coopers

chartered consulting engineers

Our ref: 8211_FCA

Flood Consequences Assessment

for

Quarry Farm, Oakenholt,

Flintshire

For : Castle Green Homes Ltd
Unit 20, St Asaph Business Park
St Asaph
Denbighshire
LL17 0LJ

1st November 2023

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Chester Business Park,
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Document Verification

Project Title	Quarry Farm, Oakenholt, Flintshire
Project Number	8211
Document Title	Flood Consequences Assessment
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This document is not to be used for contractual or engineering purposes unless the document verification sheet is signed where indicated by the approver of the document.	

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Document Revision

Report Reference	Date	Description	Prepared	Checked and Approved
8211_FCA	01/11//2023	Flood Consequences Assessment	A Jones	P R Sykes

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1.0 Introduction

Coopers (Chester) Ltd, (Coopers) have been appointed by Castle Green Homes Ltd to assess the risk of flooding for Quarry Farm, Oakenholt, Flintshire. Castle Green Homes Ltd are proposing a new housing development, comprising of approximately 128 No. dwellings.

Castle Green Homes Ltd are planning the construction of a mixture of semi-detached and detached residential properties with associated access road, parking, vehicular access and landscaping subject to conditions. It is understood the site does not currently benefit from any planning decision.

This flood consequences assessment (FCA) evaluates the proposals regarding to flood risk, identifying and appraising potential flood risk both to and from the whole site. Coopers have carried out the following:

i. Assessment of the development potential of the site in line with the Welsh Government's Technical Advice Note 15: Development and Flood Risk (TAN15) and;
ii. An assessment of surface water runoff and drainage strategy

Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 No. properties or the construction area is more than 100m^2. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

2.0 Site Characteristics

2.1 Site Location

The site is a parcel of agricultural land in Oakenholt. The site is situated to the south of the A548 (Chester Road), accessed off Leadbrook Drive at approximate grid reference SJ258716.

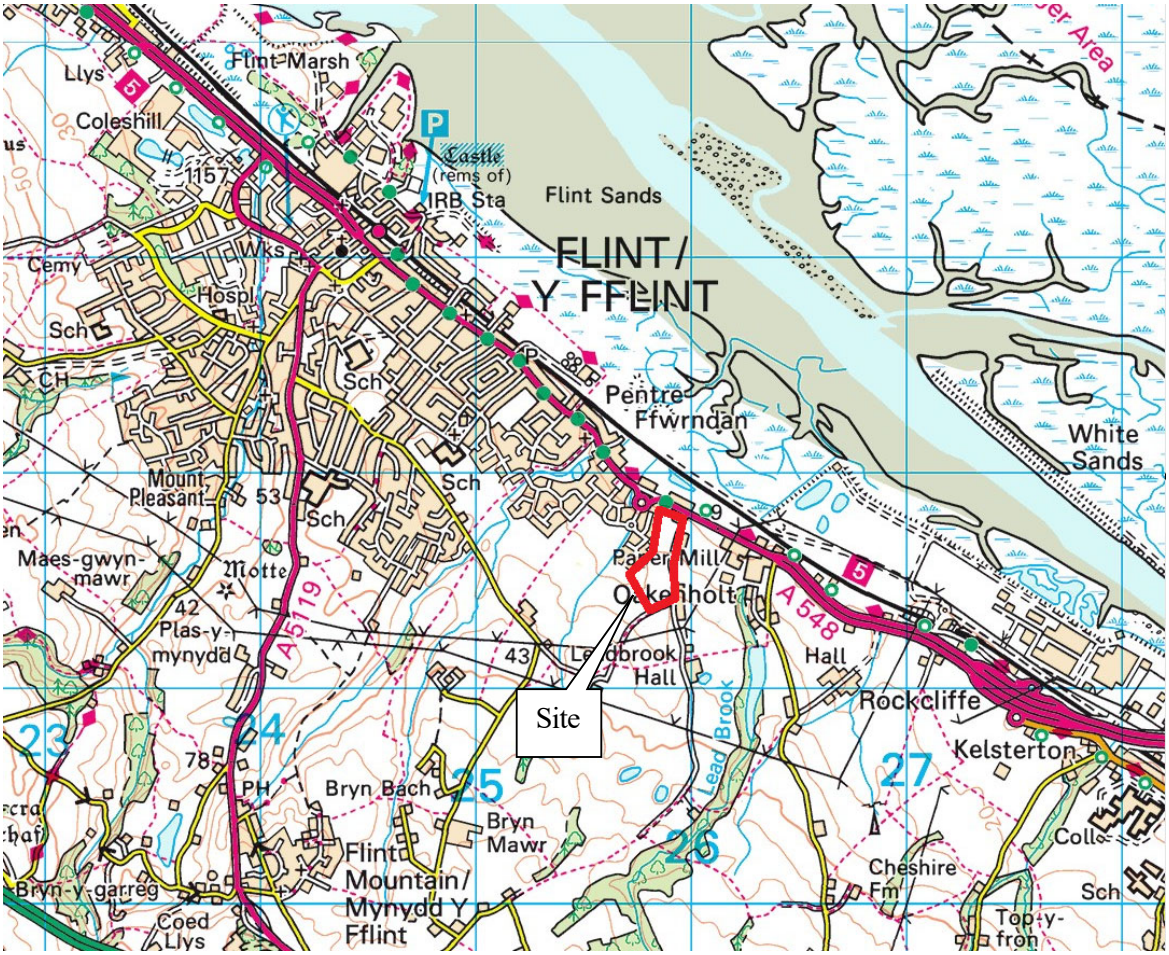


Figure 1 – Site Location

2.2 Site Description

The site covers an area of approximately 4.87 Hectares of land located approximately 1.5km southeast of Flint Town Centre. The surrounding area is primarily a mixture of residential, and agricultural land with Chester Road located to the north and Leadbrook Drive to the east, and an un-named watercourse along the southwest boundary.

The topography of the site varies with a high point splitting the site into a northern and southern portion. The northern portion falls towards Chester Road to the north at a gradient of approximately 1:20, whilst the southern portion falls towards the west at a gradient of approximately 1:16 towards the watercourse.

3.0 Sources of Flood Risk Information

3.1 The Welsh Government Development Advice Map

The Welsh Government Development Advice Map shows the site is located within Flood Zone A – an area considered to be at little or no risk of fluvial or tidal flooding, with a less than 1 in 1000 (0.1%) annual probability of flooding in any given year.

The proposed residential development is considered to be a 'highly vulnerable' development in accordance with Figure 2 of the Welsh Governments Technical Advice Note 15. Highly vulnerable development is considered to be appropriate within Flood Zone A.

3.2 Natural Resources Wales

The NRW Flood Map shows the site is located within Flood Zone 1 – an area considered to have the lowest probability of fluvial flooding. It is assessed as having a less than 0.1% annual probability of flooding in any given year. See Figures 2 and 3 below.

Figure 2 – Natural Resources Wales Flood Map for Planning (Sea)

Figure 3 – Natural Resources Wales Flood Map for Planning (River)

The Natural Resources Wales long term flood risk maps do not indicate any flood risk from surface water. See Figure 4 below.

Figure 4 – Natural Resources Wales Surface Water Flooding Map

The Natural Resources Wales long term flood risk maps do not indicate any flood risk from Development Advice Maps (DAM). See Figure 5 below.

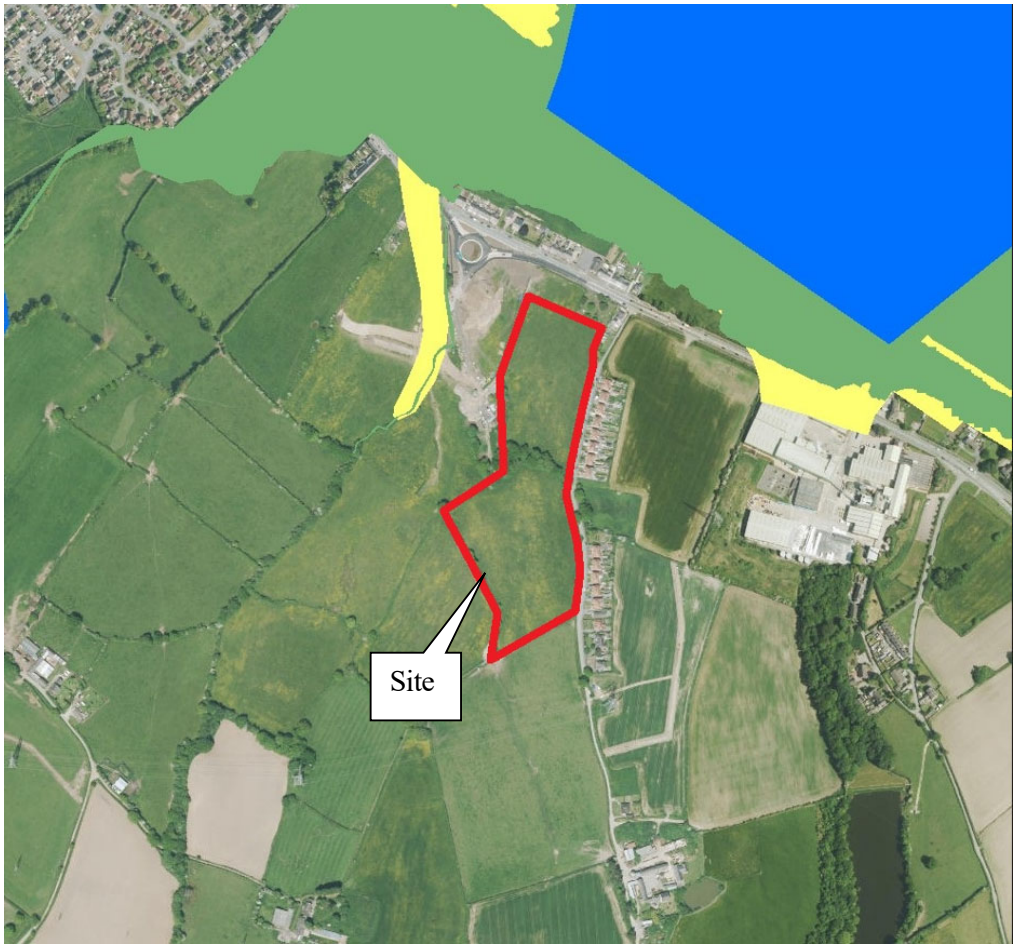


Figure 5 – Natural Resources Wales Development Advice Flooding (DAM) Map

It should be noted that flooding can occur at any time and in any place from sources such as rising groundwater levels, burst water mains, blocked road drains, run-off from hillsides, sewer overflows, etc.

3.3 Flintshire County Council LLFA

We have contacted Flintshire County Council for confirmation of any known historical flooding within the vicinity of the site. They have responded to confirm they are not aware of any flood incidents.

Refer to Appendix 4 for all correspondence.

4.0 Sources of Flood Risk

4.1 Fluvial

Extreme fluvial flood events have the potential to cause rapid inundation of the site whilst posing a threat to welfare and users. As outlined in Section 3.2; the site is within Flood Zone 1 and is therefore not at risk from extreme fluvial or tidal flooding. Therefore, the risk from extreme fluvial flooding to the site is considered to be low.

4.2 Infrastructure Failure (Existing and Proposed)

The failure of infrastructure such as culverts or bridges could increase the risk of flooding at the site. The risk of flooding is considered as very low.

4.3 Overland Flow

Overland flow occurs when the infiltration capacity of the ground is exceeded in a storm event. This can result in water travelling as a sheet flow overland or excess water being conveyed from one location to another via local road networks. The site currently drains in 2 directions with the northern portion falling towards Chester Road and the southern portion falling towards the watercourse. Overland flow is not considered a significant risk as flows from the site will be significantly reduced post development with the incorporation of positive drainage and an internal road network.

4.4 Sewer Flooding

If the capacity of the sewers is exceeded in an extreme event, or a blockage occurs, surcharging of the network can result in surface flooding. Welsh Water sewer plans which are included in Appendix 1, indicate sewers to the north and west of the development, but as the site is at a higher elevation sewer flooding is not considered a significant risk.

We are proposing to discharge all foul flows into the 225mm Diameter combined sewer to the west of the site subject to Welsh Water approval.

Welsh Water may have confirmed they have no records or any known flooding within the vicinity of the site. Refer to Appendix 4 for correspondence.

The overall risk from sewer flooding is considered as low.

4.5 Groundwater Flooding

Groundwater flooding occurs as a result of water rising up from the underlying superficial deposits, bedrock or from springs.

The site trial pits undertaken for the infiltration tests were at depths of between 1.4 – 2.3m and encountered no groundwater during excavation. Additionally, the Envirocheck Flood Report presented in Appendix 2 indicated there is negligible risk of ground water flooding within the site boundary other than a small area located in the southwest corner of the site which is identified as being a moderate risk. This should be investigated further during the intrusive site investigation.

The overall risk from groundwater flooding is considered as low.

4.6 Coastal Flooding

The development site is located approximately 1.0km south of the Dee Estuary. No flooding is shown to the south of Chester Road which is at an elevation of approximately 8.8m AOD. However, the lowest site elevation is approximately 11.5m AOD and is therefore not at risk from tidal inundation.

Refer to Figure 2 – NRW Flood Map for Planning (Sea).

4.7 Reservoirs

The site is not located in proximity of any reservoirs. Additionally, the NRW maps indicate the site is not at risk of flooding from reservoirs. See Figure 6 below.

Figure 6 – Natural Resources Wales Reservoir Flooding Map

5.0 Surface Water Drainage

5.1 General

The design for a surface water drainage system for the proposed development will be guided by the principles set out in the Welsh Government's 'Recommended non-statutory standards for sustainable drainage (SuDS) in Wales – designing, constructing, operating and maintaining surface water drainage systems' (2017)

The SuDS Standards Wales sets out the following hierarchy for surface water runoff destination:

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

Note that Priority Level 1 is the preferred (highest priority) and that 4 and 5 should only be used in exceptional circumstances.

5.2 Existing Surface Water Drainage

The site does not benefit from any existing drainage and will rely on infiltration and surface water run-off to dispose of surface water flows. The flows will follow topography with the northern portion of the site draining towards Chester Road and the southern end of the site draining towards the watercourse along the southwest boundary of the site. We are not aware of any existing land drainage within the site to assist with drainage.

5.3 Existing Site Runoff

The greenfield run-off rates for the site have been calculated using the HR Wallingford Greenfield runoff rate estimation tool. Calculations below are based on a 0.81ha developable site area for the northern portion and 2.18ha for the southern portion.

Northern Portion		Southern Portion	
1-year	= 3.7 l/s	1-year	= 9.9 l/s
100-year	= 9.1 l/s	100-year	= 24.5 l/s
QBAR	**= 4.2 l/s**	**QBAR**	**= 11.2 l/s**

Refer to Appendix 5 for surface water greenfield run-off calculations based on a 1 Hectare site area.

5.4 Proposed Surface Water Drainage and Runoff Rates

Priority Level 1

Whilst rainwater harvesting has been considered for the proposed development it should be noted that any device enabling water re-use cannot be taken into account when sizing attenuation as the storage facility may be full when a storm event occurs. Therefore, an overflow to an infiltration device (where ground conditions allow) or to a watercourse / sewer will be required.

Castle Green Homes Ltd are not proposing to incorporate rainwater harvesting within the development; however, they are proposing to install a water butt to each dwelling which will allow for water collection for garden re-use.

Priority Level 2

Site investigation has determined the site is not suitable for infiltration techniques to dispose of surface water flows from the site due to the cohesive underlying strata.

Refer to Appendix 3 infiltration test results.

Priority Level 3

Pentre Brook is located approximately 400m west of the site and Lead Brook is located approximately 400m east of the site. Both watercourses pass under Chester Road before outfalling to the River Dee estuary which is located approximately 1.0km to the north of the site.

There is an ordinary watercourse flowing along the southwest boundary of the site. This watercourse continues to flow through the residential development (Anwyl Homes Croes Atti development) to the west of the site via culverts and open watercourses which discharges into a watercourse network to the north of Chester Road. This flows into the Pentre Brook and ultimately outfalls to the River Dee estuary.

A review of levels has determined the southern portion of the site can drain to the watercourse, but the northern portion cannot drain via gravity due to topography, so an alternate outfall will need to be explored.

Priority Level 4

A recent CCTV drainage survey has confirmed a highway drain within Leadbrook Drive to the east of the site and also highway drainage networks within Chester Road to the north of the development. Refer to Appendix 1 for the drainage survey plan.

There are surface water sewers recorded on the Welsh Water sewer maps within the residential development to the west of the site. A review of site levels confirms a gravity connection into these sewers is not achievable, unless the point of connection is towards Chester Road where levels are lower. Refer to Appendix 1 for Welsh Water sewer map.

Priority Level 5

The Welsh Water sewer maps indicate the presence of a 150mm Diameter combined sewer in Chester Road to the north of the development. Refer to Appendix 1 for Welsh Water sewer map.

5.5 SuDS Approval Bodies

Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 No. properties or the construction area is more than 100m^2. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

Every SuDS application should go to every attempt to satisfy the Principles and Standards of the legislation. When vetting an application, the SAB officer will look at the clear red line boundary area of the site when considering space for SuDS and water management features and not the space that's left on the proposed site layout.

The principles are as follows:

SuDS schemes should aim to:

1. *manage water on or close to the surface and as close to the source of the runoff as possible;*
2. *treat rainfall as a valuable natural resource;*
3. *ensure pollution is prevented at source, rather than relying on the drainage system to treat or intercept it;*
4. *manage rainfall to help protect people from increased flood risk, and the environment from morphological and associated ecological damage resulting from changes in flow rates, patterns and sediment movement caused by the development;*
5. *take account of likely future pressures on flood risk, the environment and water resources such as climate change and urban creep;*
6. *use the SuDS Management Train, using drainage components in series across a site to achieve a robust surface water management system (rather than using a single "end of pipe" feature, such as a pond, to serve the whole development);*
7. *maximise the delivery of benefits for amenity and biodiversity;*
8. *seek to make the best use of available land through multifunctional usage of public spaces and the public realm;*
9. *perform safely, reliably and effectively over the design life of the development taking into account the need for reasonable levels of maintenance;*
10. *avoid the need for pumping where possible; and*
11. *be affordable, taking into account both construction and long-term maintenance costs and the additional environmental and social benefits afforded by the system.*

Applicants seeking SAB Approval must demonstrate how they have complied with these principles or provide justification for any departure.

An indicative surface water strategy is presented in Appendix 1. We are proposing to drain the southern portion of the site into the watercourse via 2 new outfalls and the northern portion of the site to drain into the highway drain located in Leadbrook Drive. Flows will be restricted to greenfield QBAR rate and attenuation will be provided within a network of oversized on-line pipes, buried cellular tanks and a dry SUDS basin.

Incorporation of additional source control SuDS components such as water butts, permeable paving and bio retention (tree pits and rain gardens) will need to be considered further at detailed design stage to meet the 5mm interception design criteria.

Flood Defence Consent will be required from Flintshire LLFA for the surface water outfalls into the watercourse. Flintshire Highways will need to approve the connection into existing highway drain for the northern portion of the site. Early discussions are advised to ensure that the proposed points of connection and flow rates are acceptable to the approving authority.

5.6 Foul Drainage

We are proposing to discharge all foul flows into the existing 225mm Diameter foul public sewer in Ffordd Pedrog to the west of the site. This sewer has been constructed to accommodate flows from the Anwy Homes Croes Atti development, but as it's a 225mm Diameter capacity for additional flows should not be an issue. This will need to be discussed with Welsh Water to confirm this is an acceptable point of connection.

Topography and proposed site levels design will allow for a gravity network to serve the entire development without any need for a pumping station. Refer to the indicative drainage strategy presented in Appendix 1 for proposed foul routes and sewer levels.

6.0 Conclusions and Recommendations

The site is located in Flood Zone 1 and has been shown to be at low risk of flooding from sea, rivers, surface water, groundwater, sewers and climate change. Therefore, mitigation measures are not considered necessary for any future development at the site.

All potential sources of flooding have been considered as part of this report. There are no known records of historical flooding at the site.

The infiltration tests undertaken have determined that the underlying soils have poor infiltration characteristics. Therefore, surface water run-off from highways, roof and private drives will discharge into the ordinary watercourse.

The development will increase the impermeable area of the site. This results in an increase in surface water runoff rates and volumes. In order to ensure the increase in runoff will not have an impact elsewhere all flows will discharge via gravity to the watercourse and highway drain at greenfield QBAR flow rates.

All surface water run-off from highways, roof and private drives will be collected into gravity piped networks and discharged into networks of oversized pipes and SuDS attenuation features.

Additional on-site source control components such as permeable paving and bioretention components (tree pits and rain gardens) should be considered further at detailed design stage.

All foul sewers should be designed in accordance with Sewers for Adoption 7th Edition / Welsh Ministers Standards and will be subject to S104 Agreement.

A SuDS Maintenance and Management Plan should be produced to outline the activity and frequency of inspections and maintenance works required on any SuDS components subject to SAB Approval / Adoption.

This Flood Consequences Assessment should be submitted to the Local Planning Authority in support of the planning application.

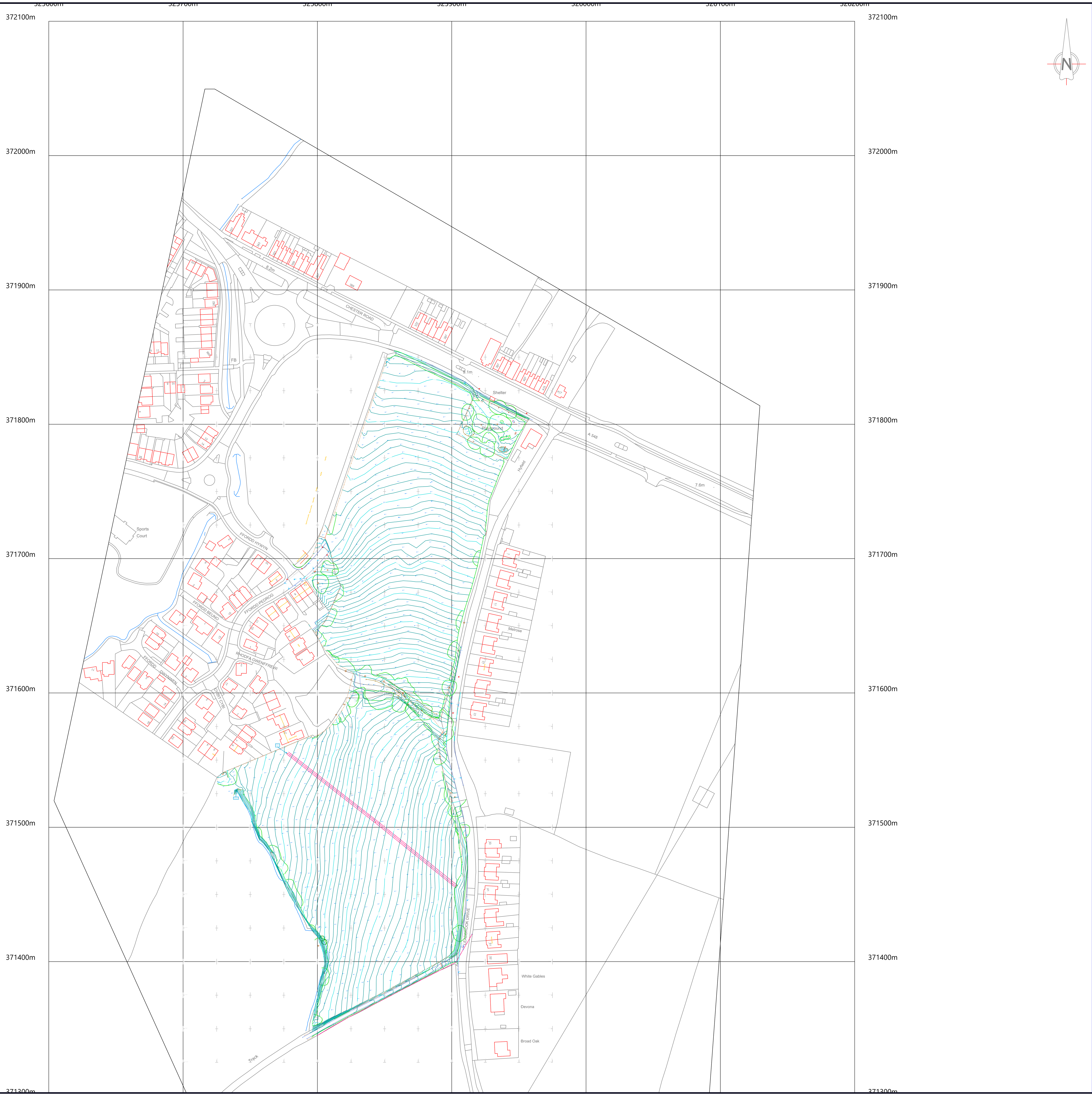
Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 properties or the construction area is more than 100m^2. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

These systems must be approved by the local authority acting in its SuDS Approving Body (SAB) role before construction work begins. The SAB will have a duty to adopt compliant systems.

Appendix 1

Reference Drawings

Drawing No.	Revision	Title
B555-00	-	Topographical Survey (Carl Williams Land Surveys Ltd)
-	-	Existing Drainage Survey
-	-	Welsh Water Sewer Map
8211 – SK01	A	Engineering Layout



Survey Site Control:

Coordinates & Levels to Ordnance Survey Datum OSGB36NG via OSTN15 & OSGM15

Station	Easting	Northing	Level
1	325807.248	371702.691	14.039
2	325803.765	371708.414	13.893
3	325788.476	371692.433	14.788
4	325777.460	371684.593	15.163
70	325900.950	371585.084	22.742
71	325905.212	371611.929	20.433
80	325920.441	371826.444	8.850
81	325955.764	371808.156	8.961

Building Roof Ridge Line

Manhole Cover - Drainage

Inspection Chamber Cover - Comms, Elec etc

Road Gulley

Stop Valve - Water

Wash Out Valve - Water

Fire Hydrant - Water

Tree Canopy & Stem Diameter

Overhead Cables & Electric Poles

Signpost

Lamp Post Street Lighting

Survey Notes:

Where possible all trees, their stems, canopies and heights have been surveyed in accordance with BS5837 (2012) Sect 4.2 Topographical Survey

Revision	Date	Description

Carl Williams Land Surveys Ltd
The Studio
15 Millfield
Neston
Cheshire
CH64 3TF
www.cwlandsurveys.com e:info@cwlandsurveys.com

Client

Castle Green Homes

Project

Oakenholt
Topographic Survey (2d)

Scale 1:1000	Surveyed By CW & VW	Date 21.08.23 - 28.08.23
Drawing No.	Checked By CW	Date 28.08.23
B555-00	Drawn By CW	Date 29.08.23

ASSUMED BLIND CONNECTION OUTO SECTION OF WATERCOURSE CROSSING CHESTER ROAD

225 Ø

8.2m

NETWORK HIGHLY SILTED + HOLDING WATER

CHESTER ROAD

HEAD OF RUN

9.1m

NM FILLED WITH DEBRIS + FOOTBALLS WASHED DOWNSTREAM FROM OPEN WATERCOURSE

FB

Shelter

Playground

Animal Sanctuary

Drain

UNABLE TO CAMERA SURVEY MAJORITY OF SEWERS ON NORTH SIDE OF CHESTER ROAD DUE TO SILT + HOLDING WATER

300 Ø

A 548

Hyfield

7.6m

UNABLE TO SURVEY BEYOND THIS POINT

MP 9.25

Track

7.9m

WB

El Sub Sta

Pipeline

CATCH PIT MH 0.9m TO OUTLET INVERT 290mm SUMP

CATCH PIT MH 1.21m TO OUTLET INVERT 290mm SUMP

BURIED MH IN VERGE

HIGHWAY DRAIN ASSUMED TO CARRY ON UP LEADBROOK DRIVE

Melrose

FFORDD HYWYN

2.110m TO INVERT

2.210m TO INVERT

3.810m TO INVERT

3.020m TO INVERT

FFORDD BEUNO

FFORDD PEDROG

RHODFA GWENFFREWI

CWRT CYBI

Dŵr Cymru
Welsh Water

Quarry Farm Chester Road Oakenholt
Flintshire CH6 5WD

N
W E
S

LEGEND(Representative of most common features)

Waste network:

Foul chamber		Outfall	
Surface water chamber		Lamphole	LH
Combined chamber		Storm Overflow	
Combined sewer overflow		Rising main	
Special purpose chamber		Gravity sewer	
Treatment works		Private sewer	
Pumping station		Private sewer subject to Sect. 104 adoption agreement	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 S24 sewers (for indicative purposes only)

Notes:

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

Map Ref:	325850,371720
Map scale:	1:1000
Printed by:	Zara Howells
Printed on:	23 Aug 2023

DO NOT SCALE

NORTH

STORM Network 1

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	450	20	Circular	17.128	S101	23.78	27.58	S102	22.90	26.73
1.001	900	398	Circular	11.937	S102	22.45	26.73	S103	22.42	26.39
1.002	1500	401	Circular	74.656	S103	20.02	26.39	S104	19.84	23.44
1.003	300	240	Circular	31.453	S104	19.84	23.44	S105	19.71	21.88
1.004	1200	400	Circular	63.544	S105	17.66	21.88	S113	17.50	19.73
1.005	1200	393	Circular	11.804	S113	17.50	19.73	S114	17.47	19.65
1.006	225	170	Circular	12.108	S114	17.47	19.65	S115	17.40	19.65
2.000	900	61	Circular	33.538	S106	19.85	25.25	S107	19.30	23.57
2.001	1500	400	Circular	13.014	S107	18.70	23.57	S108	18.66	22.91
2.002	1500	397	Circular	24.621	S108	18.66	22.91	S109	18.60	22.54
2.003	1500	397	Circular	10.706	S109	18.60	22.54	S110	18.57	22.20
2.004	1500	396	Circular	24.966	S110	18.57	22.20	S111	18.51	21.20
2.005	300	240	Circular	11.498	S111	18.51	21.20	S112	18.46	20.74
2.006	1200	398	Circular	25.054	S112	17.56	20.74	S113	17.50	19.73

FOUL Network 1

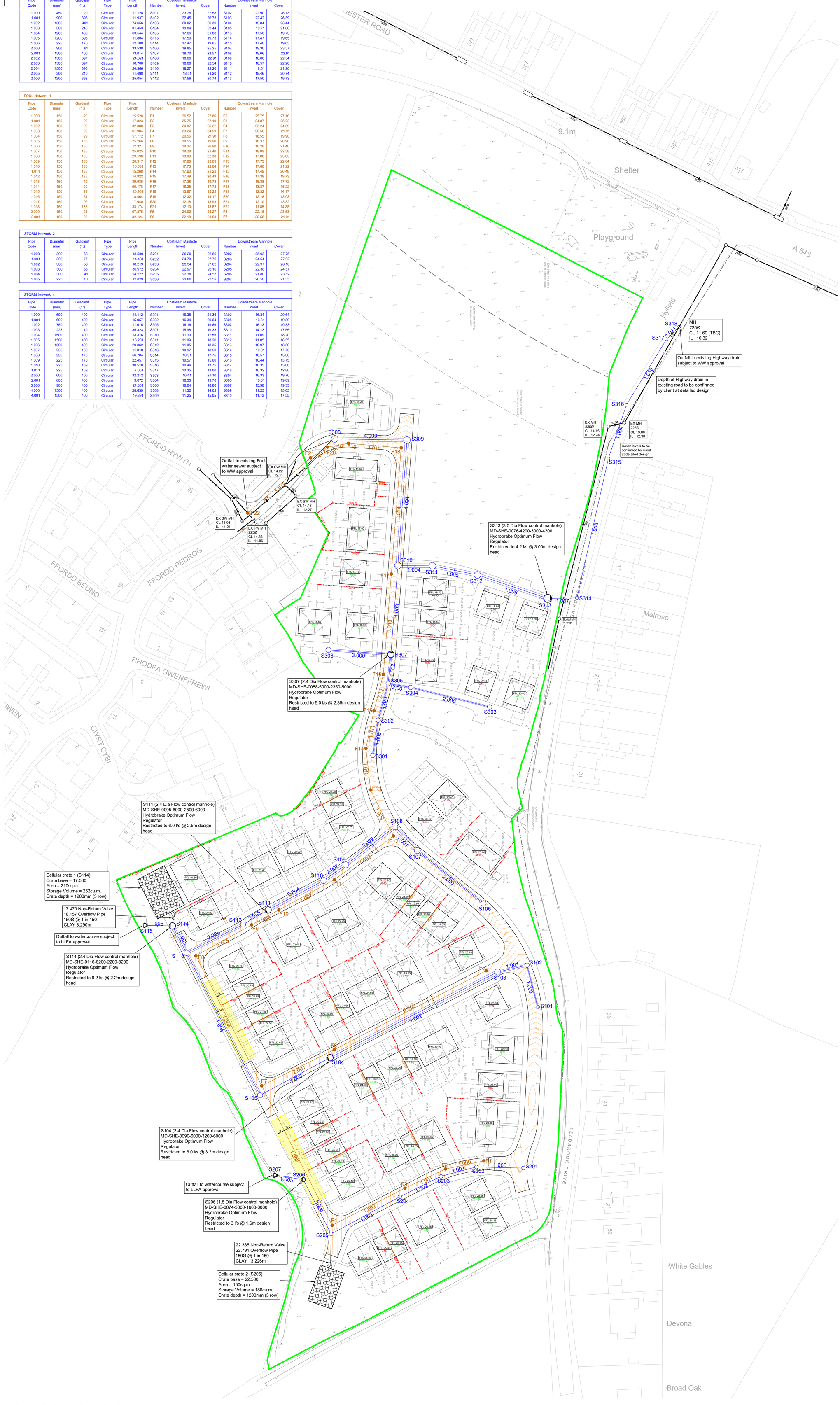
Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	150	20	Circular	15.528	F1	26.52	27.86	F2	25.75	27.10
1.001	150	20	Circular	17.823	F2	25.75	27.10	F3	24.87	26.22
1.002	150	20	Circular	32.380	F3	24.87	26.22	F4	23.24	24.59
1.003	150	23	Circular	61.984	F4	23.24	24.59	F7	20.56	21.91
1.004	150	29	Circular	57.772	F7	20.56	21.91	F8	18.55	19.90
1.005	150	135	Circular	25.266	F8	18.55	19.90	F9	18.37	20.90
1.006	150	135	Circular	12.327	F9	18.37	20.90	F10	18.28	21.40
1.007	150	135	Circular	25.025	F10	18.28	21.40	F11	18.09	22.38
1.008	150	135	Circular	29.190	F11	18.09	22.38	F12	17.88	23.03
1.009	150	135	Circular	20.317	F12	17.88	23.03	F13	17.73	22.04
1.010	150	135	Circular	16.631	F13	17.73	22.04	F14	17.60	21.22
1.011	150	135	Circular	15.268	F14	17.60	21.22	F15	17.49	20.48
1.012	150	135	Circular	14.822	F15	17.49	20.48	F16	17.38	19.73
1.013	150	40	Circular	39.935	F16	17.38	19.73	F17	16.38	17.72
1.014	150	20	Circular	50.178	F17	16.38	17.72	F18	13.87	15.22
1.015	150	13	Circular	20.961	F18	13.87	15.22	F19	12.32	14.17
1.016	150	64	Circular	8.464	F19	12.32	14.17	F20	12.18	13.93
1.017	150	92	Circular	7.940	F20	12.18	13.93	F21	12.10	13.82
1.018	150	135	Circular	33.174	F21	12.10	13.82	F22	11.85	14.88
2.000	150	25	Circular	67.875	F5	24.92	26.27	F6	22.18	23.53
2.001	150	20	Circular	32.124	F6	22.18	23.53	F7	20.56	21.91

STORM Network 2

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	300	68	Circular	18.580	S201	26.20	28.50	S202	25.93	27.76
1.001	300	77	Circular	14.481	S202	24.73	27.76	S203	24.54	27.02
1.002	300	50	Circular	18.219	S203	23.34	27.02	S204	22.97	26.10
1.003	300	53	Circular	30.972	S204	22.97	26.10	S205	22.38	24.57
1.004	300	41	Circular	24.222	S205	22.38	24.57	S206	21.80	23.52
1.005	225	10	Circular	12.829	S206	21.80	23.52	S207	20.50	21.35

STORM Network 4

Pipe Code	Diameter (mm)	Gradient (1:)	Pipe Type	Pipe Length	Upstream Manhole Number	Upstream Manhole Invert	Upstream Manhole Cover	Downstream Manhole Number	Downstream Manhole Invert	Downstream Manhole Cover
1.000	600	400	Circular	14.112	S301	16.38	21.36	S302	16.34	20.64
1.001	600	400	Circular	15.057	S302	16.34	20.64	S305	16.31	19.89
1.002	750	400	Circular	11.615	S305	16.16	19.89	S307	16.13	19.33
1.003	225	19	Circular	35.323	S307	15.98	19.33	S310	14.13	17.55
1.004	1500	400	Circular	13.316	S310	11.13	17.55	S311	11.09	18.20
1.005	1500	400	Circular	18.201	S311	11.09	18.20	S312	11.05	18.35
1.006	1500	400	Circular	29.862	S312	11.05	18.35	S313	10.97	18.50
1.007	225	169	Circular	11.010	S313	10.97	18.50	S314	10.91	17.75
1.008	225	170	Circular	56.704	S314	10.91	17.75	S315	10.57	15.00
1.009	225	170	Circular	22.457	S315	10.57	15.00	S316	10.44	13.75
1.010	225	169	Circular	30.518	S316	10.44	13.75	S317	10.35	13.00
1.011	225	169	Circular	7.061	S317	10.35	13.00	S318	10.32	12.80
2.000	600	400	Circular	32.212	S303	16.41	21.10	S304	16.33	19.70
2.001	600	400	Circular	9.072	S304	16.33	19.70	S305	16.31	19.89
3.000	900	400	Circular	24.801	S306	16.04	18.80	S307	15.98	19.33
4.000	1500	400	Circular	28.639	S308	11.32	14.02	S309	11.25	15.05
4.001	1500	400	Circular	49.891	S309	11.25	15.05	S310	11.13	17.55



0 5 10 15 20 25 30 35 40 45 50
SCALEBAR (m)

Notes

1. Setting out shall be undertaken using only the information given. Distances should not be scaled from this drawing.
2. All adoptable drainage shall be constructed in accordance with 'Sewers for Adoption' 7th Edition, Welsh Ministers Standards and Welsh Water Details and Guidelines.
3. The minimum gravity pipe diameter under adoptable highways shall be 150mm
4. It is the responsibility of the Contractor to verify all information given with regards to existing services and drainage connections etc. prior to commencing the works. The rates shall include for hand dig around services where necessary. The Contractor shall adhere to the CDM Regulations at all times
8. All materials to bear the relevant B.S. Kitemark and comply fully with the specifications. All concrete & concrete products must use Sulphate resistant cement to withstand Class 3 condition (unless the site investigation report proves that sulphate attack from soils and groundwater will not occur).
9. All opening notices etc. as required under Highways Acts etc. are to be obtained prior to commencement of works. All works are to be inspected by L.A., NHBC or the Network Operator as applicable.
10. Where structured wall UPVC pipes (or similar approved) are used in adoptable drainage they shall be handled and laid in accordance with the manufacturers instructions and will be subject to post installation deformation testing prior to adoption.
A Class S Bed and Surround must be used for structured wall pipes
10. Trench backfill in highways to within 1m of highway shall, as directed by the Highway Authority be a suitable granular material all in accordance with Sewers for Adoption.
12. Slab levels shall not be varied without reference to the Engineer for guidance.
13. Pipes have not been designed to accommodate construction traffic loading. The contractor is responsible for providing adequate protection to the pipes during construction.
14. All manhole covers and frames shall comply with BS EN124. All adoptable manholes and chambers shall comply with Sewers for Adoption 7th Edition. Covers in roads to be grade D400 and be 150mm deep. Manhole covers in car parking areas and drives to be grade B125 and covers in landscaping areas to be grade A15. All to be sized in accordance with Building Regulations Part H, Tables 11 & 12. "In-fill" type covers should not be used. Where a cover is located in an area of block paving, the bottom of the frame should be 150mm deep.

Legend

- Site Boundary

Existing

- Existing Foul Water Sewer
- Existing Surface Water Sewer
- Existing Highway Drain

Proposed

- Adoptable Surface Water Sewer
- Adoptable Foul Sewer
- Flow Control Manhole
- Plot Slab Level (FFL xx.xx)
- Sewer Easement
- Brick Retaining Wall (WALL 300 W)
- Underbuild (UB UB UB 300 UB)
- Steps in Slab (450 STEP)
- Steps to Footpath (1 No. step 150mm riser)
- Cellular Storage Crates

STRATEGY

Rev.	Date	Revision	By	Appd.
A	31.10.23	Surface Water drainage design updated	PW	AJ

coopers
chartered consulting engineers
Park House
Sandpiper Court
Chester Business Park
Chester
CH4 9QU
Tel: 01244 684910
Email: admin@coopers.co.uk
Web: http://coopers.co.uk

Client: Castle Green

Project: QUARRY FARM, OAKENHOLT, FLINT.

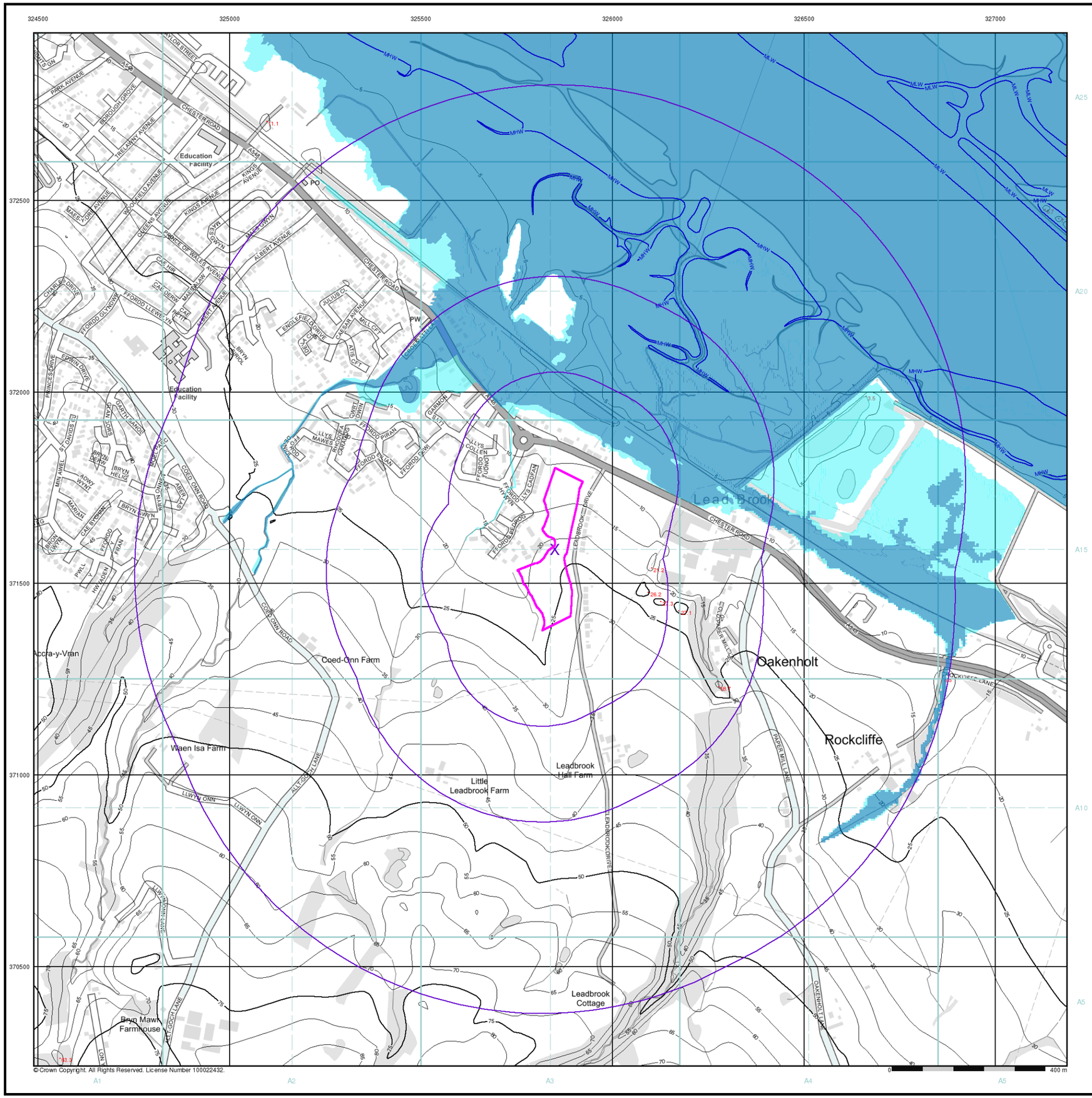
Title: Drainage Strategy

DRAWING NUMBER	SCALE at A0	1:500	
8211 / SK01	DATE	20.09.23	REVISION
	DRAWN	PW	A
	CHECKED	AJ	

Appendix 2

Envirocheck Flood Screening Report

Order Number: 312162444_1_1



Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Flood Data Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Flood Data

- Extreme Flooding from Rivers or Sea without Defences (Zone 2)
- Flooding from Rivers or Sea without Defences (Zone 3)
- Area Benefiting from Flood Defence
- Flood Water Storage Areas
- Flood Defence

Contours (height in metres)

Standard Contour 105 100 95

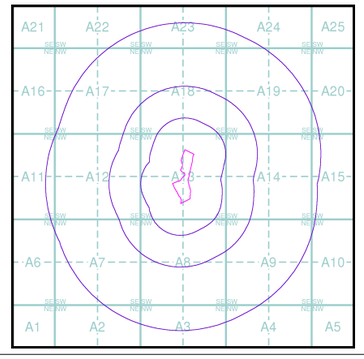
Master Contour

Spot Height *167.8

MLW Mean Low Water

MHW Mean High Water

EA/NRW Flood Data Map - Slice A



Order Details

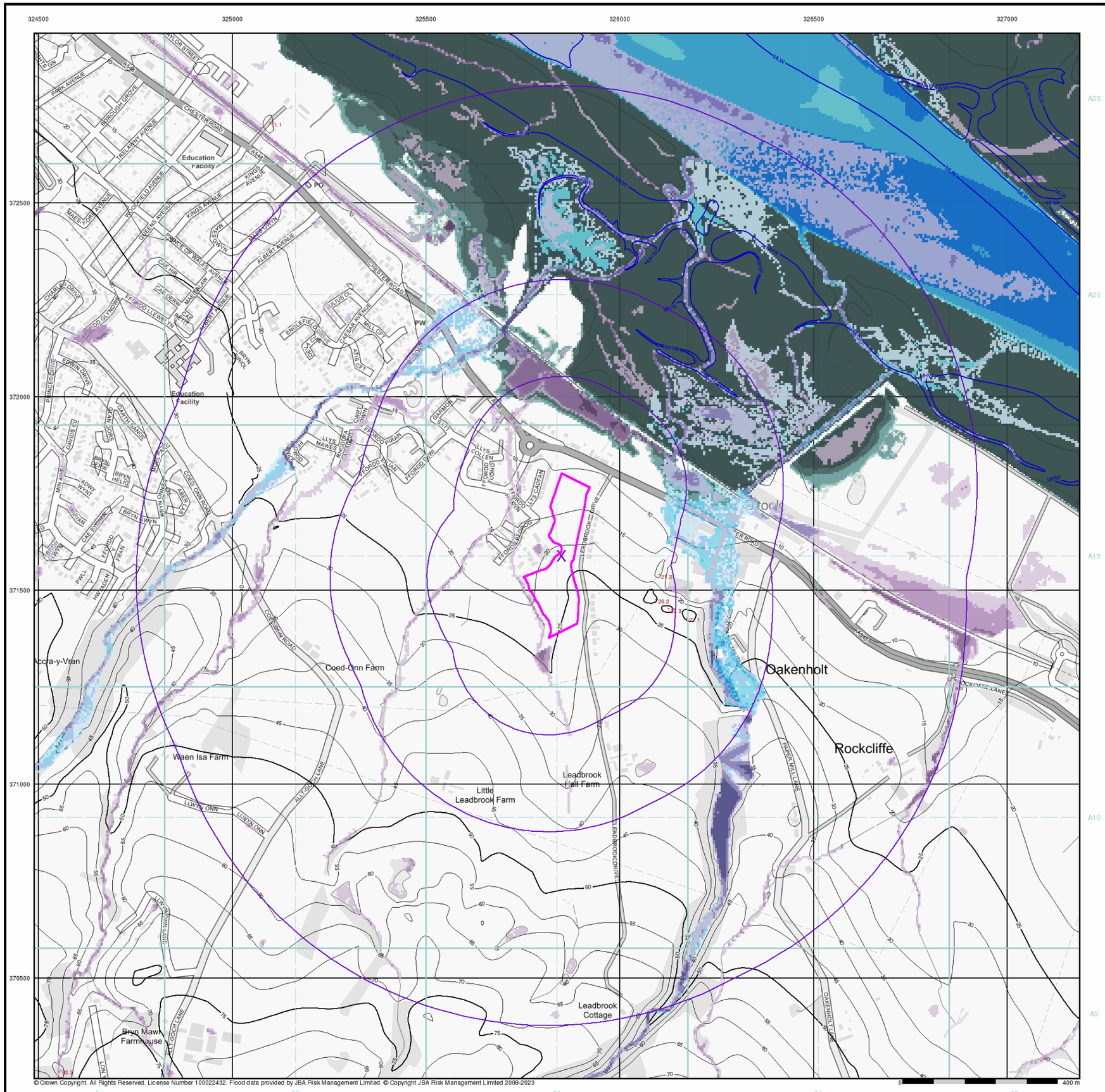
Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

Landmark® INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



Envirocheck®

LANDMARK INFORMATION GROUP®

JBA 75 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

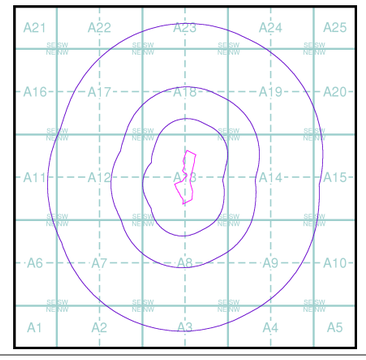
Contours (height in metres)

Standard Contour 105 100 95 — MLW Mean Low Water

Master Contour — MHW Mean High Water

Spot Height 157.8

JBA 75 Year Return Flood Map (Undefended) - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

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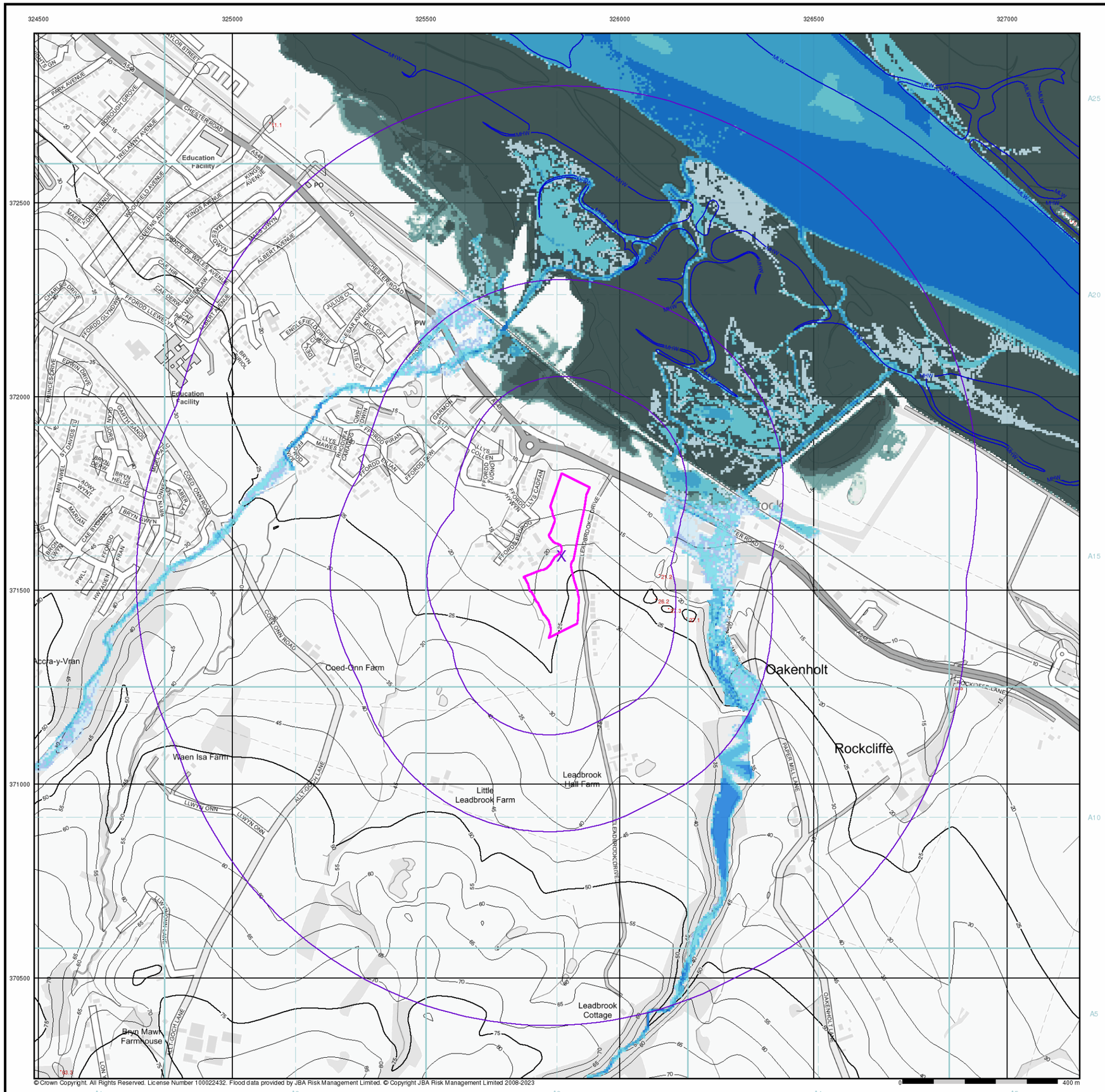


Envirocheck®

LANDMARK INFORMATION GROUP®

JBA 100 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Modelled Flood Depth

Fluvial Depth	Coastal Depth
0.01m - 0.05m	0.01m - 0.05m
0.05m - 0.1m	0.05m - 0.1m
0.1m - 0.3m	0.1m - 0.3m
0.3m - 1m	0.3m - 1m
>1m	>1m

Contours (height in metres)

Standard Contour 105

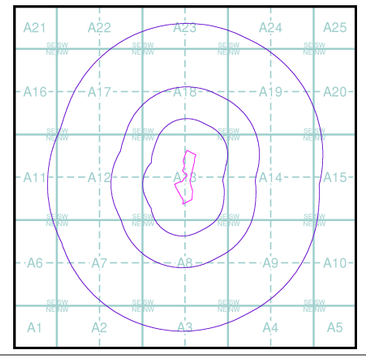
Master Contour 100 95

Spot Height 167.8

MLW Mean Low Water

MHW Mean High Water

JBA 100 Year Return Flood Map (Undefended) - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

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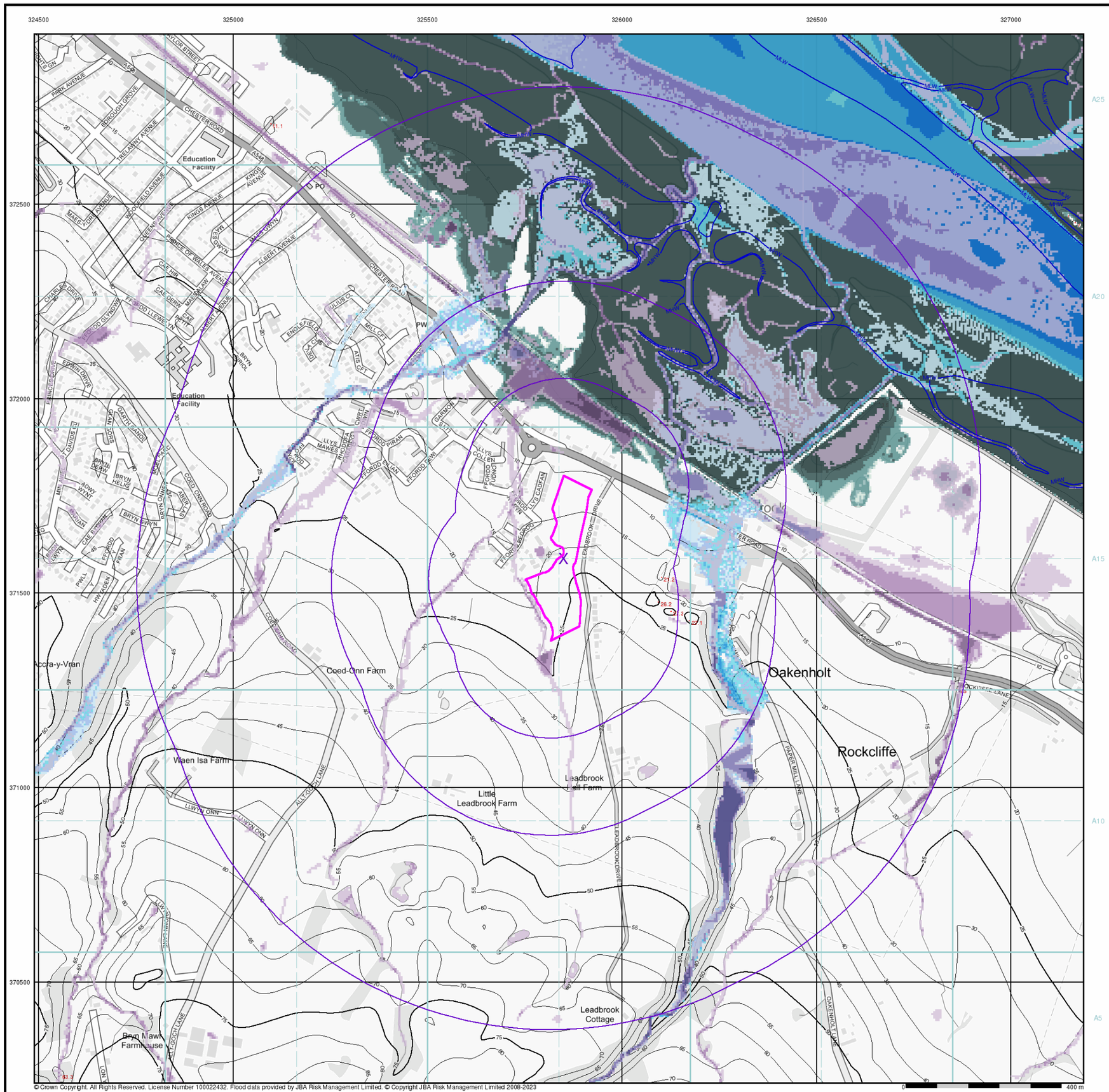


Envirocheck®

LANDMARK INFORMATION GROUP®

JBA 200 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour — 105 — 100 — 95

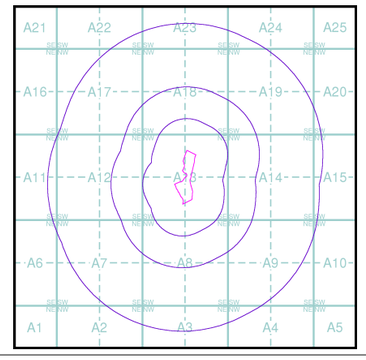
Master Contour

Spot Height 157.8

MLW Mean Low Water

MHW Mean High Water

JBA 200 Year Return Flood Map (Undefended) - Slice A



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Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

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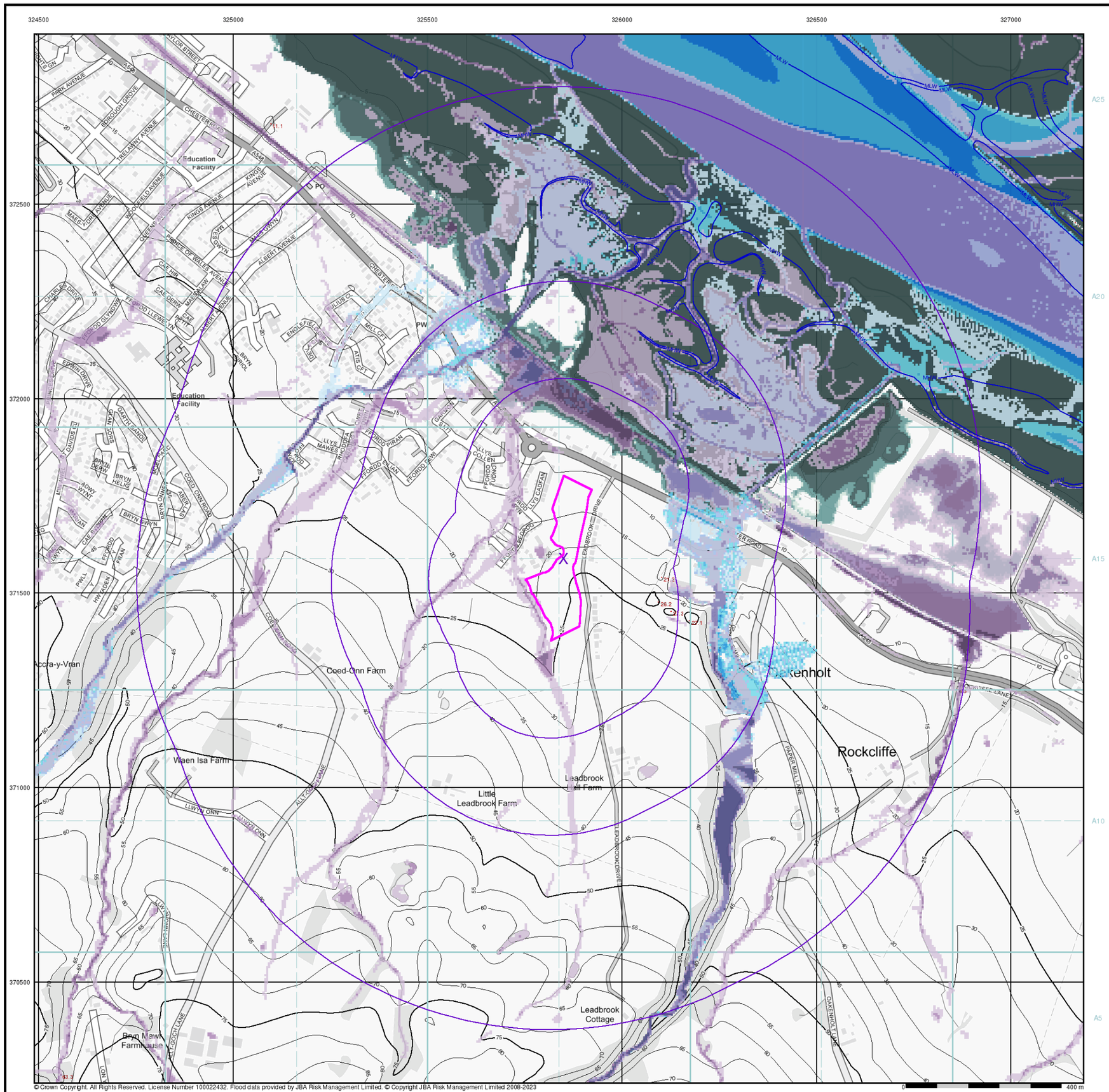


Envirocheck®

LANDMARK INFORMATION GROUP®

JBA 1000 Year Return Flood Map (Undefended) (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

Modelled Flood Depth

Pluvial Depth	Fluvial Depth	Coastal Depth
0.1m	0.01m - 0.05m	0.01m - 0.05m
0.1m - 0.3m	0.05m - 0.1m	0.05m - 0.1m
0.3m - 1m	0.1m - 0.3m	0.1m - 0.3m
>1m	0.3m - 1m	0.3m - 1m
	>1m	>1m

Contours (height in metres)

Standard Contour — 105 — 100 — 95

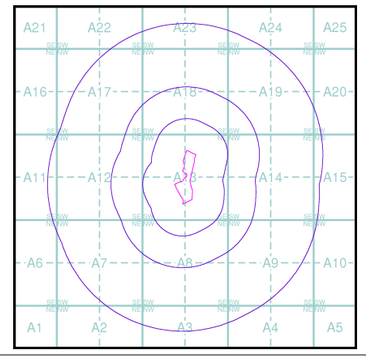
Master Contour

Spot Height — 157.8

MLW Mean Low Water

MHW Mean High Water

JBA 1000 Year Return Flood Map (Undefended) - Slice A



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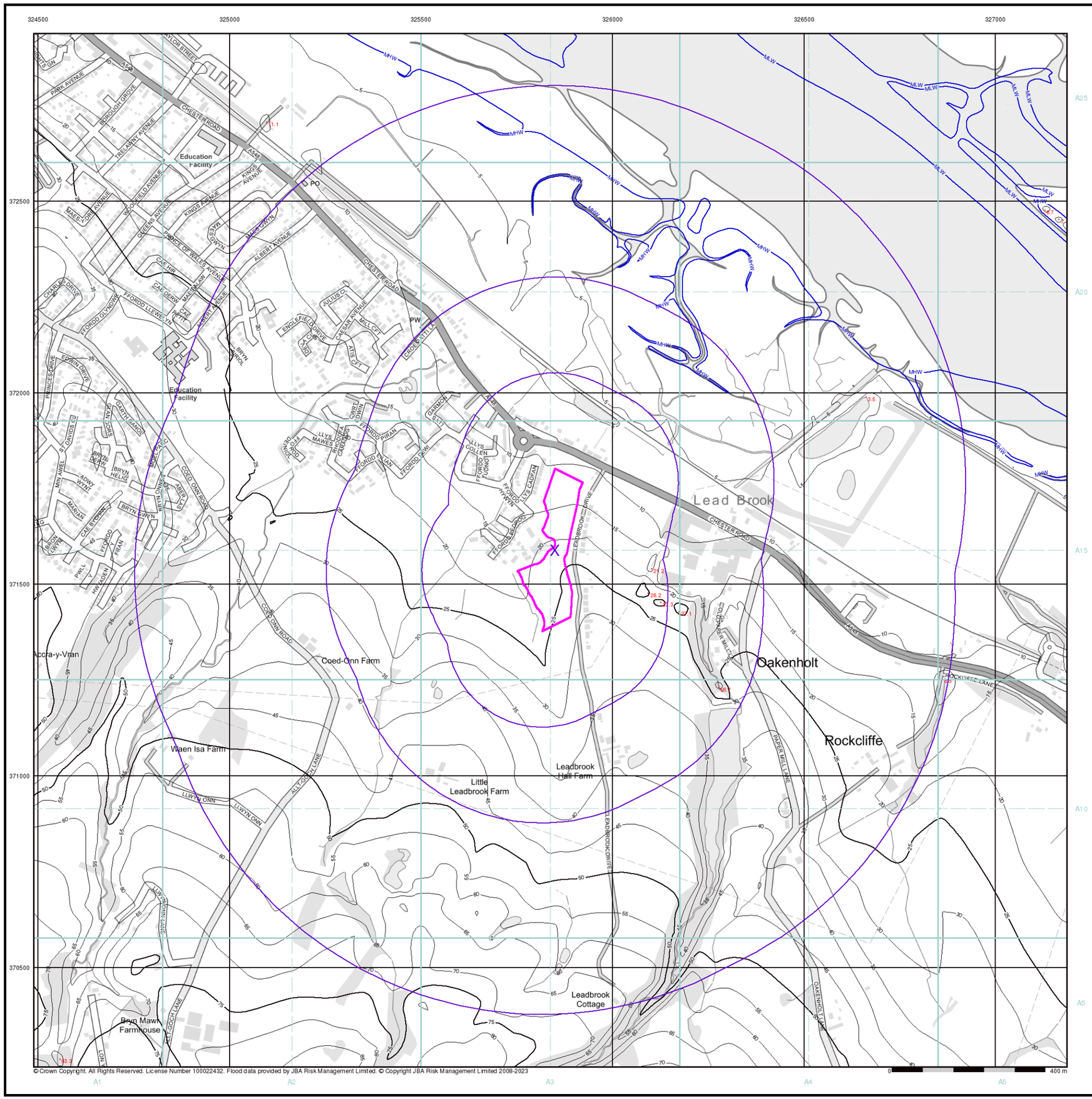


Envirocheck®

LANDMARK INFORMATION GROUP®

JBA Canal Failure Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point

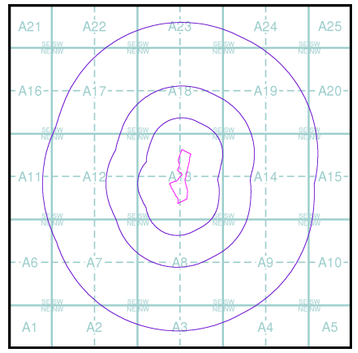
Flood Data

- Canal Failure
- Coverage

Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height *167.8
- MLW Mean Low Water
- MHW Mean High Water

JBA Canal Failure Flood Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

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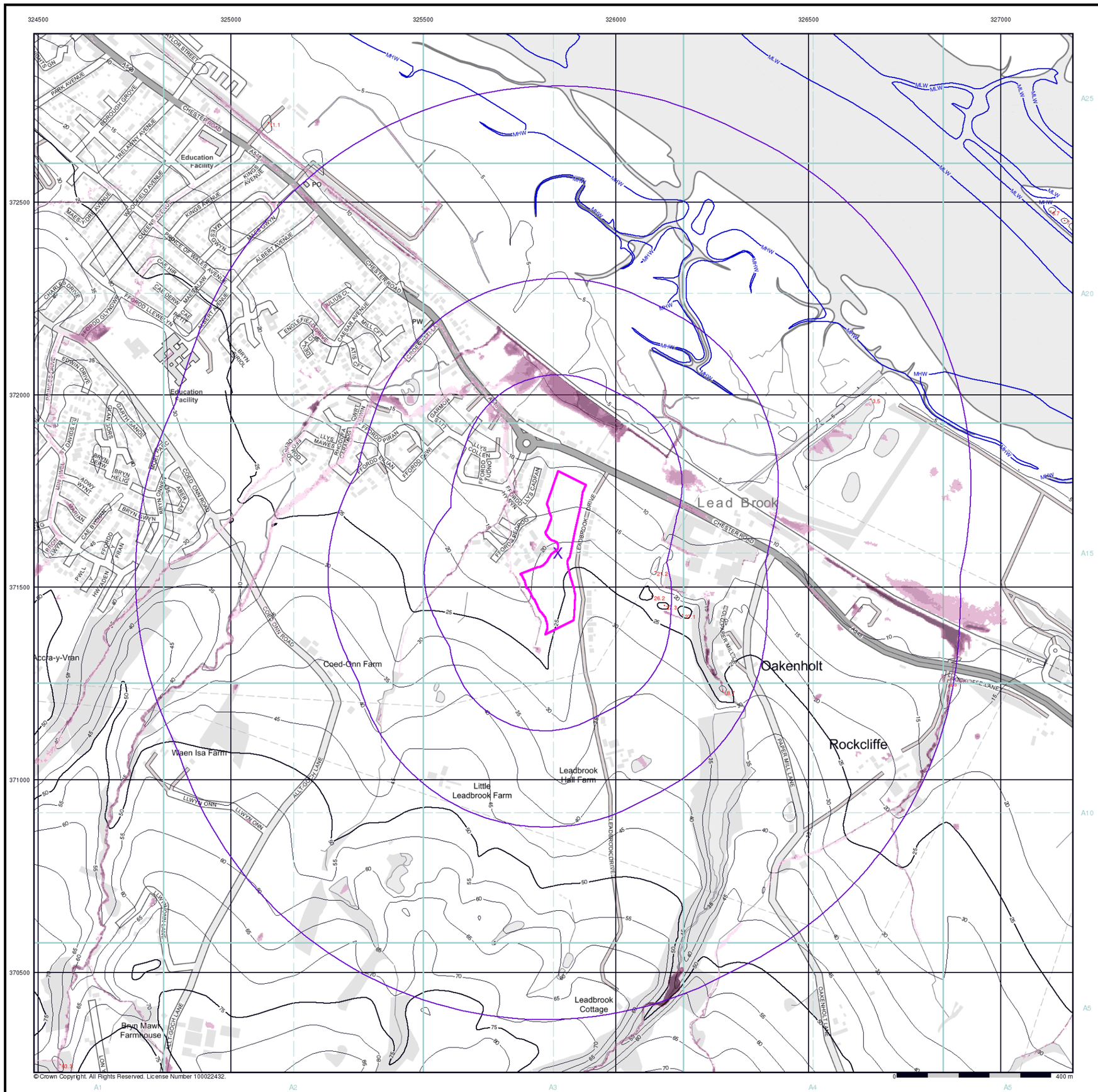


Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 30 Year Return Depth Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

Standard Contour | Master Contour | Spot Height 167.8

MLW Mean Low Water

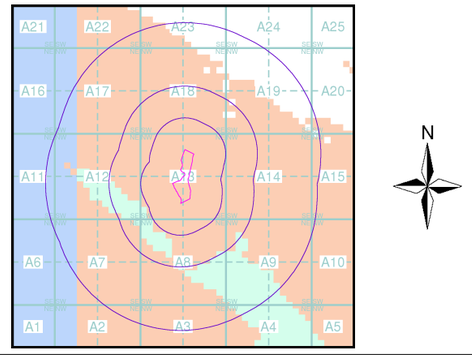
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

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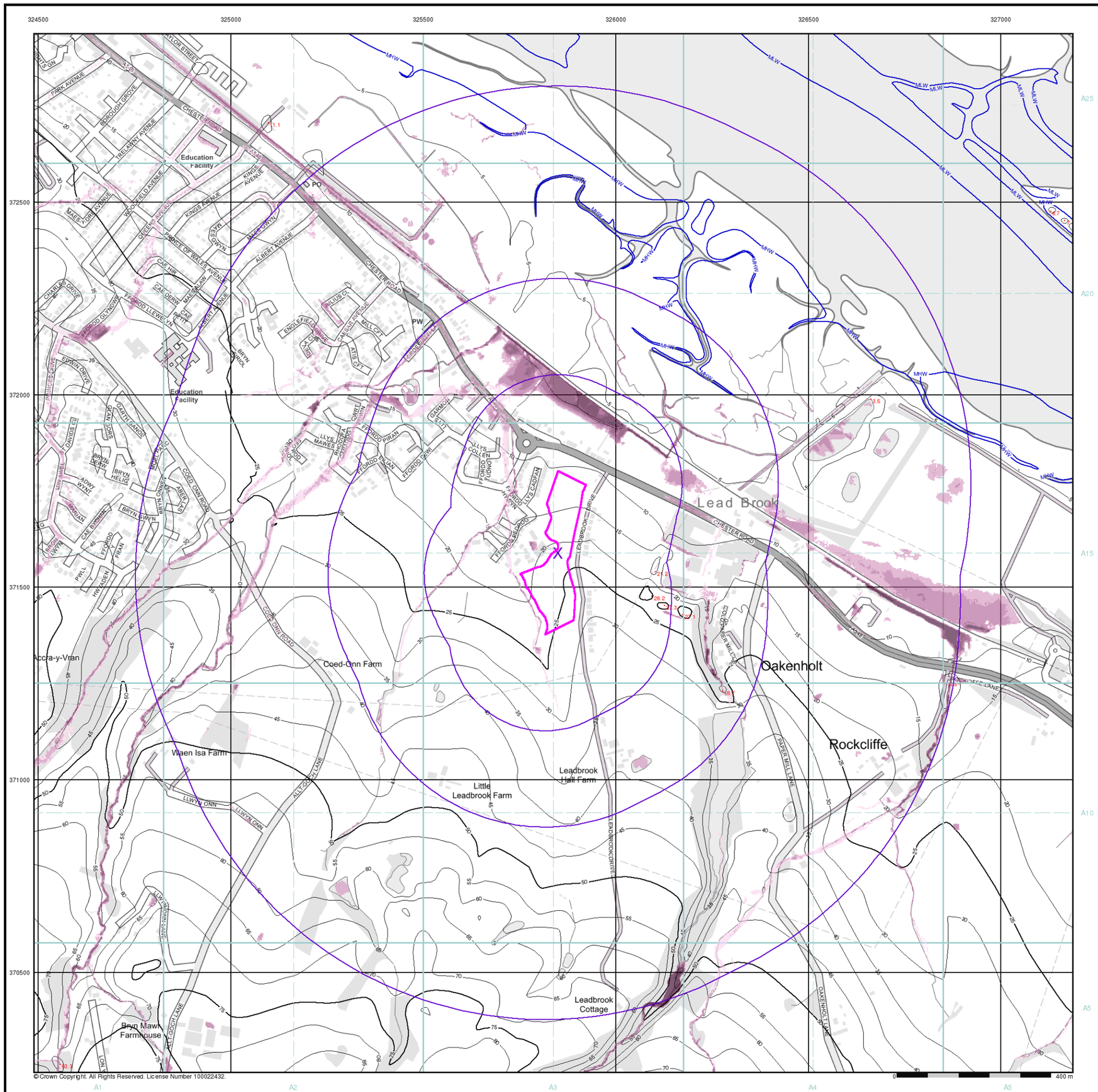


Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 100 Year Return Depth Map

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

Standard Contour | Master Contour | Spot Height 167.8

MLW Mean Low Water

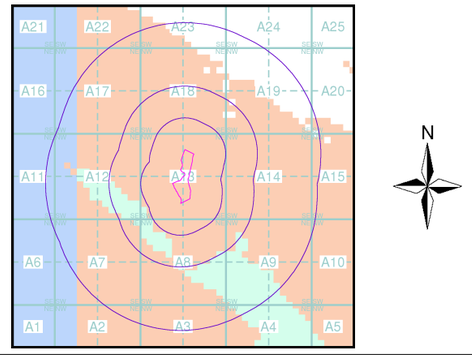
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

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Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

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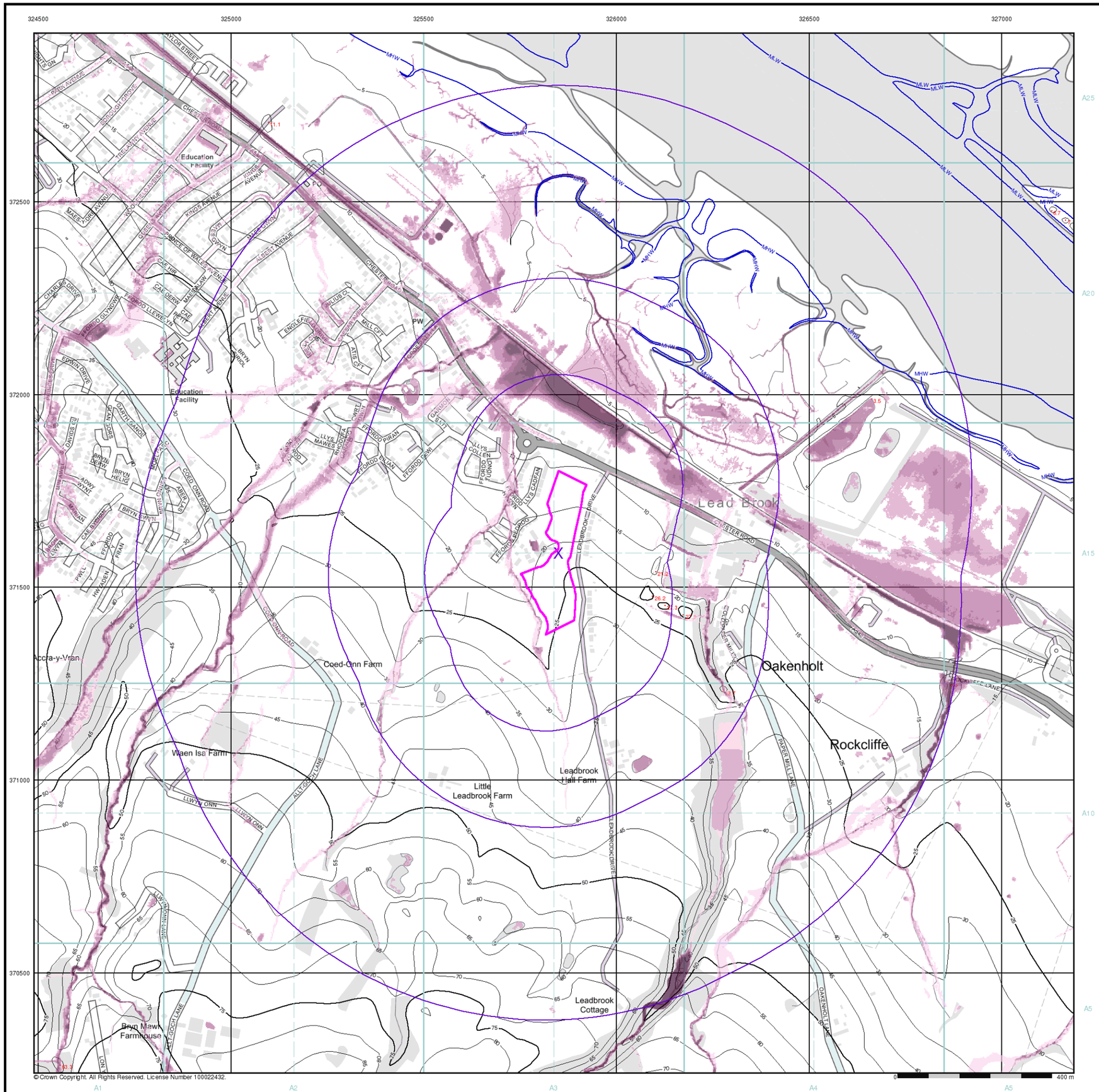


Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 1000 Year Return Depth Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Depth

- 0 - 0.15m
- 0.15 - 0.30m
- 0.30 - 0.60m
- 0.60 - 0.90m
- 0.90 - 1.20m
- > 1.20m

Contours (height in metres)

Standard Contour | Master Contour | Spot Height 167.8

MLW Mean Low Water

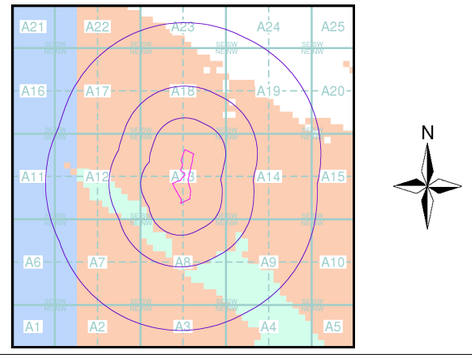
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

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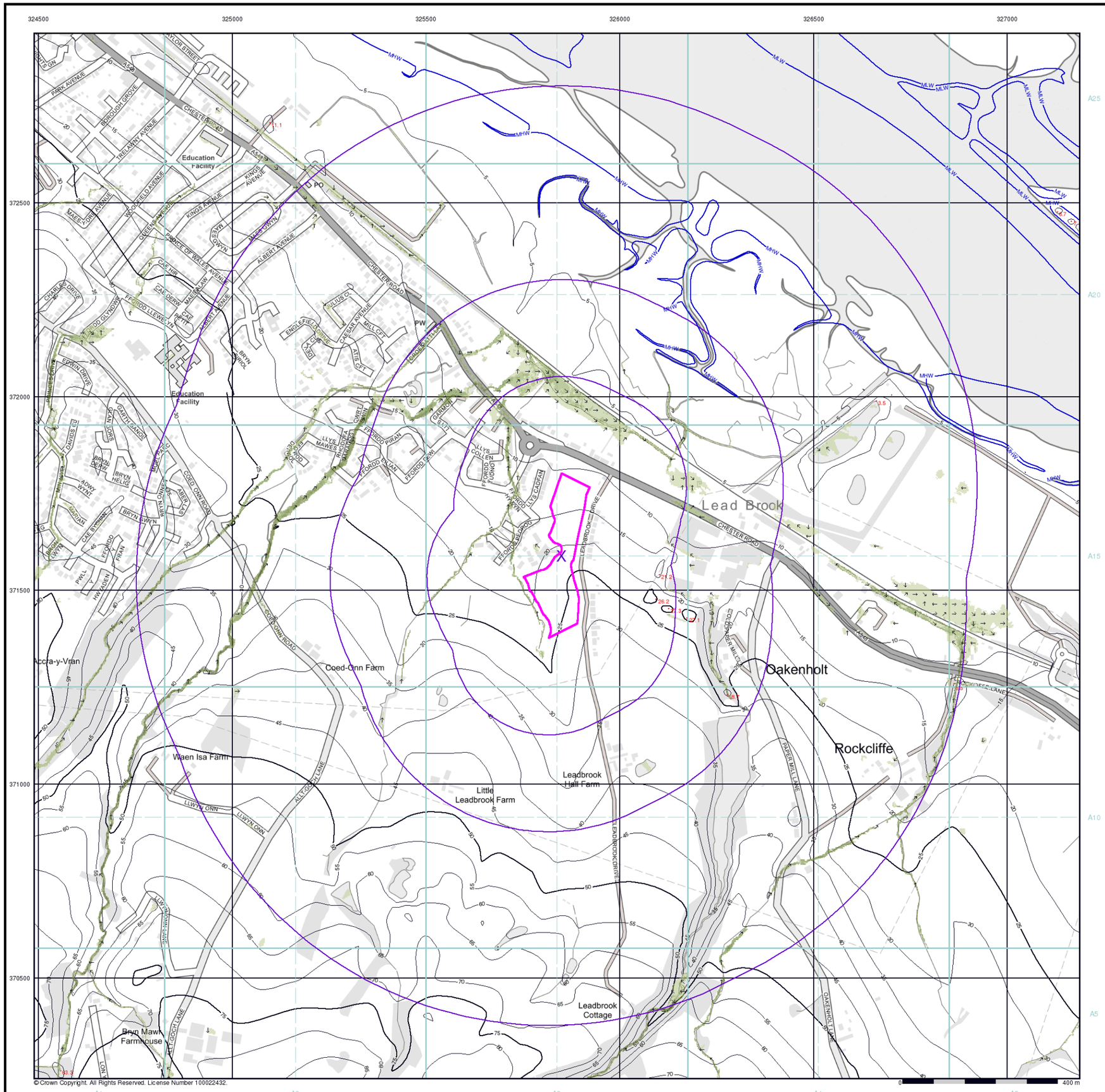


Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 30 Year Return Velocity and Flow Direction Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Velocity and Direction

- 0.00 - 0.25m/s
- 0.25 - 0.50m/s
- 0.50 - 1.00m/s
- 1.00 - 2.00m/s
- > 2.00m/s

Flow Direction at maximum velocity

Contours (height in metres)

Standard Contour | Master Contour | Spot Height *167.8

MLW Mean Low Water

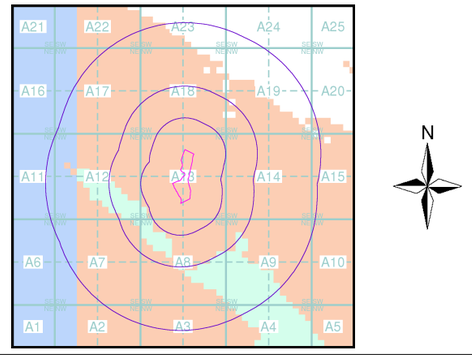
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

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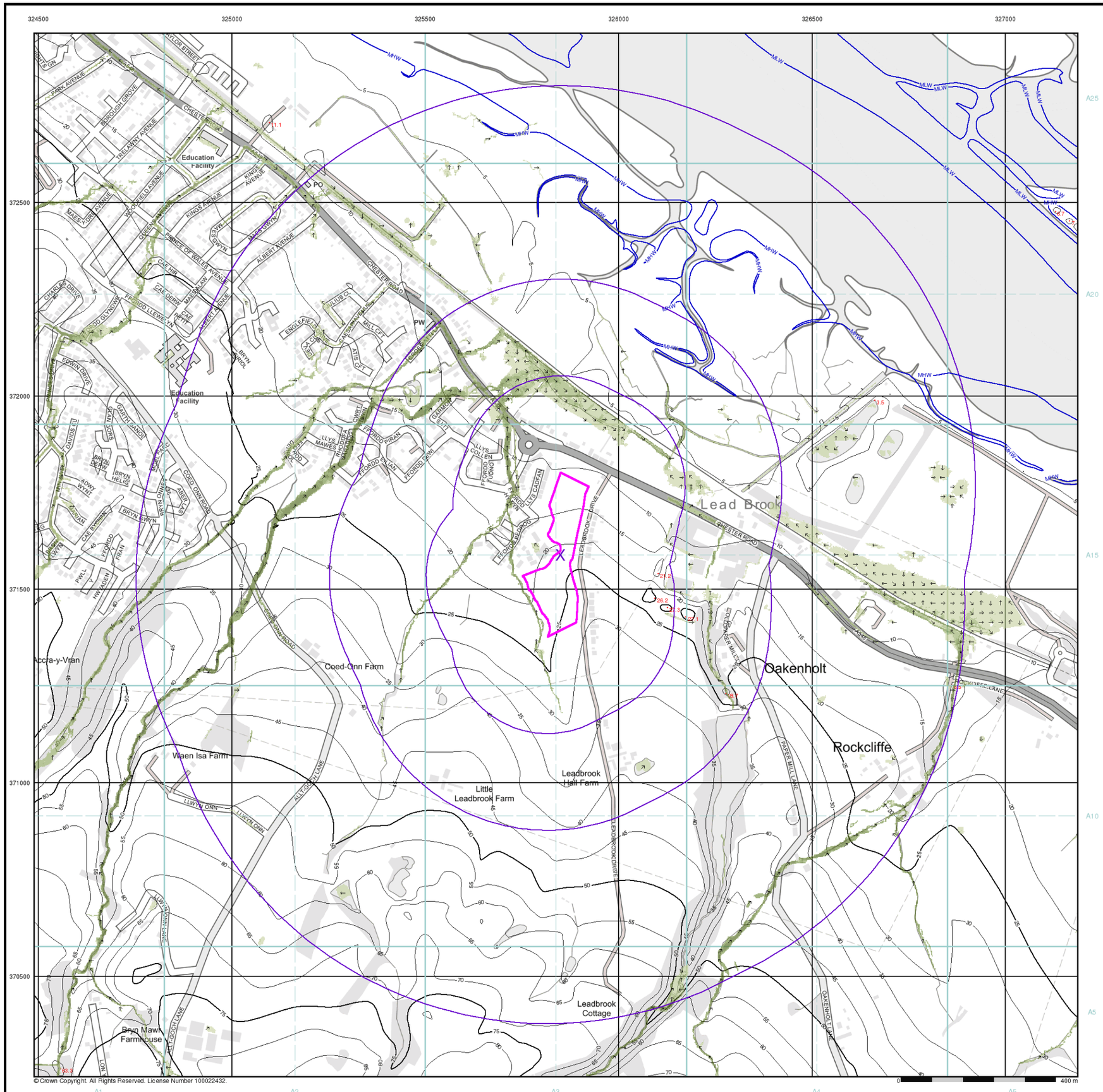


Envirocheck®

LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 100 Year Return Velocity and Flow Direction Map (1:10,000)

General

Specified Site | Specified Buffer(s) | Bearing Reference Point

Surface Water Velocity and Direction

- 0.00 - 0.25m/s
- 0.25 - 0.50m/s
- 0.50 - 1.00m/s
- 1.00 - 2.00m/s
- > 2.00m/s

Flow Direction at maximum velocity

Contours (height in metres)

Standard Contour | Master Contour | Spot Height *167.8

MLW Mean Low Water

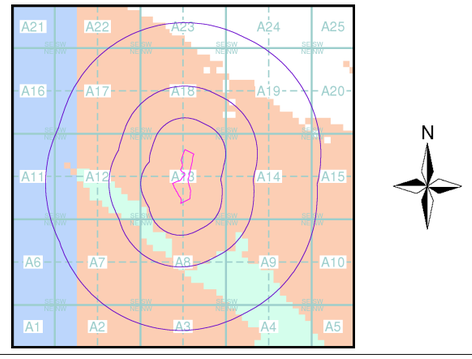
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

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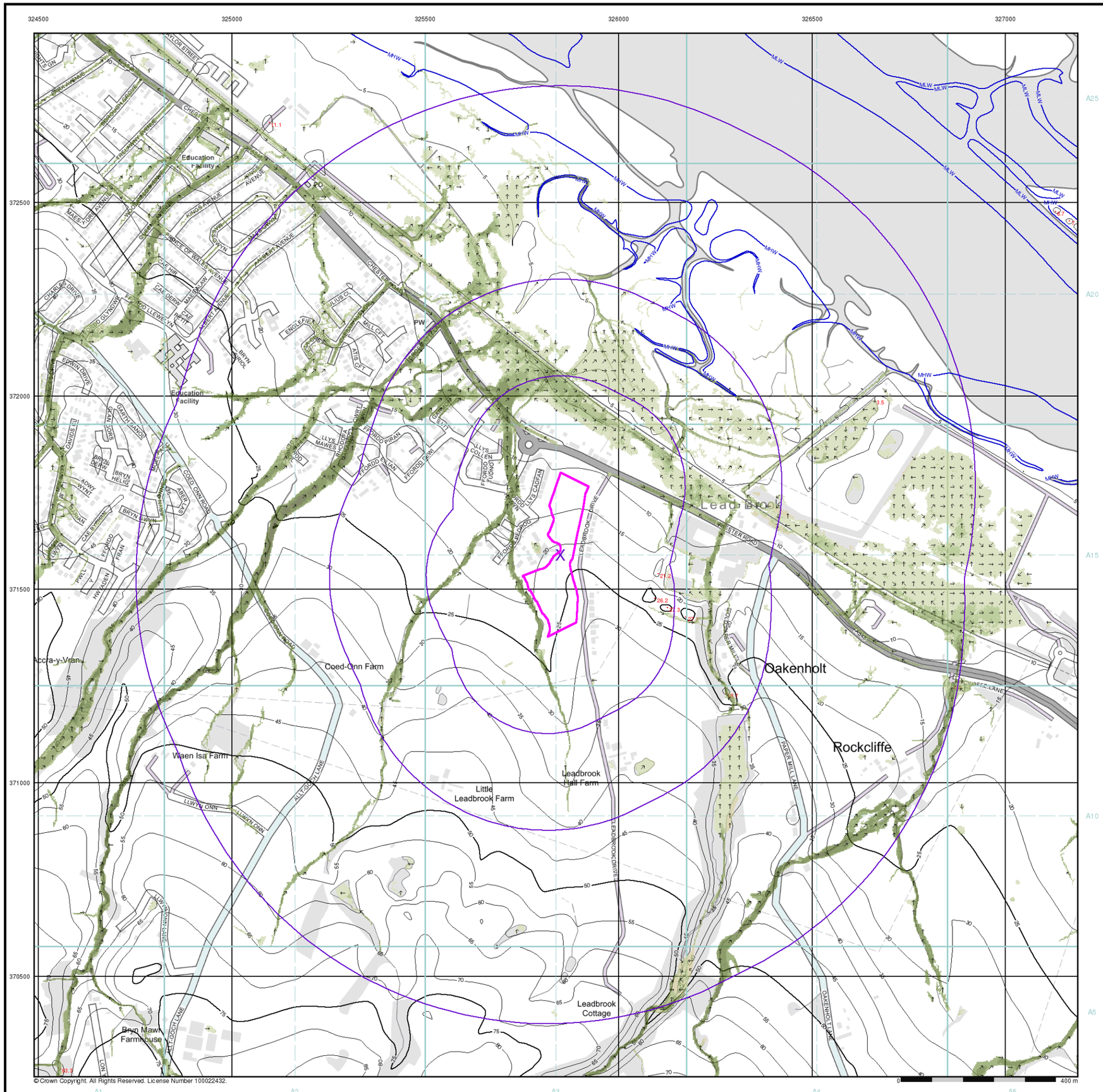
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

Landmark® INFORMATION GROUP

Tel: 0844 844 9952
Fax: 0844 844 9951
Web: www.envirocheck.co.uk



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LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 1000 Year Return Velocity and Flow Direction Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Velocity and Direction

- 0.00 - 0.25m/s
- 0.25 - 0.50m/s
- 0.50 - 1.00m/s
- 1.00 - 2.00m/s
- > 2.00m/s

Flow Direction at maximum velocity

Contours (height in metres)

Standard Contour | Master Contour | Spot Height *167.8

MLW Mean Low Water

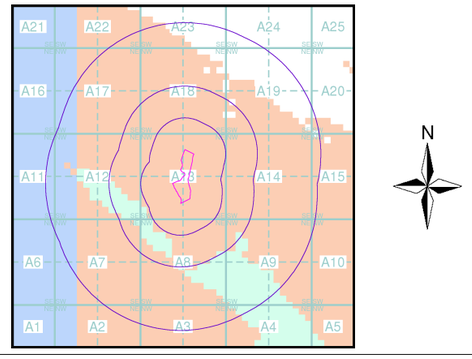
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

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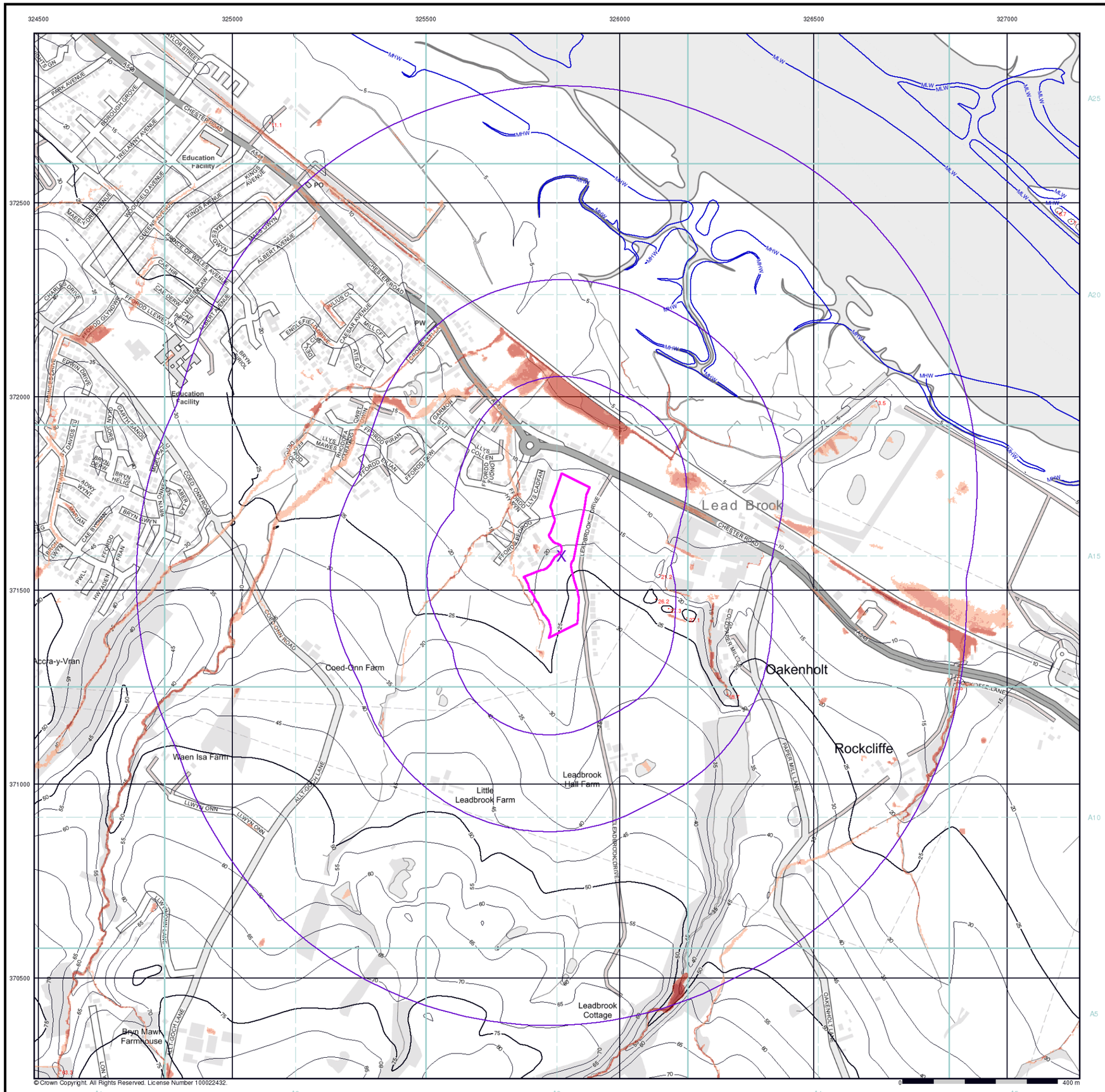

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EA/NRW Surface Water 30 Year Return Hazard Rating Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

Contours (height in metres)

Standard Contour | Master Contour | Spot Height *167.8

MLW Mean Low Water

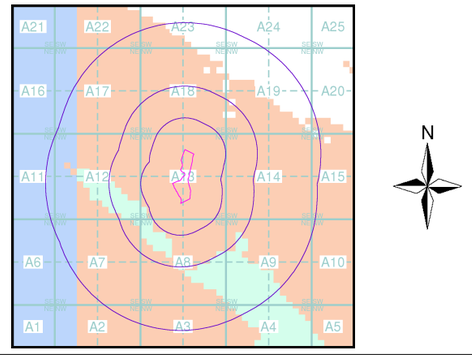
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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Customer Ref:	8211
National Grid Reference:	325850, 371590
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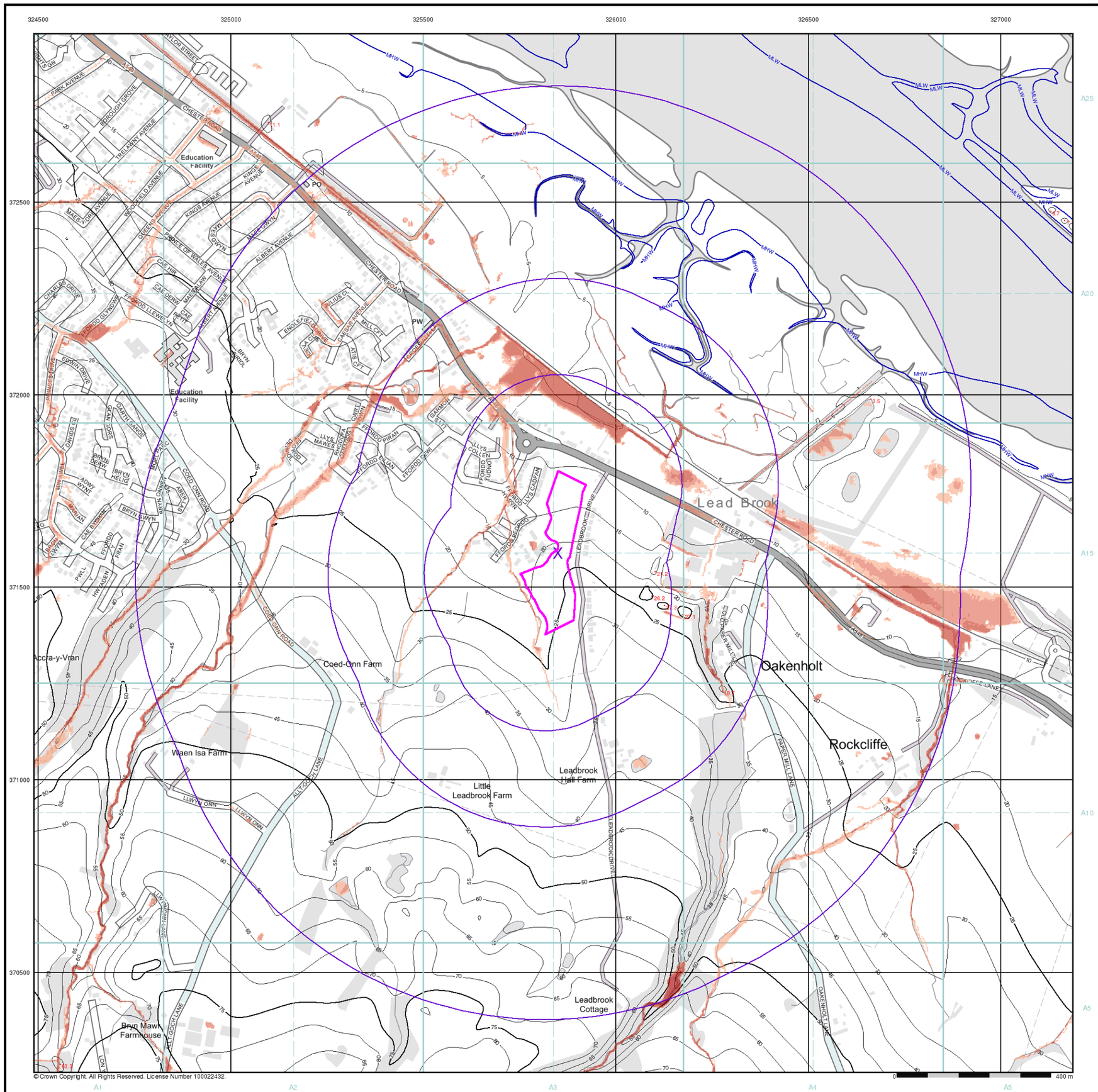

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LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 100 Year Return Hazard Rating Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

Contours (height in metres)

Standard Contour — 105 — 100 — 95

Master Contour

Spot Height *167.8

MLW Mean Low Water

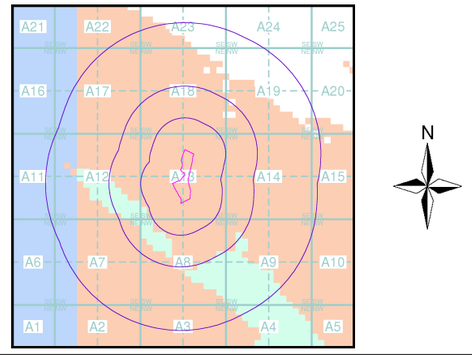
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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National Grid Reference:	325850, 371590
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Site Details

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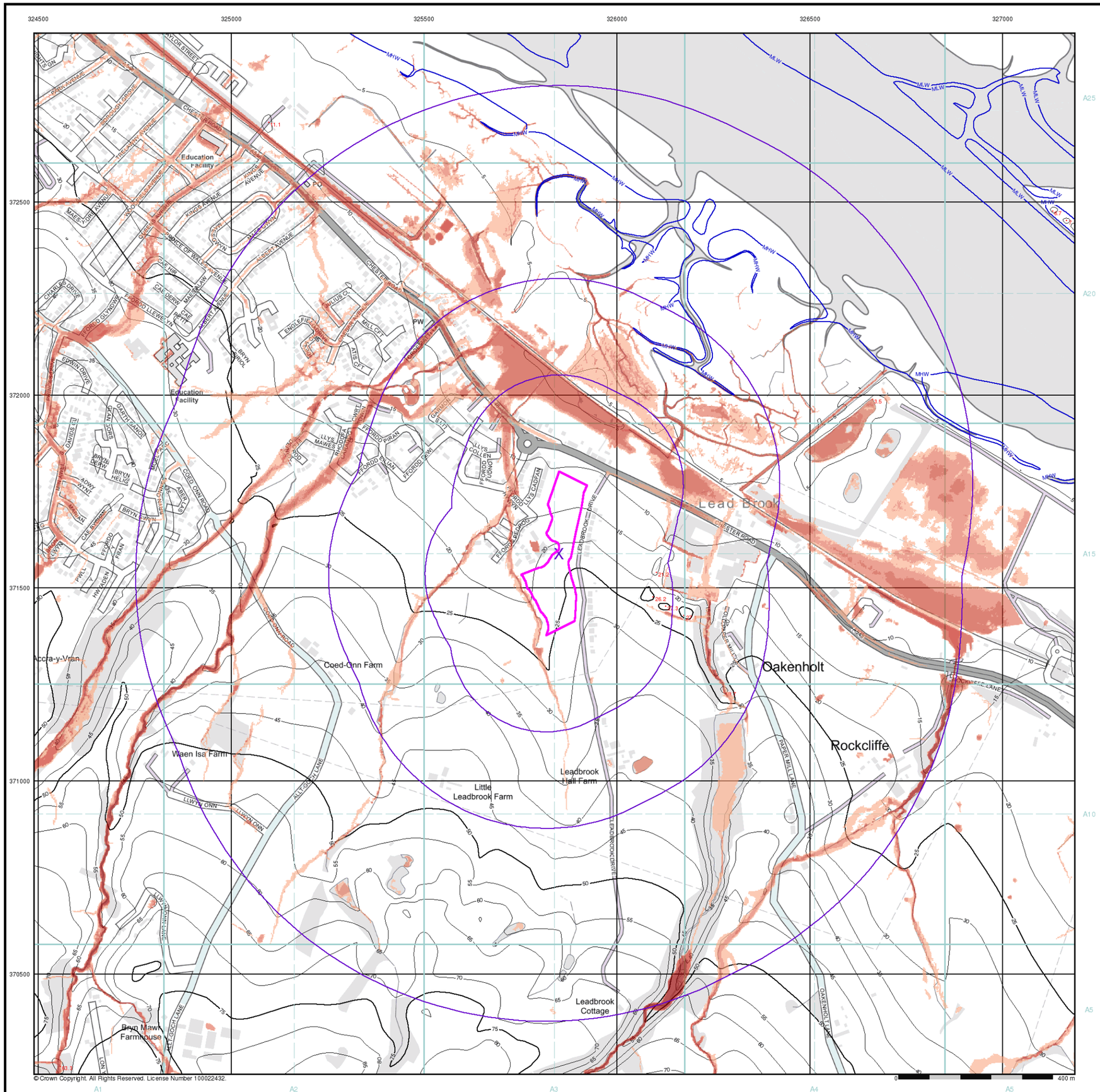

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LANDMARK INFORMATION GROUP®

EA/NRW Surface Water 1000 Year Return Hazard Rating Map (1:10,000)

General

Specified Site | Specified Buffer(s) | X Bearing Reference Point

Surface Water Hazard Rating

- Low (0.5 – 0.75)
- Moderate (0.75 – 1.25)
- Significant (1.25 – 2.0)
- Extreme (>2.0)

Contours (height in metres)

Standard Contour | Master Contour | Spot Height (*167.8)

MLW Mean Low Water

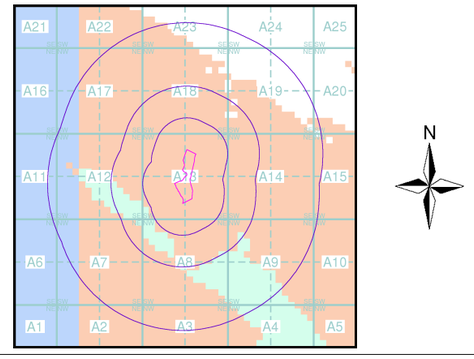
MHW Mean High Water

Suitability

See the suitability map below

- National to county
- County to town
- Town to street
- Street to parcels of land
- Property

EA/NRW Suitability Map - Slice A



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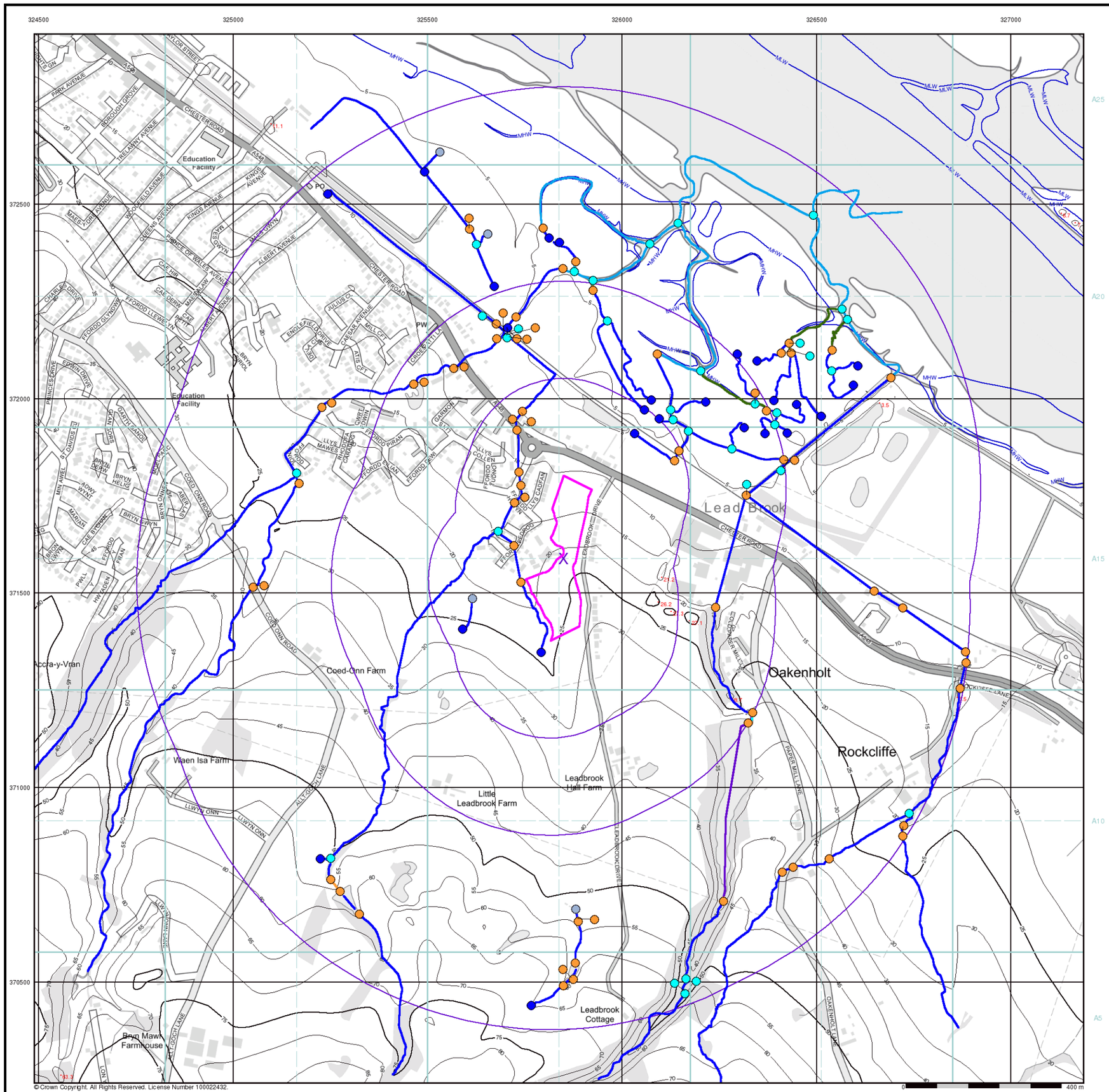

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LANDMARK INFORMATION GROUP®

OS Water Network Lines Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- X Bearing Reference Point

OS Water Network Data

- Canal
- Reservoir
- Foreshore
- Marsh
- Tidal River
- Inland River
- Drain
- Other
- Lake
- Transfer
- Lock Or Flight Of Locks
- Sea
- Junction
- Outlet
- Pseudo
- Source
- Other

Contours (height in meters)

Standard Contour 105 100 95

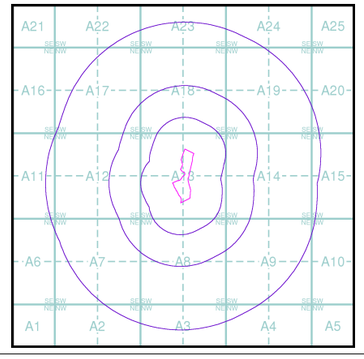
Master Contour

Spot Height 167.3

MLW Mean Low Water

MHW Mean High Water

OS Water Network Map - Slice A



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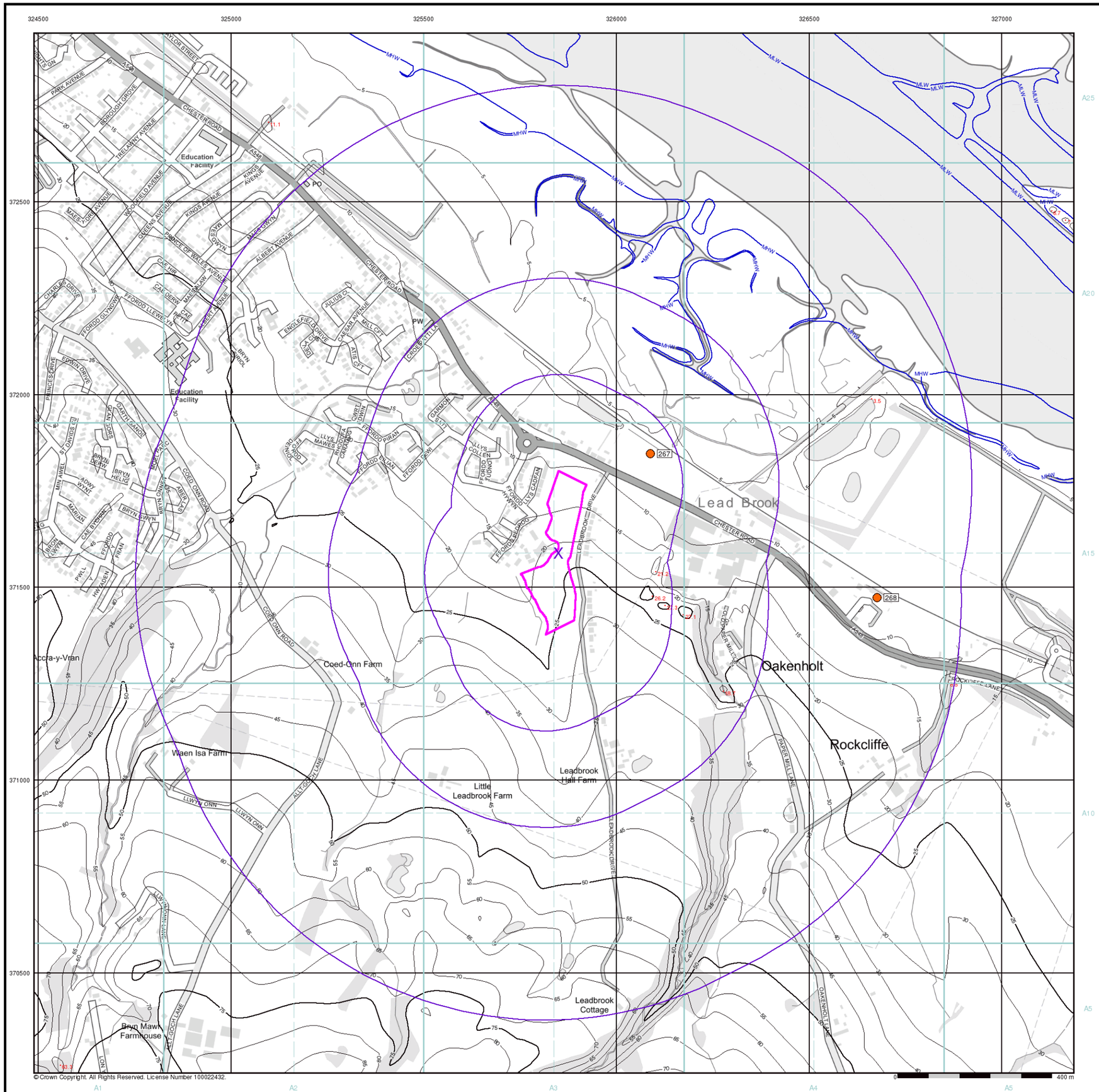

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EA/NRW Historic Flood Map (1:10,000)

General

- Specified Site
- Specified Buffer(s)
- Bearing Reference Point
- Map ID

Historic Flood Events Data

- Channel Capacity Exceeded (no raised defences)
- Channel Capacity Exceeded /Surface Water
- Groundwater/High Water Table
- Local Drainage/Surface Water
- Mechanical Failure
- Obstruction/Blockage - Bridge
- Obstruction/Blockage - Channel
- Historical Flood Liabilities
- Obstruction/Blockage - Culvert
- Obstruction/Blockage - Debris Screen
- Operational Failure/ Breach of Defence
- Other
- Overtopping of Defences
- Surface Water
- Unknown

Contours (height in metres)

Standard Contour 105 100 95

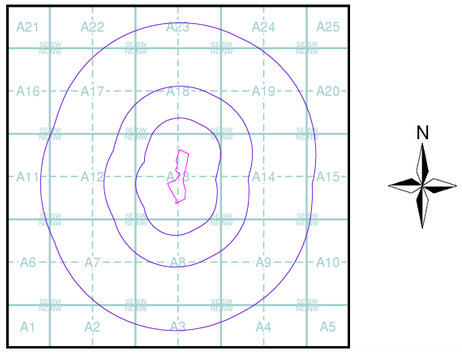
Master Contour

Spot Height *167.8

MLW Mean Low Water

MHW Mean High Water

EA/NRW Historic Flood Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

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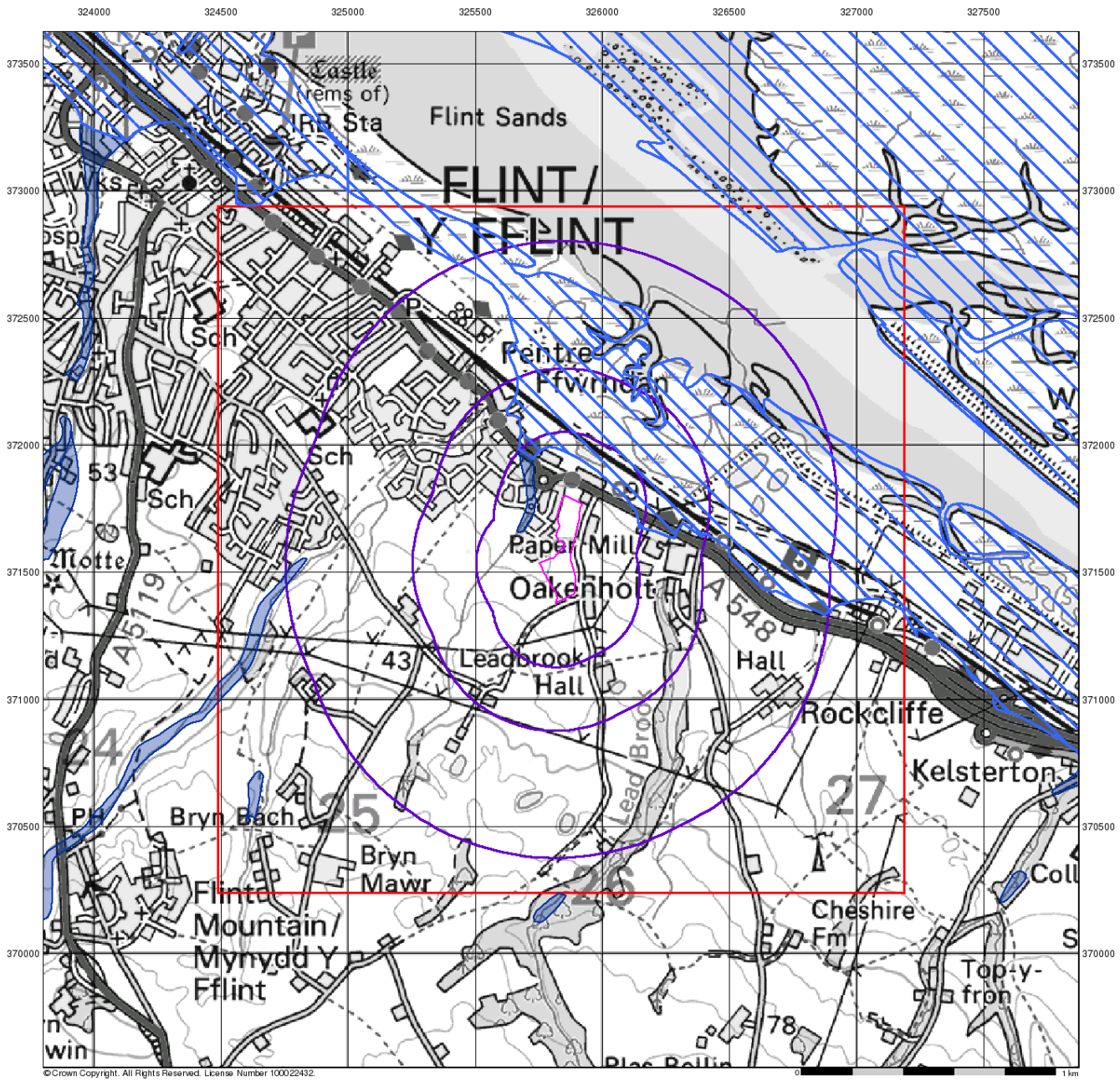

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BGS Flood Data (1:50,000)

General

Specified Site | Specified Buffer(s) | Bearing Reference Point

Slice | Map ID

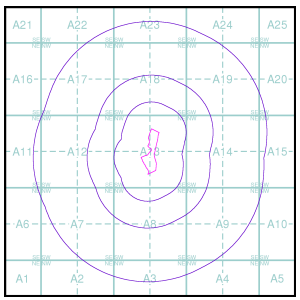
BGS Geological Indicators of Flooding

Coastal

Inland

Bodies of Water

BGS Flood Data Map - Slice A



Order Details

Order Number:	312162444_1_1
Customer Ref:	8211
National Grid Reference:	325850, 371590
Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

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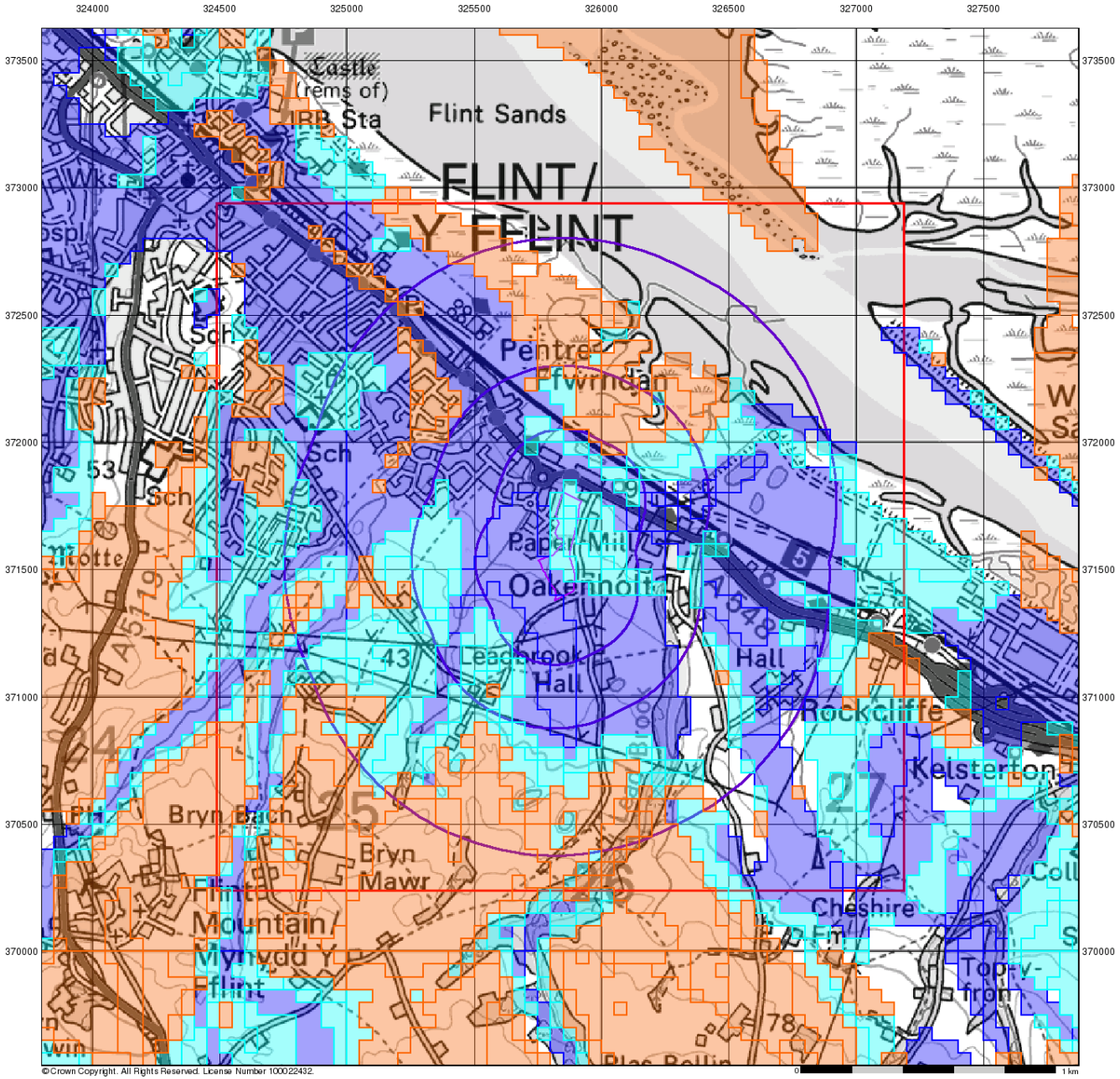

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BGS Flood Data (1:50,000)

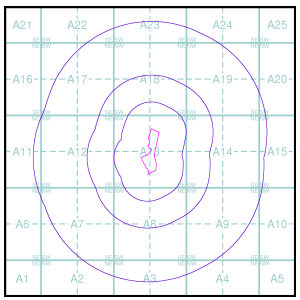
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice | Map ID

BGS Groundwater Flooding Susceptibility

- Potential for Groundwater Flooding to Occur at Surface
- Potential for Groundwater Flooding of Property Situated Below Ground Level
- Limited Potential for Groundwater Flooding to Occur

BGS Flood Data Map - Slice A



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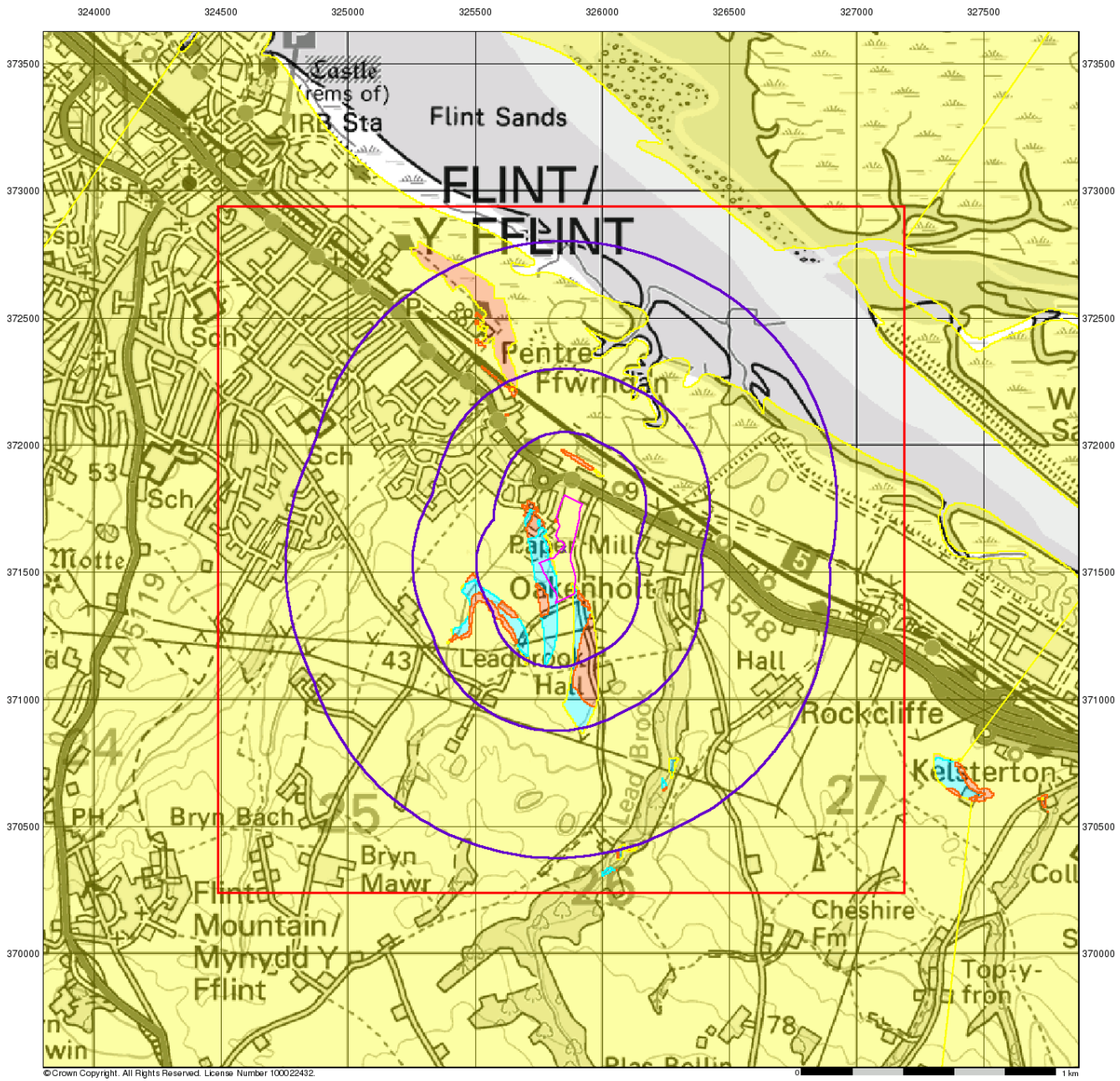

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GeoSmart Information Groundwater Flood Map (1:50,000)

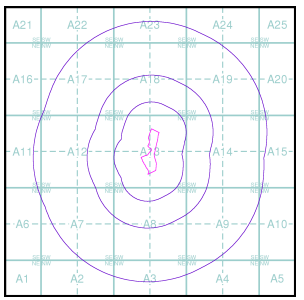
General

Specified Site | Specified Buffer(s) | Bearing Reference Point | Slice

GeoSmart Information Groundwater Flooding Risk

- High Risk
- Moderate Risk
- Low Risk
- Negligible Risk

GeoSmart Information Groundwater Flood Map - Slice A



Order Details

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Slice:	A
Site Area (Ha):	3.19
Search Buffer (m):	1000

Site Details

Quarry Farm, Oakenholt, CH6 5ST

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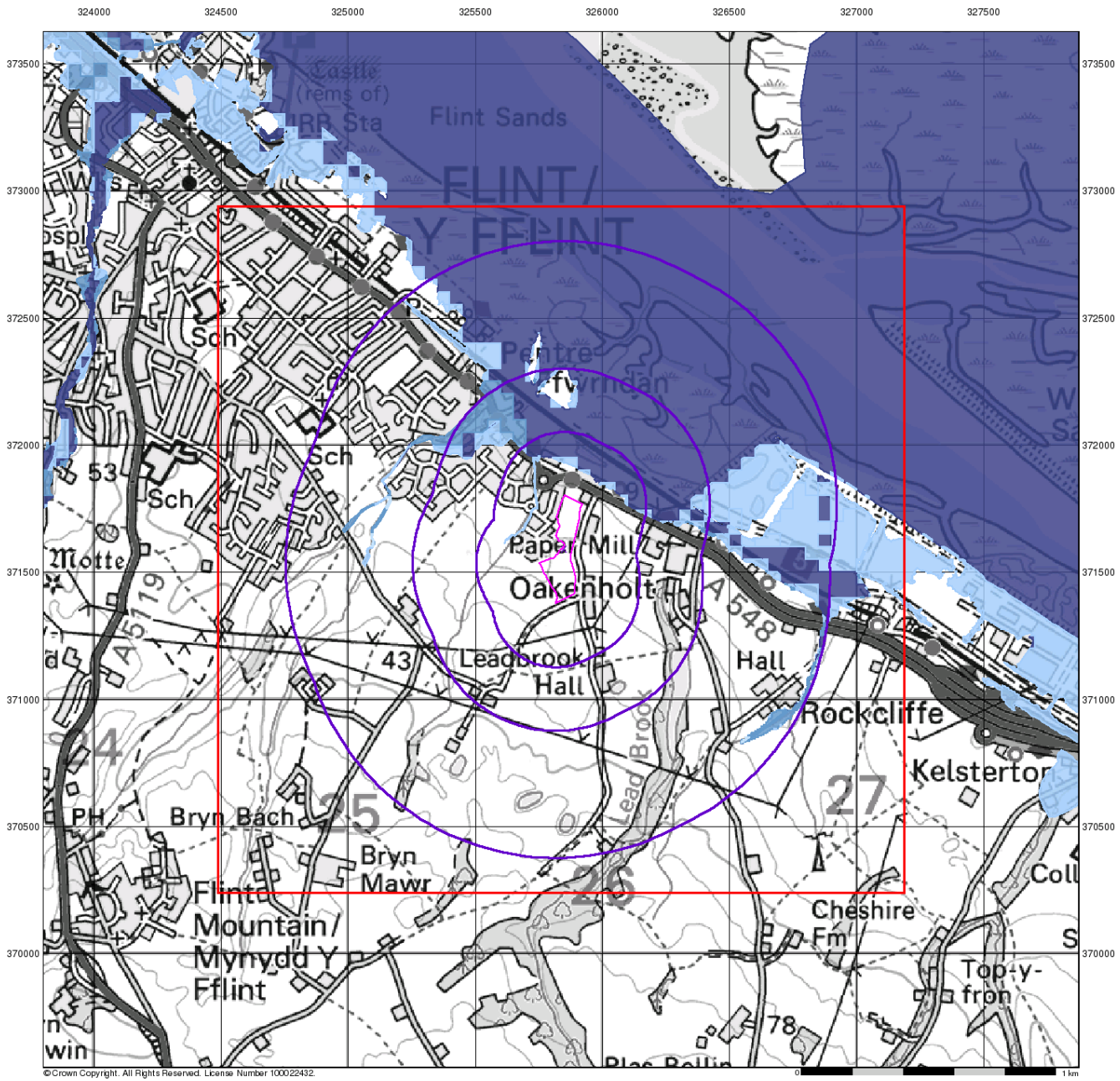

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EA/NRW RoFRS Data (1:50,000)

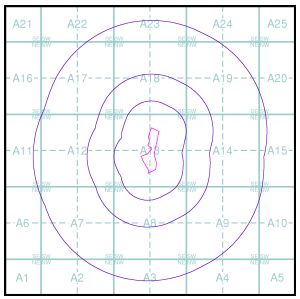
General

Specified Site | Specified Buffer(s) | Bearing Reference Point
Slice | Map ID

Risk of Flooding from Rivers and Sea (RoFRS)

- High Risk
- Medium Risk
- Low Risk
- Very Low Risk

EA/NRW RoFRS Data Map - Slice A



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Appendix 3

Infiltration Consideration

Trial Pit Information

and

Infiltration Test Results

DO NOT SCALE

NORTH

KEY TO EXISTING FEATURES
(All positions are approximate unless otherwise stated)

- Surveyed tree / vegetation (taken from ref. a)
- Surveyed stream (taken from ref. a)
- Topographical contours (taken from ref. a)
- Surveyed top of bank (taken from ref. a)
- Surveyed bottom of bank (taken from ref. a)
- Surveyed fenceline (taken from ref. a)
- Scheduled Ancient monument (taken from ref. c)
- Tree protection orders (TPO's) (taken from ref. j))
- Surface depression feature noted on LiDAR mapping (taken from ref. k)
- Site boundary (taken from ref. b)

KEY TO EXPLORATORY HOLES
(All positions are approximate unless otherwise stated)

- Infiltration pit locations ITP01 - ITP05 excavated by Coopers between 16 & 17 August 2023.

KEY TO GEOLOGICAL FEATURES
(All positions are approximate unless otherwise stated)

- Fault line (taken from ref. c)
- Inferred coal seam (taken from ref. c)

KEY TO FORMER FEATURES
(All positions are approximate unless otherwise stated)

- Former buildings (taken from ref. c)
- Former pond (taken from ref. c)
- Former coal mine shaft (taken from ref. c)
- Former stream (taken from ref. c)
- Former quarry (taken from ref. c)

KEY TO CONJECTURED SERVICES
(All positions are approximate unless otherwise stated)

- BT lines (taken from ref. d)
- High voltage electricity lines (taken from ref. e)
- Low voltage electricity lines (taken from ref. e)
- Gas lines (taken from ref. f)
- Potable water lines (taken from ref. g)
- Foul sewer line (taken from ref. g)
- Foul (combined) water (taken from ref. g)
- EirGrid lines (taken from ref. h)
- GTC electric lines (taken from ref. i)

Note:
Only above services available to Coopers at time of drawing production.

This drawing is to be read in conjunction with the following:-

a) Wardell Armstong LLP, Quarry Farm, Flintshire, [Topographical Survey], ref. CP10907, dated 03 June 2014.

b) PDF' ref. 'Infiltration Test Location Plan', received by Coopers on 19 May 2023.

c) GroundSure, Quarry Farm Oakenholt, ref. GS-T8W-574-JQH-H7G, dated 25 May 2023.

d) BT Openreach utilities map, ref. HJK08416L, dated 26 May 2023.

e) SP Energy Networks, Quarry Farm, Oakenholt, ref. 29615597, dated 25 May 2023.

f) Wales and West Utilities, Quarry Farm, Oakenholt, ref. 29615597, dated 25 May 2023.

g) Welsh Water, map centre: 325855, 371468, dated 16 July 2014.

h) EirGrid, East West Interconnector, ref. VIL-X-8.3.2-477, rev. 3.3, dated 27 July 2015 & ref. VIL-X-8.3.2-478, rev. 3.2, dated 15 November 2012.

i) GTC, Oakenholt, Flint, ref. 24263, dated 04 August 2014.

j) Flintshire County Council, Tree Preservation Orders database search.

k) Environment Agency, 1m DTM 2022 LiDAR records.

THIS DRAWING SHOULD ONLY BE PRINTED IN COLOUR

REVISION BOX				
Rev.	Date	Revision	By	Appd.
A	30.08.23	Infiltration pit locations added to drawing.	OS	AW

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Park House
Sandpiper Court
Chester Business Park
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CH4 9QU
Tel: 01244 684910
Email: admin@coopers.co.uk
Web: http://coopers.co.uk

Client: Castle Green

Project: Quarry Farm, Leadbrook Drive, Oakenholt.

Title: SITE PLAN

DRAWING NUMBER: 8215 / 01

SCALE at A0	1:500	REVISION
DATE	13.07.23	A
DRAWN	AH	
CHECKED	AW	

SCALE BAR (m) 0 5 10 15 20 25 30 35 40 45 50

coopers
chartered consulting engineers

Coopers (Chester) Ltd
tel: 01244 684 910
web: www.coopers.co.uk
email: admin@coopers.co.uk

Site
QUARRY FARM, OAKENHOLT, FLINT

Trial Pit Number
ITP01

Machine : JCB 3CX

Method : Mechanical Excavation

Dimensions
2.30 x 0.60 x 2.00m

Ground Level (mOD)

Client
Castle Green Homes Ltd

Job Number
8215

Location (Observed measurements)

Dates
16/08/2023

Engineer
Coopers (Chester) Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B				(0.30)	TOPSOIL. Grass over brown, slightly gravelly, clayey SAND. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies.		
					0.30			
0.40	SV 82kPa					Very weak, orangish brown mottled grey MUDSTONE, recovered as firm, slightly sandy, slightly gravelly, silty clay. Residual.		
0.45	B					At 0.40m: Ceramic land drain, approximately 75mm in diameter, orientated east to west. Dry		
						From 0.40m: Firm to stiff, high strength		
					(1.50)			
1.10	SV 94kPa							
					1.80			
1.90	B				(0.20)	Weak, greyish brown MUDSTONE, recovered as stiff, gravelly clay. Residual.		
					2.00			
						Complete at 2.00m		

Remarks

Location CAT scanned prior to excavation.
Sides stable during excavation.
No groundwater encountered during excavation.
Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy.
Trial pit excavated for infiltration test and backfilled with single size stone and slotted pipe. Reinstated at surface with topsoil.
Trial pit location shown on Drawing No. 8215/01.

North	Scale (approx)	Logged By	Checked By
	1:25	ST	PRS

coopers
chartered consulting engineers

Coopers (Chester) Ltd
tel: 01244 684 910
web: www.coopers.co.uk
email: admin@coopers.co.uk

Site
QUARRY FARM, OAKENHOLT, FLINT

Trial Pit Number
ITP02

Machine : JCB 3CX

Method : Mechanical Excavation

Dimensions
2.50 x 0.60 x 2.30m.

Ground Level (mOD)

Client
Castle Green Homes Ltd

Job Number
8215

Location (Observed measurements)

Dates
16/08/2023

Engineer
Coopers (Chester) Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B				(0.30)	TOPSOIL. Grass over brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies.		
0.50	SV 88kPa				0.30	Firm, reddish brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including coal. From 0.50m: Firm to stiff, high strength		
0.70	B				(0.70)			
0.90	SV 84kPa				1.00	Very weak, orangish brown mottled grey MUDSTONE, recovered as stiff, slightly sandy, gravelly, silty clay. Residual.		
1.10	B							
1.30	SV 164kPa					From 1.30m: Very stiff, very high strength		
					(1.30)			
					2.30	Complete at 2.30m		

Remarks

Location CAT scanned prior to excavation.
Sides stable during excavation.
No groundwater encountered during excavation.
Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy.
Trial pit excavated for infiltration test and backfilled with single size stone and slotted pipe. Reinstated at surface with topsoil.
Trial pit location shown on Drawing No. 8215/01.

Scale (approx)	Logged By	Checked By
1:25	ST	PRS

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Coopers (Chester) Ltd
tel: 01244 684 910
web: www.coopers.co.uk
email: admin@coopers.co.uk

Site
QUARRY FARM, OAKENHOLT, FLINT

Trial Pit Number
ITP03

Machine : JCB 3CX

Method : Mechanical Excavation

Dimensions
2.50 x 0.60 x 1.40m.

Ground Level (mOD)

Client
Castle Green Homes Ltd

Job Number
8215

Location (Observed measurements)

Dates
16/08/2023

Engineer
Coopers (Chester) Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B				(0.30)	TOPSOIL. Grass over brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies.		
0.40	B				0.30			
0.60	SV 104kPa				(0.50)	Stiff, reddish brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including coal. From 0.60m: High strength		
0.90	B				0.80	Weak, orangish brown and grey MUDSTONE, recovered as fine to coarse gravel with a high cobble content and boulder content in a clay matrix. Residual. From 1.00 - 1.40m: Recovered as cobbles and boulder of siltstone. Hard to dig		
					(0.60)			
					1.40	From 1.40m: Coal		
						Complete at 1.40m		

Remarks

Location CAT scanned prior to excavation.
Sides stable during excavation.
No groundwater encountered during excavation.
Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy.
Trial pit excavated for infiltration test and backfilled with single size stone and slotted pipe. Reinstated at surface with topsoil.
Trial pit location shown on Drawing No. 8215/01.

Scale (approx)	Logged By	Checked By
1:25	ST	PRS

coopers
chartered consulting engineers

Coopers (Chester) Ltd
tel: 01244 684 910
web: www.coopers.co.uk
email: admin@coopers.co.uk

Site
QUARRY FARM, OAKENHOLT, FLINT

Trial Pit Number
ITP04

Machine : JCB 3CX

Method : Mechanical Excavation

Dimensions
2.40 x 0.60 x 2.00m.

Ground Level (mOD)

Client
Castle Green Homes Ltd

Job Number
8215

Location (Observed measurements)

Dates
16/08/2023

Engineer
Coopers (Chester) Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B				(0.30)	TOPSOIL. Grass over dark brown, slightly gravelly, clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies.		
0.40	SV 102kPa				0.30	Stiff, reddish brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including coal and mudstone. From 0.40m: High strength		
0.50	B				(0.70)			
0.80	SV 109kPa				1.00	Weak, grey MUDSTONE, recovered as very stiff clay with gravel of mudstone. Residual.		
1.20	B				(1.00)	From 1.60 - 2.00m: Recovered as fine to coarse gravel of mudstone		
					2.00	Complete at 2.00m		

Remarks

Location CAT scanned prior to excavation.
Sides stable during excavation.
No groundwater encountered during excavation.
Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy.
Smoking bucket at 2.00m.
Trial pit excavated for infiltration test and backfilled with single size stone and slotted pipe. Reinstated at surface with topsoil.
Trial pit shown on Drawing No. 8215/01.

Scale (approx)	Logged By	Checked By
1:25	ST	PRS

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Coopers (Chester) Ltd
tel: 01244 684 910
web: www.coopers.co.uk
email: admin@coopers.co.uk

Site
QUARRY FARM, OAKENHOLT, FLINT

Trial Pit Number
ITP05

Machine : JCB 3CX

Method : Mechanical Excavation

Dimensions
2.30 x 0.60 x 2.00m.

Ground Level (mOD)

Client
Castle Green Homes Ltd

Job Number
8215

Location (Observed measurements)

Dates
16/08/2023

Engineer
Coopers (Chester) Ltd

Sheet
1/1

Depth (m)	Sample / Tests	Water Depth (m)	Field Records	Level (mOD)	Depth (m) (Thickness)	Description	Legend	Water
0.10	B				(0.40)	TOPSOIL. Grass over brown, slightly gravelly, clayey SAND. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies.		
					0.40			
0.60	B				(0.60)	Stiff, reddish brown, slightly sandy, slightly gravelly, silty CLAY. Sand is fine to medium. Gravel is sub-angular to sub-rounded, fine to coarse of various lithologies including coal.		
					1.00			
1.30	B				(1.00)	Weak, orangish brown mottled grey MUDSTONE, recovered as very stiff, slightly sandy, slightly gravelly, silty clay. Residual. From 1.60 - 2.00m: Competent bedrock of mudstone		
					2.00	Complete at 2.00m		

Remarks

Location CAT scanned prior to excavation.
Sides stable during excavation.
No groundwater encountered during excavation.
Please note that discolouration of photographs may occur when viewed on screen as a PDF, or when printed as a hard copy.
Smoking bucket at 1.60m on the north face of the trial pit. Smoking bucket at 2.00m across whole of pit.
Trial pit excavated for infiltration test and backfilled with single size stone and slotted pipe. Reinstated at surface with topsoil.
Trial pit location shown on Drawing No. 8215/01.

North	Scale (approx)	Logged By	Checked By
←	1:25	ST	PRS

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Date of Test: 16th August 2023

Produced by: S Thomas

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Consulting Engineers

QUARRY FARM, OAKENHOLT, FLINT

INFILTRATION TEST PIT No 1 (Test 1)

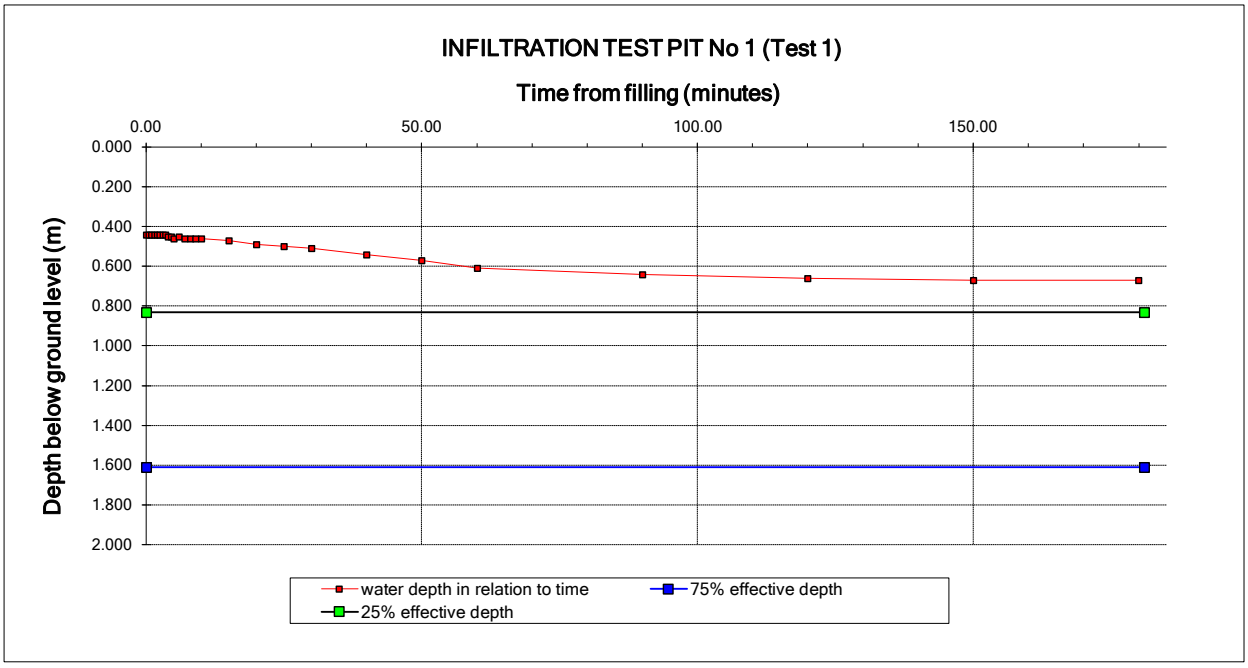
Time of reading			Absolute Time	Depth below Ground level
hrs	min	sec	mins	m
0	00	00	0.00	0.440
0	00	30	0.50	0.440
0	01	00	1.00	0.440
0	01	30	1.50	0.440
0	02	00	2.00	0.440
0	02	30	2.50	0.440
0	03	00	3.00	0.440
0	03	30	3.50	0.440
0	04	00	4.00	0.450
0	04	30	4.50	0.450
0	05	00	5.00	0.460
0	06	00	6.00	0.450
0	07	00	7.00	0.460
0	08	00	8.00	0.460
0	09	00	9.00	0.460
0	10	00	10.00	0.460
0	15	00	15.00	0.470
0	20	00	20.00	0.490
0	25	00	25.00	0.500
0	30	00	30.00	0.510
0	40	00	40.00	0.540
0	50	00	50.00	0.570
1	00	00	60.00	0.610
1	30	00	90.00	0.640
2	00	00	120.00	0.660
2	30	00	150.00	0.670
3	00	00	180.00	0.670

Test Pit Dimensions

Test Pit Length	2.30 m
Test Pit Width	0.60 m
Test Pit Depth	2.00 m
Standing Water Level	m

Infiltration Parameters

Total Depth	1.560 m
Total Effective Depth	1.560 m
25% Depth	0.830 m
75% Depth	1.610 m
25% Time	FAIL min
75% Time	FAIL min
Free Volume	FAIL cu.m
Surface Area	FAIL sq.m
Time of Outflow	FAIL min



Soil infiltration Rate	**N/A**	**m/hr**
	N/A	**m/sec**

Park House, Sandpiper Court,
Chester Business Park,
Chester, CH4 9QU

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Date of Test: 16th August 2023

Produced by: S Thomas

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QUARRY FARM, OAKENHOLT, FLINT
INFILTRATION TEST PIT No 2 (Test 1)

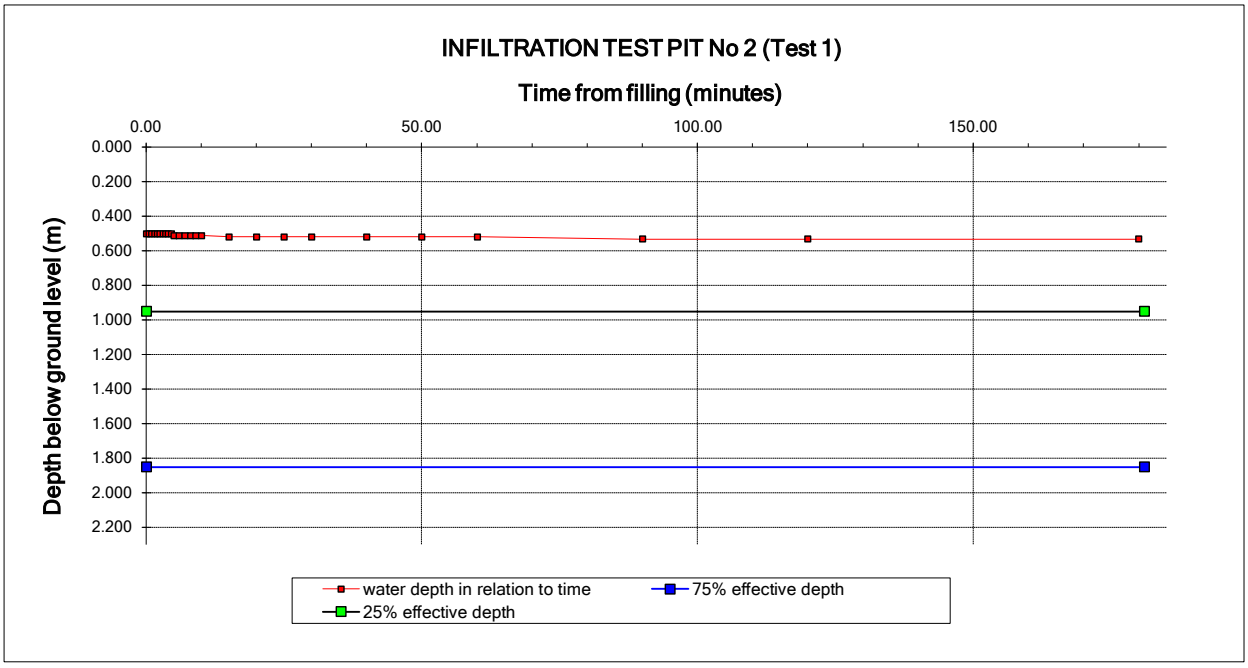
Time of reading			Absolute Time	Depth below Ground level
hrs	min	sec	mins	m
0	00	00	0.00	0.500
0	00	30	0.50	0.500
0	01	00	1.00	0.500
0	01	30	1.50	0.500
0	02	00	2.00	0.500
0	02	30	2.50	0.500
0	03	00	3.00	0.500
0	03	30	3.50	0.500
0	04	00	4.00	0.500
0	04	30	4.50	0.500
0	05	00	5.00	0.510
0	06	00	6.00	0.510
0	07	00	7.00	0.510
0	08	00	8.00	0.510
0	09	00	9.00	0.510
0	10	00	10.00	0.510
0	15	00	15.00	0.520
0	20	00	20.00	0.520
0	25	00	25.00	0.520
0	30	00	30.00	0.520
0	40	00	40.00	0.520
0	50	00	50.00	0.520
1	00	00	60.00	0.520
1	30	00	90.00	0.530
2	00	00	120.00	0.530
3	00	00	180.00	0.530

Test Pit Dimensions

Test Pit Length	2.50 m
Test Pit Width	0.60 m
Test Pit Depth	2.30 m
Standing Water Level	m

Infiltration Parameters

Total Depth	1.800 m
Total Effective Depth	1.800 m
25% Depth	0.950 m
75% Depth	1.850 m
25% Time	FAIL min
75% Time	FAIL min
Free Volume	FAIL cu.m
Surface Area	FAIL sq.m
Time of Outflow	FAIL min



Soil infiltration Rate	**N/A**	**m/hr**
	N/A	**m/sec**

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Chester, CH4 9QU

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Date of Test: 16th August 2023

Produced by: S Thomas

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QUARRY FARM, OAKENHOLT, FLINT
INFILTRATION TEST PIT No 3 (Test 1)

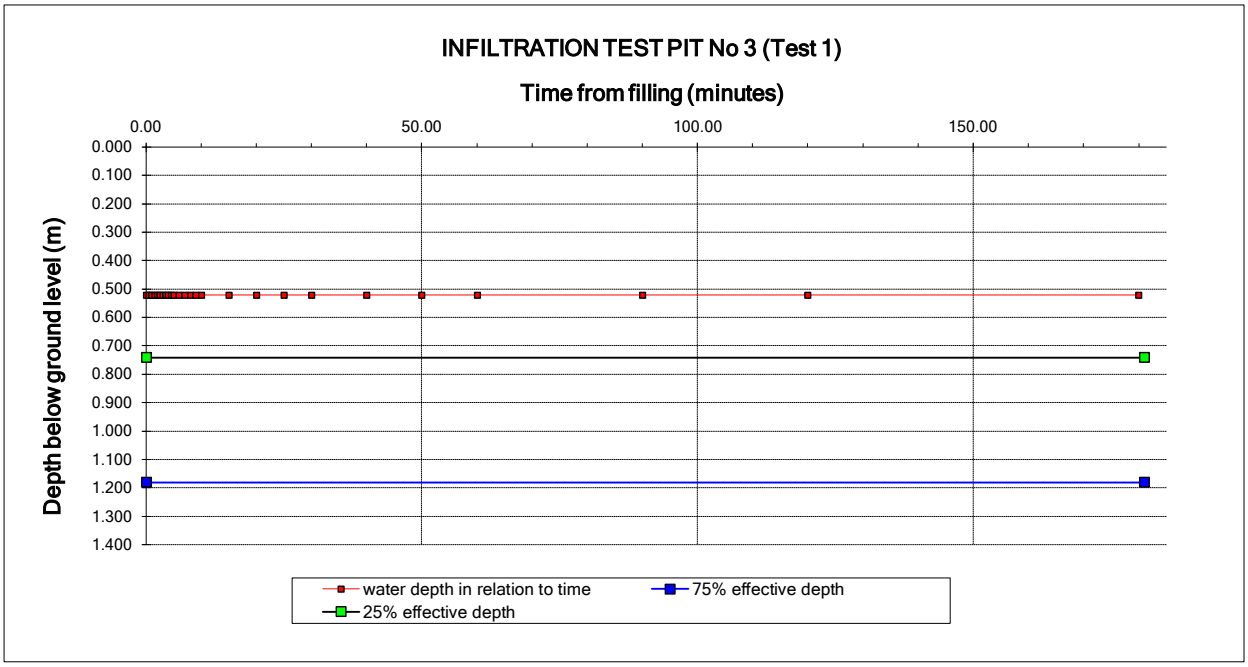
Time of reading			Absolute Time	Depth below Ground level
hrs	min	sec	mins	m
0	00	00	0.00	0.520
0	00	30	0.50	0.520
0	01	00	1.00	0.520
0	01	30	1.50	0.520
0	02	00	2.00	0.520
0	02	30	2.50	0.520
0	03	00	3.00	0.520
0	03	30	3.50	0.520
0	04	00	4.00	0.520
0	04	30	4.50	0.520
0	05	00	5.00	0.520
0	06	00	6.00	0.520
0	07	00	7.00	0.520
0	08	00	8.00	0.520
0	09	00	9.00	0.520
0	10	00	10.00	0.520
0	15	00	15.00	0.520
0	20	00	20.00	0.520
0	25	00	25.00	0.520
0	30	00	30.00	0.520
0	40	00	40.00	0.520
0	50	00	50.00	0.520
1	00	00	60.00	0.520
1	30	00	90.00	0.520
2	00	00	120.00	0.520
3	00	00	180.00	0.520

Test Pit Dimensions

Test Pit Length	2.50	m
Test Pit Width	0.60	m
Test Pit Depth	1.40	m
Standing Water Level		m

Infiltration Parameters

Total Depth	0.880	m
Total Effective Depth	0.880	m
25% Depth	0.740	m
75% Depth	1.180	m
25% Time	FAIL	min
75% Time	FAIL	min
Free Volume	FAIL	cu.m
Surface Area	FAIL	sq.m
Time of Outflow	FAIL	min



Soil infiltration Rate	**N/A**	**m/hr**
	N/A	**m/sec**

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Date of Test: 17th August 2023

Produced by: S Thomas

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QUARRY FARM, OAKENHOLT, FLINT

INFILTRATION TEST PIT No 4 (Test 1)

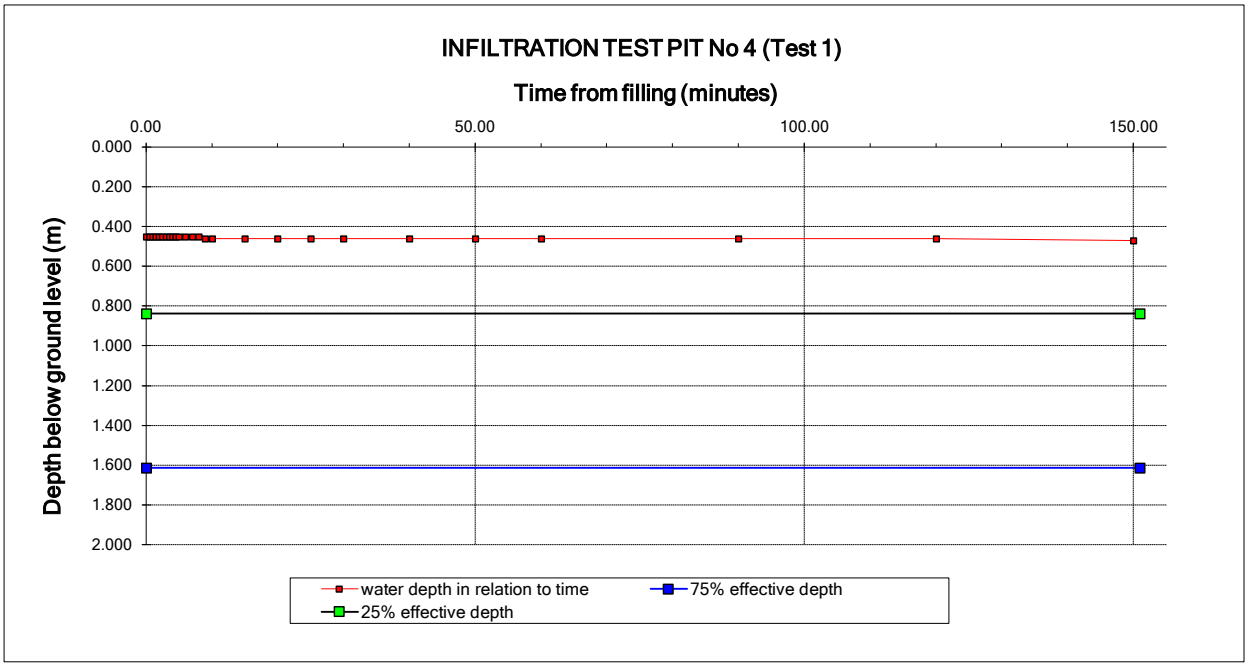
Time of reading			Absolute Time	Depth below Ground level
hrs	min	sec	mins	m
0	00	00	0.00	0.450
0	00	30	0.50	0.450
0	01	00	1.00	0.450
0	01	30	1.50	0.450
0	02	00	2.00	0.450
0	02	30	2.50	0.450
0	03	00	3.00	0.450
0	03	30	3.50	0.450
0	04	00	4.00	0.450
0	04	30	4.50	0.450
0	05	00	5.00	0.450
0	06	00	6.00	0.450
0	07	00	7.00	0.450
0	08	00	8.00	0.450
0	09	00	9.00	0.460
0	10	00	10.00	0.460
0	15	00	15.00	0.460
0	20	00	20.00	0.460
0	25	00	25.00	0.460
0	30	00	30.00	0.460
0	40	00	40.00	0.460
0	50	00	50.00	0.460
1	00	00	60.00	0.460
1	30	00	90.00	0.460
2	00	00	120.00	0.460
2	30	00	150.00	0.470

Test Pit Dimensions

Test Pit Length	2.40	m
Test Pit Width	0.60	m
Test Pit Depth	2.00	m
Standing Water Level		m

Infiltration Parameters

Total Depth	1.550	m
Total Effective Depth	1.550	m
25% Depth	0.838	m
75% Depth	1.613	m
25% Time	FAIL	min
75% Time	FAIL	min
Free Volume	FAIL	cu.m
Surface Area	FAIL	sq.m
Time of Outflow	FAIL	min



Soil infiltration Rate	**N/A**	**m/hr**
	N/A	**m/sec**

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Chester, CH4 9QU

tel: 01244 684 910
web: www.coopers.co.uk
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chartered consulting engineers

Date of Test: 17th August 2023

Produced by: S Thomas

Coopers

Consulting Engineers

QUARRY FARM, OAKENHOLT, FLINT

INFILTRATION TEST PIT No 5 (Test 1)

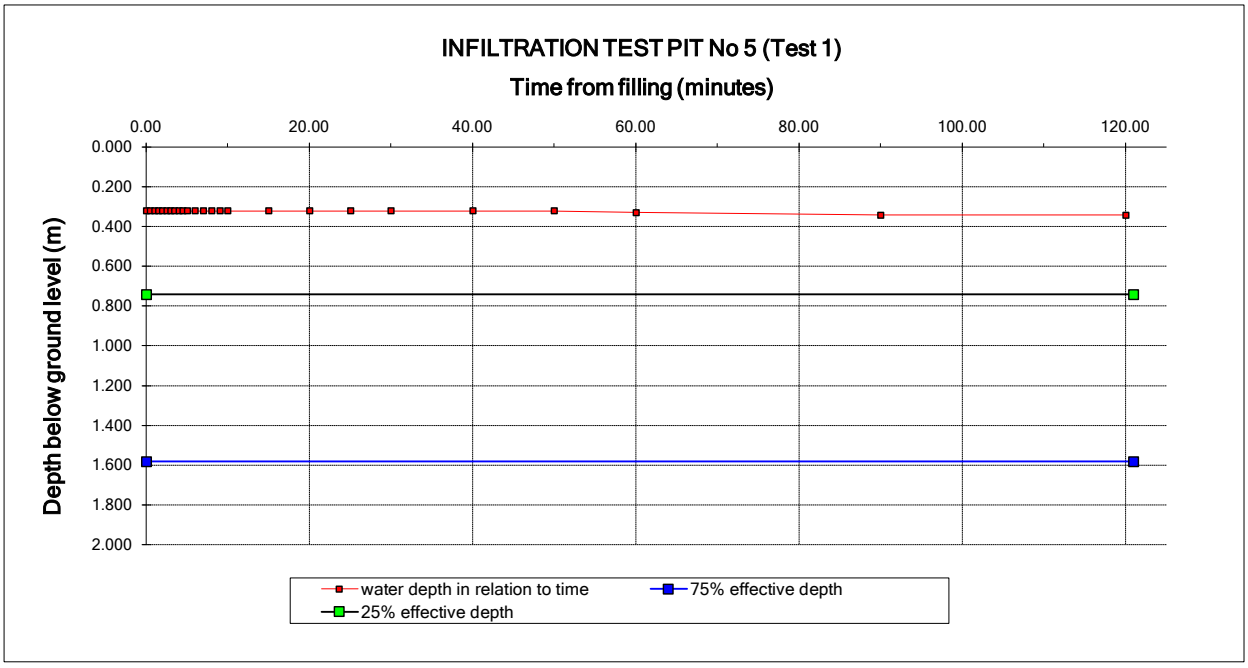
Time of reading			Absolute Time	Depth below Ground level
hrs	min	sec	mins	m
0	00	00	0.00	0.320
0	00	30	0.50	0.320
0	01	00	1.00	0.320
0	01	30	1.50	0.320
0	02	00	2.00	0.320
0	02	30	2.50	0.320
0	03	00	3.00	0.320
0	03	30	3.50	0.320
0	04	00	4.00	0.320
0	04	30	4.50	0.320
0	05	00	5.00	0.320
0	06	00	6.00	0.320
0	07	00	7.00	0.320
0	08	00	8.00	0.320
0	09	00	9.00	0.320
0	10	00	10.00	0.320
0	15	00	15.00	0.320
0	20	00	20.00	0.320
0	25	00	25.00	0.320
0	30	00	30.00	0.320
0	40	00	40.00	0.320
0	50	00	50.00	0.320
1	00	00	60.00	0.330
1	30	00	90.00	0.340
2	00	00	120.00	0.340

Test Pit Dimensions

Test Pit Length	2.30 m
Test Pit Width	0.60 m
Test Pit Depth	2.00 m
Standing Water Level	m

Infiltration Parameters

Total Depth	1.680 m
Total Effective Depth	1.680 m
25% Depth	0.740 m
75% Depth	1.580 m
25% Time	FAIL min
75% Time	FAIL min
Free Volume	FAIL cu.m
Surface Area	FAIL sq.m
Time of Outflow	FAIL min



Soil infiltration Rate	**N/A**	**m/hr**
	N/A	**m/sec**

Park House, Sandpiper Court,
Chester Business Park,
Chester, CH4 9QU

tel: 01244 684 910
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email: admin@coopers.co.uk

Appendix 4

Correspondence

Dwr Cymru Welsh Water Historical Flooding

Flintshire County Council Historical Flooding

Natural Resources Wales Historical Flooding

Andy Jones

From: Environmental Information Requests <EnvironmentalInformationRequests@dwrcymru.com>
Sent: 05 July 2023 11:50
To: Andy Jones
Subject: RE: FCA Historical Flood Information

Our Reference: EIR/1528/2023

Dear Andy Jones,

Request for information
Re: 8211 Land Off Chester Road / Leadbrook Drive, Oakenholt, Flint, Flintshire, Wales, CH6 5ST, United Kingdom. SJ258716

We write further to your request for information dated 20th June 2023, which we have been considering under the Environmental Information Regulations 2004.

We can confirm that we have reviewed our flooding database and we have no flooding risk within the location or vicinity requested. We have however, had instances of flooding in the area due to blockages which have now been resolved.

Turning to your query on specific drainage requirements, we have a dedicated Planning Team within our Developer Services function that can provide advice on the capacity in our infrastructure to accommodate new development.

Our pre-planning service will review the capacity available in our sewerage network, wastewater treatment works and clean water network to accommodate the flows/demand from a proposed development. It will also raise awareness of any of our assets crossing the site which will need to be factored into the layout of your development and provide general advice on surface water drainage.

An application for pre-planning advice can be submitted online via the following address https://developers.dwrcymru.com/en/applications/planning/pre-planning. If you wish to discuss in more detail our Planning Team are contactable on 08009172652 or alternatively by email developer.services@dwrcymru.com.

We hope that this response is clear. Should you have any questions, please contact us by email at EnvironmentalInformationRequests@dwrcymru.com.

If you are dissatisfied with the handling of your request, you have the right to ask for an internal review. Internal review requests should be submitted within 40 working days of the date of receipt of this response and should be addressed to Company Secretary, Linea, Fortran Road, St Mellons, Cardiff CF3 0LT.

If you are not content with the outcome of the internal review, you have the right to apply directly to the Information Commissioner for a decision.

Yours faithfully

Dŵr Cymru Welsh Water

From: Andy Jones <ajones@coopers.co.uk>
Sent: Tuesday, June 20, 2023 11:20 AM

To: Sewerage Services <Sewerage.Services@dwrcymru.com>
Subject: FCA Historical Flood Information

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

8211 Land Off Chester Road / Leadbrook Drive, Oakenholt, Flint, Flintshire, Wales, CH6 5ST, United Kingdom
SJ258716
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

Andy Jones

From: Neil L Parry (S&T - Drainage) <Neil.L.Parry@Flintshire.Gov.UK>
Sent: 05 July 2023 10:26
To: Andy Jones; Flood Risk Management
Subject: RE: EXTERNAL FCA Historical Flood Information

Morning Andy

I refer to your enquiry pertinent to Chester Road / Leadbrook Drive, Oakenholt.

I have consulted with colleagues and none of us has any recollection of flooding at this location which would help inform a FCA.

Kind regards

Neil.

From: Flood Risk Management <FloodRiskManagement@flintshire.gov.uk>
Sent: 29 June 2023 10:08
To: Neil L Parry (S&T - Drainage) <Neil.L.Parry@Flintshire.Gov.UK>
Subject: FW: EXTERNAL FCA Historical Flood Information

Hi Neil,

Are you able to help with this enquiry please re: flooding info.

Thanks
Diane

Diane Strong
Information Technician / Technogydd Gwybodaeth
Built Conservation Section / Chadwraeth Adeiledig
Planning, Environment & Economy / Cynllunio, Amgylchedd ac Economi
Flintshire County Council / Cyngor Sir y Fflint
County Hall / Neuadd y Sir
Mold / Yr Wyddgrug CH7 6NF
_____
Tel/Ffon: 01352 703218 / **07770 211401**
Welsh/Cymraeg: 01267 224923

E-mail/Ebost: diane.strong@flintshire.gov.uk / diane.strong@siryfflint.gov.uk

http://www.flintshire.gov.uk / http://www.siryfflint.gov.uk

From: Andy Jones <ajones@coopers.co.uk>
Sent: 20 June 2023 11:32
To: SAB <SAB@flintshire.gov.uk>
Cc: Info <info@aura.wales>
Subject: EXTERNAL FCA Historical Flood Information

8211 Land Off Chester Road / Leadbrook Drive, Oakenholt, Flint, Flintshire, Wales, CH6 5ST, United Kingdom
SJ258716
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

********** Rydym yn croesawu gohebiaeth yn y Gymraeg a'r Saesneg a byddwn yn ymateb i ohebiaeth yn yr un iaith. Ni fydd y defnydd o'r naill iaith yn arwain at oedi. Mae'r e-bost hwn, gan gynnwys unrhyw atodiadau, yn breifat a chyfrinachol ac ni ddylid ei rannu heb ganiatâd yr anfonwr. Os derbynioch chi'r e-bost hwn ar gam, rhowch wybod i'r anfonwr a dileu'r e-bost. Os cyflwynir unrhyw farn, cyngor, casgliadau ac unrhyw wybodaeth arall yn y neges hon nad oes a wnelo â busnes swyddogol Cyngor Sir y Fflint, deellir nad ydynt wedi'u rhoi na'u cymeradwyo ganddo nac ar ei ran, ac felly ni fydd Cyngor Sir y Fflint yn derbyn unrhyw gyfrifoldeb o gwbl amdanynt. We welcome correspondence in Welsh and English and you will receive a response in the same language. Use of either language will not lead to a delay. This email, including any attachments, is private and confidential and should not be shared without permission from the sender. If you have received this message in error, please notify the sender and delete it from your account.

Andy Jones

From: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Sent: 20 June 2023 11:29
To: Andy Jones
Subject: RE: FCA Historical Flood Information
Attachments: Briefing Note Flood Products - External.pdf; Flood Products FAQs V3.pdf; NRW Flood Product Descriptions.pdf

Dear Mr Jones,

Thank you for your email concerning the above.

Historical information is available here – Recorded Flood Extents | DataMapWales (gov.wales)

Do you still require any flood model data? Please see attached documentation and let me know if you do.

We look forward to hearing from you in due course.

Enw / Name Michelle Lewis
Teitl swydd / Job title Data Licensing Officer
Adran / Department Customer, Communications and Commercial
Rhif ffôn / Phone number 07917243096
Dyddiau gweithio (os yn berthnasol) / Working days Mon-Fri

Croesewir gohebiaeth yn Gymraeg a byddwn yn ymateb yn Gymraeg, heb i hynny arwain at oedi.
Correspondence in Welsh is welcomed, and we will respond in Welsh without it leading to a delay.

From: Andy Jones <ajones@coopers.co.uk>
Sent: 20 June 2023 11:21
To: Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
Subject: FCA Historical Flood Information

8211 Land Off Chester Road / Leadbrook Drive, Oakenholt, Flint, Flintshire, Wales, CH6 5ST, United Kingdom
SJ258716
FCA Historical Flood Information

To whom it may concern

We are undertaking a Flood Consequences Assessment for the above site (see attached Site Location Plan) and request any information you may have in relation to historical flooding or any information you may consider relevant to assist with the production of the FCA report.

Please let me know if you require any further information or please contact me on the details below should you want to discuss further.

Regards

Andy Jones
Senior Infrastructure Engineer
COOPERS
Park House, Sandpiper Court, Chester Business Park, Chester, CH4 9QU

☎: (01244) 684910 ☎: Direct Dial No. (01244) 684933
🖷: (01244) 684911
✉: ajones@coopers.co.uk
Web: http://www.coopers.co.uk

DataMapWales

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Appendix 5

Calculations

Source Control Greenfield Run-off Calculation (1ha)

Surface Water Design - MicroDrainage Calculations

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Andy Jones
Site name:	Quarry Farm
Site location:	Oakenhall, Flint

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:	53.23672° N
Longitude:	3.11229° W
Reference:	3264946486
Date:	Sep 13 2023 17:35

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:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	741	741
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):	5.16	5.16
1 in 1 year (l/s):	4.54	4.54
1 in 30 years (l/s):	9.19	9.19
1 in 100 year (l/s):	11.25	11.25
1 in 200 years (l/s):	12.69	12.69

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
101	0.076	5.00	27.577	1500	325900.332	371491.780	3.800
102	0.015	5.00	26.734	1800	325896.033	371508.360	4.280
103	0.030	5.00	26.394	2400	325884.389	371505.732	6.370
104	0.223	5.00	23.436	2400	325817.922	371471.736	3.598
105	0.118	5.00	21.876	2100	325790.218	371456.844	4.217
106	0.042	5.00	25.248	2100	325878.786	371532.935	5.398
107	0.112	5.00	23.574	2400	325852.552	371553.829	4.878
108	0.051	5.00	22.908	2400	325843.624	371563.298	4.245
109	0.053	5.00	22.539	2400	325824.181	371548.194	3.938
110	0.011	5.00	22.200	2400	325815.455	371541.990	3.626
111	0.133	5.00	21.204	2400	325793.394	371530.303	2.693
112	0.011	5.00	20.743	2100	325783.443	371524.543	3.180
113	0.117	5.00	19.727	2100	325761.054	371513.300	2.227
114	0.053	5.00	19.650	2400	325755.558	371523.746	2.180
115			19.650	1200	325743.461	371524.254	2.251

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
2.000	101	102	17.128	0.600	23.777	22.904	0.873	19.6	450	5.06	50.0
2.001	102	103	11.937	0.600	22.454	22.424	0.030	397.9	900	5.19	50.0
2.002	103	104	74.656	0.600	20.024	19.838	0.186	401.4	1500	5.77	50.0
2.003	104	105	31.453	0.600	19.838	19.707	0.131	240.1	300	6.29	50.0
1.005	105	113	63.544	0.600	17.659	17.500	0.159	399.6	1200	6.86	50.0
3.000	106	107	33.538	0.600	19.850	19.296	0.554	60.5	900	5.14	50.0
3.001	107	108	13.014	0.600	18.696	18.663	0.033	400.0	1500	5.24	50.0
3.002	108	109	24.620	0.600	18.663	18.601	0.062	397.1	1500	5.43	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
2.000	4.605	732.5	10.3	3.350	3.380	0.076	0.0	36	1.676
2.001	1.564	995.1	12.3	3.380	3.070	0.091	0.0	69	0.556
2.002	2.134	3771.8	16.4	4.870	2.098	0.121	0.0	69	0.560
2.003	1.010	71.4	46.6	3.298	1.869	0.344	0.0	177	1.075
1.005	1.865	2109.1	62.6	3.017	1.027	0.462	0.0	139	0.860
3.000	4.030	2564.1	5.7	4.498	3.378	0.042	0.0	30	0.851
3.001	2.138	3778.4	20.9	3.378	2.745	0.154	0.0	77	0.602
3.002	2.146	3792.2	27.8	2.745	2.438	0.205	0.0	88	0.657

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
3.003	109	110	10.707	0.600	18.601	18.574	0.027	396.5	1500	5.51	50.0
3.004	110	111	24.965	0.600	18.574	18.511	0.063	396.3	1500	5.71	50.0
3.005	111	112	11.498	0.600	18.511	18.463	0.048	239.5	300	5.90	50.0
3.006	112	113	25.053	0.600	17.563	17.500	0.063	397.7	1200	6.12	50.0
1.006	113	114	11.804	0.600	17.500	17.470	0.030	393.5	1200	6.96	50.0
1.007	114	115	12.108	0.600	17.470	17.399	0.071	170.5	225	7.17	50.0

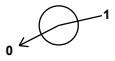
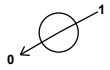
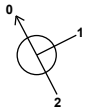
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
3.003	2.147	3794.9	35.0	2.438	2.126	0.258	0.0	99	0.705
3.004	2.148	3796.2	36.5	2.126	1.193	0.269	0.0	101	0.715
3.005	1.011	71.5	54.5	2.393	1.980	0.402	0.0	197	1.110
3.006	1.870	2114.4	56.0	1.980	1.027	0.413	0.0	131	0.833
1.006	1.880	2125.8	134.4	1.027	0.980	0.992	0.0	201	1.079
1.007	0.998	39.7	141.6	1.955	2.026	1.045	0.0	225	1.017

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)
2.000	17.128	19.6	450	Circular_Default Sewer Type	27.577	23.777	3.350	26.734	22.904	3.380
2.001	11.937	397.9	900	Circular_Default Sewer Type	26.734	22.454	3.380	26.394	22.424	3.070
2.002	74.656	401.4	1500	Circular_Default Sewer Type	26.394	20.024	4.870	23.436	19.838	2.098
2.003	31.453	240.1	300	Circular_Default Sewer Type	23.436	19.838	3.298	21.876	19.707	1.869
1.005	63.544	399.6	1200	Circular_Default Sewer Type	21.876	17.659	3.017	19.727	17.500	1.027
3.000	33.538	60.5	900	Circular_Default Sewer Type	25.248	19.850	4.498	23.574	19.296	3.378
3.001	13.014	400.0	1500	Circular_Default Sewer Type	23.574	18.696	3.378	22.908	18.663	2.745
3.002	24.620	397.1	1500	Circular_Default Sewer Type	22.908	18.663	2.745	22.539	18.601	2.438
3.003	10.707	396.5	1500	Circular_Default Sewer Type	22.539	18.601	2.438	22.200	18.574	2.126
3.004	24.965	396.3	1500	Circular_Default Sewer Type	22.200	18.574	2.126	21.204	18.511	1.193
3.005	11.498	239.5	300	Circular_Default Sewer Type	21.204	18.511	2.393	20.743	18.463	1.980
3.006	25.053	397.7	1200	Circular_Default Sewer Type	20.743	17.563	1.980	19.727	17.500	1.027
1.006	11.804	393.5	1200	Circular_Default Sewer Type	19.727	17.500	1.027	19.650	17.470	0.980
1.007	12.108	170.5	225	Circular_Default Sewer Type	19.650	17.470	1.955	19.650	17.399	2.026

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
2.000	101	1500	Manhole	Adoptable	102	1800	Manhole	Adoptable
2.001	102	1800	Manhole	Adoptable	103	2400	Manhole	Adoptable
2.002	103	2400	Manhole	Adoptable	104	2400	Manhole	Adoptable
2.003	104	2400	Manhole	Adoptable	105	2100	Manhole	Adoptable
1.005	105	2100	Manhole	Adoptable	113	2100	Manhole	Adoptable
3.000	106	2100	Manhole	Adoptable	107	2400	Manhole	Adoptable
3.001	107	2400	Manhole	Adoptable	108	2400	Manhole	Adoptable
3.002	108	2400	Manhole	Adoptable	109	2400	Manhole	Adoptable
3.003	109	2400	Manhole	Adoptable	110	2400	Manhole	Adoptable
3.004	110	2400	Manhole	Adoptable	111	2400	Manhole	Adoptable
3.005	111	2400	Manhole	Adoptable	112	2100	Manhole	Adoptable
3.006	112	2100	Manhole	Adoptable	113	2100	Manhole	Adoptable
1.006	113	2100	Manhole	Adoptable	114	2400	Manhole	Adoptable
1.007	114	2400	Manhole	Adoptable	115	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
101	325900.332	371491.780	27.577	3.800	1500		0	2.000	23.777	450
102	325896.033	371508.360	26.734	4.280	1800		1	2.000	22.904	450
							0	2.001	22.454	900
103	325884.389	371505.732	26.394	6.370	2400		1	2.001	22.424	900
							0	2.002	20.024	1500
104	325817.922	371471.736	23.436	3.598	2400		1	2.002	19.838	1500
							0	2.003	19.838	300
105	325790.218	371456.844	21.876	4.217	2100		1	2.003	19.707	300
							0	1.005	17.659	1200
106	325878.786	371532.935	25.248	5.398	2100		0	3.000	19.850	900
107	325852.552	371553.829	23.574	4.878	2400		1	3.000	19.296	900
							0	3.001	18.696	1500
108	325843.624	371563.298	22.908	4.245	2400		1	3.001	18.663	1500
							0	3.002	18.663	1500
109	325824.181	371548.194	22.539	3.938	2400		1	3.002	18.601	1500
							0	3.003	18.601	1500
110	325815.455	371541.990	22.200	3.626	2400		1	3.003	18.574	1500
							0	3.004	18.574	1500
111	325793.394	371530.303	21.204	2.693	2400		1	3.004	18.511	1500
							0	3.005	18.511	300
112	325783.443	371524.543	20.743	3.180	2100		1	3.005	18.463	300
							0	3.006	17.563	1200
113	325761.054	371513.300	19.727	2.227	2100		1	3.006	17.500	1200
							2	1.005	17.500	1200
							0	1.006	17.500	1200

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
114	325755.558	371523.746	19.650	2.180	2400	1	1.006	17.470	1200
									
						0	1.007	17.470	225
115	325743.461	371524.254	19.650	2.251	1200	1	1.007	17.399	225
									

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Detailed		

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 %)
1	0	0	0
30	0	0	0
100	50	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 114 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	17.470	Product Number	CTL-SHE-0116-8200-2200-8200
Design Depth (m)	2.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	8.2	Min Node Diameter (mm)	1200

Node 111 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	18.511	Product Number	CTL-SHE-0095-6000-2500-6000
Design Depth (m)	2.500	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 104 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	19.838	Product Number	CTL-SHE-0090-6000-3200-6000
Design Depth (m)	3.200	Min Outlet Diameter (m)	0.150
Design Flow (l/s)	6.0	Min Node Diameter (mm)	1200

Node 114 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	17.470
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)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	210.0	0.0	1.200	210.0	0.0	1.201	0.0	0.0

Results for 1 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	101	10	23.811	0.034	8.2	0.0734	0.0000	OK
15 minute winter	102	10	22.517	0.063	9.7	0.1643	0.0000	OK
120 minute winter	103	90	20.221	0.197	7.9	0.9115	0.0000	OK
120 minute winter	104	92	20.222	0.384	12.8	2.2112	0.0000	SURCHARGED
480 minute winter	105	408	17.790	0.131	5.9	0.5288	0.0000	OK
15 minute winter	106	11	19.878	0.028	4.6	0.1022	0.0000	OK
120 minute winter	107	92	18.891	0.195	6.2	0.9725	0.0000	OK
120 minute winter	108	92	18.891	0.228	7.4	1.0868	0.0000	OK
120 minute winter	109	92	18.891	0.290	7.6	1.3894	0.0000	OK
120 minute winter	110	92	18.891	0.317	5.4	1.4529	0.0000	OK
120 minute winter	111	92	18.891	0.380	7.2	2.0932	0.0000	SURCHARGED
480 minute winter	112	408	17.791	0.228	4.7	0.8038	0.0000	OK
480 minute winter	113	408	17.791	0.291	12.1	1.3114	0.0000	OK
480 minute winter	114	408	17.791	0.321	11.9	68.9114	0.0000	SURCHARGED
15 minute summer	115	1	17.399	0.000	5.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	2.000	102	8.1	1.531	0.011	0.0908	
15 minute winter	102	2.001	103	9.6	0.571	0.010	0.2018	
120 minute winter	103	2.002	104	6.1	0.076	0.002	18.1639	
120 minute winter	104	Hydro-Brake®	105	4.0				
480 minute winter	105	1.005	113	5.9	0.227	0.003	8.7855	
15 minute winter	106	3.000	107	4.4	0.797	0.002	0.1855	
120 minute winter	107	3.001	108	5.3	0.353	0.001	1.9670	
120 minute winter	108	3.002	109	6.0	0.314	0.002	5.0023	
120 minute winter	109	3.003	110	5.1	0.286	0.001	2.7228	
120 minute winter	110	3.004	111	3.7	0.131	0.001	7.7432	
120 minute winter	111	Hydro-Brake®	112	4.6				
480 minute winter	112	3.006	113	4.4	0.213	0.002	4.4883	
480 minute winter	113	1.006	114	11.0	0.575	0.005	2.6643	
480 minute winter	114	Hydro-Brake®	115	7.0				195.7

Results for 30 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	101	10	23.829	0.052	20.1	0.1136	0.0000	OK
15 minute winter	102	10	22.552	0.098	23.9	0.2555	0.0000	OK
180 minute winter	103	176	20.698	0.674	15.5	3.1124	0.0000	OK
180 minute winter	104	172	20.698	0.860	17.0	4.9586	0.0000	SURCHARGED
960 minute winter	105	975	18.157	0.498	6.7	2.0054	0.0000	OK
15 minute winter	106	10	19.892	0.042	11.1	0.1534	0.0000	OK
180 minute winter	107	176	19.395	0.699	11.4	3.4820	0.0000	OK
180 minute winter	108	176	19.395	0.732	12.5	3.4862	0.0000	OK
180 minute winter	109	176	19.395	0.794	10.5	3.8052	0.0000	OK
180 minute winter	110	176	19.395	0.821	6.1	3.7641	0.0000	OK
180 minute winter	111	176	19.395	0.884	9.8	4.8723	0.0000	SURCHARGED
960 minute winter	112	975	18.157	0.594	4.9	2.1003	0.0000	OK
960 minute winter	113	975	18.157	0.657	13.0	2.9679	0.0000	OK
960 minute winter	114	975	18.157	0.687	12.8	147.8160	0.0000	SURCHARGED
15 minute summer	115	1	17.399	0.000	6.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	2.000	102	19.9	1.993	0.027	0.1712	
15 minute winter	102	2.001	103	23.5	0.700	0.024	0.4022	
180 minute winter	103	2.002	104	8.4	0.083	0.002	67.6071	
180 minute winter	104	Hydro-Brake®	105	4.0				
960 minute winter	105	1.005	113	5.8	0.232	0.003	34.1434	
15 minute winter	106	3.000	107	10.7	1.026	0.004	0.3510	
180 minute winter	107	3.001	108	8.7	0.315	0.002	10.7809	
180 minute winter	108	3.002	109	6.6	0.304	0.002	22.1467	
180 minute winter	109	3.003	110	4.8	0.331	0.001	10.3448	
180 minute winter	110	3.004	111	3.8	0.133	0.001	25.7883	
180 minute winter	111	Hydro-Brake®	112	4.6				
960 minute winter	112	3.006	113	4.5	0.199	0.002	14.8931	
960 minute winter	113	1.006	114	11.6	0.550	0.005	7.6716	
960 minute winter	114	Hydro-Brake®	115	7.3				423.0

Results for 100 year +50% 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
15 minute winter	101	10	23.850	0.073	38.7	0.1580	0.0000	OK
240 minute winter	102	228	23.177	0.723	13.6	1.8902	0.0000	OK
240 minute winter	103	228	23.174	3.150	25.8	14.5476	0.0000	SURCHARGED
240 minute winter	104	232	23.176	3.338	26.7	19.2366	0.0000	FLOOD RISK
960 minute winter	105	1020	19.649	1.990	8.6	8.0052	0.0000	SURCHARGED
360 minute winter	106	336	20.881	1.031	9.3	3.7325	0.0000	SURCHARGED
360 minute winter	107	336	20.882	2.186	13.8	10.8924	0.0000	SURCHARGED
360 minute winter	108	336	20.882	2.219	13.3	10.5714	0.0000	SURCHARGED
360 minute winter	109	336	20.882	2.281	10.3	10.9340	0.0000	SURCHARGED
360 minute winter	110	336	20.882	2.308	6.8	10.5836	0.0000	SURCHARGED
360 minute winter	111	336	20.882	2.371	11.9	13.0714	0.0000	SURCHARGED
960 minute winter	112	1020	19.649	2.086	5.4	7.3688	0.0000	SURCHARGED
960 minute winter	113	1020	19.649	2.149	15.9	9.6993	0.0000	FLOOD RISK
960 minute winter	114	1020	19.649	2.179	15.7	263.0203	0.0000	FLOOD RISK
15 minute summer	115	1	17.399	0.000	7.0	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	101	2.000	102	38.4	2.401	0.052	0.2740	
240 minute winter	102	2.001	103	10.9	0.591	0.011	6.6284	
240 minute winter	103	2.002	104	-11.5	0.089	-0.003	131.4306	
240 minute winter	104	Hydro-Brake®	105	6.1				
960 minute winter	105	1.005	113	7.0	0.259	0.003	71.5956	
360 minute winter	106	3.000	107	-7.1	0.720	-0.003	21.2555	
360 minute winter	107	3.001	108	8.9	0.293	0.002	22.9109	
360 minute winter	108	3.002	109	6.3	0.289	0.002	43.3431	
360 minute winter	109	3.003	110	6.2	0.324	0.002	18.8495	
360 minute winter	110	3.004	111	5.4	0.126	0.001	43.9505	
360 minute winter	111	Hydro-Brake®	112	5.9				
960 minute winter	112	3.006	113	5.0	0.245	0.002	28.2274	
960 minute winter	113	1.006	114	13.4	0.683	0.006	13.2997	
960 minute winter	114	Hydro-Brake®	115	8.2				456.2

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	✓

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
201	0.036	5.00	28.497	1500	325894.500	371427.964	2.297
202	0.070	5.00	27.756	1500	325875.925	371428.402	3.029
203	0.011	5.00	27.020	1500	325861.923	371424.708	3.682
204	0.083	5.00	26.104	1500	325845.611	371416.593	3.130
205	0.075	5.00	24.570	1500	325818.380	371401.838	2.185
206	0.000		23.524	1500	325807.341	371423.399	1.728
207	0.000		21.354	1500	325794.677	371425.451	0.854

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	201	202	18.580	0.600	26.200	25.927	0.273	68.1	300	5.16	50.0
1.001	202	203	14.481	0.600	24.727	24.538	0.189	76.6	300	5.30	50.0
1.002	203	204	18.219	0.600	23.338	22.974	0.364	50.1	300	5.43	50.0
1.003	204	205	30.972	0.600	22.974	22.385	0.589	52.6	300	5.67	50.0
1.004	205	206	24.223	0.600	22.385	21.796	0.589	41.1	300	5.83	50.0
1.005	206	207	12.829	0.600	21.796	20.500	1.296	9.9	225	5.89	50.0

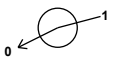
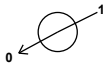
Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.908	134.9	4.9	1.997	1.529	0.036	0.0	39	0.919
1.001	1.798	127.1	14.4	2.729	2.182	0.106	0.0	68	1.204
1.002	2.227	157.4	15.9	3.382	2.830	0.117	0.0	64	1.440
1.003	2.173	153.6	27.1	2.830	1.885	0.200	0.0	85	1.648
1.004	2.458	173.8	37.3	1.885	1.428	0.275	0.0	94	1.972
1.005	4.183	166.3	37.3	1.503	0.629	0.275	0.0	73	3.400

Pipeline Schedule

Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.000	18.580	68.1	300	Circular_Default Sewer Type	28.497	26.200	1.997	27.756	25.927	1.529
1.001	14.481	76.6	300	Circular_Default Sewer Type	27.756	24.727	2.729	27.020	24.538	2.182
1.002	18.219	50.1	300	Circular_Default Sewer Type	27.020	23.338	3.382	26.104	22.974	2.830
1.003	30.972	52.6	300	Circular_Default Sewer Type	26.104	22.974	2.830	24.570	22.385	1.885
1.004	24.223	41.1	300	Circular_Default Sewer Type	24.570	22.385	1.885	23.524	21.796	1.428
1.005	12.829	9.9	225	Circular_Default Sewer Type	23.524	21.796	1.503	21.354	20.500	0.629

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	201	1500	Manhole	Adoptable	202	1500	Manhole	Adoptable
1.001	202	1500	Manhole	Adoptable	203	1500	Manhole	Adoptable
1.002	203	1500	Manhole	Adoptable	204	1500	Manhole	Adoptable
1.003	204	1500	Manhole	Adoptable	205	1500	Manhole	Adoptable
1.004	205	1500	Manhole	Adoptable	206	1500	Manhole	Adoptable
1.005	206	1500	Manhole	Adoptable	207	1500	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
201	325894.500	371427.964	28.497	2.297	1500		0	1.000	26.200	300
202	325875.925	371428.402	27.756	3.029	1500		1 0	1.000 1.001	25.927 24.727	300 300
203	325861.923	371424.708	27.020	3.682	1500		1 0	1.001 1.002	24.538 23.338	300 300
204	325845.611	371416.593	26.104	3.130	1500		1 0	1.002 1.003	22.974 22.974	300 300
205	325818.380	371401.838	24.570	2.185	1500		1 0	1.003 1.004	22.385 22.385	300 300
206	325807.341	371423.399	23.524	1.728	1500		1 0	1.004 1.005	21.796 21.796	300 225
207	325794.677	371425.451	21.354	0.854	1500		1	1.005	20.500	225

Simulation Settings

Rainfall Methodology	FSR	Skip Steady State	✓
FSR Region	England and Wales	Drain Down Time (mins)	240
M5-60 (mm)	17.000	Additional Storage (m³/ha)	20.0
Ratio-R	0.300	Check Discharge Rate(s)	✓
Summer CV	0.750	Check Discharge Volume	✓
Winter CV	0.840	100 year 360 minute (m³)	
Analysis Speed	Normal		

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 %)
1	0	0	0
30	0	0	0
100	50	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 206 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	21.796	Product Number	CTL-SHE-0074-3000-1600-3000
Design Depth (m)	1.600	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	3.0	Min Node Diameter (mm)	1200

Node 205 Depth/Area Storage Structure

Base Inf Coefficient (m/hr)	0.00000	Safety Factor	2.0	Invert Level (m)	22.385
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)	Depth (m)	Area (m²)	Inf Area (m²)
0.000	150.0	0.0	1.200	150.0	0.0	1.201	0.0	0.0

Results for 1 year Critical Storm Duration. Lowest mass balance: 98.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	201	10	26.235	0.035	3.9	0.0733	0.0000	OK
15 minute winter	202	10	24.790	0.063	11.4	0.1398	0.0000	OK
15 minute winter	203	10	23.394	0.056	12.4	0.1030	0.0000	OK
15 minute winter	204	10	23.061	0.087	21.3	0.1999	0.0000	OK
240 minute winter	205	184	22.505	0.120	7.3	18.2960	0.0000	OK
180 minute winter	206	140	22.511	0.715	6.0	1.2635	0.0000	SURCHARGED
15 minute summer	207	1	20.500	0.000	2.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	201	1.000	202	3.8	0.838	0.028	0.0845	
15 minute winter	202	1.001	203	11.2	1.089	0.088	0.1490	
15 minute winter	203	1.002	204	12.3	0.977	0.078	0.2376	
15 minute winter	204	1.003	205	21.4	2.114	0.140	0.3467	
240 minute winter	205	1.004	206	5.1	0.304	0.029	1.1714	
180 minute winter	206	Hydro-Brake®	207	2.5				36.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 98.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	201	10	26.255	0.055	9.5	0.1142	0.0000	OK
15 minute winter	202	10	24.828	0.101	27.8	0.2261	0.0000	OK
15 minute winter	203	10	23.427	0.089	30.4	0.1629	0.0000	OK
15 minute winter	204	10	23.108	0.134	52.0	0.3082	0.0000	OK
240 minute winter	205	232	22.791	0.406	16.9	61.9290	0.0000	SURCHARGED
240 minute winter	206	232	22.791	0.995	4.9	1.7583	0.0000	SURCHARGED
15 minute summer	207	1	20.500	0.000	2.5	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	201	1.000	202	9.3	1.085	0.069	0.1595	
15 minute winter	202	1.001	203	27.5	1.382	0.216	0.2878	
15 minute winter	203	1.002	204	30.1	1.311	0.191	0.4373	
15 minute winter	204	1.003	205	51.9	2.409	0.338	0.8142	
240 minute winter	205	1.004	206	4.9	0.353	0.028	1.7058	
240 minute winter	206	Hydro-Brake®	207	2.5				61.4

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.58%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	201	10	26.277	0.077	18.3	0.1607	0.0000	OK
15 minute winter	202	10	24.876	0.149	53.6	0.3322	0.0000	OK
15 minute winter	203	10	23.471	0.133	58.6	0.2437	0.0000	OK
480 minute winter	204	456	23.375	0.401	14.5	0.9207	0.0000	SURCHARGED
480 minute winter	205	456	23.375	0.990	19.9	150.8780	0.0000	SURCHARGED
480 minute winter	206	456	23.374	1.578	3.6	2.7891	0.0000	FLOOD RISK
15 minute summer	207	1	20.500	0.000	2.4	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	201	1.000	202	18.0	1.303	0.134	0.2570	
15 minute winter	202	1.001	203	53.0	1.625	0.417	0.4726	
15 minute winter	203	1.002	204	58.2	1.542	0.370	0.7109	
480 minute winter	204	1.003	205	14.5	1.080	0.094	2.1810	
480 minute winter	205	1.004	206	3.6	0.327	0.021	1.7058	
480 minute winter	206	Hydro-Brake®	207	3.0				109.8

Design Settings

Rainfall Methodology	FSR	Maximum Time of Concentration (mins)	30.00
Return Period (years)	100	Maximum Rainfall (mm/hr)	50.0
Additional Flow (%)	0	Minimum Velocity (m/s)	1.00
FSR Region	England and Wales	Connection Type	Level Soffits
M5-60 (mm)	17.000	Minimum Backdrop Height (m)	0.200
Ratio-R	0.300	Preferred Cover Depth (m)	1.200
CV	0.750	Include Intermediate Ground	✓
Time of Entry (mins)	5.00	Enforce best practice design rules	x

Nodes

Name	Area (ha)	T of E (mins)	Cover Level (m)	Diameter (mm)	Easting (m)	Northing (m)	Depth (m)
301	0.033	5.00	21.363	1800	325834.927	371591.578	4.983
302	0.015	5.00	20.636	1800	325837.006	371605.536	4.291
303	0.031	5.00	21.100	1800	325881.224	371610.800	4.689
304	0.031	5.00	19.700	1800	325849.949	371618.513	3.370
305	0.015	5.00	19.888	1800	325841.008	371620.051	3.731
306	0.057	5.00	18.800	2100	325817.317	371633.427	2.760
307	0.033	5.00	19.326	2400	325842.052	371631.619	3.348
308	0.036	5.00	14.024	2700	325820.434	371717.696	2.700
309	0.117	5.00	15.054	2700	325849.050	371716.543	3.802
310	0.076	5.00	17.548	2700	325845.228	371666.799	6.421
311	0.038	5.00	18.200	2700	325858.544	371666.720	7.106
312	0.010	5.00	18.350	2700	325876.385	371663.119	7.302
313	0.050	5.00	18.500	3000	325904.835	371654.045	7.527
314	0.000		17.750	1200	325915.845	371653.956	6.842
315	0.000		15.000	1200	325928.293	371709.276	4.426
316	0.000		13.750	1200	325935.455	371730.560	3.308
317	0.000		13.000	1200	325951.370	371756.600	2.652
318	0.000		12.800	1200	325956.390	371761.566	2.478

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
1.000	301	302	14.112	0.600	16.380	16.345	0.035	400.0	600	5.19	50.0
1.001	302	305	15.057	0.600	16.345	16.307	0.038	400.0	600	5.40	50.0
2.000	303	304	32.212	0.600	16.411	16.330	0.081	400.0	600	5.44	50.0
2.001	304	305	9.072	0.600	16.330	16.307	0.023	400.0	600	5.57	50.0
1.002	305	307	11.615	0.600	16.157	16.128	0.029	400.0	750	5.71	50.0
3.000	306	307	24.801	0.600	16.040	15.978	0.062	400.0	900	5.26	50.0
1.003	307	310	35.323	0.600	15.978	14.127	1.851	19.1	225	5.90	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
1.000	1.211	342.4	4.5	4.383	3.691	0.033	0.0	47	0.431
1.001	1.211	342.4	6.5	3.691	2.981	0.048	0.0	57	0.483
2.000	1.211	342.4	4.2	4.089	2.770	0.031	0.0	46	0.424
2.001	1.211	342.4	8.4	2.770	2.981	0.062	0.0	64	0.520
1.002	1.393	615.3	16.9	2.981	2.448	0.125	0.0	84	0.623
3.000	1.560	992.5	7.7	1.860	2.448	0.057	0.0	55	0.479
1.003	3.009	119.6	29.1	3.123	3.196	0.215	0.0	75	2.491

Links

Name	US Node	DS Node	Length (m)	ks (mm) / n	US IL (m)	DS IL (m)	Fall (m)	Slope (1:X)	Dia (mm)	T of C (mins)	Rain (mm/hr)
4.000	308	309	28.639	0.600	11.324	11.252	0.072	400.0	1500	5.22	50.0
4.001	309	310	49.891	0.600	11.252	11.127	0.125	400.0	1500	5.61	50.0
1.004	310	311	13.316	0.600	11.127	11.094	0.033	400.0	1500	6.01	50.0
1.005	311	312	18.201	0.600	11.094	11.048	0.046	400.0	1500	6.15	50.0
1.006	312	313	29.862	0.600	11.048	10.973	0.075	400.0	1500	6.38	50.0
1.007	313	314	11.010	0.600	10.973	10.908	0.065	169.4	225	6.56	50.0
1.008	314	315	56.703	0.600	10.908	10.574	0.334	169.8	225	7.51	50.0
1.009	315	316	22.457	0.600	10.574	10.442	0.132	170.1	225	7.88	50.0
1.010	316	317	15.905	0.600	10.442	10.348	0.094	169.2	225	8.15	50.0
1.011	317	318	4.405	0.600	10.348	10.322	0.026	169.4	225	8.22	50.0

Name	Vel (m/s)	Cap (l/s)	Flow (l/s)	US Depth (m)	DS Depth (m)	Σ Area (ha)	Σ Add Inflow (l/s)	Pro Depth (mm)	Pro Velocity (m/s)
4.000	2.138	3778.4	4.9	1.200	2.302	0.036	0.0	39	0.387
4.001	2.138	3778.4	20.7	2.302	4.921	0.153	0.0	77	0.602
1.004	2.138	3778.4	60.2	4.921	5.606	0.444	0.0	128	0.824
1.005	2.138	3778.4	65.3	5.606	5.802	0.482	0.0	133	0.844
1.006	2.138	3778.4	66.7	5.802	6.027	0.492	0.0	134	0.850
1.007	1.001	39.8	73.5	7.302	6.617	0.542	0.0	225	1.020
1.008	1.000	39.8	73.5	6.617	4.201	0.542	0.0	225	1.019
1.009	0.999	39.7	73.5	4.201	3.083	0.542	0.0	225	1.018
1.010	1.002	39.8	73.5	3.083	2.427	0.542	0.0	225	1.021
1.011	1.001	39.8	73.5	2.427	2.253	0.542	0.0	225	1.020

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	14.112	400.0	600	Circular_Default Sewer Type	21.363	16.380	4.383	20.636	16.345	3.691
1.001	15.057	400.0	600	Circular_Default Sewer Type	20.636	16.345	3.691	19.888	16.307	2.981
2.000	32.212	400.0	600	Circular_Default Sewer Type	21.100	16.411	4.089	19.700	16.330	2.770
2.001	9.072	400.0	600	Circular_Default Sewer Type	19.700	16.330	2.770	19.888	16.307	2.981
1.002	11.615	400.0	750	Circular_Default Sewer Type	19.888	16.157	2.981	19.326	16.128	2.448
3.000	24.801	400.0	900	Circular_Default Sewer Type	18.800	16.040	1.860	19.326	15.978	2.448
1.003	35.323	19.1	225	Circular_Default Sewer Type	19.326	15.978	3.123	17.548	14.127	3.196
4.000	28.639	400.0	1500	Circular_Default Sewer Type	14.024	11.324	1.200	15.054	11.252	2.302
4.001	49.891	400.0	1500	Circular_Default Sewer Type	15.054	11.252	2.302	17.548	11.127	4.921
1.004	13.316	400.0	1500	Circular_Default Sewer Type	17.548	11.127	4.921	18.200	11.094	5.606

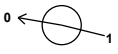
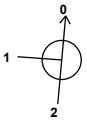
Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.000	301	1800	Manhole	Adoptable	302	1800	Manhole	Adoptable
1.001	302	1800	Manhole	Adoptable	305	1800	Manhole	Adoptable
2.000	303	1800	Manhole	Adoptable	304	1800	Manhole	Adoptable
2.001	304	1800	Manhole	Adoptable	305	1800	Manhole	Adoptable
1.002	305	1800	Manhole	Adoptable	307	2400	Manhole	Adoptable
3.000	306	2100	Manhole	Adoptable	307	2400	Manhole	Adoptable
1.003	307	2400	Manhole	Adoptable	310	2700	Manhole	Adoptable
4.000	308	2700	Manhole	Adoptable	309	2700	Manhole	Adoptable
4.001	309	2700	Manhole	Adoptable	310	2700	Manhole	Adoptable
1.004	310	2700	Manhole	Adoptable	311	2700	Manhole	Adoptable

Pipeline Schedule

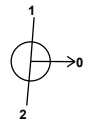
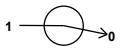
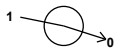
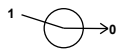
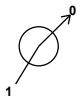
Link	Length (m)	Slope (1:X)	Dia (mm)	Link Type	US CL (m)	US IL (m)	US Depth (m)	DS CL (m)	DS IL (m)	DS Depth (m)
1.005	18.201	400.0	1500	Circular_Default Sewer Type	18.200	11.094	5.606	18.350	11.048	5.802
1.006	29.862	400.0	1500	Circular_Default Sewer Type	18.350	11.048	5.802	18.500	10.973	6.027
1.007	11.010	169.4	225	Circular_Default Sewer Type	18.500	10.973	7.302	17.750	10.908	6.617
1.008	56.703	169.8	225	Circular_Default Sewer Type	17.750	10.908	6.617	15.000	10.574	4.201
1.009	22.457	170.1	225	Circular_Default Sewer Type	15.000	10.574	4.201	13.750	10.442	3.083
1.010	15.905	169.2	225	Circular_Default Sewer Type	13.750	10.442	3.083	13.000	10.348	2.427
1.011	4.405	169.4	225	Circular_Default Sewer Type	13.000	10.348	2.427	12.800	10.322	2.253

Link	US Node	Dia (mm)	Node Type	MH Type	DS Node	Dia (mm)	Node Type	MH Type
1.005	311	2700	Manhole	Adoptable	312	2700	Manhole	Adoptable
1.006	312	2700	Manhole	Adoptable	313	3000	Manhole	Adoptable
1.007	313	3000	Manhole	Adoptable	314	1200	Manhole	Adoptable
1.008	314	1200	Manhole	Adoptable	315	1200	Manhole	Adoptable
1.009	315	1200	Manhole	Adoptable	316	1200	Manhole	Adoptable
1.010	316	1200	Manhole	Adoptable	317	1200	Manhole	Adoptable
1.011	317	1200	Manhole	Adoptable	318	1200	Manhole	Adoptable

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
301	325834.927	371591.578	21.363	4.983	1800				
						0	1.000	16.380	600
302	325837.006	371605.536	20.636	4.291	1800		1	1.000	16.345	600
						0	1.001	16.345	600
303	325881.224	371610.800	21.100	4.689	1800				
						0	2.000	16.411	600
304	325849.949	371618.513	19.700	3.370	1800		1	2.000	16.330	600
						0	2.001	16.330	600
305	325841.008	371620.051	19.888	3.731	1800		1	2.001	16.307	600
							2	1.001	16.307	600
						0	1.002	16.157	750
306	325817.317	371633.427	18.800	2.760	2100				
						0	3.000	16.040	900
307	325842.052	371631.619	19.326	3.348	2400		1	3.000	15.978	900
							2	1.002	16.128	750
						0	1.003	15.978	225

Manhole Schedule

Node	Easting (m)	Northing (m)	CL (m)	Depth (m)	Dia (mm)	Connections	Link	IL (m)	Dia (mm)
308	325820.434	371717.696	14.024	2.700	2700				
						0	4.000	11.324	1500
309	325849.050	371716.543	15.054	3.802	2700	1	4.000	11.252	1500
									
						0	4.001	11.252	1500
310	325845.228	371666.799	17.548	6.421	2700	1	4.001	11.127	1500
						2	1.003	14.127	225
									
						0	1.004	11.127	1500
311	325858.544	371666.720	18.200	7.106	2700	1	1.004	11.094	1500
									
						0	1.005	11.094	1500
312	325876.385	371663.119	18.350	7.302	2700	1	1.005	11.048	1500
									
						0	1.006	11.048	1500
313	325904.835	371654.045	18.500	7.527	3000	1	1.006	10.973	1500
									
						0	1.007	10.973	225
314	325915.845	371653.956	17.750	6.842	1200	1	1.007	10.908	225
									
						0	1.008	10.908	225
315	325928.293	371709.276	15.000	4.426	1200	1	1.008	10.574	225
									
						0	1.009	10.574	225
316	325935.455	371730.560	13.750	3.308	1200	1	1.009	10.442	225
									
						0	1.010	10.442	225
317	325951.370	371756.600	13.000	2.652	1200	1	1.010	10.348	225
									
						0	1.011	10.348	225
318	325956.390	371761.566	12.800	2.478	1200	1	1.011	10.322	225
									

Simulation Settings

Rainfall Methodology	FSR	Analysis Speed	Normal
FSR Region	England and Wales	Skip Steady State	✓
M5-60 (mm)	17.000	Drain Down Time (mins)	240
Ratio-R	0.300	Additional Storage (m³/ha)	20.0
Summer CV	0.750	Check Discharge Rate(s)	✓
Winter CV	0.840	Check Discharge Volume	✓

Simulation Settings

100 year 360 minute (m³)

Storm Durations

15	30	60	120	180	240	360	480	600	720	960	1440	2160

Return Period (years)	Climate Change (CC %)	Additional Area (A %)	Additional Flow (Q %)
1	0	0	0
30	0	0	0
100	50	0	0

Pre-development Discharge Rate

Site Makeup	Greenfield	Growth Factor 30 year	1.95
Greenfield Method	IH124	Growth Factor 100 year	2.48
Positively Drained Area (ha)		Betterment (%)	0
SAAR (mm)		QBar	
Soil Index	1	Q 1 year (l/s)	
SPR	0.10	Q 30 year (l/s)	
Region	1	Q 100 year (l/s)	
Growth Factor 1 year	0.85		

Pre-development Discharge Volume

Site Makeup	Greenfield	Return Period (years)	100
Greenfield Method	FSR/FEH	Climate Change (%)	0
Positively Drained Area (ha)		Storm Duration (mins)	360
Soil Index	1	Betterment (%)	0
SPR	0.10	PR	
CWI		Runoff Volume (m³)	

Node 313 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	10.973	Product Number	CTL-SHE-0076-4200-3000-4200
Design Depth (m)	3.000	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	4.2	Min Node Diameter (mm)	1200

Node 307 Online Hydro-Brake® Control

Flap Valve	x	Objective	(HE) Minimise upstream storage
Replaces Downstream Link	✓	Sump Available	✓
Invert Level (m)	15.978	Product Number	CTL-SHE-0088-5000-2350-5000
Design Depth (m)	2.350	Min Outlet Diameter (m)	0.100
Design Flow (l/s)	5.0	Min Node Diameter (mm)	1200

Results for 1 year Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
15 minute winter	301	10	16.422	0.042	3.6	0.1137	0.0000	OK
15 minute winter	302	11	16.396	0.051	5.1	0.1344	0.0000	OK
15 minute winter	303	11	16.452	0.041	3.4	0.1095	0.0000	OK
15 minute winter	304	11	16.388	0.057	6.5	0.1569	0.0000	OK
60 minute winter	305	48	16.348	0.191	7.6	0.5015	0.0000	OK
60 minute winter	306	48	16.348	0.308	4.3	1.1942	0.0000	OK
60 minute winter	307	48	16.348	0.370	9.0	1.7471	0.0000	SURCHARGED
480 minute winter	308	360	11.468	0.144	0.6	0.8636	0.0000	OK
360 minute winter	309	280	11.468	0.216	3.1	1.3674	0.0000	OK
360 minute winter	310	288	11.467	0.340	7.5	2.0292	0.0000	OK
360 minute winter	311	288	11.467	0.373	6.2	2.1783	0.0000	OK
360 minute winter	312	288	11.467	0.419	5.1	2.4132	0.0000	OK
360 minute winter	313	288	11.467	0.494	4.2	3.5606	0.0000	SURCHARGED
180 minute winter	314	368	10.947	0.039	2.6	0.0445	0.0000	OK
30 minute summer	315	41	10.614	0.040	2.6	0.0450	0.0000	OK
30 minute summer	316	42	10.482	0.040	2.6	0.0450	0.0000	OK
30 minute summer	317	42	10.390	0.042	2.6	0.0470	0.0000	OK
30 minute summer	318	42	10.361	0.039	2.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
15 minute winter	301	1.000	302	3.5	0.353	0.010	0.1424	
15 minute winter	302	1.001	305	5.0	0.492	0.015	0.1524	
15 minute winter	303	2.000	304	3.3	0.301	0.009	0.3525	
15 minute winter	304	2.001	305	6.3	0.520	0.019	0.1111	
60 minute winter	305	1.002	307	7.0	0.511	0.011	1.1371	
60 minute winter	306	3.000	307	1.5	0.193	0.002	5.4220	
60 minute winter	307	Hydro-Brake®	310	3.8				
480 minute winter	308	4.000	309	0.7	0.114	0.000	3.4507	
360 minute winter	309	4.001	310	2.8	0.191	0.001	11.3272	
360 minute winter	310	1.004	311	5.5	0.341	0.001	4.2683	
360 minute winter	311	1.005	312	4.9	0.309	0.001	6.7699	
360 minute winter	312	1.006	313	3.2	0.155	0.001	13.5549	
360 minute winter	313	Hydro-Brake®	314	2.6				
180 minute winter	314	1.008	315	2.6	0.567	0.067	0.2649	
30 minute summer	315	1.009	316	2.6	0.562	0.067	0.1059	
30 minute summer	316	1.010	317	2.6	0.543	0.067	0.0776	
30 minute summer	317	1.011	318	2.6	0.551	0.067	0.0212	32.6

Results for 30 year Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
120 minute winter	301	114	16.682	0.302	3.2	0.8079	0.0000	OK
120 minute winter	302	114	16.682	0.337	4.0	0.8802	0.0000	OK
120 minute winter	303	110	16.683	0.272	3.9	0.7290	0.0000	OK
120 minute winter	304	114	16.681	0.351	5.8	0.9587	0.0000	OK
120 minute winter	305	114	16.681	0.524	9.7	1.3765	0.0000	OK
120 minute winter	306	112	16.682	0.642	5.5	2.4874	0.0000	OK
120 minute winter	307	114	16.681	0.703	9.6	3.3210	0.0000	SURCHARGED
600 minute winter	308	585	11.961	0.637	1.9	3.8155	0.0000	OK
600 minute winter	309	585	11.961	0.709	4.3	4.4943	0.0000	OK
600 minute winter	310	585	11.961	0.834	7.9	4.9709	0.0000	OK
600 minute winter	311	585	11.961	0.867	5.8	5.0557	0.0000	OK
600 minute winter	312	585	11.961	0.913	4.8	5.2509	0.0000	OK
600 minute winter	313	585	11.961	0.988	4.2	7.1124	0.0000	SURCHARGED
15 minute winter	314	10	10.948	0.040	2.6	0.0448	0.0000	OK
15 minute summer	315	243	10.614	0.040	2.7	0.0450	0.0000	OK
15 minute summer	316	244	10.482	0.040	2.6	0.0450	0.0000	OK
15 minute summer	317	244	10.390	0.042	2.6	0.0470	0.0000	OK
15 minute summer	318	244	10.361	0.039	2.6	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
120 minute winter	301	1.000	302	2.7	0.324	0.008	2.1494	
120 minute winter	302	1.001	305	3.8	0.443	0.011	2.6169	
120 minute winter	303	2.000	304	2.9	0.274	0.008	4.7610	
120 minute winter	304	2.001	305	4.7	0.479	0.014	1.6162	
120 minute winter	305	1.002	307	7.1	0.448	0.011	3.9326	
120 minute winter	306	3.000	307	3.6	0.202	0.004	12.5900	
120 minute winter	307	Hydro-Brake®	310	3.8				
600 minute winter	308	4.000	309	-0.9	0.118	0.000	21.9139	
600 minute winter	309	4.001	310	2.3	0.155	0.001	45.5014	
600 minute winter	310	1.004	311	4.9	0.313	0.001	13.7126	
600 minute winter	311	1.005	312	4.6	0.319	0.001	19.8031	
600 minute winter	312	1.006	313	3.2	0.137	0.001	35.1132	
600 minute winter	313	Hydro-Brake®	314	2.6				
15 minute winter	314	1.008	315	2.7	0.622	0.067	0.2650	
15 minute summer	315	1.009	316	2.6	0.562	0.067	0.1059	
15 minute summer	316	1.010	317	2.6	0.544	0.067	0.0776	
15 minute summer	317	1.011	318	2.6	0.551	0.067	0.0212	38.6

Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.21%

Node Event	US Node	Peak (mins)	Level (m)	Depth (m)	Inflow (l/s)	Node Vol (m³)	Flood (m³)	Status
240 minute winter	301	192	18.629	2.249	4.0	6.0208	0.0000	SURCHARGED
240 minute winter	302	192	18.629	2.284	4.1	5.9732	0.0000	SURCHARGED
240 minute winter	303	192	18.628	2.217	4.8	5.9345	0.0000	SURCHARGED
240 minute winter	304	192	18.629	2.299	5.9	6.2739	0.0000	SURCHARGED
240 minute winter	305	192	18.629	2.472	7.3	6.4899	0.0000	SURCHARGED
240 minute winter	306	192	18.630	2.590	6.8	10.0406	0.0000	FLOOD RISK
240 minute winter	307	192	18.630	2.652	8.3	12.5183	0.0000	SURCHARGED
2160 minute winter	308	1680	13.861	2.537	2.2	15.1997	0.0000	FLOOD RISK
2160 minute winter	309	1680	13.860	2.608	3.6	16.5398	0.0000	SURCHARGED
2160 minute winter	310	1680	13.858	2.731	9.6	16.2851	0.0000	SURCHARGED
2160 minute winter	311	1680	13.860	2.766	6.4	16.1352	0.0000	SURCHARGED
2160 minute winter	312	1680	13.859	2.811	9.3	16.1713	0.0000	SURCHARGED
2160 minute winter	313	1680	13.860	2.887	5.9	20.7876	0.0000	SURCHARGED
2160 minute winter	314	1680	10.957	0.049	4.1	0.0553	0.0000	OK
2160 minute winter	315	1680	10.624	0.050	4.1	0.0561	0.0000	OK
2160 minute winter	316	1680	10.492	0.050	4.1	0.0564	0.0000	OK
2160 minute winter	317	1680	10.400	0.052	4.1	0.0592	0.0000	OK
2160 minute winter	318	1680	10.371	0.049	4.1	0.0000	0.0000	OK

Link Event (Upstream Depth)	US Node	Link	DS Node	Outflow (l/s)	Velocity (m/s)	Flow/Cap	Link Vol (m³)	Discharge Vol (m³)
240 minute winter	301	1.000	302	2.6	0.294	0.008	3.9750	
240 minute winter	302	1.001	305	3.8	0.390	0.011	4.2412	
240 minute winter	303	2.000	304	2.2	0.240	0.006	9.0734	
240 minute winter	304	2.001	305	3.4	0.433	0.010	2.5554	
240 minute winter	305	1.002	307	5.3	0.419	0.009	5.1120	
240 minute winter	306	3.000	307	3.8	0.142	0.004	15.7182	
240 minute winter	307	Hydro-Brake®	310	5.3				
2160 minute winter	308	4.000	309	2.6	0.090	0.001	50.4185	
2160 minute winter	309	4.001	310	5.2	0.148	0.001	87.8323	
2160 minute winter	310	1.004	311	6.1	0.299	0.002	23.4426	
2160 minute winter	311	1.005	312	9.2	0.295	0.002	32.0425	
2160 minute winter	312	1.006	313	5.7	0.105	0.001	52.5715	
2160 minute winter	313	Hydro-Brake®	314	4.1				
2160 minute winter	314	1.008	315	4.1	0.644	0.104	0.3635	
2160 minute winter	315	1.009	316	4.1	0.636	0.104	0.1460	
2160 minute winter	316	1.010	317	4.1	0.611	0.104	0.1075	
2160 minute winter	317	1.011	318	4.1	0.623	0.104	0.0292	402.9