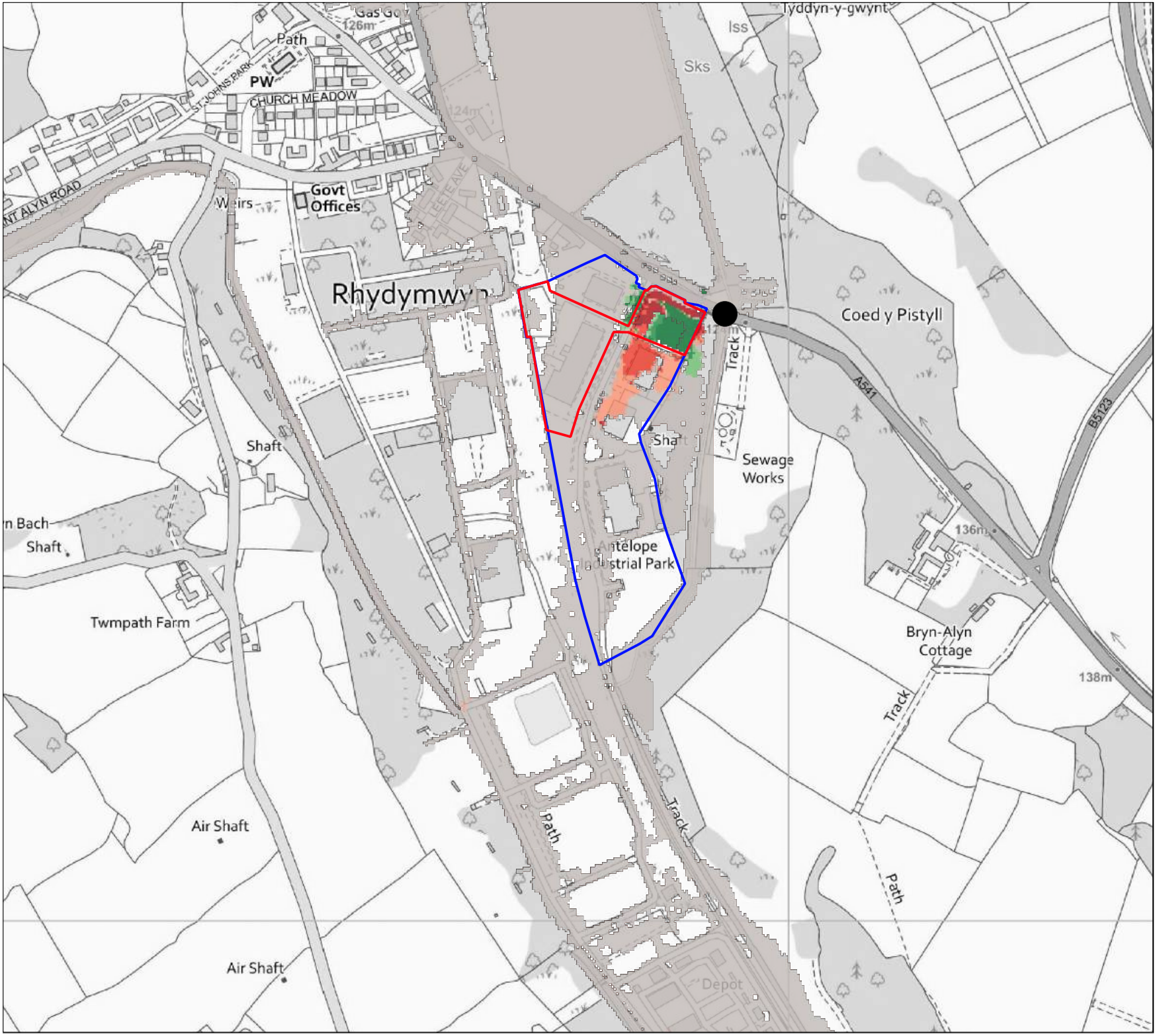

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Map Orientation:

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Project No:	Drawing No:	Rev:
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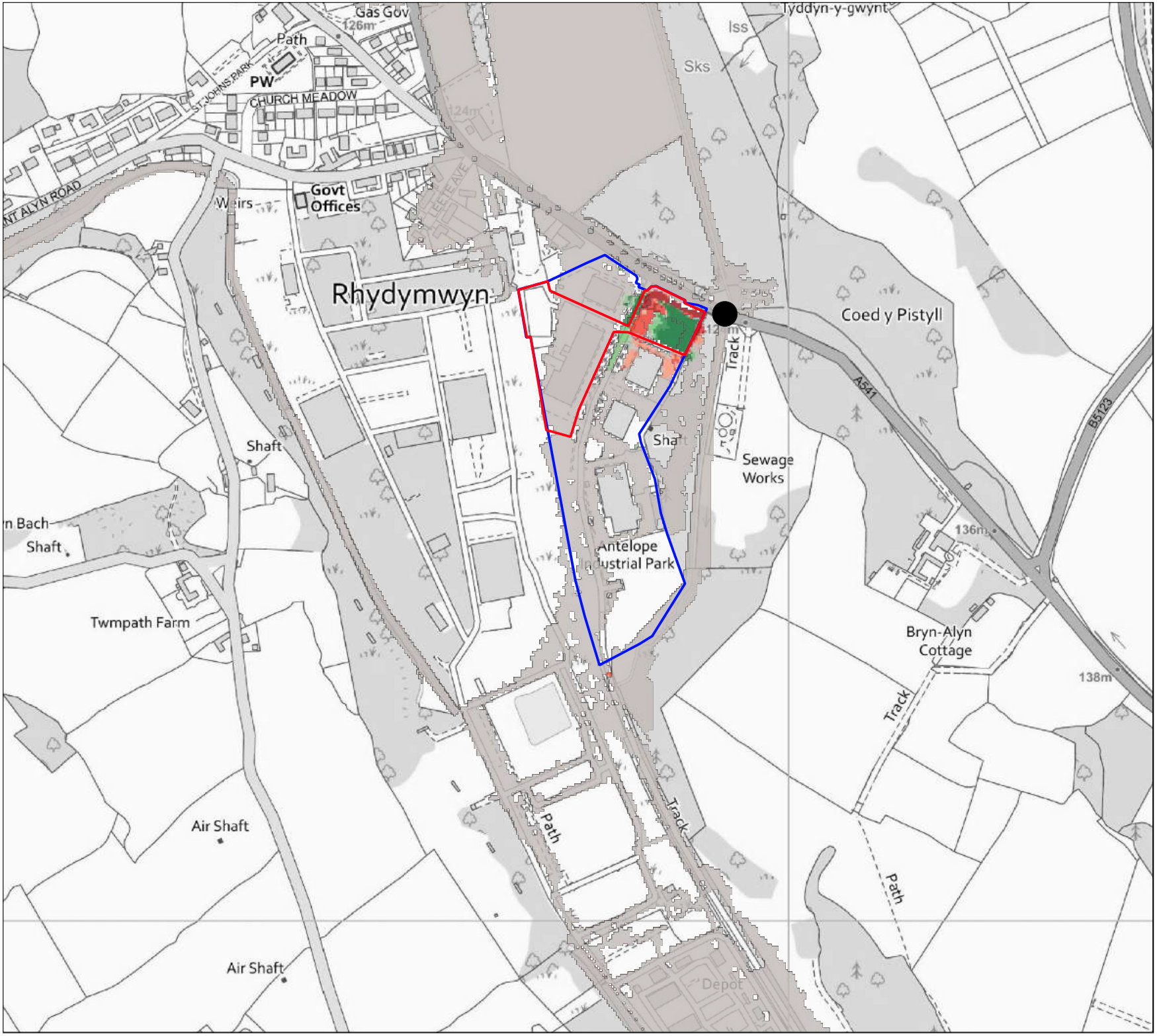

Notes:

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Legend

- Application Boundary
- Ownership Boundary
- Blockage Location

Change in Depth (m)

- Reduction < 0.1
- Reduction 0.1 to 0.03
- Reduction 0.03 to 0.01
- No Change
- Increase 0.01 to 0.03
- Increase 0.03 to 0.1
- Increase > 0.1

Weetwood
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Park House
Broncoed Business Park
Ffordd Byrnwr Gwair
Mold
CH7 1FQ
T: 01352 700045
E: info@weetwood.net
W: www.weetwood.net

Client:
Whitley Estate Co. Ltd

Project Title:
Antelope Industrial Park, Rhydymwyn, Mold

Drawing Title:
Fluvial Proposed 25% Blockage Scenario - Maximum Flood Depth
1.0% plus climate change (20%) AEP event

Map Orientation:	Scale:
	0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
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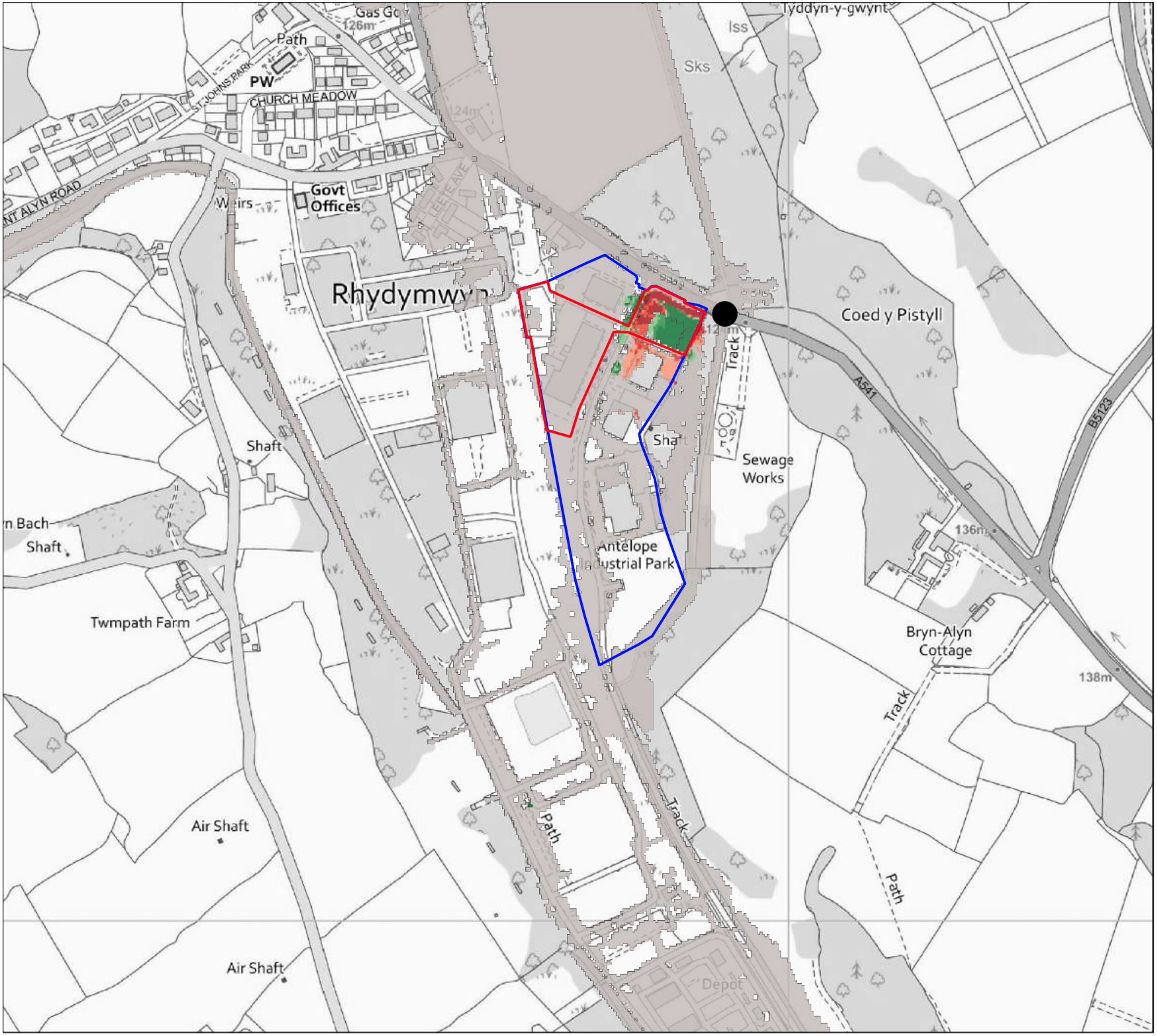

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Project Title:
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Drawing Title:
Fluvial Proposed 25% Blockage Scenario - Maximum Flood Depth
1.0% plus climate change (45%) AEP event

Map Orientation:

Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
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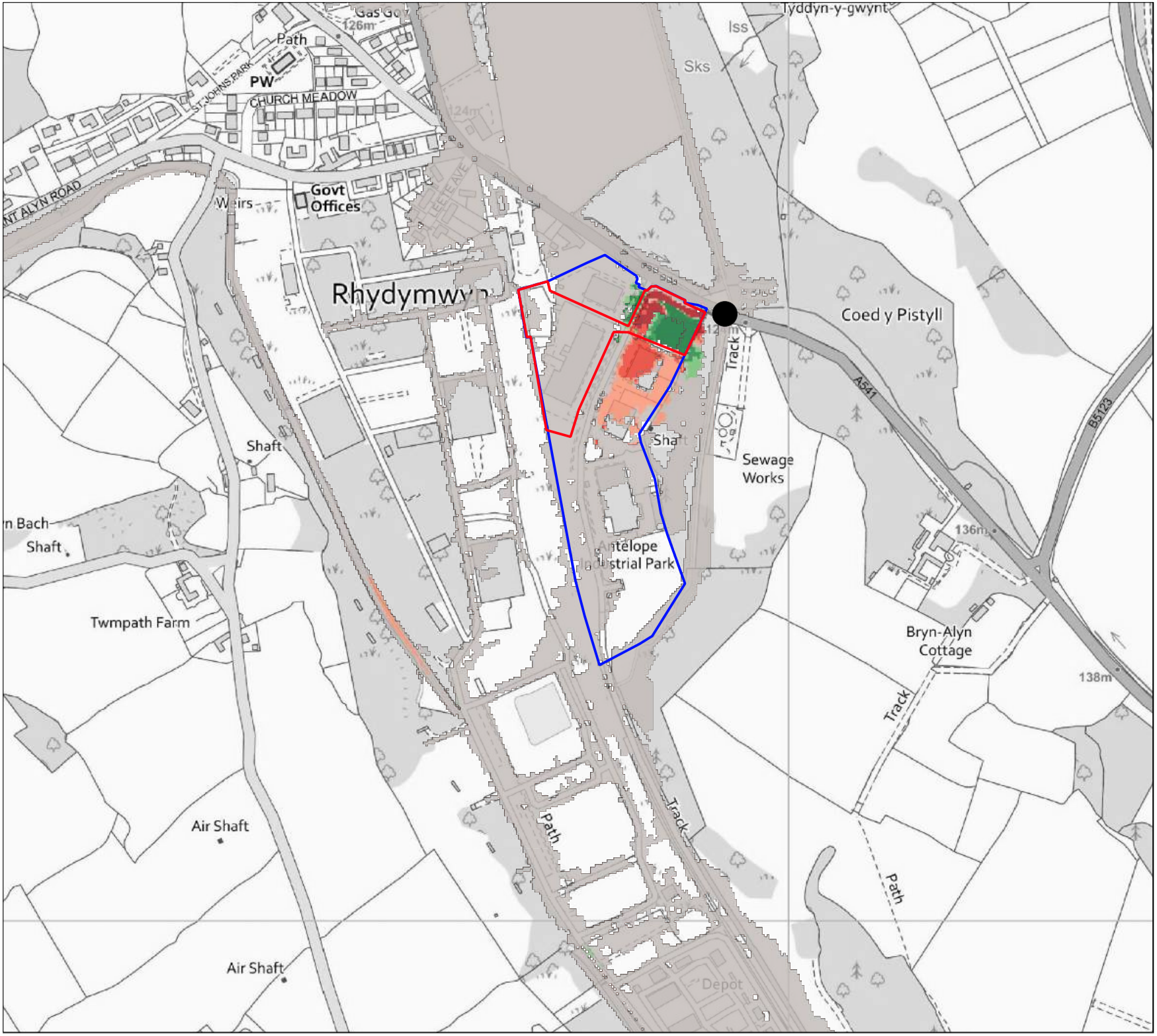

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- Ownership Boundary
- Blockage Location

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- Reduction 0.03 to 0.01
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- Increase 0.03 to 0.1
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Client: **Whitley Estate Co. Ltd**

Project Title: **Antelope Industrial Park, Rhydymwyn, Mold**

Drawing Title: **Fluvial Proposed 25% Blockage Scenario - Maximum Flood Depth 0.1% AEP event**

Map Orientation:

Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
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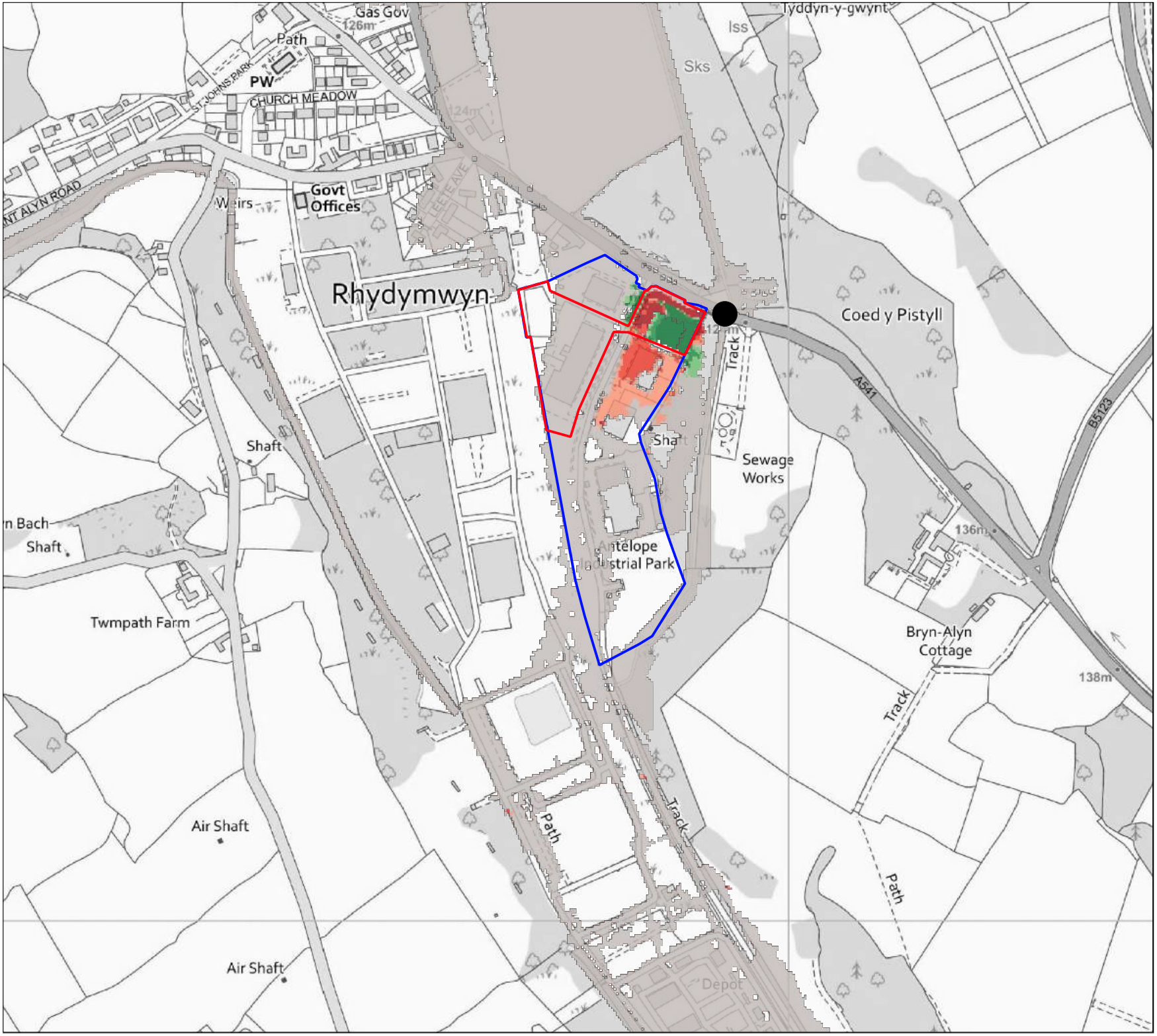

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- Blockage Location

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- Reduction 0.03 to 0.01
- No Change
- Increase 0.01 to 0.03
- Increase 0.03 to 0.1
- Increase > 0.1

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Drawing Title: **Fluvial Proposed 80% Blockage Scenario - Maximum Flood Depth**
1.0% plus climate change (20%) AEP event

Map Orientation:

Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
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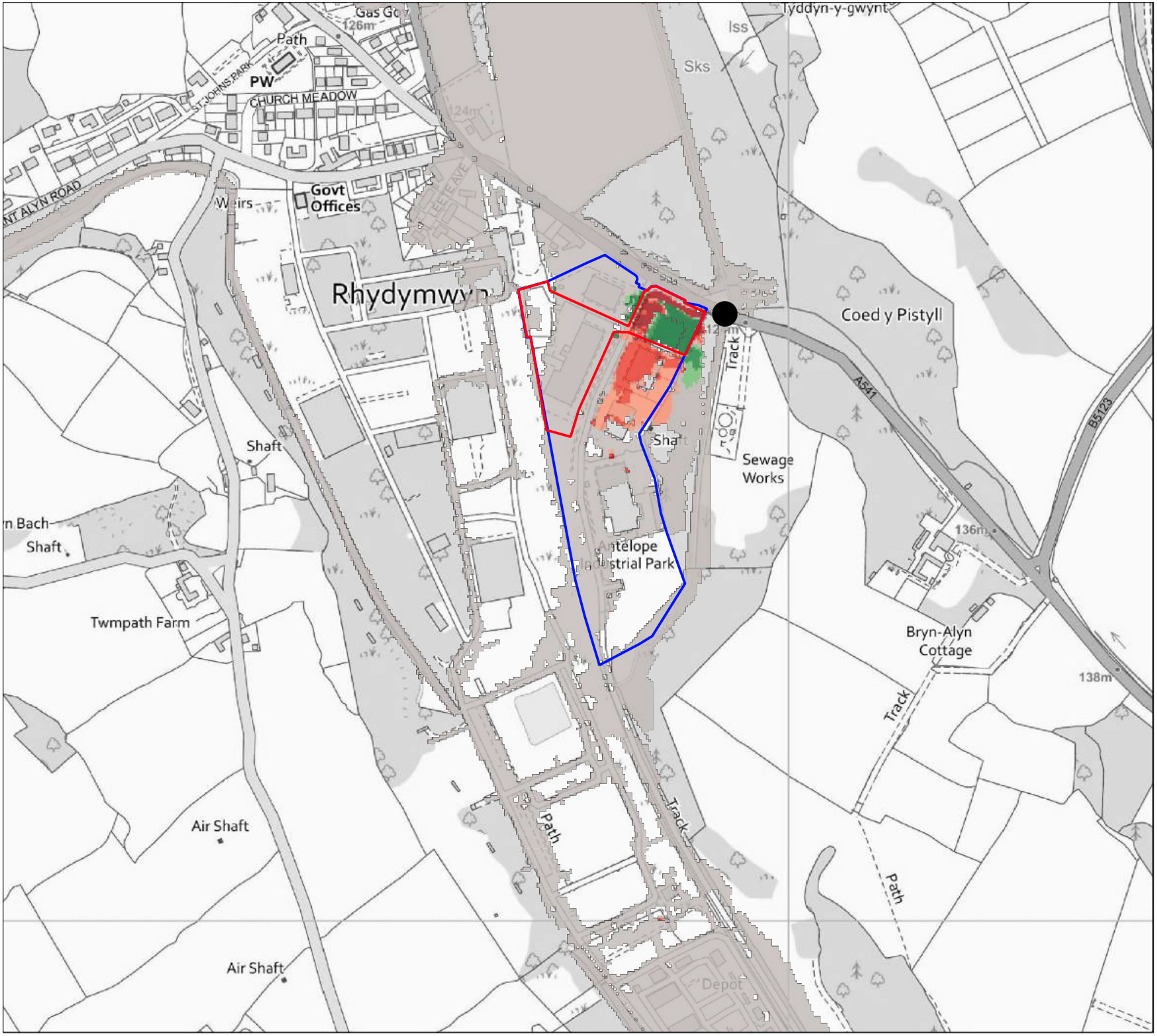

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- Increase > 0.1

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Client:
Whitley Estate Co. Ltd

Project Title:
Antelope Industrial Park, Rhydymwyn, Mold

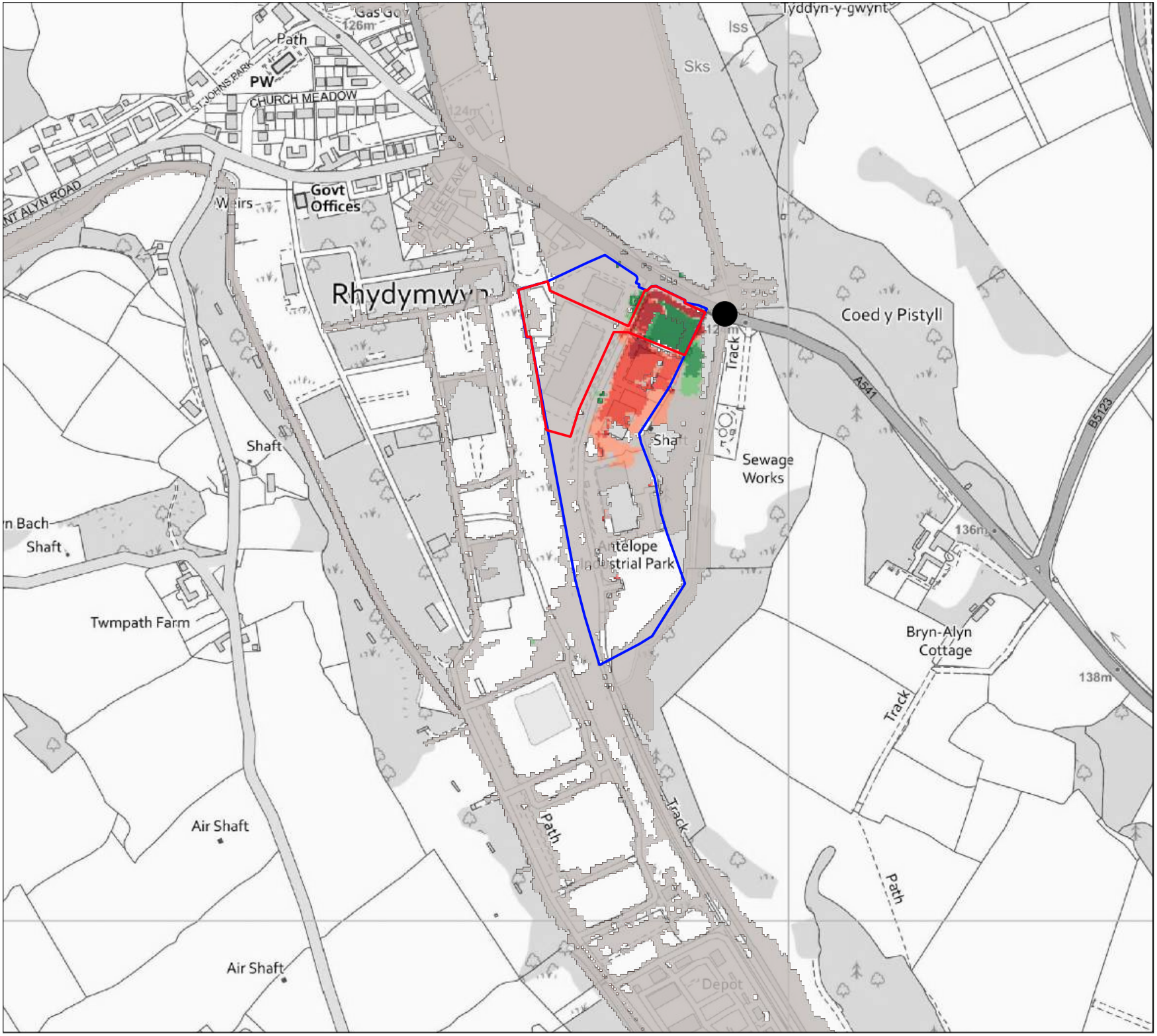
Drawing Title:
Fluvial Proposed 80% Blockage Scenario - Maximum Flood Depth
1.0% plus climate change (45%) AEP event

Map Orientation:

Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
6262	6262_017-012_rhyd_100cc45_5m_def_006_d	A



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Client: **Whitley Estate Co. Ltd**

Project Title: **Antelope Industrial Park, Rhydymwyn, Mold**

Drawing Title: **Fluvial Proposed 80% Blockage Scenario - Maximum Flood Depth 0.1% AEP event**

Map Orientation:

Scale: 0 20 40 60 80 100 m

Drawn:	Checked:	Date:
FL	AE	15 November 2024

Project No:	Drawing No:	Rev:
6262	6262_025-024_rhyd_1000yr_5m_def_006_d	A

APPENDIX F

Drainage Survey Drawing

WHITLEY ESTATES LTD
BRONCOED BUSINESS PARK
MOLD, CH7 1HP
TOPOGRAPHICAL SURVEY

DATE: October 2024

APPENDIX G

Greenfield Runoff Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	dan hodson
Site name:	Antelope Ind Estate
Site location:	CH7 5HG

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:	53.19288° N
Longitude:	3.18739° W
Reference:	3295669084
Date:	Oct 07 2024 16:49

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):	882	882
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):	2.39	2.39
1 in 1 year (l/s):	2.1	2.1
1 in 30 years (l/s):	4.25	4.25
1 in 100 year (l/s):	5.21	5.21
1 in 200 years (l/s):	5.88	5.88

APPENDIX H

Surface Water Attenuation - Storage Volume Calculation

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	1	0.054	5.00	122.850	Manhole	Adoptable	1200	5072.568	4948.236	1.450
✓	2	0.073	5.00	122.850	Manhole	Adoptable	1500	5073.625	4971.099	1.700
✓	4	0.031	5.00	122.850	Manhole	Adoptable	1500	5035.155	4976.336	1.800
✓	50	0.051	5.00	122.850	Manhole	Adoptable	1200	5030.581	4942.666	1.450
✓	5	0.075	5.00	122.850	Manhole	Adoptable	1500	5034.078	4968.412	1.850
✓	EX SW			122.900	Manhole	Adoptable	1200	5015.400	4970.949	2.050

Links (Input)

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
✓	1.000	1	2	22.887	0.600	Colebrook-White	121.400	121.150	0.250	91.5	225	Circular	5.28	48.2
✓	1.001	2	4	4.000	0.600	Colebrook-White	121.150	121.050	0.100	40.0	225	Circular	5.31	48.1
✓	1.002	4	5	7.997	0.600	Colebrook-White	121.050	121.000	0.050	159.9	225	Circular	5.44	47.6
✓	2.000	50	5	25.982	0.600	Colebrook-White	121.400	121.000	0.400	65.0	225	Circular	5.27	48.3
?	1.003	5	EX SW	18.850	0.600	Colebrook-White	121.000	120.850	0.150	125.7	150	Circular	5.79	46.4

Pipeline Schedule

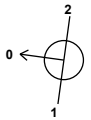
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	22.887	91.5	225	Circular	122.850	121.400	1.225	122.850	121.150	1.475
1.001	4.000	40.0	225	Circular	122.850	121.150	1.475	122.850	121.050	1.575
1.002	7.997	159.9	225	Circular	122.850	121.050	1.575	122.850	121.000	1.625
2.000	25.982	65.0	225	Circular	122.850	121.400	1.225	122.850	121.000	1.625
1.003	18.850	125.7	150	Circular	122.850	121.000	1.700	122.900	120.850	1.900

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	1	1200	Manhole	Adoptable	2	1500	Manhole	Adoptable
1.001	2	1500	Manhole	Adoptable	4	1500	Manhole	Adoptable
1.002	4	1500	Manhole	Adoptable	5	1500	Manhole	Adoptable
2.000	50	1200	Manhole	Adoptable	5	1500	Manhole	Adoptable
1.003	5	1500	Manhole	Adoptable	EX SW	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
1	5072.568	4948.236	122.850	1.450	1200	Manhole	Adoptable					
								0	1.000	121.400	225	Circular
2	5073.625	4971.099	122.850	1.700	1500	Manhole	Adoptable	1	1.000	121.150	225	Circular
												
								0	1.001	121.150	225	Circular
4	5035.155	4976.336	122.850	1.800	1500	Manhole	Adoptable	1	1.001	121.050	225	Circular
												
								0	1.002	121.050	225	Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
50	5030.581	4942.666	122.850	1.450	1200	Manhole	Adoptable					
								0	2.000	121.400	225	Circular
5	5034.078	4968.412	122.850	1.850	1500	Manhole	Adoptable		1	2.000	121.000	225	Circular
									2	1.002	121.000	225	Circular
									0	1.003	121.000	150	Circular
EX SW	5015.400	4970.949	122.900	2.050	1200	Manhole	Adoptable		1	1.003	120.850	150	Circular

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
Summer CV	0.750	Skip Steady State	x	Starting Level (m)			

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

Node 5 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	121.000	Product Number	CTL-SHE-0041-1000-1700-1000
Design Depth (m)	1.700	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node 4 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	121.100
Side Inf Coefficient (m/hr)	0.00000	Porosity	0.95	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	315.0	0.0	0.800	315.0	0.0	0.801	0.0	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	121.454	0.054	7.0	0.1010	0.0000	OK
720 minute winter	2	705	121.274	0.124	5.9	0.3244	0.0000	OK
720 minute winter	4	690	121.273	0.223	9.6	52.4734	0.0000	OK
15 minute winter	50	10	121.448	0.048	6.7	0.0886	0.0000	OK
720 minute winter	5	690	121.273	0.273	2.0	0.7044	0.0000	SURCHARGED
15 minute summer	EX SW	1	120.850	0.000	0.6	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	6.9	0.710	0.127	0.2235	
15 minute winter	2	1.001	4	16.1	1.413	0.196	0.0487	
15 minute winter	4	1.002	5	-15.2	-0.649	-0.371	0.1900	
15 minute winter	50	2.000	5	6.6	0.316	0.102	0.5368	
480 minute winter	5	Hydro-Brake®	EX SW	0.6				25.1

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1410	121.744	0.344	1.4	0.6446	0.0000	SURCHARGED
1440 minute winter	2	1410	121.744	0.594	6.3	1.5588	0.0000	SURCHARGED
1440 minute winter	4	1410	121.744	0.694	10.7	194.2092	0.0000	SURCHARGED
1440 minute winter	50	1410	121.744	0.344	1.3	0.6301	0.0000	SURCHARGED
1440 minute winter	5	1410	121.744	0.744	3.3	1.9170	0.0000	SURCHARGED
15 minute summer	EX SW	1	120.850	0.000	0.6	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	22.6	0.917	0.415	0.5582	
15 minute winter	2	1.001	4	52.6	2.002	0.638	0.1269	
15 minute winter	4	1.002	5	-51.1	-1.439	-1.246	0.3177	
15 minute winter	50	2.000	5	21.4	0.671	0.331	0.7050	
1440 minute winter	5	Hydro-Brake®	EX SW	0.7				62.1

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 99.57%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1380	122.701	1.301	1.8	2.4400	0.0000	FLOOD RISK
1440 minute winter	2	1380	122.701	1.551	4.1	4.0719	0.0000	FLOOD RISK
1440 minute winter	4	1380	122.701	1.651	9.9	243.1853	0.0000	FLOOD RISK
1440 minute winter	50	1380	122.701	1.301	1.7	2.3853	0.0000	FLOOD RISK
1440 minute winter	5	1380	122.701	1.701	4.0	4.3841	0.0000	FLOOD RISK
15 minute summer	EX SW	1	120.850	0.000	0.6	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	28.3	0.951	0.521	0.6619	
15 minute winter	2	1.001	4	65.5	2.089	0.795	0.1490	
15 minute winter	4	1.002	5	-64.1	-1.726	-1.563	0.3180	
15 minute winter	50	2.000	5	26.7	0.811	0.414	0.7386	
1440 minute winter	5	Hydro-Brake®	EX SW	1.0				69.8

Design Settings

Rainfall Methodology	FEH-22	Maximum Time of Concentration (mins)	30.00	Preferred Cover Depth (m)	1.200
Return Period (years)	2	Maximum Rainfall (mm/hr)	50.0	Include Intermediate Ground	✓
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00	Enforce best practice design rules	x
CV	0.750	Connection Type	Level Soffits		
Time of Entry (mins)	5.00	Minimum Backdrop Height (m)	0.200		

Nodes

	Name	Area (ha)	T of E (mins)	Cover Level (m)	Node Type	Manhole Type	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
✓	1	0.062	5.00	122.550	Manhole	Adoptable	1200	4976.798	4936.567	1.150
✓	2	0.062	5.00	122.740	Manhole	Adoptable	1200	4932.958	4942.979	1.690
✓	BASIN	0.068	5.00	122.500	Junction			4929.071	4909.876	1.500
✓	3			122.900	Manhole	Adoptable	1200	4926.378	4882.594	2.040
✓	4	0.086	5.00	122.100	Manhole	Adoptable	1200	4952.148	4829.453	1.500
✓	5	0.030	5.00	122.100	Manhole	Adoptable	1200	4976.917	4826.215	1.610
✓	6	0.090	5.00	122.300	Manhole	Adoptable	1200	4980.534	4830.901	1.840
✓	EX SW			122.200	Manhole	Adoptable	1200	4996.357	4826.028	1.950

Links (Input)

	Name	US Node	DS Node	Length (m)	ks (mm) / n	Velocity Equation	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	Link Type	T of C (mins)	Rain (mm/hr)
?	1.000	1	2	44.306	0.600	Colebrook-White	121.400	121.050	0.350	126.6	225	Circular	5.64	47.0
✓	1.001	2	BASIN	6.300	0.600	Colebrook-White	121.050	121.000	0.050	126.0	225	Circular	5.73	46.6
✓	1.002	BASIN	3	21.000	0.600	Colebrook-White	121.000	120.860	0.140	150.0	300	Circular	6.00	45.7
✓	1.003	3	4	59.060	0.600	Colebrook-White	120.860	120.600	0.260	227.2	300	Circular	6.95	42.8
✓	1.004	4	5	24.980	0.600	Colebrook-White	120.600	120.490	0.110	227.1	300	Circular	7.35	41.7
✓	1.005	5	6	5.920	0.600	Colebrook-White	120.490	120.460	0.030	197.3	300	Circular	7.44	41.5
?	1.006	6	EX SW	16.556	0.600	Colebrook-White	120.460	120.250	0.210	78.8	150	Circular	7.68	40.8

Pipeline Schedule

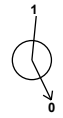
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	44.306	126.6	225	Circular	122.550	121.400	0.925	122.740	121.050	1.465
1.001	6.300	126.0	225	Circular	122.740	121.050	1.465	122.500	121.000	1.275
1.002	21.000	150.0	300	Circular	122.500	121.000	1.200	122.900	120.860	1.740
1.003	59.060	227.2	300	Circular	122.900	120.860	1.740	122.100	120.600	1.200
1.004	24.980	227.1	300	Circular	122.100	120.600	1.200	122.100	120.490	1.310
1.005	5.920	197.3	300	Circular	122.100	120.490	1.310	122.300	120.460	1.540
1.006	16.556	78.8	150	Circular	122.300	120.460	1.690	122.200	120.250	1.800

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	BASIN		Junction	
1.002	BASIN		Junction		3	1200	Manhole	Adoptable
1.003	3	1200	Manhole	Adoptable	4	1200	Manhole	Adoptable
1.004	4	1200	Manhole	Adoptable	5	1200	Manhole	Adoptable
1.005	5	1200	Manhole	Adoptable	6	1200	Manhole	Adoptable
1.006	6	1200	Manhole	Adoptable	EX SW	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections	Link	IL (m)	Dia (mm)	Link Type
1	4976.798	4936.567	122.550	1.150	1200	Manhole	Adoptable					
								0	1.000	121.400	225	Circular
2	4932.958	4942.979	122.740	1.690	1200	Manhole	Adoptable	1	1.000	121.050	225	Circular
												
								0	1.001	121.050	225	Circular

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Node Type	MH Type	Connections		Link	IL (m)	Dia (mm)	Link Type
BASIN	4929.071	4909.876	122.500	1.500		Junction			1	1.001	121.000	225	Circular
									0	1.002	121.000	300	Circular
3	4926.378	4882.594	122.900	2.040	1200	Manhole	Adoptable		1	1.002	120.860	300	Circular
									0	1.003	120.860	300	Circular
4	4952.148	4829.453	122.100	1.500	1200	Manhole	Adoptable		1	1.003	120.600	300	Circular
									0	1.004	120.600	300	Circular
5	4976.917	4826.215	122.100	1.610	1200	Manhole	Adoptable		1	1.004	120.490	300	Circular
									0	1.005	120.490	300	Circular
6	4980.534	4830.901	122.300	1.840	1200	Manhole	Adoptable		1	1.005	120.460	300	Circular
									0	1.006	120.460	150	Circular
EX SW	4996.357	4826.028	122.200	1.950	1200	Manhole	Adoptable		1	1.006	120.250	150	Circular

Simulation Settings

Rainfall Methodology	FEH-22	Winter CV	0.840	Drain Down Time (mins)	240	Check Discharge Rate(s)	x
Rainfall Events	Singular	Analysis Speed	Detailed	Additional Storage (m³/ha)	20.0	Check Discharge Volume	x
Summer CV	0.750	Skip Steady State	x	Starting Level (m)			

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

Node 6 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	120.460	Product Number	CTL-SHE-0042-1000-1600-1000
Design Depth (m)	1.600	Min Outlet Diameter (m)	0.075
Design Flow (l/s)	1.0	Min Node Diameter (mm)	1200

Node BASIN Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	121.000
Side Inf Coefficient (m/hr)	0.00000	Porosity	1.00	Time to half empty (mins)	

Depth (m)	Area (m²)	Inf Area (m²)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	228.4	0.0	1.500	644.8	0.0

Results for 2 year Critical Storm Duration. Lowest mass balance: 97.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	1	10	121.462	0.062	8.1	0.1376	0.0000	OK
720 minute winter	2	690	121.261	0.211	2.1	0.3938	0.0000	OK
720 minute winter	BASIN	690	121.261	0.261	7.7	69.3471	0.0000	OK
720 minute winter	3	690	121.261	0.401	2.6	0.4537	0.0000	SURCHARGED
720 minute winter	4	690	121.261	0.661	2.7	1.5061	0.0000	SURCHARGED
720 minute winter	5	690	121.261	0.771	1.3	1.1598	0.0000	SURCHARGED
720 minute winter	6	690	121.261	0.801	1.5	1.6896	0.0000	SURCHARGED
15 minute summer	EX SW	1	120.250	0.000	0.6	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	7.8	0.670	0.170	0.5215	
15 minute winter	2	1.001	BASIN	15.6	2.128	0.337	0.0544	
30 minute winter	BASIN	1.002	3	-14.1	0.518	-0.155	0.7409	
15 minute winter	3	1.003	4	-17.5	-0.297	-0.239	3.6832	
15 minute summer	4	1.004	5	-11.9	0.280	-0.162	1.7591	
15 minute summer	5	1.005	6	-9.2	-0.130	-0.116	0.4169	
720 minute winter	6	Hydro-Brake®	EX SW	0.7				37.7

Results for 30 year +30% CC Critical Storm Duration. Lowest mass balance: 97.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1410	121.794	0.394	1.6	0.8705	0.0000	SURCHARGED
1440 minute winter	2	1410	121.794	0.744	3.2	1.3876	0.0000	SURCHARGED
1440 minute winter	BASIN	1410	121.794	0.794	9.2	269.5925	0.0000	SURCHARGED
1440 minute winter	3	1410	121.794	0.934	4.4	1.0564	0.0000	SURCHARGED
1440 minute winter	4	1410	121.794	1.194	4.5	2.7200	0.0000	SURCHARGED
1440 minute winter	5	1410	121.794	1.304	2.3	1.9612	0.0000	SURCHARGED
1440 minute winter	6	1410	121.794	1.334	2.4	2.8134	0.0000	SURCHARGED
15 minute summer	EX SW	1	120.250	0.000	0.9	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	25.7	0.874	0.556	1.2747	
15 minute winter	2	1.001	BASIN	52.6	2.399	1.137	0.2356	
15 minute winter	BASIN	1.002	3	-77.8	-1.453	-0.860	1.3622	
15 minute winter	3	1.003	4	-79.1	-1.124	-1.078	4.1590	
15 minute winter	4	1.004	5	-45.6	-0.648	-0.621	1.7591	
15 minute winter	5	1.005	6	-34.2	-0.486	-0.434	0.4169	
1440 minute winter	6	Hydro-Brake®	EX SW	0.9				78.4

Results for 100 year +30% CC Critical Storm Duration. Lowest mass balance: 97.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
1440 minute winter	1	1410	121.971	0.571	2.0	1.2621	0.0000	SURCHARGED
1440 minute winter	2	1410	121.971	0.921	3.9	1.7183	0.0000	SURCHARGED
1440 minute winter	BASIN	1410	121.971	0.971	11.6	353.7029	0.0000	SURCHARGED
1440 minute winter	3	1410	121.971	1.111	5.7	1.2569	0.0000	SURCHARGED
1440 minute winter	4	1410	121.971	1.371	5.7	3.1239	0.0000	FLOOD RISK
1440 minute winter	5	1410	121.971	1.481	3.0	2.2279	0.0000	FLOOD RISK
15 minute winter	6	11	121.979	1.519	47.6	3.2039	0.0000	SURCHARGED
15 minute summer	EX SW	1	120.250	0.000	1.0	0.0000	0.0000	OK

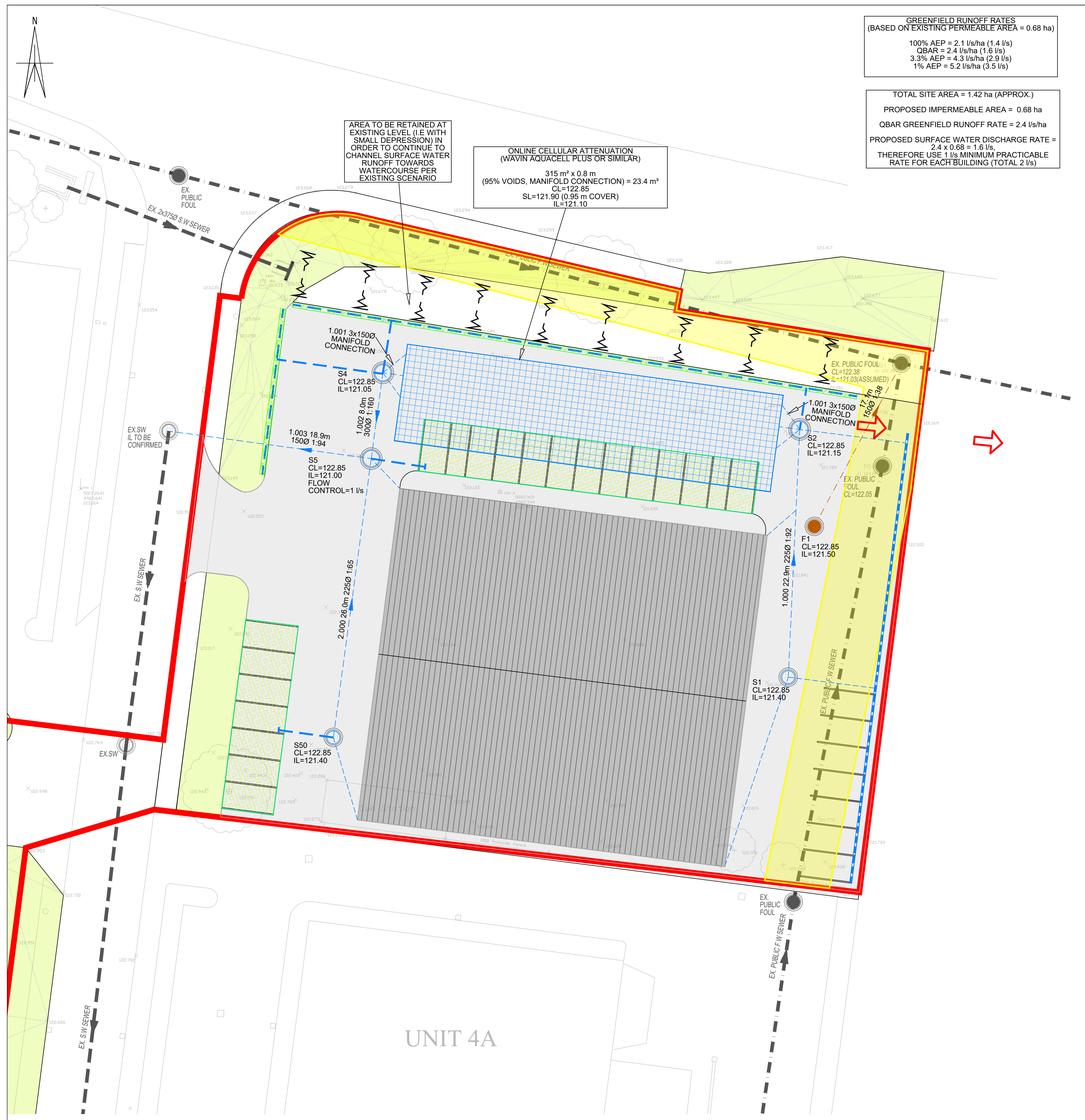
Link Event (Outflow)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	1	1.000	2	32.2	0.979	0.697	1.4230	
15 minute winter	2	1.001	BASIN	66.5	2.431	1.438	0.2506	
15 minute winter	BASIN	1.002	3	-96.7	-1.587	-1.068	1.4770	
15 minute winter	3	1.003	4	-98.0	-1.391	-1.334	4.1590	
15 minute winter	4	1.004	5	-56.5	-0.802	-0.769	1.7591	
15 minute winter	5	1.005	6	-42.5	-0.604	-0.539	0.4169	
15 minute winter	6	Hydro-Brake®	EX SW	1.0				11.3

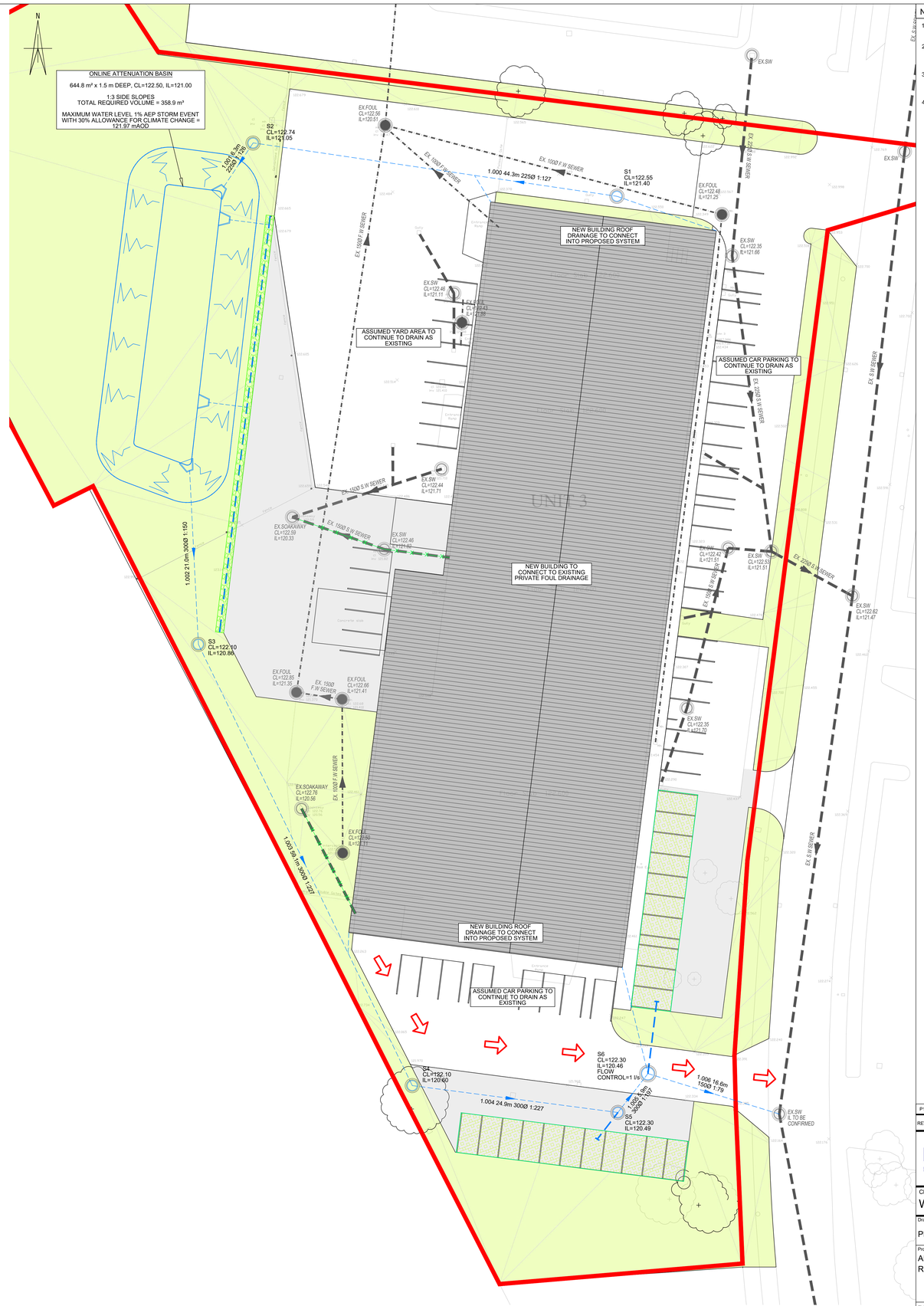
Water Quality

Area (ha)	Intended Land Use	Entering via Node or Link	Name	SuDS Component	Pollution hazard indices TSS	Metals	Hydrocarbons	Pollution mitigation indices TSS	Metals	Hydrocarbons	Cumulative pollution hazard indices TSS	Metals	Hydrocarbons
		Node	BASIN	Detention Basin				0.5	0.5	0.6			
		Node	EX SW								Sufficient	Sufficient	Sufficient

APPENDIX I

Preliminary Drainage Layout





NOTES

1. THIS DRAWING TO BE READ IN CONJUNCTION WITH ALL RELEVANT WEETWOOD DRAWINGS.
2. PROPOSED SITE LAYOUT TAKEN FROM NWD ARCHITECTS 'PROPOSED SITE PLAN' DRAWING (REF: 6977-04 REV B, OCT 2024).
3. EXISTING LEVEL INFORMATION TAKEN FROM CAD DWG FILE 'ANTELOPE UNIT 3 TOPOGRAPHIC SURVEY' (JAN 2024).
4. EXISTING DRAINAGE LOCATION TAKEN FROM CLIENT SUPPLIED DRAINAGE SURVEY, CAD DWG FILE REFERENCE 'ANTELOPE UNIT 3 DRAINAGE 2024' (OCT 2024).

REV	DATE	DESCRIPTION	DRAWN	CHECK
P1	15.11.24	INITIAL ISSUE	DSH	TB

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Client: WHITLEY ESTATES LTD

Drawing Status: PLANNING
Date: OCT 2024
Scale (A0): 1:200
Project: ANTELOPE INDUSTRIAL PARK RHYDYMWYN, MOLD
Drawn: DSH
Checked: TB
Project No: 6262
Title: PRELIMINARY DRAINAGE LAYOUT
Drawing No: 100
Revision: P1

APPENDIX J

Dŵr Cymru Welsh Water Public Sewer Record

Dŵr Cymru
Welsh Water

Rhydymwyn Flintshire CH7 5JH

N
W E
S

LEGEND(Representative of most common features)

Waste network:

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

NB: Sewer symbol colour indicates the type.
RED - Combined
GREEN - Surface Water
BROWN - Foul
Purple - Former 524 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

Map Ref:	320499,366557
Map scale:	1:3000
Printed by:	Warren Rees
Printed on:	12 Sep 2024

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Flood Risk Assessments
Flood Consequences Assessments
Surface Water Drainage
Foul Water Drainage
Environmental Impact Assessments
River Realignment and Restoration
Water Framework Directive Assessments
Environmental Permit and Land Drainage Applications
Sequential, Justification and Exception Tests
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