coopers
chartered consulting engineers

Our ref: 8352_FCA

# Flood Consequences Assessment

for

Land off Holywell Road,

Ewloe Green, Ewloe,

Flintshire

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

08th March 2024

## Document Verification

| | |
|---|---|
| **Project Title** | Land off Holywell Road, Ewloe Green, Ewloe, Flintshire |
| **Project Number** | 8352 |
| **Document Title** | Flood Consequences Assessment |
| **Document Number** | 8352_FCA_Issue 1 |
| 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. | |

Prepared by

A Jones

*Senior Infrastructure Engineer*

Checked and Approved

P R Sykes

*BSc (Hons), MSc (Eng), CGeol, FGS*

THE GEOLOGICAL SOCIETY CGeol CHARTERED GEOLOGIST Fellow No. 17046

**Document Revision**

| Report Reference | Date | Description | Prepared | Checked and Approved |
|---|---|---|---|---|
| 8352_FCA | 08/03/2024 | Flood Consequences Assessment | A Jones | P R Sykes |

This report has been prepared for and on behalf of our client, in accordance with the terms and conditions of the appointment agreement with Coopers. Other than where specifically allowed for in the said appointment agreement, any other party using this report for any purpose whatsoever does so at their own risk and any duty of care to that party is specifically excluded.

## Contents



## Figures



## List of Appendices

# 1.0 Introduction

Coopers (Chester) Ltd, (Coopers) have been appointed by Castle Green Homes Ltd to assess the risk of flooding for a parcel of land off Holywell Road, Ewloe, Flintshire. Castle Green Homes Ltd are proposing a new housing development, comprising of approximately 315 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 Ewloe Green to the northwest of Ewloe. The site is situated to the south of Holywell Road (B5125) and to the north of Green Lane, at approximate grid reference SJ291667.

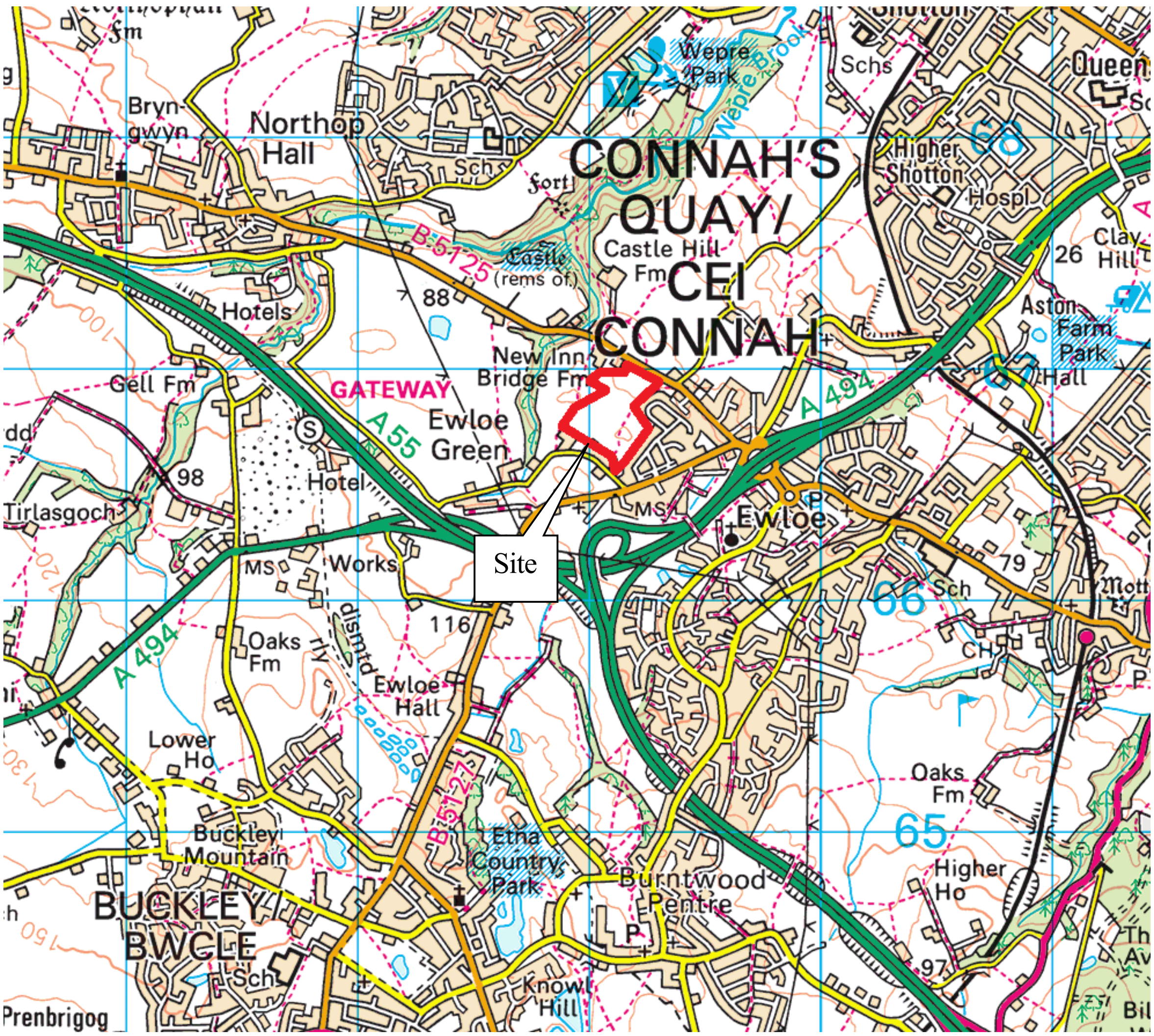



Figure 1 – Site Location

### 2.2 Site Description

The site covers an area of approximately 10.0 Hectares of land located approximately 1.0km northwest of Ewloe Town Centre. The site is presently pasture ground, with hedgerows and trees located along the field boundaries.

The surrounding area is primarily a mixture of residential, and agricultural land with existing properties to the east, open fields to the west, Holywell Road to the north and Green Lane to the south.

There are two existing ordinary watercourses within the site. The watercourse in the southern portion of the site drains in a south easterly direction and the watercourse in the northern portion of the site has been confirmed to drain north under Holywell Road and into open watercourses in the field to the north. This is a tributary of New Inn brook located 200m west of the site. Both watercourses currently take flows from surface runoff within the site.

Figure 2 – Aerial View

The topography of the site has a highpoint at the centre of the site at an elevation of 90.00m AOD with falls towards the southern (86.7m AOD), western (88.1m AOD) and northern (77.50m AOD) boundaries.

Refer to Appendix 1 for the Topographical Survey.

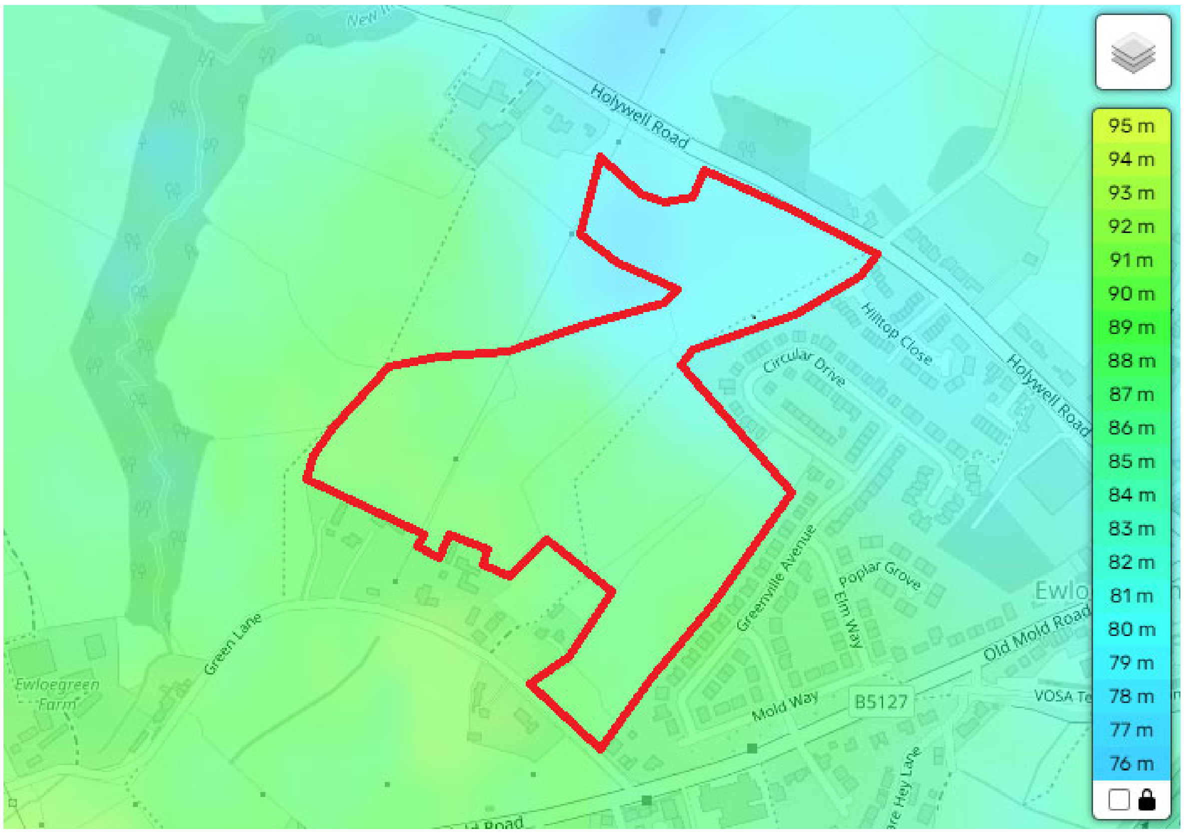



Figure 3 – Site Topography

# 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.

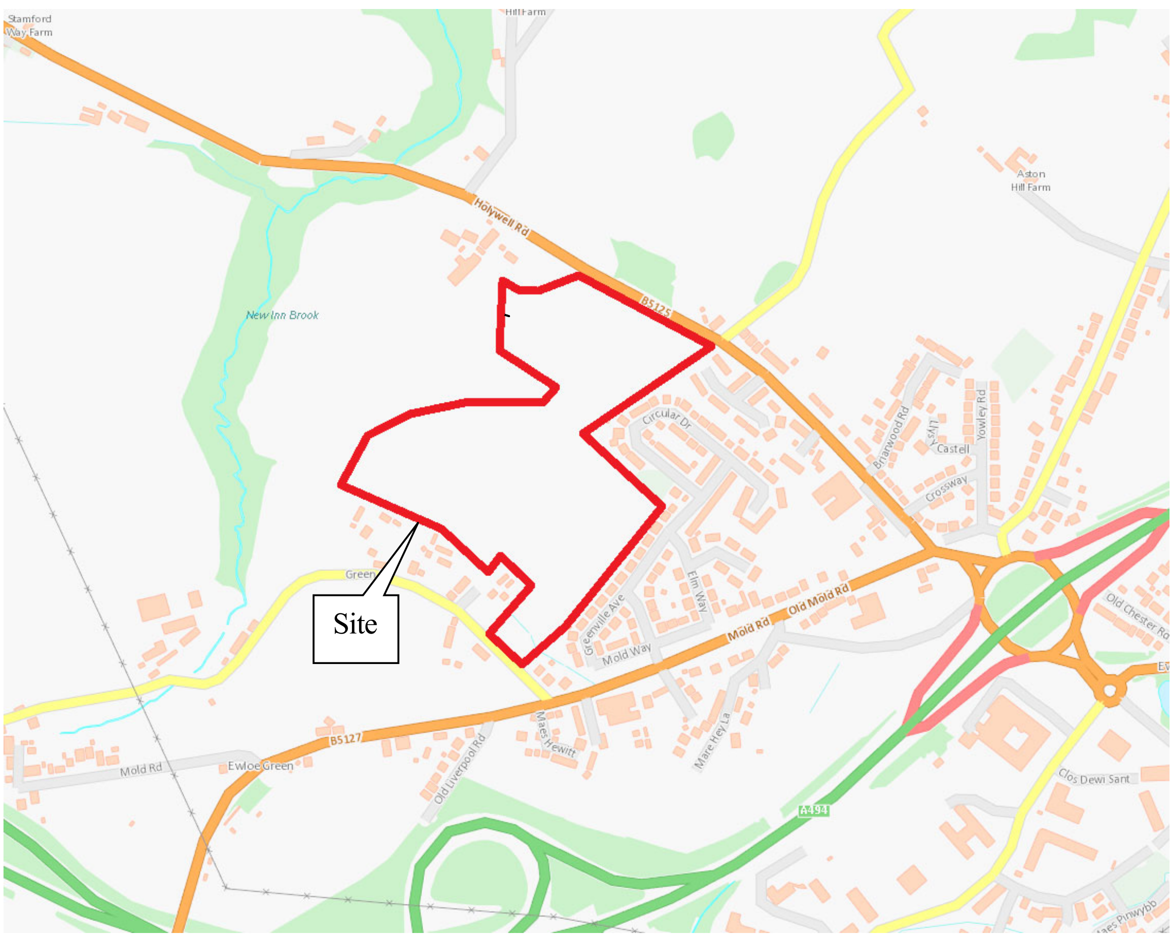



Figure 4 – Natural Resources Wales Flood Map for Planning (Sea and Rivers)

The Natural Resources Wales long term flood risk maps indicates that the majority of the site is at a very low risk of flooding from surface water, with areas towards the north-east and south-west at low to high risk.

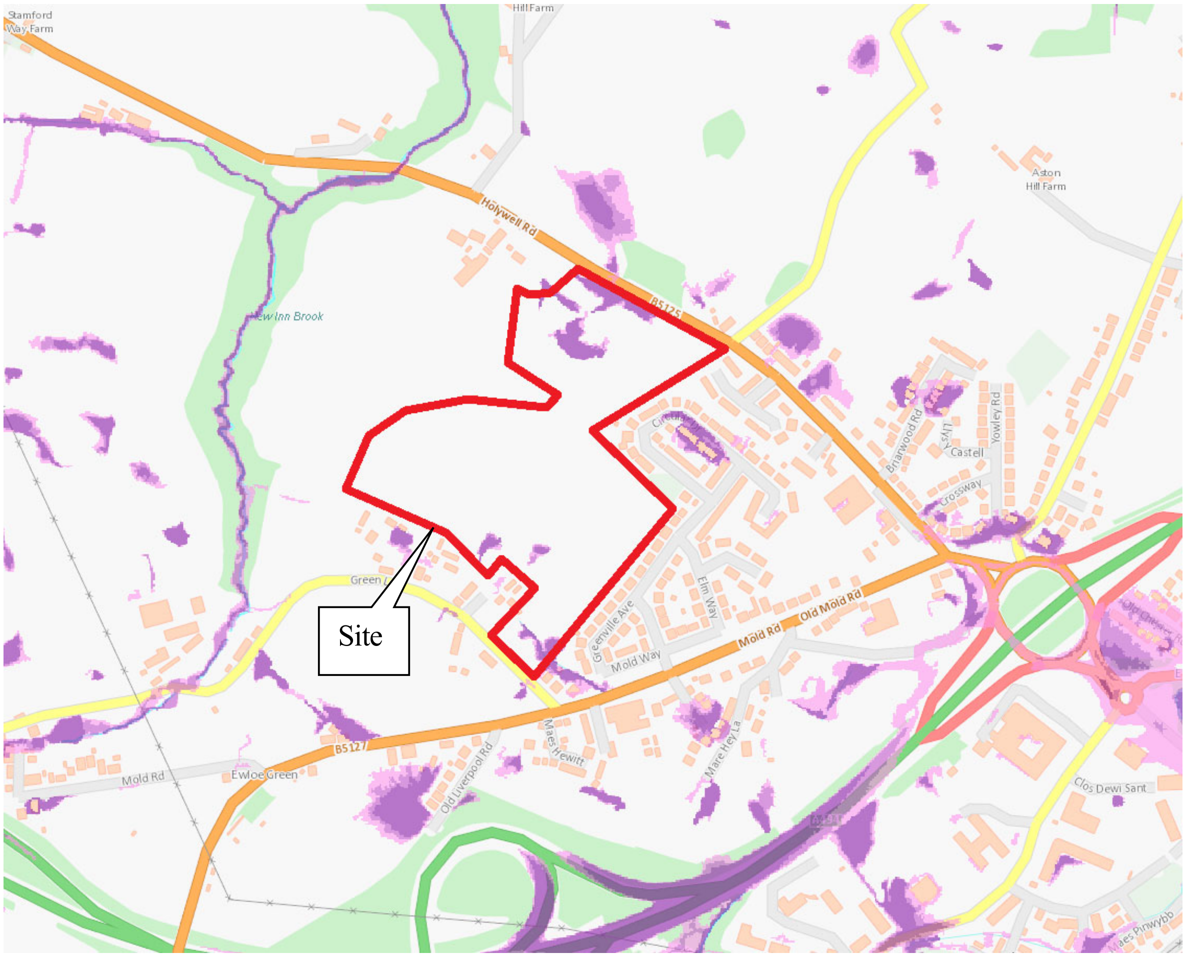



Figure 5 – Natural Resources Wales Surface Water Flooding Map

These areas are associated with the watercourses and low-lying areas of the site. The introduction of a new drainage network post development will ensure that the drainage has capacity to cater for a 100-year storm event including allowance for urban creep and climate change. Finished slab levels will also be kept a minimum 150mm above existing levels to negate any flood risk and ground levels will be designed to fall away from dwellings to enable any potential overland flows to be conveyed through the site without any increased flood risk to properties.

The current masterplan indicates development including a proposed foul pumping station within the northern area currently identified as within the surface water flood risk area. Mitigation will be required to ensure there is no loss of flood storage within the site so providing areas of compensatory flood storage will be required. There appears to be sufficient space to the west of this flood area to reprofile the ground to provide a like for like compensatory flood storage volume to ensure there is no increased risk on or off site as a consequence of development.

The overall risk from surface water flooding is considered as low.

The Natural Resources Wales long term flood risk maps do not indicate any flood risk from Development Advice Maps

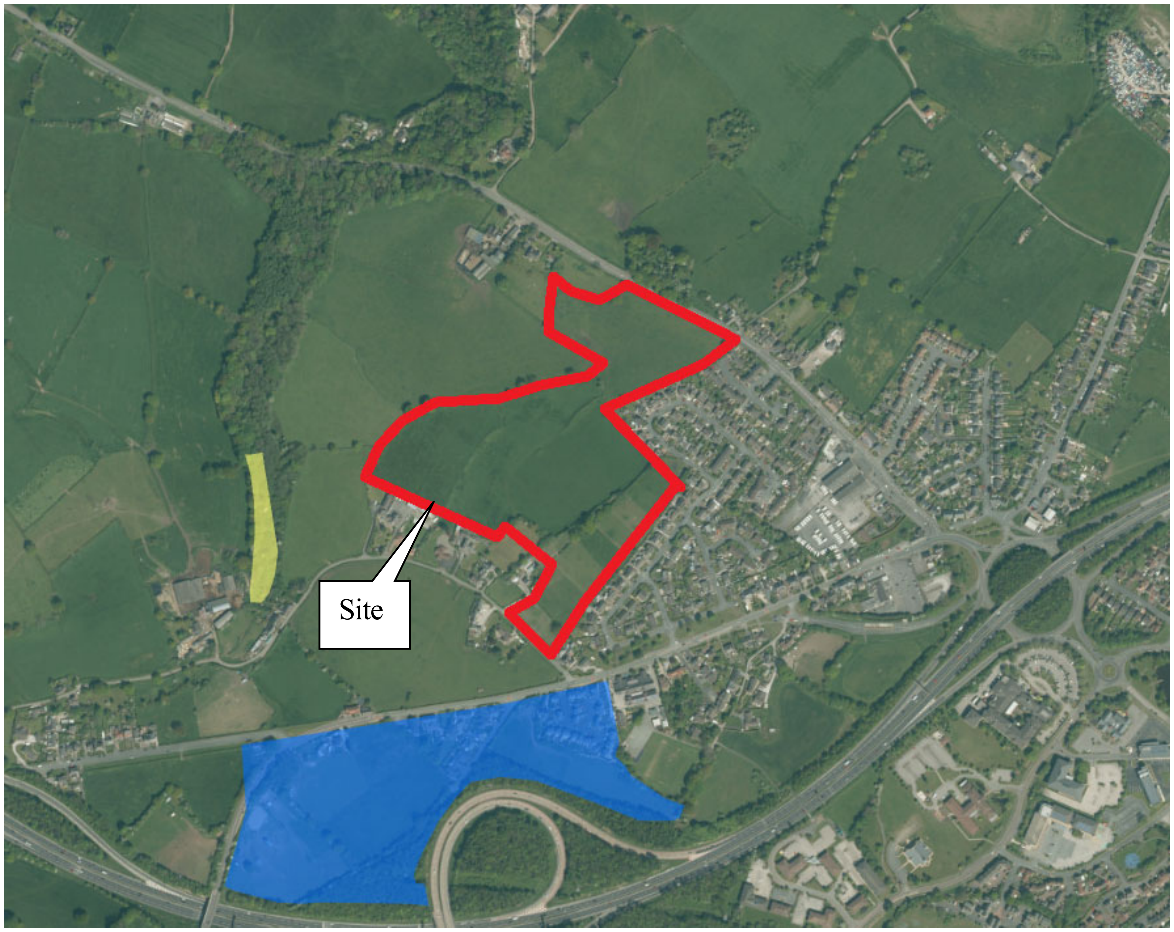



Figure 6 – Natural Resources Wales Development Advice Flooding (DAM) Map

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 no records of flooding within the site but have noted potential hotspots which correlate to the NRW surface water flood maps.

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. There are a number of culverts along the existing watercourse within the site boundary. The client should consider construction of headwalls with safety grilles and ensuring a maintenance plan is in place to reduce the risk of blockages.

The risk of flooding is considered as 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 naturally from a high point within the centre of the site towards the south, west and north boundaries. 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 the presence of a 300mm diameter surface water sewer in the northern end of the site flowing northwest and discharging to the watercourse. This sewer will need to be diverted to suit the masterplan and will be subject to a S185 sewer diversion application with Welsh Water.

We are proposing to discharge all foul flows into the 150mm Diameter foul sewer to the northeast of the site located in Holywell Road / Hilltop Close subject to Welsh Water approval. A foul pumping station will be required as site levels do not allow for a gravity connection from the site. Welsh Water are currently undertaking a Hydraulic Modelling Assessment (HMA) to determine capacity of the receiving sewer network and suitable points of connection for foul flows from the development.

At the time of writing this report Welsh Water have not confirmed if they have any 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.

Groundwater was encountered between depths of 2.1 – 3.2m within the window samples undertaken as part of the initial site investigation. Further information will be available following a full site investigation.

The Envirocheck Flood Report presented in Appendix 2 indicates there is negligible risk of ground water flooding within the site boundary.

The overall risk from groundwater flooding is considered as low.

4.6 Coastal Flooding

The development site is located approximately 3.0km south of the River Dee Estuary. No flooding is indicated on NRW flood mapping and is therefore not at risk from tidal inundation.

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

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. Refer to Figure 7.

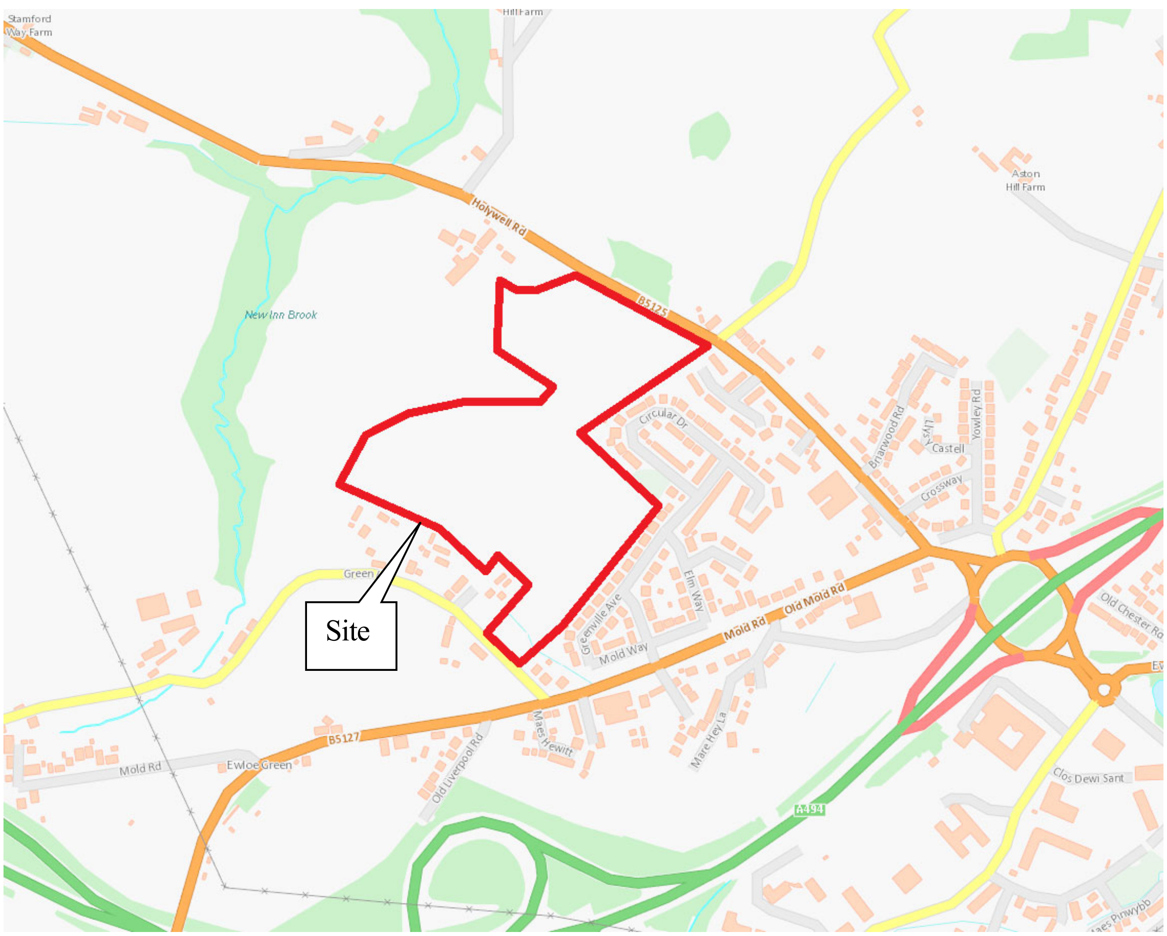



Figure 7 – Natural Resources Wales Reservoir Flooding Map

## 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 majority of the site draining to the two ordinary watercourses located to the northern and southern ends 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 8.7ha developable site area and the default soil type 4 indicating cohesive materials exhibiting limited infiltration properties.

| | |
|---|---|
| 1-year | = 39.69 l/s |
| 30-year | = 80.29 l/s |
| 100-year | = 98.33 l/s |
| **QBAR** | **= 40.11 l/s** |

Refer to Appendix 5 for surface water run-off calculations.

## 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

Preliminary site investigation has determined the site is generally not suitable for infiltration techniques to dispose of surface water flows from the site due to the slow infiltration rates determined within the falling head tests undertaken within the window samples. However, we are proposing to use some areas of the site for partial infiltration where feasible.

It should be noted the infiltration testing undertaken is not compliant with BRE 365 and full testing would be required for infiltration designs and assessments.

The investigation has identified areas of shallow perched groundwater and slower anticipated infiltration rates, reflective of the drift geology, where traditional soakaways would not typically be considered feasible. Parts of the site indicate the potential for higher drainage rates where infiltration testing may determine soakaways are viable.

Further infiltration testing in accordance with BRE365 is required and the results will need to be considered further to determine if any infiltration / partial infiltration components can be utilised for the disposal of surface water flows from the site.

Refer to Appendix 3 for trial pit information.

Priority Level 3

There are 2 existing watercourses within the site. The watercourse in the southern portion of the site drains in a south easterly direction and the watercourse in the northern portion of the site has been confirmed to drain north under Holywell Road. This is a tributary of New Inn brook located 200m west of the site. Both watercourses currently take flows from surface runoff within the site.

The site may have existing land drains discharging into this watercourse which would follow the topography, but this has not been proven at this time.

A review of levels has determined the entire site can drain to the two watercourses located within the site, using a number of outfalls to suit the proposed gravity sewer routes / networks.

The southern watercourse will require a culvert diversion within the site to suit the masterplan. This will be subject to Land Drainage Consent (LDC) from Flintshire LLFA.

Priority Level 4

A review of the Welsh Water sewer records indicates the presence of a 300mm Diameter surface water sewer flowing northwest through the northern portion of the site. This sewer takes flows from Circular Drive residential road (located to the east of the site), through the proposed development and discharges to the watercourse in the northern corner. Refer to Appendix 1 for the Welsh Water sewer map.

This sewer will require a diversion to suit the masterplan proposals and will be subject to a S185 Sewer diversion application to Welsh Water. The proposed sewer will be routed through adoptable roads, shared drives and areas of POS. This new route will allow for surface water connections from the northern portion of the site, and we are proposing to increase the pipe size from a 300mm to 375mm Dia to accommodate the additional flows. This will need to be discussed further with Welsh Water and agreed with Flintshire SABS.

Priority Level 5

The nearest combined sewer is located in Mold Road to the southeast of the site. Refer to Appendix 1 for Welsh Water sewer map. We are not proposing any surface water connections into this asset.

## 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 drainage strategy is presented in Appendix 1. We are proposing to ultimately drain the entire site into the two watercourses within the site via new outfalls.

The proposed surface water networks will discharge restricted flows into the open / culverted watercourse at numerous locations. We are also proposing to culvert an 85m long section of open watercourse in the southern portion of the site to accommodate the proposed layout. The culvert will be aligned through the road network / shared drives. This will require consent via a formal Flood Defence Consent (FDC) Application with Flintshire Local Lead Flood Authority (LLFA). 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 SUDS basins. Any new surface water outfalls will also require FDC approval.

The proposal will mimic the existing situation as the existing topography of the site generally falls towards the watercourses. Flow controls will limit the flows to the greenfield QBAR run-off rate. This is the 2.3-year rainfall event, so any storm event greater than this will have a post development flow rate reduction in the receiving watercourse and therefore will provide a reduced post development flood risk.

Incorporation of additional source control SuDS components such as water butts, permeable paving, filter drains, and bioretention components (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. Early discussions are advised to ensure that the proposed points of connection and flow rates are acceptable to the approving authority.

Flintshire LLFA will also advise on any requirements on the existing watercourse including minimum distances on buffer zones for future maintenance and wildlife corridors. This will generally be a minimum of 3m from top of bank.

5.6 Foul Drainage

We are proposing to discharge all foul flows into the 150mm Diameter foul sewer to the northeast of the site located in Holywell Road / Hilltop Close subject to Welsh Water approval. A foul pumping station will be required as site levels do not allow for a gravity connection from the site. Welsh Water are currently undertaking a Hydraulic Modelling Assessment (HMA) to determine capacity of the receiving sewer network and suitable points of connection for foul flows from the development.

## 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, groundwater, sewers and climate change. Therefore, mitigation measures are not considered necessary for any future development at the site.

There is a risk of surface water flooding associated with the existing watercourses and the low-lying ground within the site. This will need to be considered further and a detailed scheme for flood compensation may be required.

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 slow to poor infiltration characteristics. Therefore, surface water run-off from highways, roof and private drives will discharge into the existing ordinary watercourses within the site. Further infiltration testing in accordance with BRE365 is required and the results will need to be considered further to determine if any infiltration / partial infiltration components can be utilised for the disposal of surface water flows from the site.

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 watercourses and surface water sewer at greenfield QBAR flow rates.

The possible effects of climate change have been considered by acknowledging the requirements to make allowance for increased rainfall in the calculation of surface water discharge rates over the lifespan of the development in line with current guidance. An allowance for urban creep should also be incorporated in the design with a proportional increase to node catchments.

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 and ultimately discharge to the ordinary watercourses located within the site.

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.

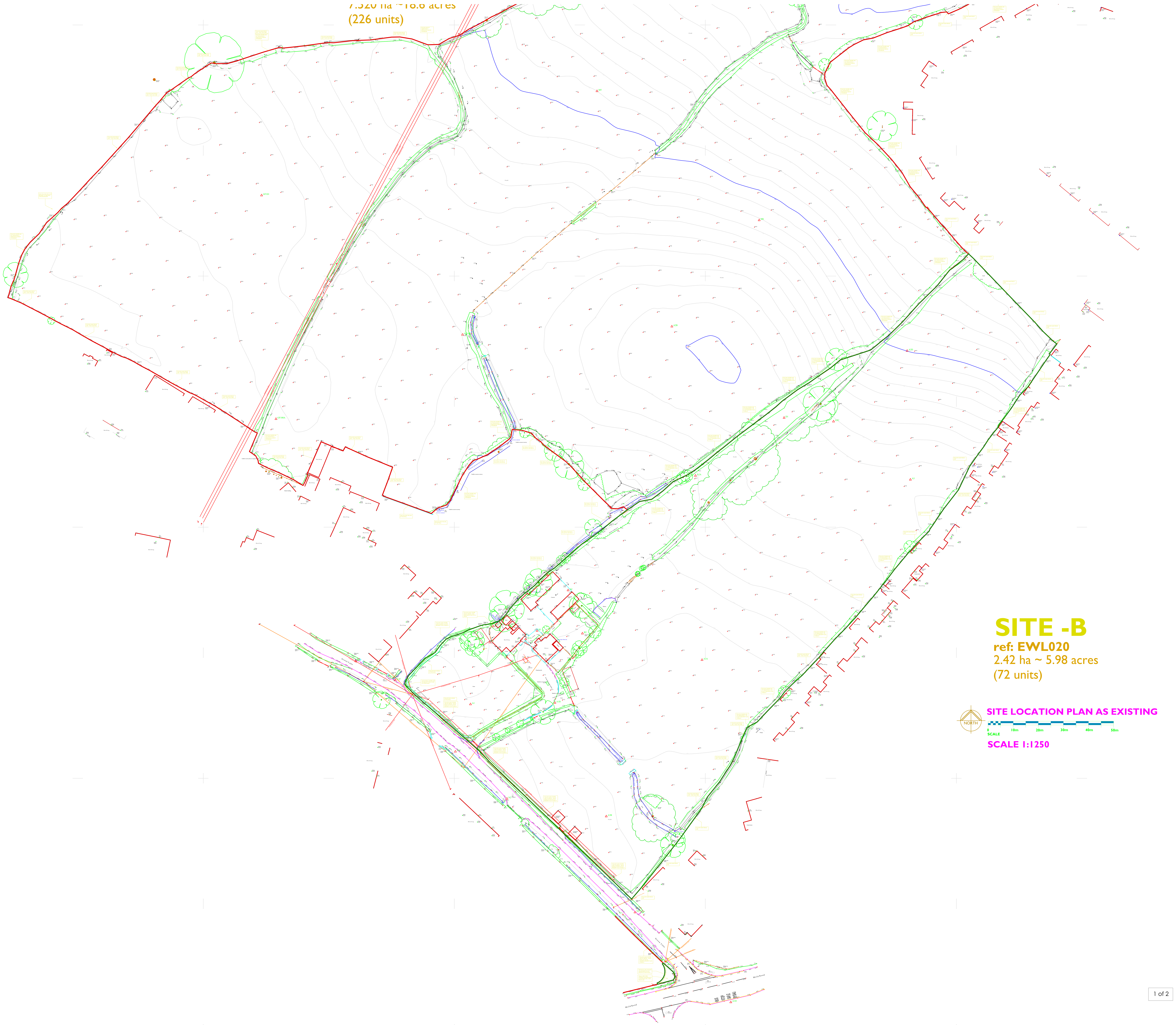
Since January 7th, 2019, all new developments will require sustainable drainage for surface water if there are at least 2 properties or the construction area is more than $100m^2$. The surface water drainage systems must be designed and built to meet Welsh Government standards for sustainable drainage.

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 |
|---|---|---|
| 18030-703 | - | Topographical Survey (South) |
| 18030-704 | - | Topographical Survey (North) |
| - | - | Welsh Water Sewer Map |
| 8271 / SK01-1 | A | Drainage Strategy. Sheet 1 of 2 |
| 8271 / SK01-2 | A | Drainage Strategy. Sheet 2 of 2 |
| 8271 / SK04-1 | - | Constraints Plan. Sheet 1 of 2 |
| 8271 / SK04-2 | - | Constraints Plan. Sheet 2 of 2 |
| 8271 / SK03 | - | SUDS Details |




TOPOGRAPHICAL SURVEY PLAN
2019 / 2020, by Cheshire Surveys

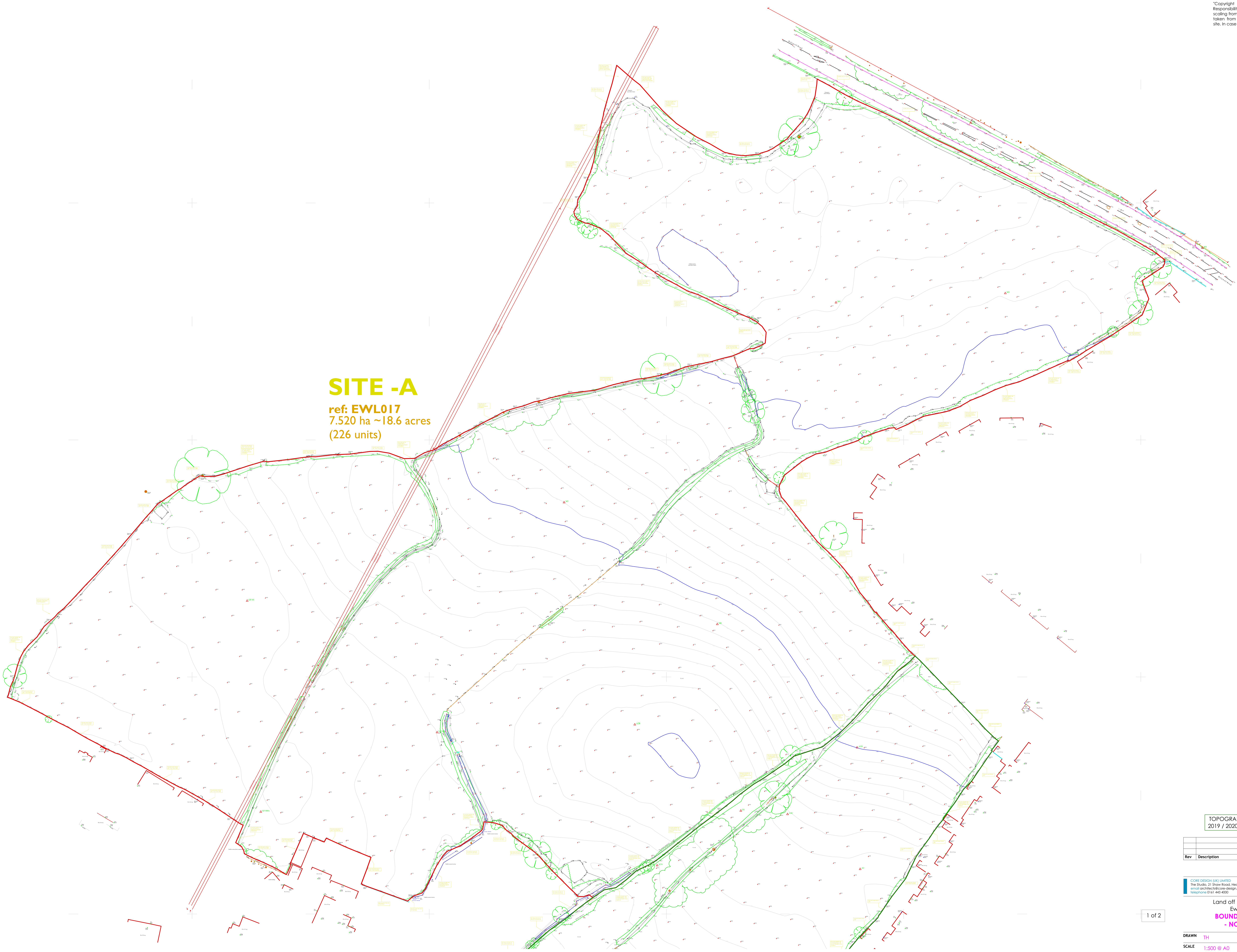
| Rev | Description | By | Date |
|---|---|---|---|
| | | | |
| | | | |
| | | | |

CORE DESIGN (UK) LIMITED
The Studio, 21 Shaw Road, Heaton Moor Stockport SK4 4AG
email architects@core-design.net website www.core-design.net
telephone 0161 443 4000

Land off Holywell Road / Green Lane
Ewloe Green CH5 3HA

**BOUNDARY LINES AS EXISTING - SOUTHERN BOUNDARY**

| | | | | |
|---|---|---|---|---|
| DRAWN | TH | DATE | | DRAWING NO. |
| SCALE | 1:500 @ A0 | REV. | | 18030-703 |




TOPOGRAPHICAL SURVEY PLAN
2019 / 2020, by Cheshire Surveys

| Rev | Description | By | Date |
|---|---|---|---|

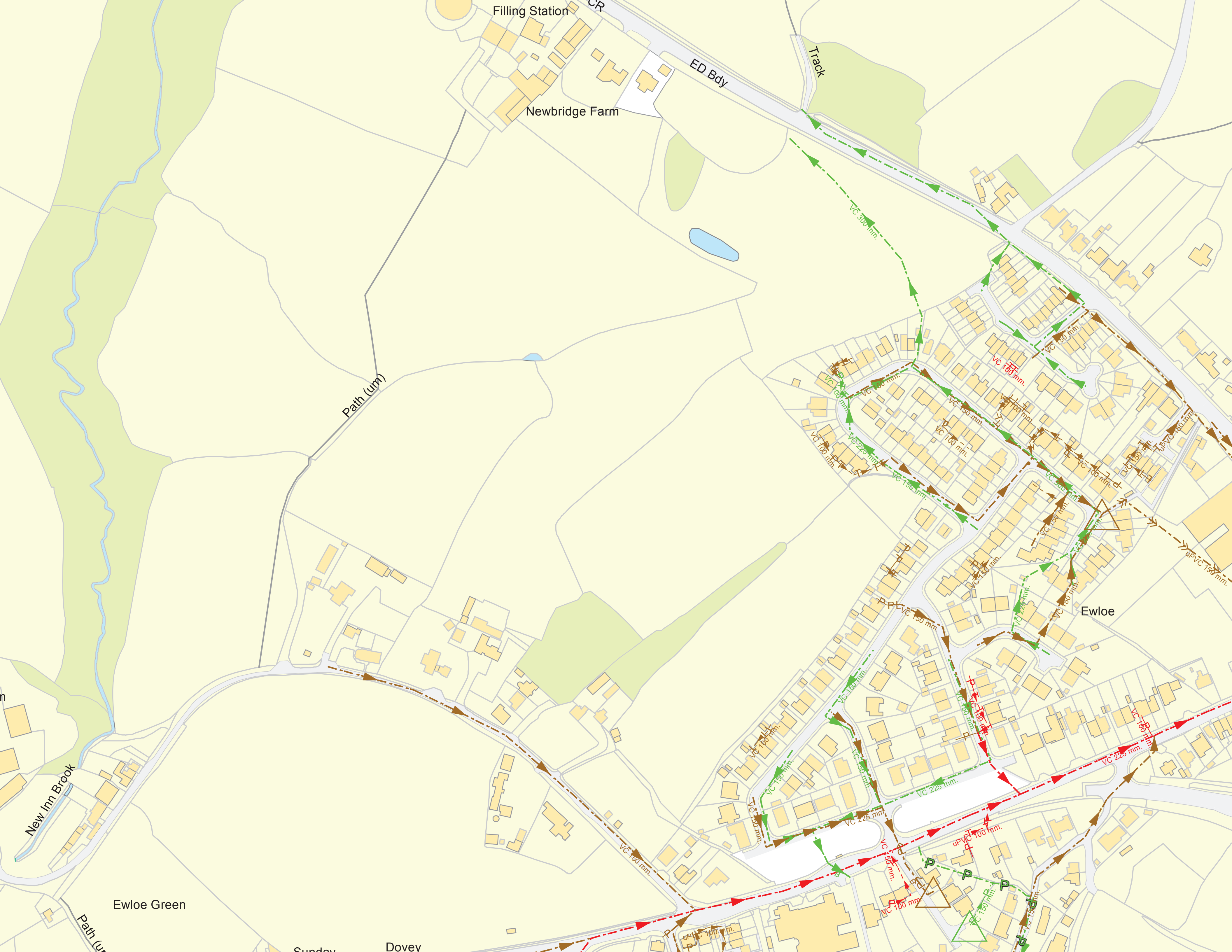
CORE DESIGN (UK) LIMITED
The Studio, 21 Shaw Road, Heaton Moor Stockport SK4 4AG
email architects@core-design.net website www.core-design.net
telephone 0161 443 4000

Land off Holywell Road / Green Lane
Ewloe Green CH5 3HA

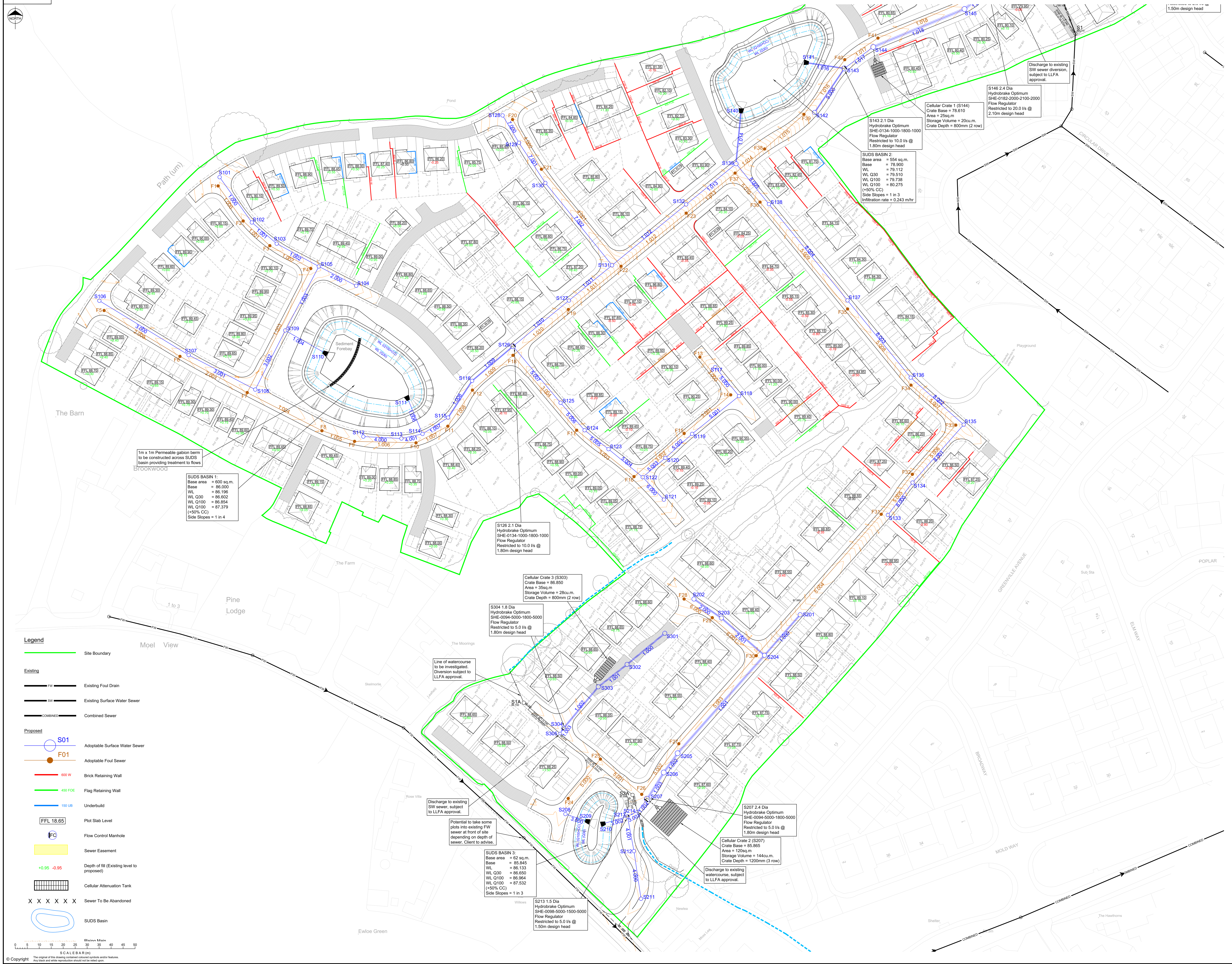
**BOUNDARY LINES AS EXISTING - NORTHERN BOUNDARY**



| DRAWN | TH | DATE | | DRAWING NO. |
|---|---|---|---|---|
| SCALE | 1:500 @ A0 | REV. | | 18030-704 |


Filling Station
CR
ED Bdy
Track
Newbridge Farm
Path (um)
VC 300 mm.
VC 150 mm.
VC 100 mm.
VC 225 mm.
uPVC 150 mm.
uPVC 100 mm.
Ewloe
New Inn Brook
Ewloe Green
Dovey

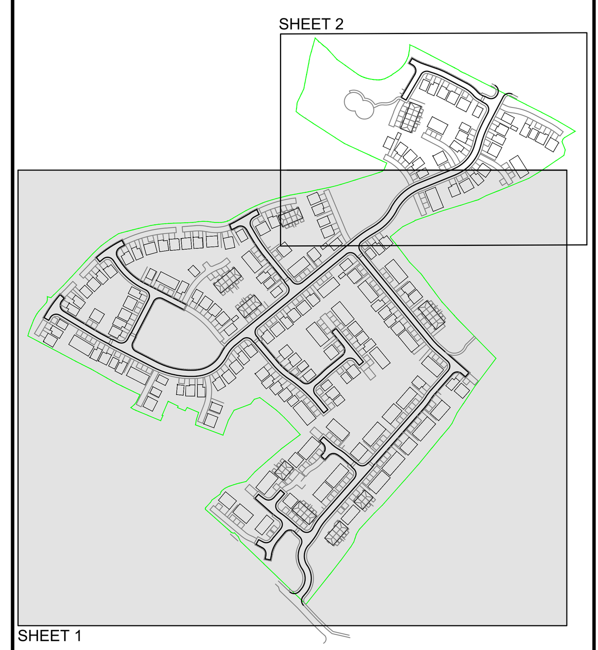
DO NOT SCALE






## 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.




KEY PLAN

STRATEGY

| Rev. | Date | Revision | By | Appd. |
|---|---|---|---|---|
| A | 07.03.24 | Watercourse notes 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

GREEN LANE,
EWLOE.

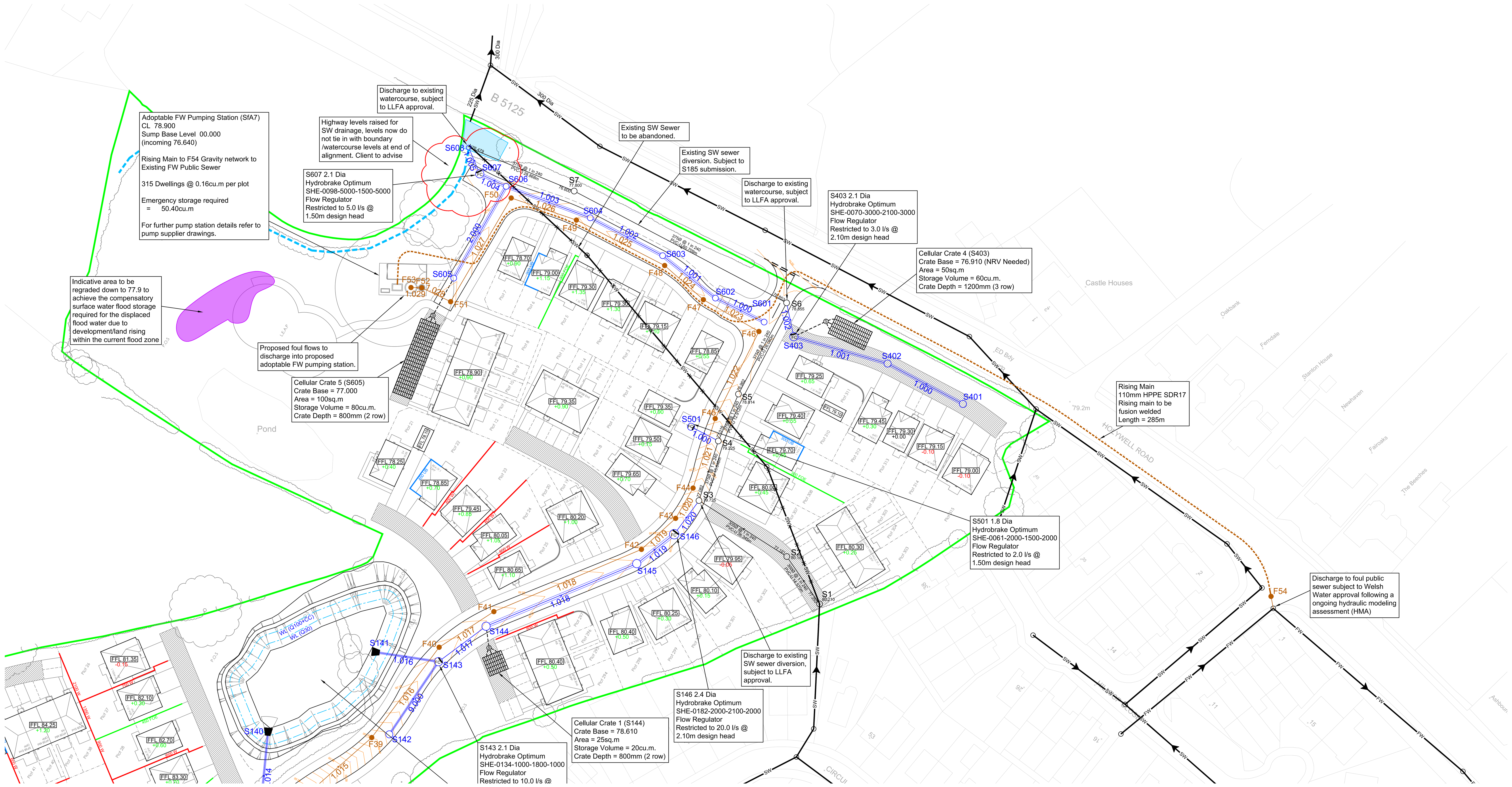
Title

Drainage Strategy
Sheet 1 of 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | REVISION |
|---|---|---|---|
| 8352 / SK01-1 | DATE | 27.02.24 | A |
| | DRAWN | PW | |
| | CHECKED | AJ | |

DO NOT SCALE

NORTH




## Legend

Site Boundary

Existing

Existing Foul Drain

Existing Surface Water Sewer

Combined Sewer

Proposed

Adoptable Surface Water Sewer

Adoptable Foul Sewer

Brick Retaining Wall

Flag Retaining Wall

Underbuild

Plot Slab Level

Flow Control Manhole

Sewer Easement

Depth of fill (Existing level to proposed)

Cellular Attenuation Tank

Sewer To Be Abandoned

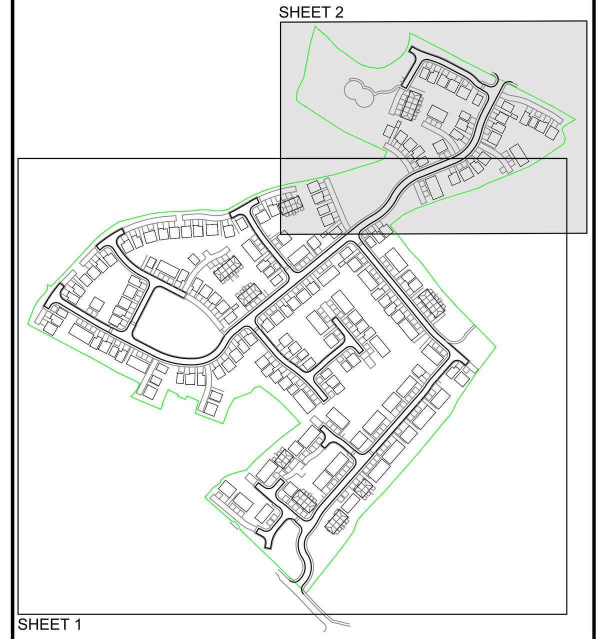
SUDS Basin

Rising Main

Indicative Area To Be Regraded

## 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.




KEY PLAN

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 | 225 | 170 | Circular | 23.202 | S101 | 88.22 | 89.65 | S102 | 88.09 | 89.94 |
| 1.001 | 225 | 170 | Circular | 13.642 | S102 | 88.09 | 89.94 | S103 | 88.01 | 89.92 |
| 1.002 | 225 | 37 | Circular | 19.981 | S103 | 88.01 | 89.92 | S105 | 87.47 | 89.51 |
| 1.003 | 225 | 39 | Circular | 30.187 | S105 | 87.47 | 89.51 | S109 | 86.69 | 89.30 |
| 1.004 | 300 | 240 | Circular | 15.403 | S109 | 86.61 | 89.30 | S110 | 86.55 | 88.93 |
| 1.005 | 375 | 300 | Circular | 46.743 | S110 | 86.17 | 88.93 | S111 | 86.02 | 88.49 |
| 1.006 | 375 | 300 | Circular | 12.609 | S111 | 86.02 | 88.49 | S114 | 85.98 | 88.64 |
| 1.007 | 375 | 300 | Circular | 12.669 | S114 | 85.98 | 88.64 | S115 | 85.93 | 88.38 |
| 1.008 | 450 | 400 | Circular | 18.317 | S115 | 85.86 | 88.38 | S116 | 85.81 | 88.06 |
| 1.009 | 450 | 400 | Circular | 22.376 | S116 | 85.81 | 88.06 | S126 | 85.76 | 88.22 |
| 1.010 | 225 | 170 | Circular | 30.137 | S126 | 85.76 | 88.22 | S127 | 85.58 | 87.72 |
| 1.011 | 300 | 14 | Circular | 23.241 | S127 | 85.58 | 87.72 | S131 | 83.95 | 86.55 |
| 1.012 | 375 | 300 | Circular | 40.041 | S131 | 82.07 | 86.55 | S132 | 81.94 | 84.55 |
| 1.013 | 450 | 71 | Circular | 26.875 | S132 | 81.94 | 84.55 | S139 | 81.56 | 83.21 |
| 1.014 | 450 | 400 | Circular | 21.491 | S139 | 79.87 | 83.21 | S140 | 79.82 | 81.17 |
| 1.015 | 450 | 41 | Circular | 25.339 | S140 | 79.52 | 81.17 | S141 | 78.90 | 80.50 |
| 1.016 | 450 | 400 | Circular | 35.613 | S141 | 78.90 | 80.50 | S143 | 78.81 | 80.88 |
| 1.017 | 225 | 171 | Circular | 15.007 | S143 | 78.81 | 80.88 | S144 | 78.72 | 80.68 |
| 1.018 | 900 | 400 | Circular | 41.266 | S144 | 78.05 | 80.68 | S145 | 77.94 | 80.16 |
| 1.019 | 900 | 400 | Circular | 12.171 | S145 | 77.94 | 80.16 | S146 | 77.91 | 79.97 |
| 1.020 | 225 | 171 | Circular | 10.581 | S146 | 77.91 | 79.97 | S147 | 77.85 | 79.72 |
| 2.000 | 150 | 100 | Circular | 17.558 | S104 | 87.72 | 89.07 | S105 | 87.55 | 89.51 |
| 3.000 | 225 | 170 | Circular | 43.617 | S106 | 87.29 | 88.72 | S107 | 87.03 | 89.27 |
| 3.001 | 225 | 170 | Circular | 31.322 | S107 | 87.03 | 89.27 | S108 | 86.85 | 89.65 |
| 3.002 | 225 | 170 | Circular | 27.650 | S108 | 86.85 | 89.65 | S109 | 86.69 | 89.30 |
| 4.000 | 225 | 170 | Circular | 15.912 | S112 | 86.27 | 89.15 | S113 | 86.18 | 88.83 |
| 4.001 | 225 | 170 | Circular | 9.017 | S113 | 86.18 | 88.83 | S114 | 86.13 | 88.64 |
| 5.000 | 225 | 170 | Circular | 15.609 | S117 | 87.57 | 89.70 | S118 | 87.48 | 90.17 |
| 5.001 | 225 | 170 | Circular | 25.142 | S118 | 87.48 | 90.17 | S119 | 87.34 | 90.15 |
| 5.002 | 225 | 170 | Circular | 15.017 | S119 | 87.34 | 90.15 | S120 | 87.25 | 89.64 |
| 5.003 | 225 | 170 | Circular | 12.413 | S120 | 87.25 | 89.64 | S122 | 87.17 | 89.10 |
| 5.004 | 300 | 240 | Circular | 18.460 | S122 | 87.10 | 89.10 | S123 | 87.02 | 89.34 |
| 5.005 | 300 | 240 | Circular | 12.711 | S123 | 87.02 | 89.34 | S124 | 86.97 | 89.08 |
| 5.006 | 375 | 240 | Circular | 15.226 | S124 | 86.89 | 89.08 | S125 | 86.83 | 88.73 |
| 5.007 | 375 | 29 | Circular | 30.838 | S125 | 86.83 | 88.73 | S126 | 85.76 | 88.22 |
| 6.000 | 300 | 240 | Circular | 12.865 | S121 | 87.15 | 88.67 | S122 | 87.10 | 89.10 |
| 7.000 | 225 | 170 | Circular | 13.311 | S128 | 82.60 | 85.16 | S129 | 82.52 | 85.38 |
| 7.001 | 225 | 170 | Circular | 20.036 | S129 | 82.52 | 85.38 | S130 | 82.40 | 85.72 |
| 7.002 | 300 | 240 | Circular | 44.243 | S130 | 82.33 | 85.72 | S131 | 82.14 | 86.55 |
| 8.000 | 225 | 20 | Circular | 16.994 | S133 | 86.76 | 88.11 | S134 | 85.91 | 87.26 |
| 8.001 | 225 | 24 | Circular | 32.241 | S134 | 85.83 | 87.26 | S135 | 84.47 | 85.89 |
| 8.002 | 300 | 21 | Circular | 29.593 | S135 | 84.39 | 85.89 | S136 | 83.01 | 84.66 |
| 8.003 | 300 | 240 | Circular | 41.627 | S136 | 83.01 | 84.66 | S137 | 82.84 | 84.48 |
| 8.004 | 300 | 62 | Circular | 51.858 | S137 | 82.84 | 84.48 | S138 | 82.01 | 83.65 |
| 8.005 | 375 | 58 | Circular | 21.748 | S138 | 81.94 | 83.65 | S139 | 81.56 | 83.21 |
| 9.000 | 450 | 400 | Circular | 22.182 | S142 | 78.86 | 81.35 | S143 | 78.81 | 80.88 |

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 | 600 | 400 | Circular | 22.525 | S201 | 86.26 | 88.80 | S204 | 86.20 | 88.05 |
| 1.001 | 750 | 399 | Circular | 54.638 | S204 | 86.05 | 88.05 | S205 | 85.92 | 87.85 |
| 1.002 | 750 | 396 | Circular | 9.891 | S205 | 85.92 | 87.85 | S206 | 85.89 | 87.74 |
| 1.003 | 750 | 400 | Circular | 13.190 | S206 | 85.89 | 87.74 | S207 | 85.86 | 87.77 |
| 1.004 | 225 | 169 | Circular | 6.579 | S207 | 85.86 | 87.77 | S214 | 85.82 | 87.86 |
| 1.005 | 225 | 246 | Circular | 6.876 | S214 | 85.82 | 87.86 | S215 | 85.79 | 86.40 |
| 2.000 | 600 | 400 | Circular | 13.929 | S202 | 86.30 | 88.36 | S203 | 86.26 | 88.19 |
| 2.001 | 600 | 403 | Circular | 23.783 | S203 | 86.26 | 88.19 | S204 | 86.20 | 88.05 |
| 3.000 | 300 | 240 | Circular | 6.486 | S208 | 86.26 | 87.94 | S209 | 86.23 | 88.00 |
| 3.001 | 300 | 240 | Circular | 10.709 | S209 | 85.93 | 88.00 | S210 | 85.88 | 88.00 |
| 3.002 | 300 | 239 | Circular | 9.554 | S210 | 85.88 | 88.00 | S213 | 85.84 | 87.90 |
| 3.003 | 225 | 168 | Circular | 4.547 | S213 | 85.84 | 87.90 | S214 | 85.82 | 87.86 |
| 4.000 | 300 | 170 | Circular | 20.110 | S211 | 86.05 | 87.68 | S212 | 85.93 | 87.92 |
| 4.001 | 300 | 170 | Circular | 14.725 | S212 | 85.93 | 87.92 | S213 | 85.84 | 87.90 |

STORM Network 3

| 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 | 20.431 | S301 | 86.21 | 88.15 | S302 | 86.16 | 88.00 |
| 1.001 | 600 | 400 | Circular | 15.208 | S302 | 86.16 | 88.00 | S303 | 86.12 | 88.00 |
| 1.002 | 600 | 402 | Circular | 22.493 | S303 | 86.12 | 88.00 | S304 | 86.06 | 88.24 |
| 1.003 | 225 | 171 | Circular | 2.707 | S304 | 86.06 | 88.24 | S305 | 86.01 | 88.25 |

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 | 750 | 400 | Circular | 21.616 | S401 | 77.02 | 79.20 | S402 | 76.97 | 79.00 |
| 1.001 | 750 | 400 | Circular | 24.686 | S402 | 76.97 | 79.00 | S403 | 76.90 | 78.90 |
| 1.002 | 225 | 171 | Circular | 8.741 | S403 | 76.90 | 78.90 | S404 | 76.85 | 78.85 |

STORM Network 5

| 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 | 225 | 170 | Circular | 7.784 | S501 | 77.06 | 79.40 | S502 | 77.02 | 79.23 |

STORM Network 6

| 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 | 750 | 400 | Circular | 13.730 | S601 | 76.73 | 78.76 | S602 | 76.69 | 78.84 |
| 1.001 | 750 | 400 | Circular | 17.121 | S602 | 76.69 | 78.84 | S603 | 76.65 | 78.96 |
| 1.002 | 750 | 400 | Circular | 20.657 | S603 | 76.65 | 78.96 | S604 | 76.60 | 78.81 |
| 1.003 | 750 | 400 | Circular | 22.715 | S604 | 76.60 | 78.81 | S606 | 76.54 | 78.52 |
| 1.004 | 750 | 400 | Circular | 7.388 | S606 | 76.54 | 78.52 | S607 | 76.52 | 78.43 |
| 1.005 | 225 | 168 | Circular | 7.226 | S607 | 76.52 | 78.43 | S608 | 76.48 | 77.23 |
| 2.000 | 750 | 400 | Circular | 26.724 | S605 | 76.61 | 78.77 | S606 | 76.54 | 78.52 |

FOUL Network 7

| 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 | 80 | Circular | 17.997 | F1 | 87.88 | 89.68 | F2 | 87.66 | 89.91 |
| 1.001 | 150 | 80 | Circular | 15.168 | F2 | 87.66 | 89.91 | F3 | 87.47 | 89.94 |
| 1.002 | 150 | 135 | Circular | 19.576 | F3 | 87.47 | 89.94 | F4 | 87.32 | 89.57 |
| 1.003 | 150 | 50 | Circular | 58.182 | F4 | 87.32 | 89.57 | F7 | 86.16 | 89.62 |
| 1.004 | 150 | 135 | Circular | 35.013 | F7 | 86.16 | 89.62 | F8 | 85.90 | 89.50 |
| 1.005 | 150 | 135 | Circular | 14.317 | F8 | 85.90 | 89.50 | F9 | 85.79 | 89.22 |
| 1.006 | 150 | 135 | Circular | 25.662 | F9 | 85.79 | 89.22 | F10 | 85.60 | 88.71 |
| 1.007 | 150 | 135 | Circular | 14.962 | F10 | 85.60 | 88.71 | F11 | 85.49 | 88.42 |
| 1.008 | 150 | 135 | Circular | 18.247 | F11 | 85.49 | 88.42 | F12 | 85.36 | 88.09 |
| 1.009 | 150 | 135 | Circular | 22.310 | F12 | 85.36 | 88.09 | F18 | 85.19 | 88.18 |
| 1.010 | 150 | 135 | Circular | 29.988 | F18 | 85.19 | 88.18 | F19 | 84.97 | 87.85 |
| 1.011 | 150 | 17 | Circular | 28.429 | F19 | 84.97 | 87.85 | F22 | 83.26 | 86.42 |
| 1.012 | 150 | 135 | Circular | 35.118 | F22 | 81.76 | 86.42 | F23 | 81.50 | 84.67 |
| 1.013 | 150 | 88 | Circular | 26.368 | F23 | 81.50 | 84.67 | F37 | 81.20 | 83.35 |
| 1.014 | 225 | 170 | Circular | 15.907 | F37 | 79.70 | 83.35 | F38 | 79.61 | 82.55 |
| 1.015 | 225 | 170 | Circular | 21.870 | F38 | 79.61 | 82.55 | F39 | 79.48 | 81.49 |
| 1.016 | 225 | 170 | Circular | 28.497 | F39 | 79.48 | 81.49 | F40 | 79.31 | 80.84 |
| 1.017 | 225 | 167 | Circular | 16.516 | F40 | 79.31 | 80.84 | F41 | 79.21 | 80.63 |
| 1.018 | 225 | 104 | Circular | 40.495 | F41 | 79.09 | 80.63 | F42 | 78.70 | 80.12 |
| 1.019 | 225 | 52 | Circular | 11.690 | F42 | 78.70 | 80.12 | F43 | 78.48 | 79.90 |
| 1.020 | 225 | 37 | Circular | 8.828 | F43 | 78.48 | 79.90 | F44 | 78.24 | 79.66 |
| 1.021 | 225 | 24 | Circular | 18.450 | F44 | 78.24 | 79.66 | F45 | 77.45 | 79.06 |
| 1.022 | 225 | 163 | Circular | 24.639 | F45 | 77.45 | 79.06 | F46 | 77.30 | 78.73 |
| 1.023 | 225 | 171 | Circular | 16.198 | F46 | 77.30 | 78.73 | F47 | 77.21 | 78.92 |
| 1.024 | 225 | 170 | Circular | 13.058 | F47 | 77.21 | 78.92 | F48 | 77.13 | 78.97 |
| 1.025 | 225 | 170 | Circular | 25.057 | F48 | 77.13 | 78.97 | F49 | 76.98 | 78.77 |
| 1.026 | 225 | 170 | Circular | 17.392 | F49 | 76.98 | 78.77 | F50 | 76.88 | 78.55 |
| 1.027 | 225 | 170 | Circular | 30.367 | F50 | 76.88 | 78.55 | F51 | 76.70 | 78.83 |
| 1.028 | 225 | 170 | Circular | 10.106 | F51 | 76.70 | 78.83 | F52 | 76.64 | 78.90 |
| 1.029 | 225 | 169 | Circular | 3.548 | F52 | 76.64 | 78.90 | F53 | 76.62 | 78.90 |
| 2.000 | 150 | 80 | Circular | 37.015 | F5 | 87.02 | 88.77 | F6 | 86.55 | 89.23 |
| 2.001 | 150 | 80 | Circular | 31.871 | F6 | 86.55 | 89.23 | F7 | 86.16 | 89.62 |
| 3.000 | 150 | 80 | Circular | 20.352 | F13 | 87.45 | 89.33 | F14 | 87.20 | 90.14 |
| 3.001 | 150 | 80 | Circular | 25.231 | F14 | 87.20 | 90.14 | F15 | 86.88 | 90.10 |
| 3.002 | 150 | 135 | Circular | 27.612 | F15 | 86.88 | 90.10 | F16 | 86.68 | 89.19 |
| 3.003 | 150 | 135 | Circular | 30.791 | F16 | 86.68 | 89.19 | F17 | 86.45 | 89.02 |
| 3.004 | 150 | 33 | Circular | 41.039 | F17 | 86.45 | 89.02 | F18 | 85.19 | 88.18 |
| 4.000 | 150 | 135 | Circular | 23.988 | F20 | 83.02 | 85.21 | F21 | 82.84 | 85.63 |
| 4.001 | 150 | 48 | Circular | 52.395 | F21 | 82.84 | 85.63 | F22 | 81.76 | 86.42 |
| 5.000 | 150 | 135 | Circular | 21.233 | F24 | 86.66 | 88.01 | F25 | 86.50 | 88.00 |
| 5.001 | 150 | 58 | Circular | 22.696 | F25 | 86.50 | 88.00 | F26 | 86.11 | 87.76 |
| 5.002 | 150 | 53 | Circular | 26.194 | F26 | 86.11 | 87.76 | F27 | 85.61 | 87.90 |
| 5.003 | 150 | 135 | Circular | 48.919 | F27 | 85.61 | 87.90 | F30 | 85.25 | 87.97 |
| 5.004 | 150 | 135 | Circular | 78.824 | F30 | 85.25 | 87.97 | F31 | 84.67 | 88.19 |
| 5.005 | 150 | 150 | Circular | 21.128 | F31 | 84.67 | 88.19 | F32 | 84.53 | 87.13 |
| 5.006 | 150 | 40 | Circular | 27.386 | F32 | 84.53 | 87.13 | F33 | 83.85 | 85.86 |
| 5.007 | 150 | 21 | Circular | 25.060 | F33 | 83.85 | 85.86 | F34 | 82.65 | 84.76 |
| 5.008 | 150 | 135 | Circular | 41.365 | F34 | 82.65 | 84.76 | F35 | 82.34 | 84.44 |
| 5.009 | 150 | 65 | Circular | 57.670 | F35 | 82.34 | 84.44 | F36 | 81.46 | 83.57 |
| 5.010 | 150 | 61 | Circular | 15.970 | F36 | 81.46 | 83.57 | F37 | 81.20 | 83.35 |
| 6.000 | 150 | 80 | Circular | 14.106 | F28 | 87.04 | 88.39 | F29 | 86.86 | 88.23 |
| 6.001 | 150 | 34 | Circular | 24.230 | F29 | 86.86 | 88.23 | F30 | 86.15 | 87.97 |

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



STRATEGY

| Rev. | Date | Revision | By | Appd. |
|---|---|---|---|---|
| A | 08.03.24 | Foul Rising Main Added | PW | AJ |

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

Client: Castle Green

Project: GREEN LANE, EWOLE.

Title: Drainage Strategy Sheet 2 of 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | |
|---|---|---|---|
| 8352 / SK01-2 | DATE | 27.02.24 | REVISION |
| | DRAWN | PW | A |
| | CHECKED | AJ | |




Legend

- Site Boundary

Existing

- Existing Foul Drain
- Existing Surface Water Sewer
- Combined Sewer
- Existing Watercourse
- Existing Electric Cable
- Surface Water Flood Extents (NRW Maps)

PLANNING

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

Client
Castle Green

Project
GREEN LANE,
EWOLE.

Title
Constraits Plan
Sheet 1 of 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | |
|---|---|---|---|
| 8352 / SK04-1 | DATE | 05.03.24 | REVISION |
| | DRAWN | PW | - |
| | CHECKED | AJ | |

DO NOT SCALE

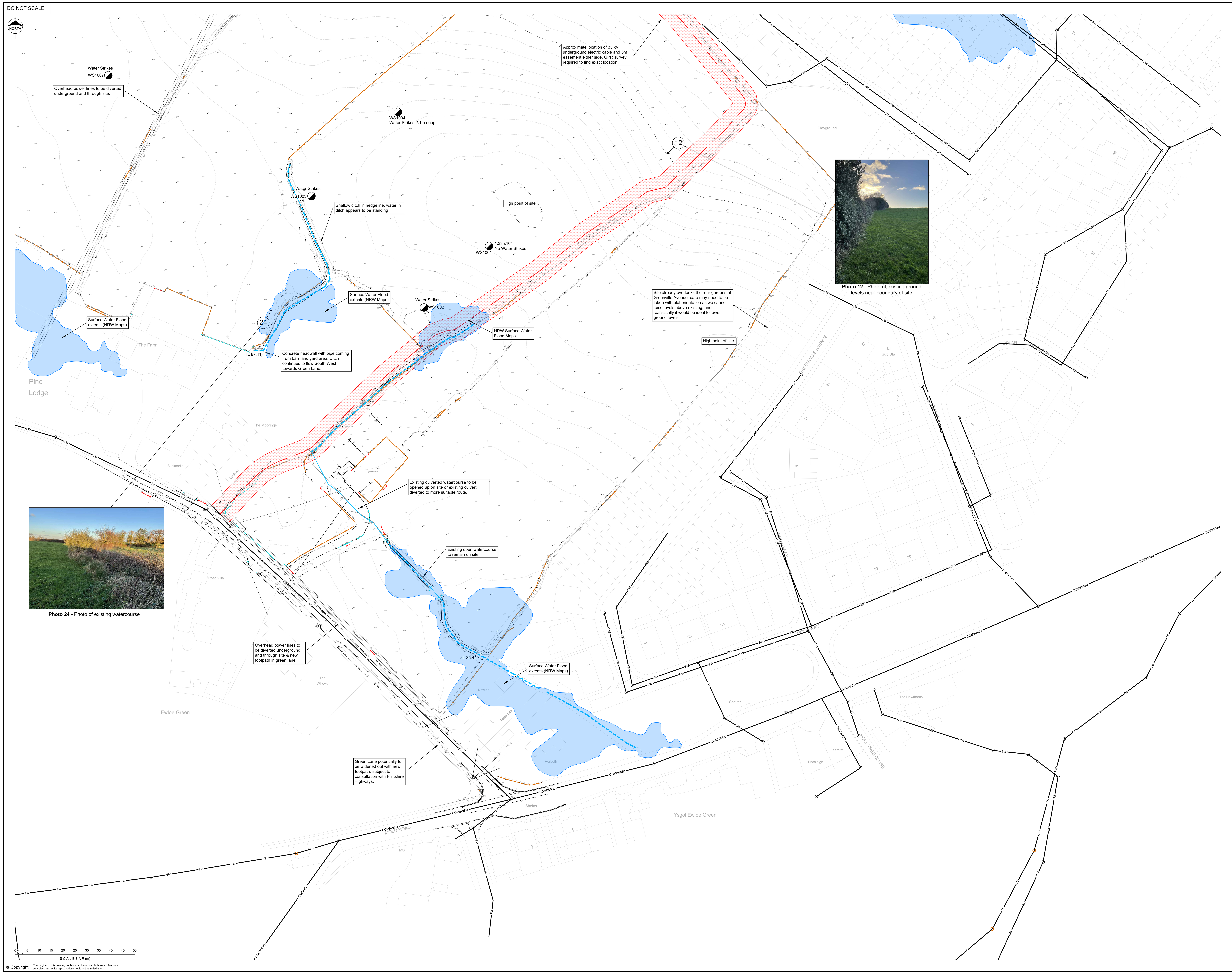



Photo 24 - Photo of existing watercourse

Photo 12 - Photo of existing ground levels near boundary of site



## Legend

- Site Boundary

Existing

- Existing Foul Drain
- Existing Surface Water Sewer
- Combined Sewer
- Existing Watercourse
- Existing Electric Cable
- Surface Water Flood Extents (NRW Maps)

PLANNING

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

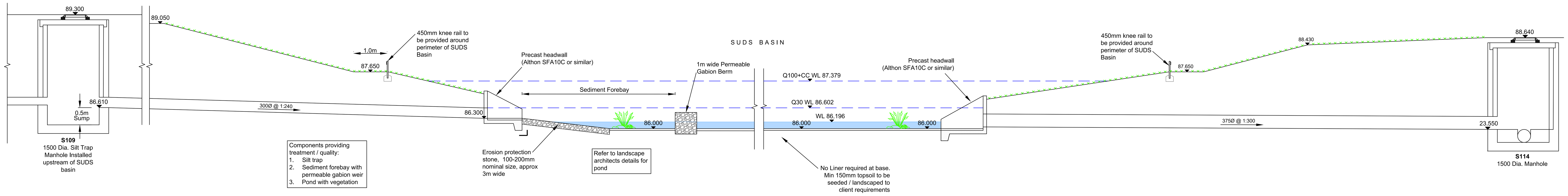
Client: Castle Green

Project: GREEN LANE, EWOLE.

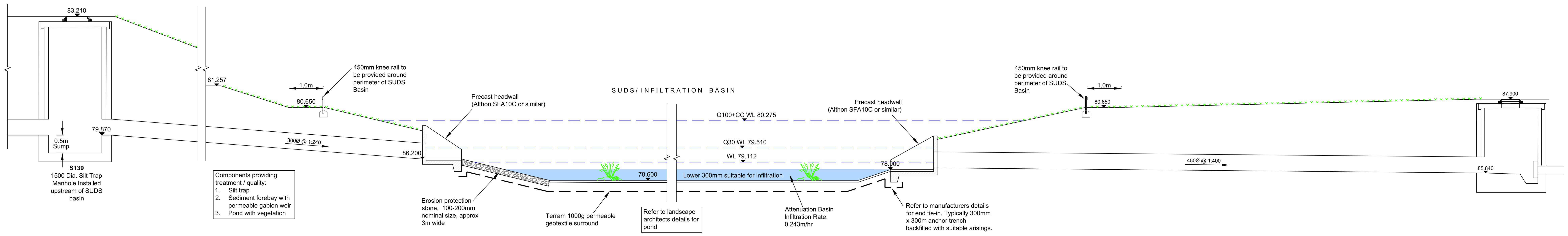
Title: Constraits Plan Sheet 1 of 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | |
|---|---|---|---|
| 8352 / SK04-1 | DATE | 05.03.24 | REVISION |
| | DRAWN | PW | - |
| | CHECKED | AJ | |

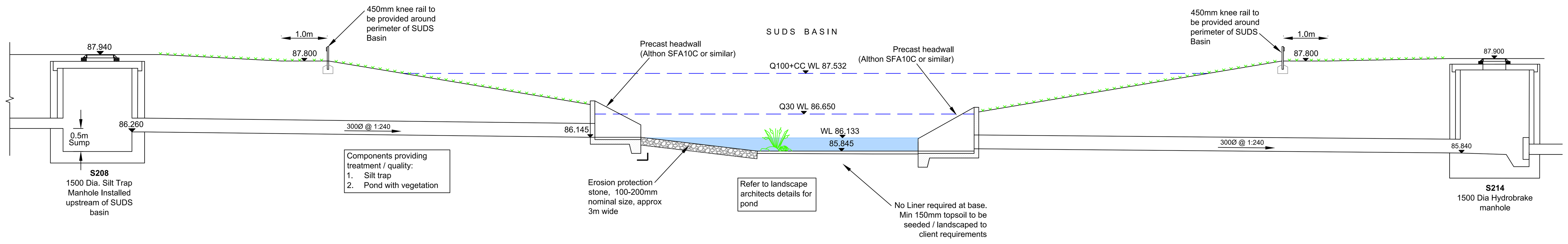
DO NOT SCALE



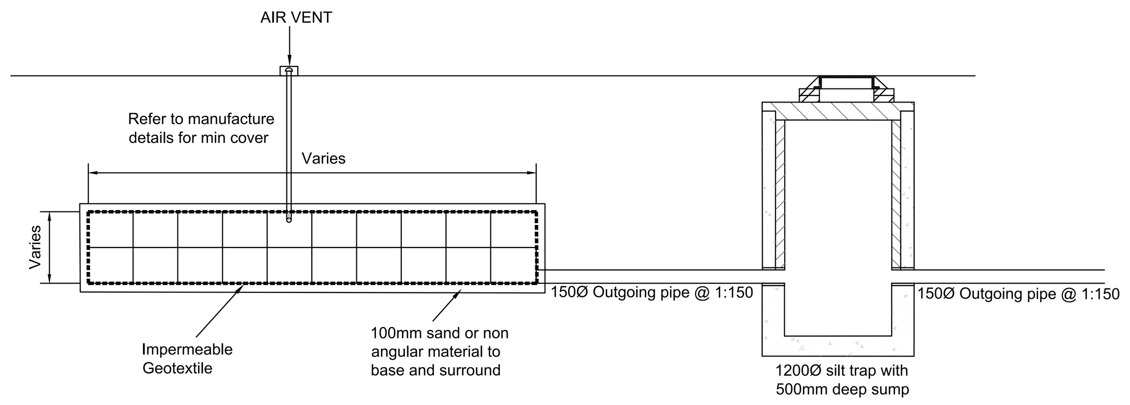

**SECTION THROUGH ATTENUATION BASIN 1 (Network 1)**
NOT TO SCALE



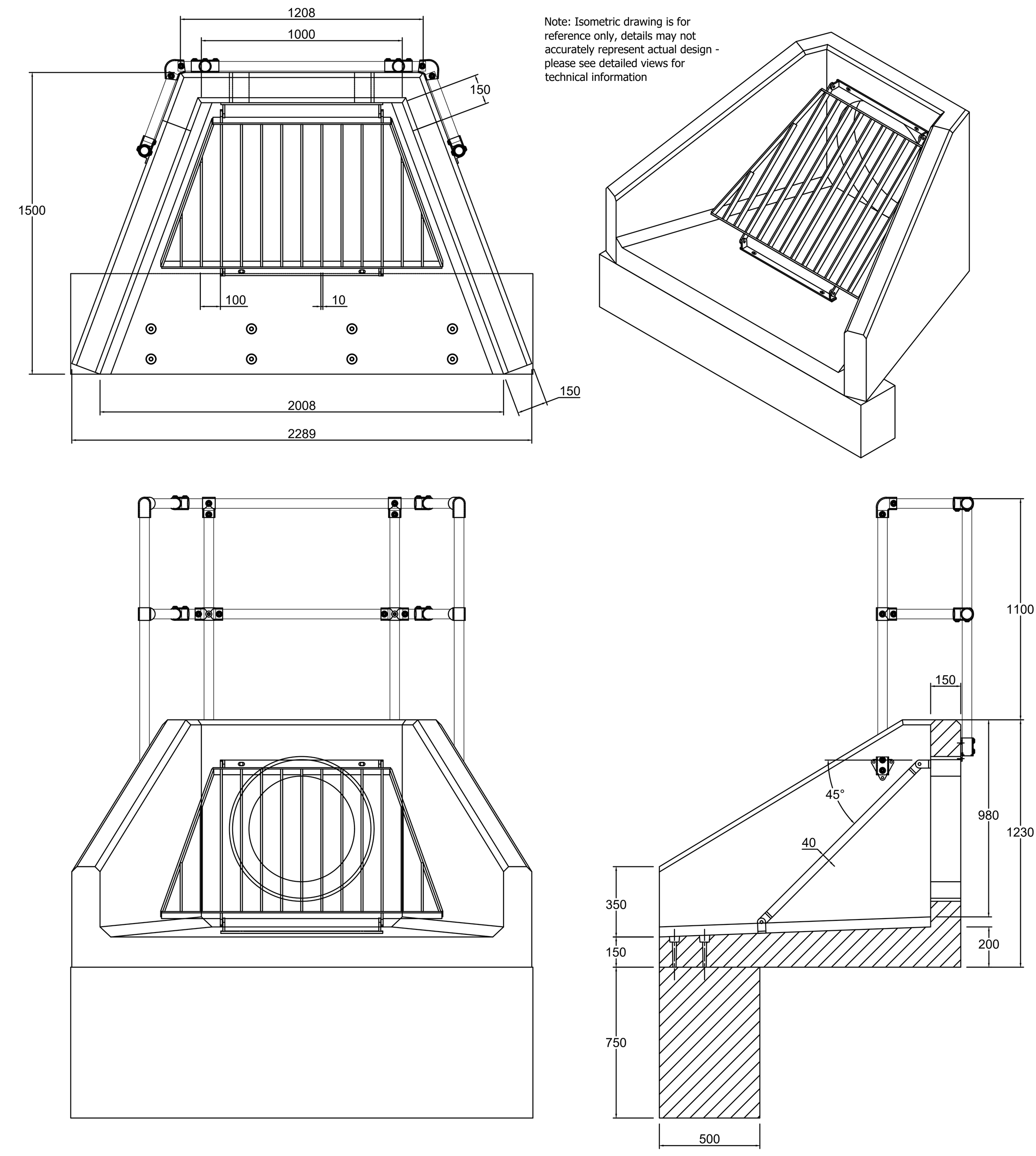

**SECTION THROUGH ATTENUATION / INFILTRATION BASIN 2 (Network 1)**
NOT TO SCALE




**SECTION THROUGH ATTENUATION BASIN 3 (Network 2)**
NOT TO SCALE




**SECTION THROUGH TYPICAL SILT TRAP / CELLULAR CRATE DETAIL**
NOT TO SCALE




SFA10 C A Headwall

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



PLANNING

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
GREEN LANE, EWOLE.

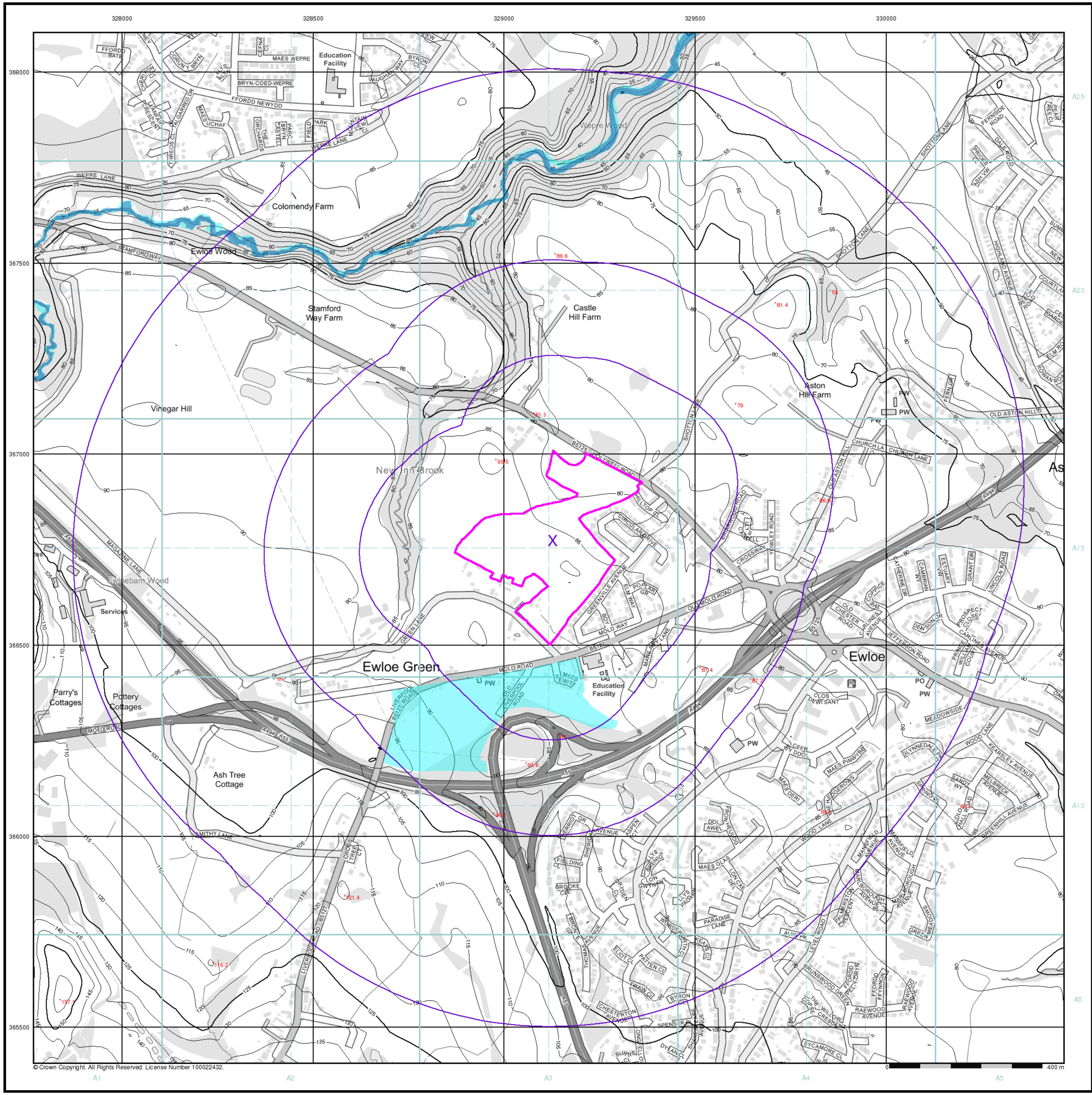
Title
SUDS Details

| DRAWING NUMBER | SCALE at A0 | 1:100 | |
|---|---|---|---|
| 8352 / SK05 | DATE | 05.03.24 | REVISION |
| | DRAWN | PW | - |
| | CHECKED | AJ | |

**Appendix 2**

**Envirocheck Flood Screening Report**

*Order Number: 335307975_1_1*




# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

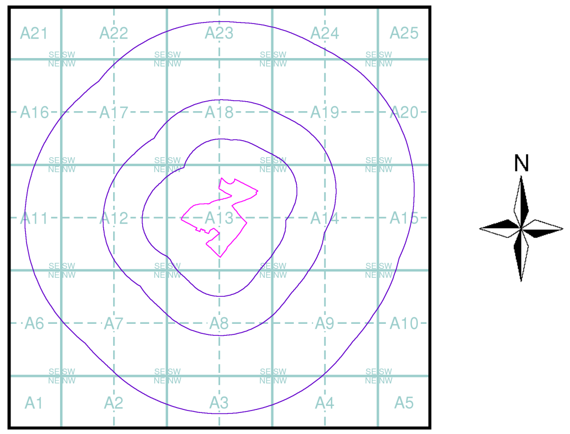
### Flood Data

- 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
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

## EA/NRW Flood Data Map - Slice A




## Order Details

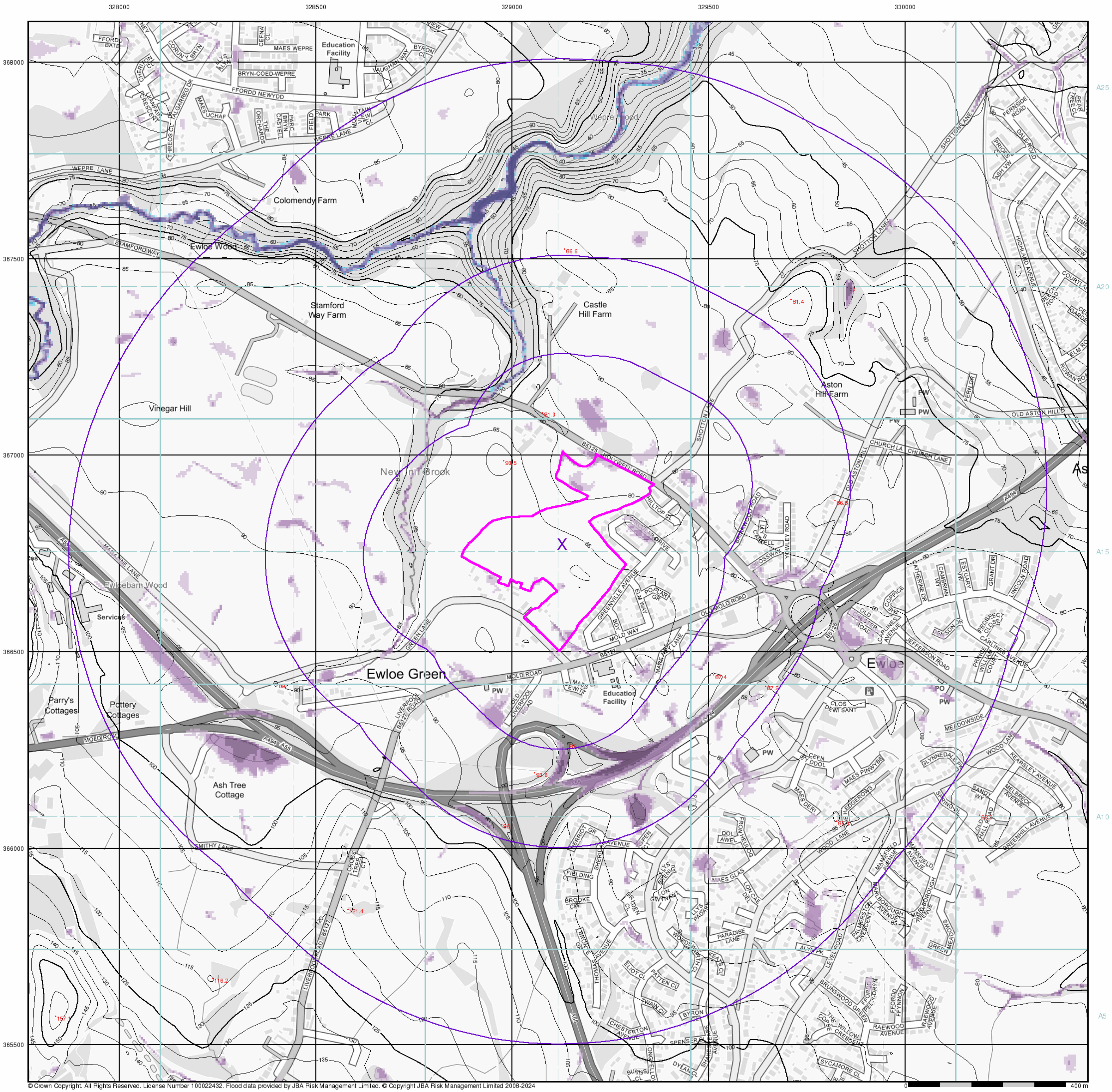
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA

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)
- X Bearing Reference Point

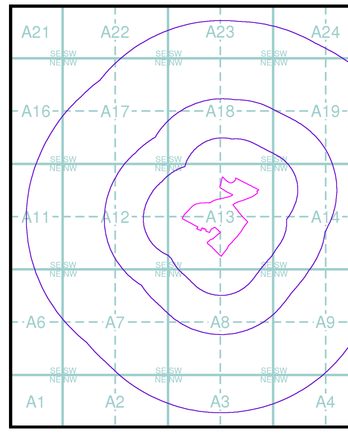
### Modelled Flood Depth

| 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
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

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




N

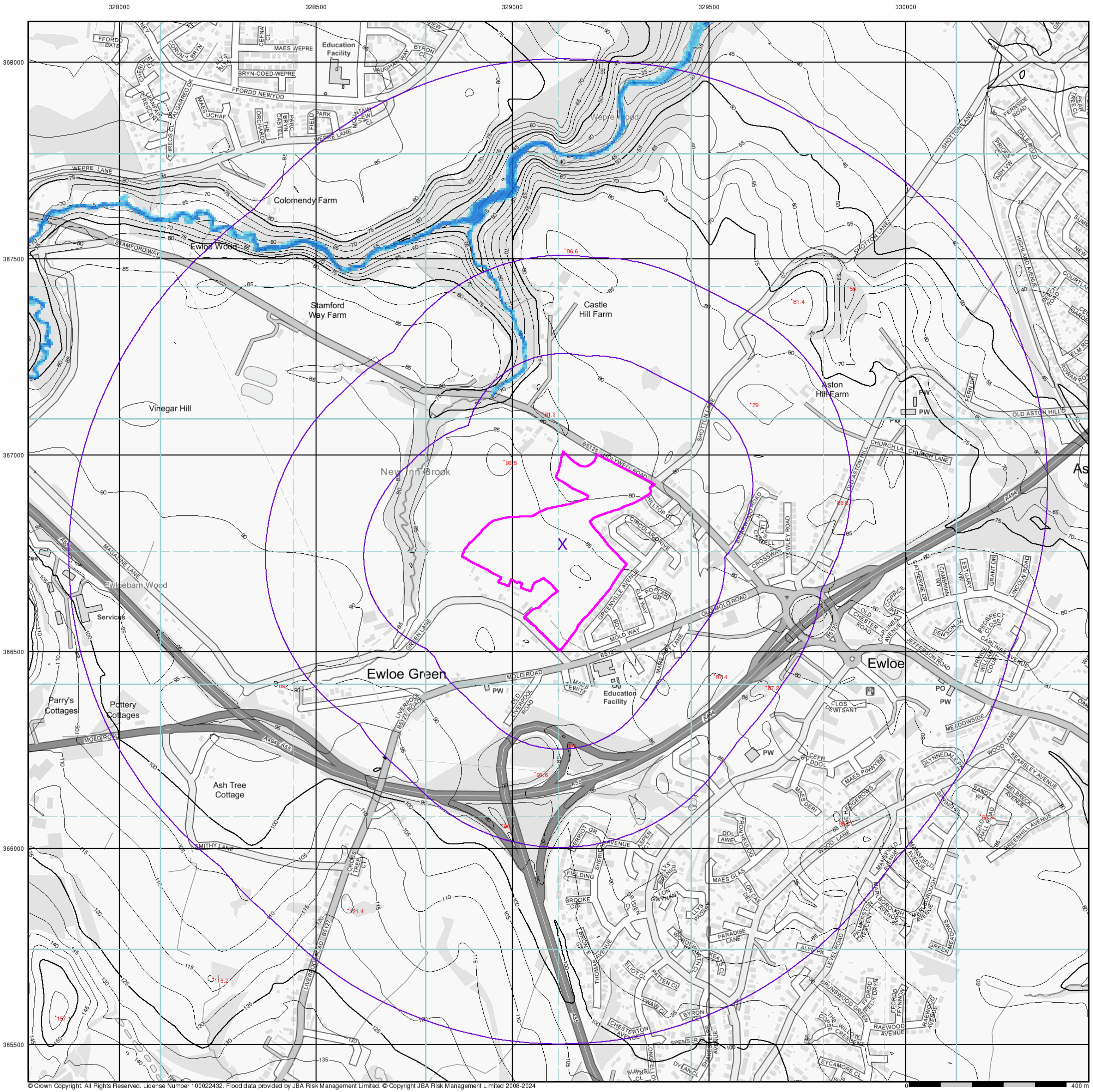
## Order Details

| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

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




© Crown Copyright. All Rights Reserved. License Number 100022432. Flood data provided by JBA Risk Management Limited. © Copyright JBA Risk Management Limited 2008-2024

# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

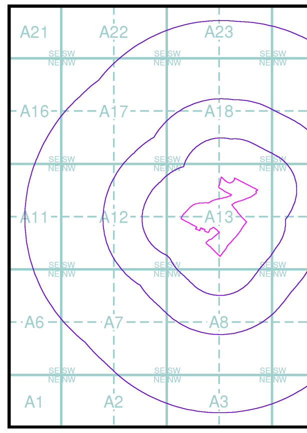
### Modelled Flood Depth

| 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
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

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




N

## Order Details

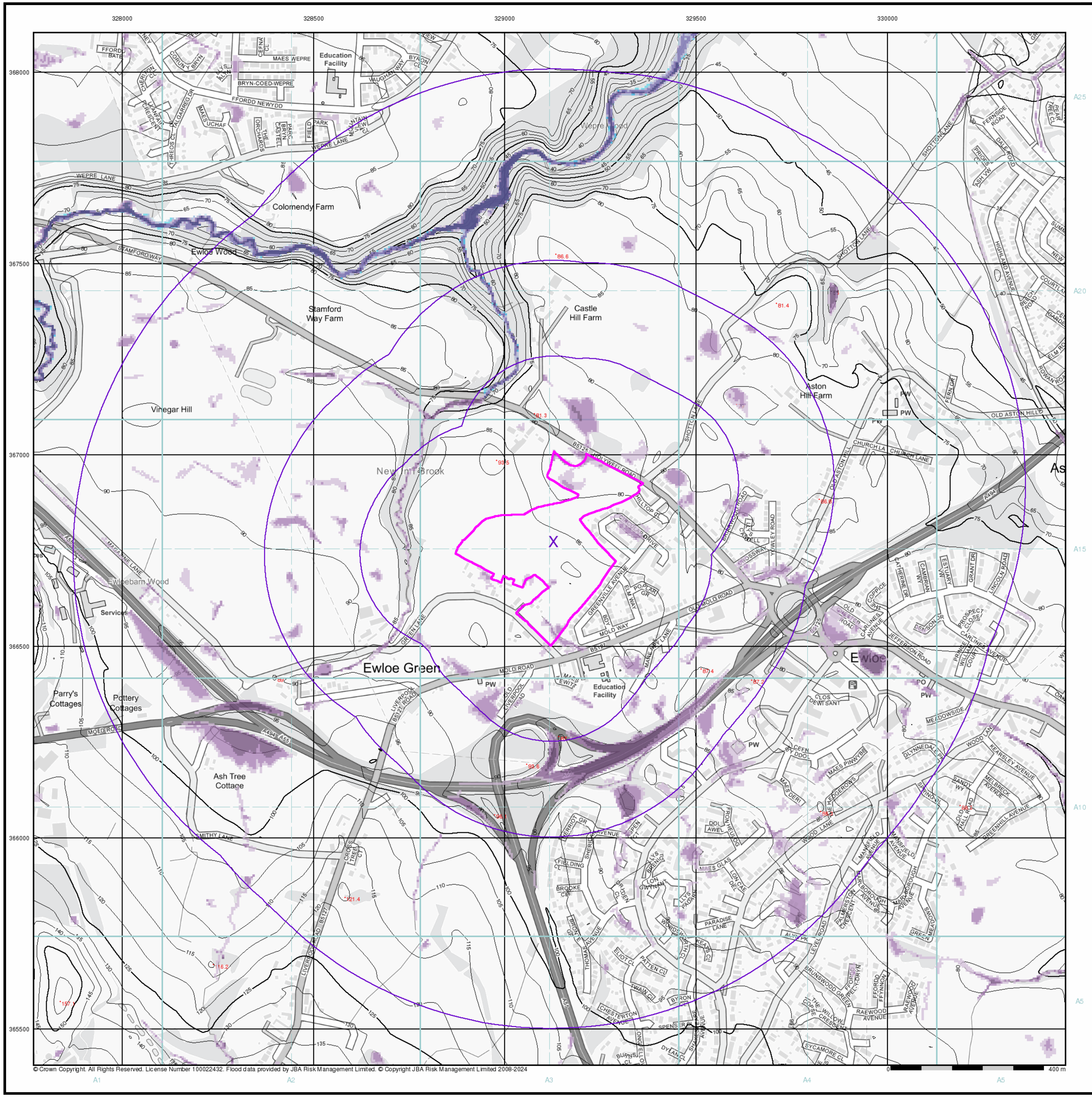
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark® INFORMATION GROUP

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




# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

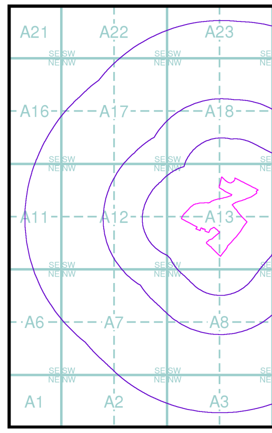
### Modelled Flood Depth

| 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
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

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




N

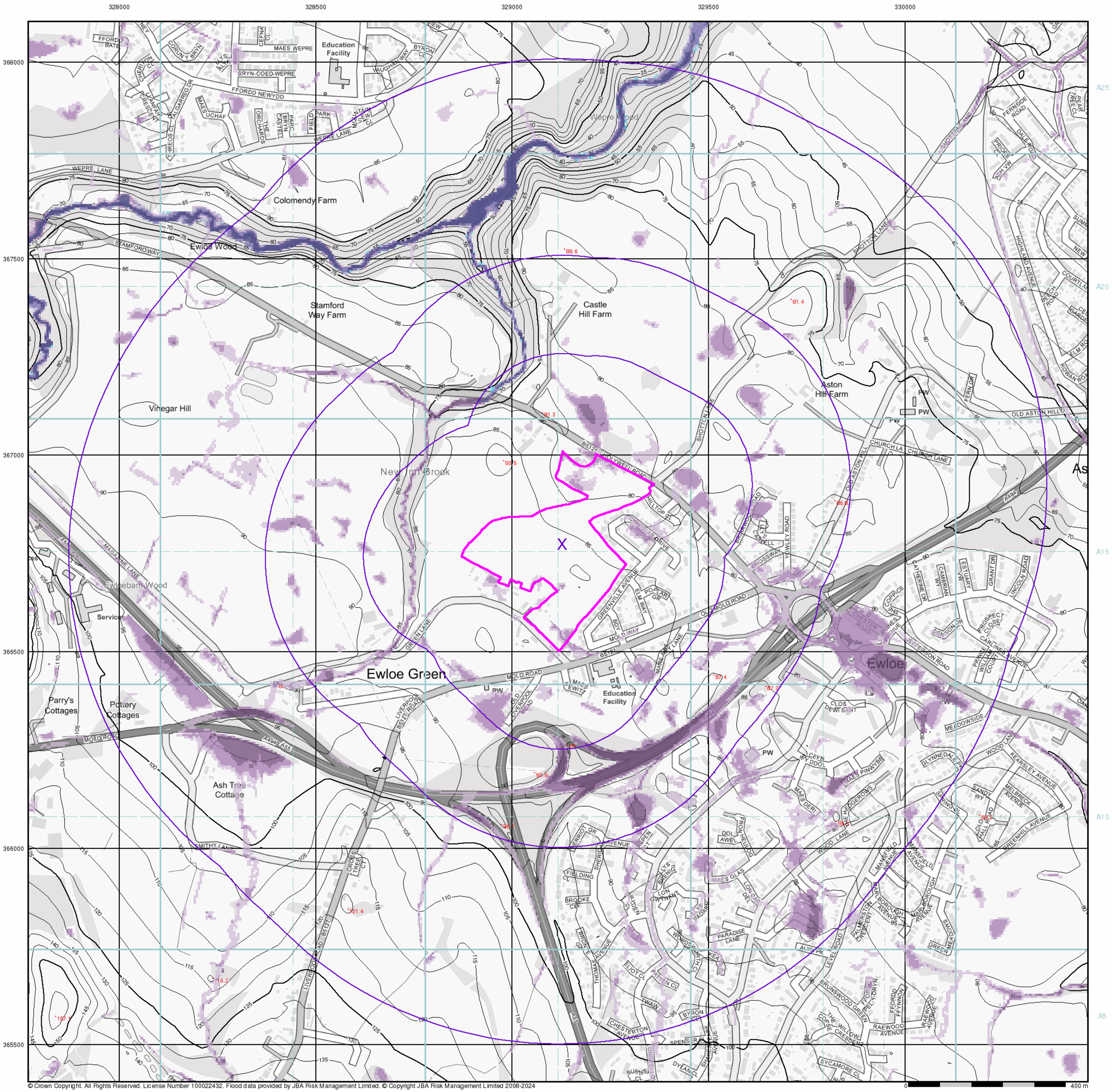
## Order Details

Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA


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






# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

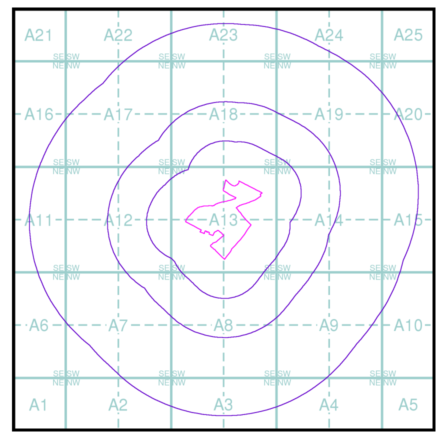
### Modelled Flood Depth

| 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
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

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




N

### Order Details

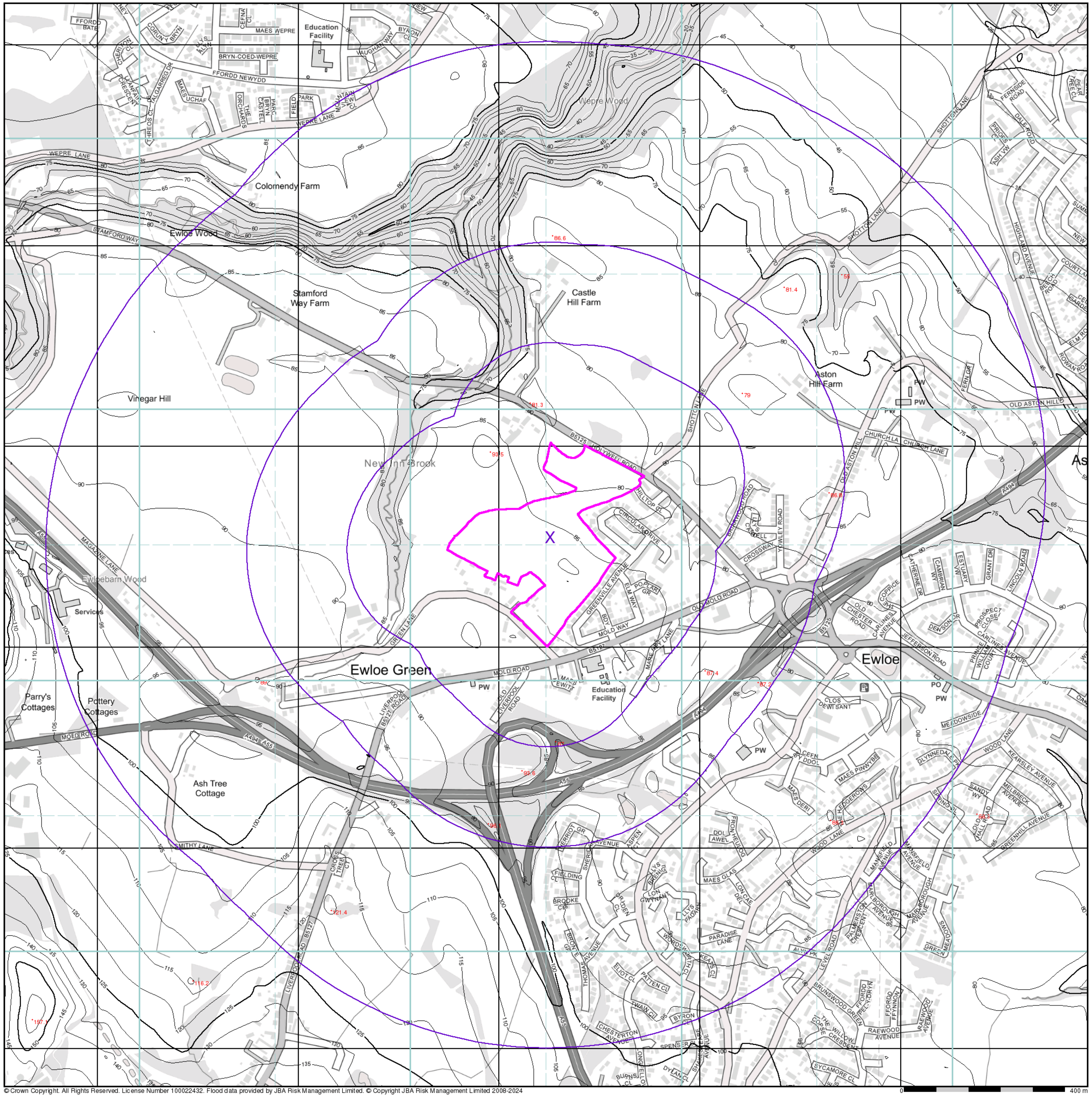
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

### Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# Envirocheck

LANDMARK INFORMATION GROUP®

## JBA Canal Failure Map (1:10,000)

### General

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

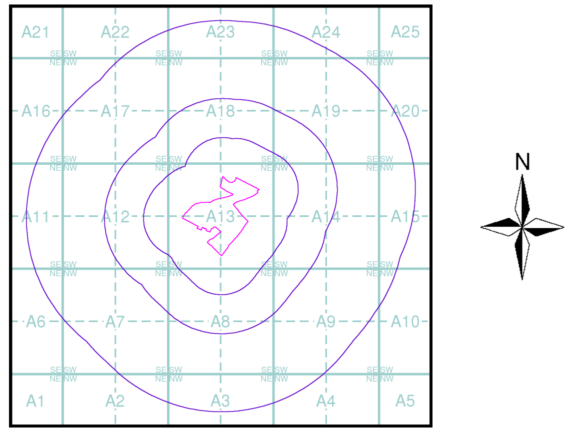
### Flood Data

- Canal Failure
- Coverage

### Contours (height in metres)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

## JBA Canal Failure Flood Map - Slice A




## Order Details

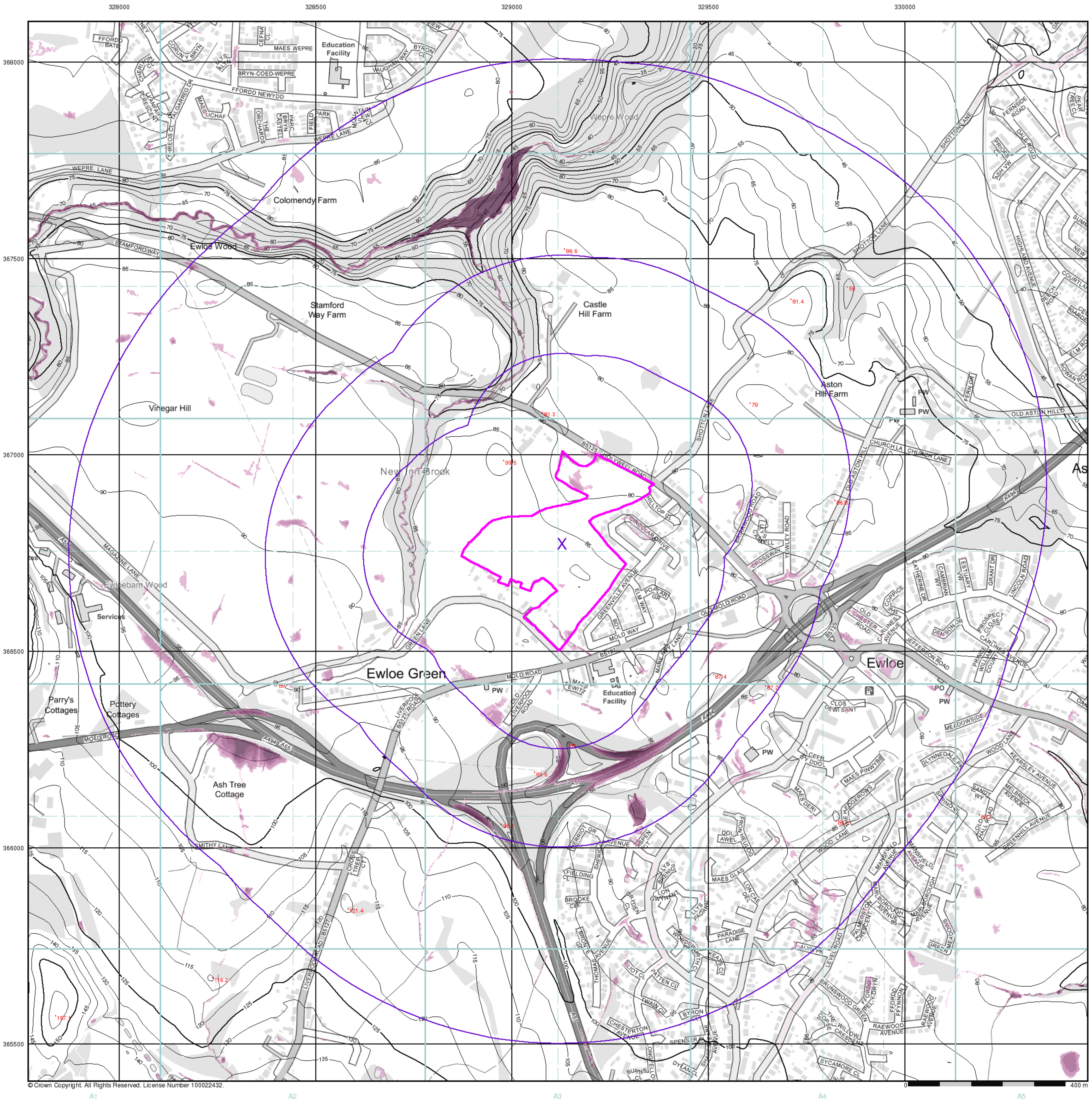
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA


Landmark INFORMATION GROUP

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




# 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)

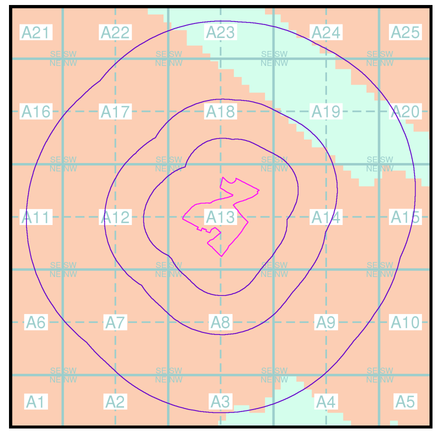
- Standard Contour (105)
- Master Contour (100, 95)
- Spot Height (167.8)
- MLW Mean Low Water
- MHW Mean High Water

### 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




N

## Order Details

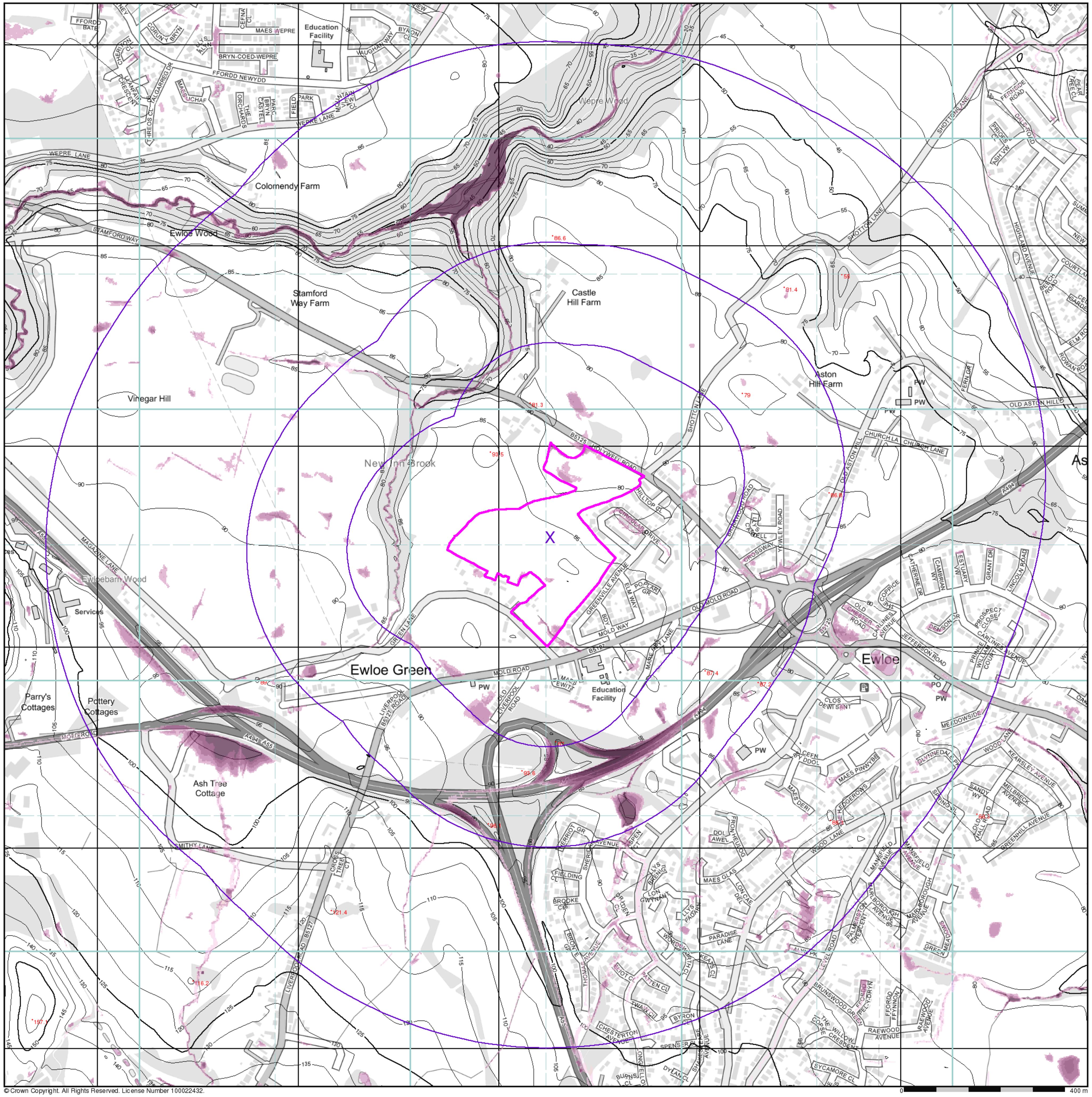
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP


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




# 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

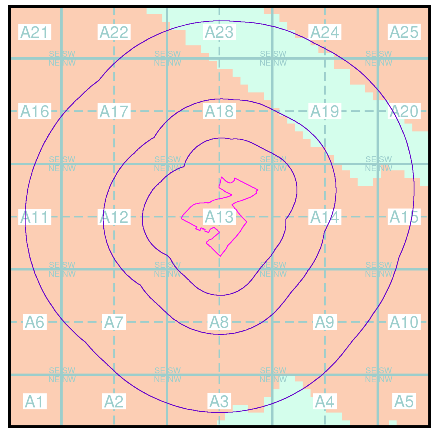
County to town

Town to street

Street to parcels of land

Property

## EA/NRW Suitability Map - Slice A




N

## Order Details

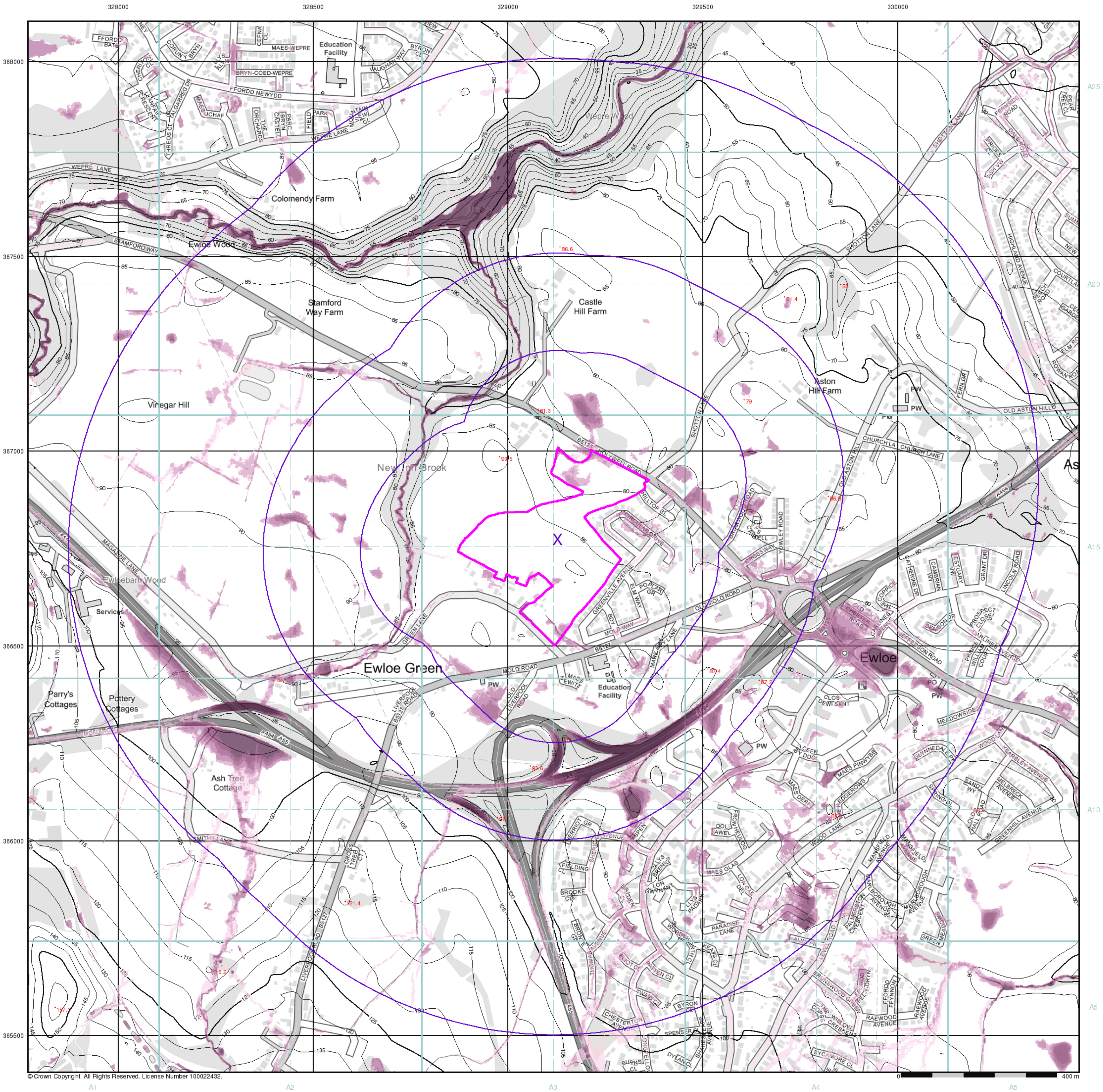
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# 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)

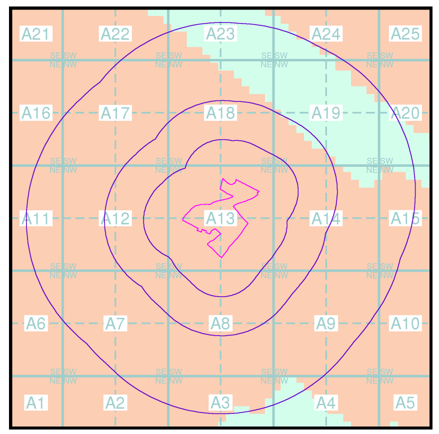
Standard Contour
Master Contour
Spot Height 167.8
Mean Low Water
Mean High Water

### 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




N

## Order Details

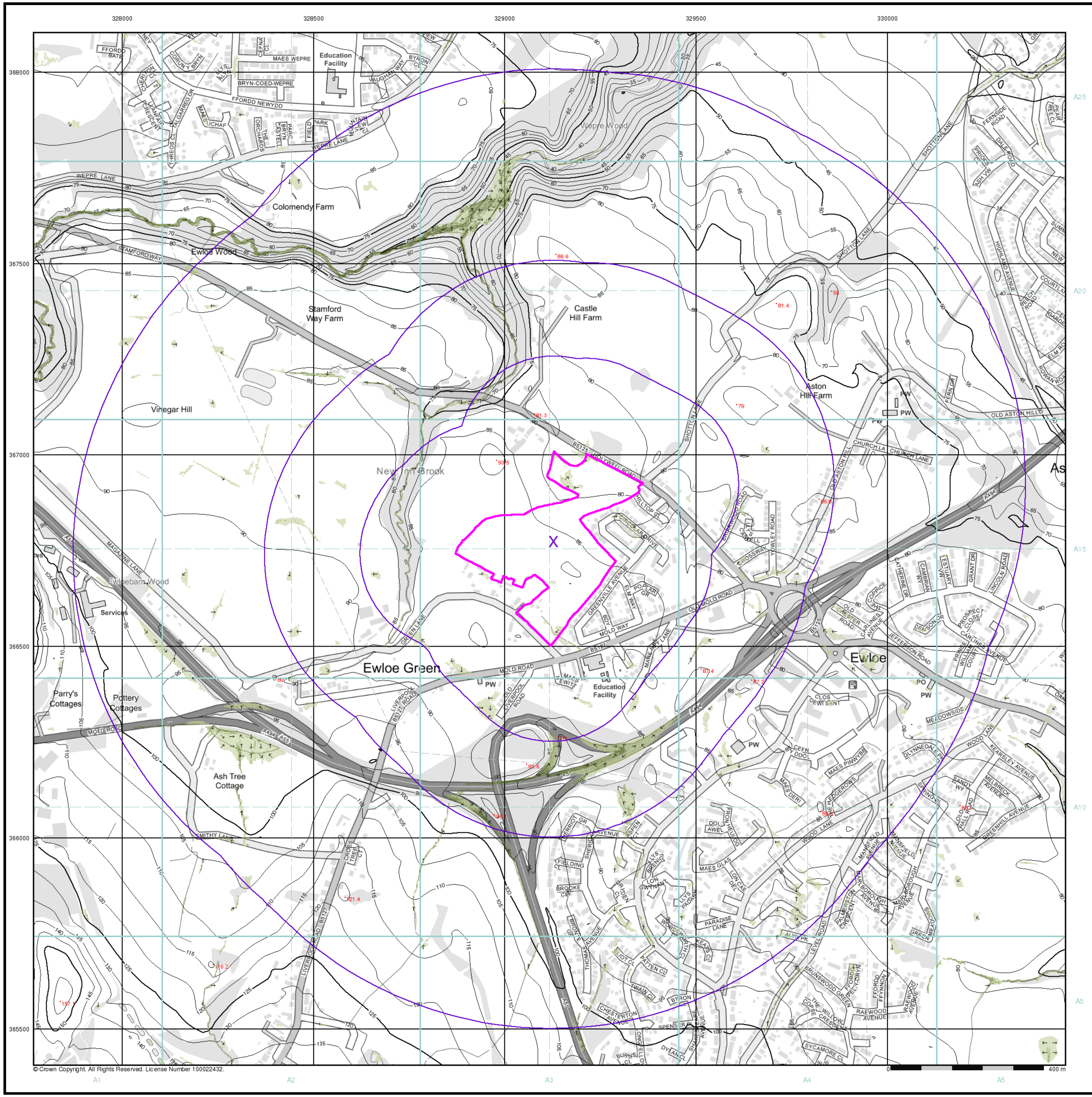
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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





# 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)

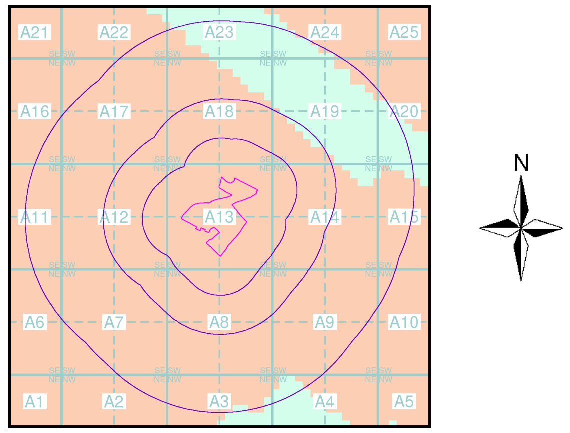
- Standard Contour
- Master Contour
- Spot Height 167.8
- MLW Mean Low Water
- MHW Mean High Water

### 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

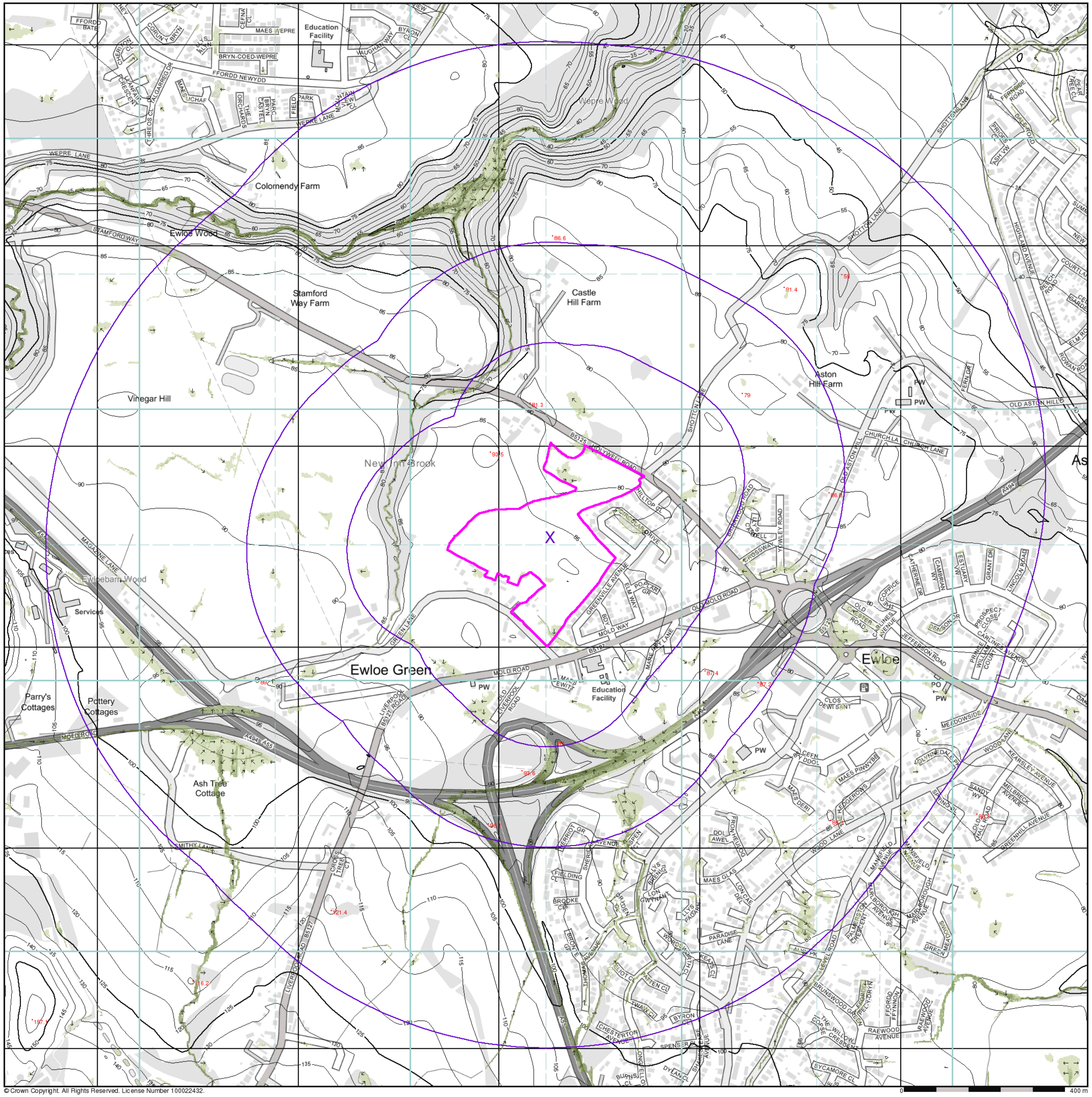
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# 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)
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)

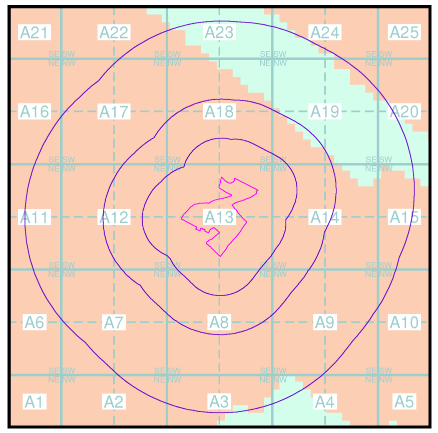
Standard Contour
Master Contour
Spot Height
MLW Mean Low Water
MHW Mean High Water

### 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

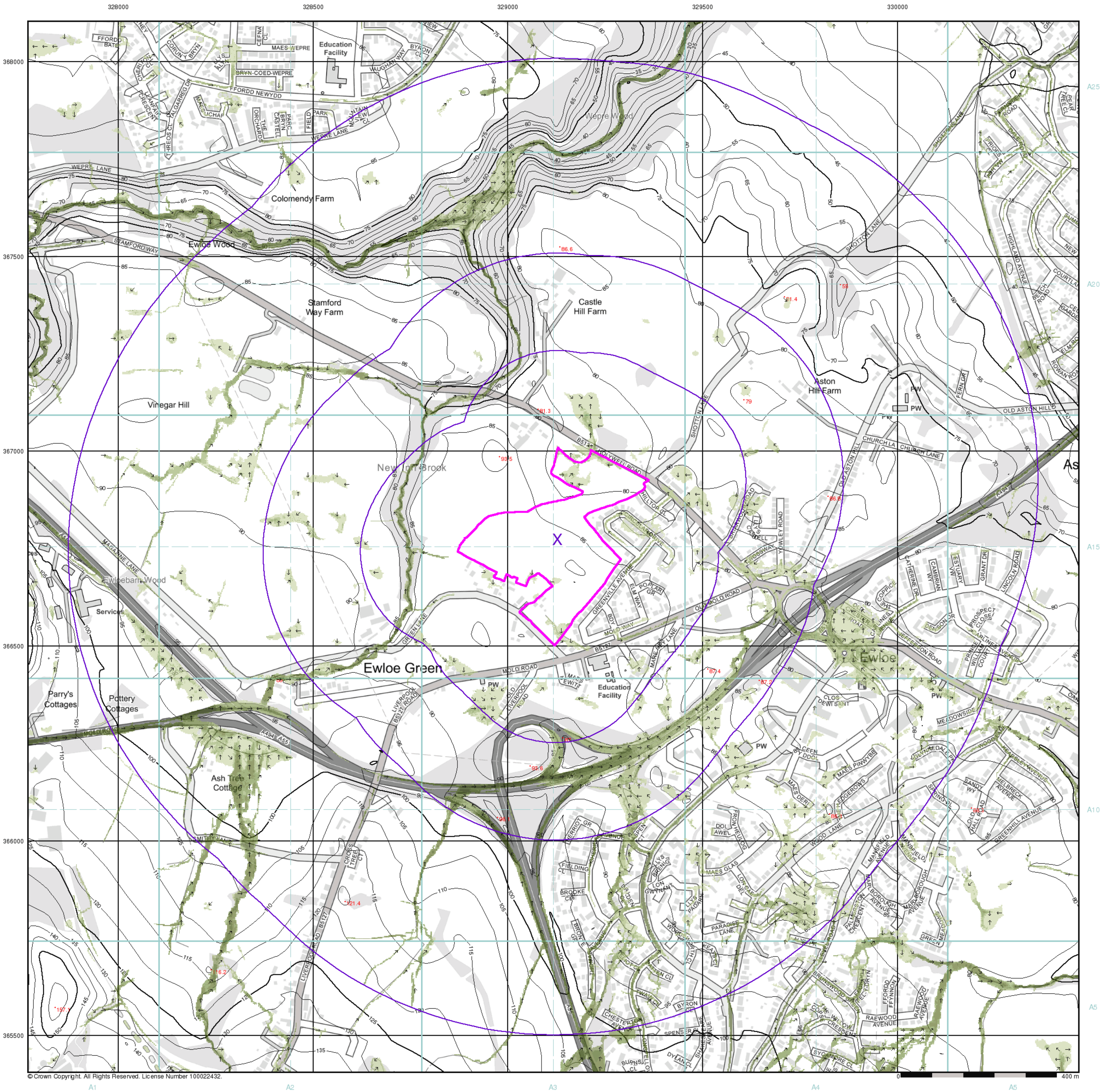
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark® INFORMATION GROUP

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






# Envirocheck®

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)

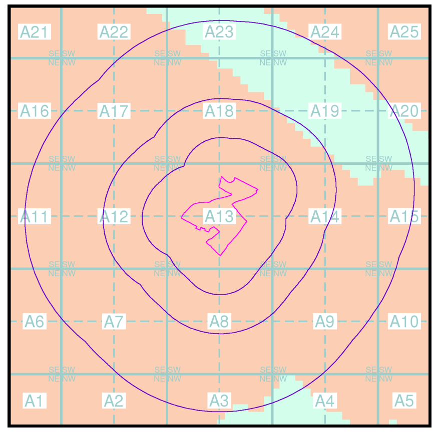
- Standard Contour
- Master Contour
- Spot Height (167.8)
- MLW Mean Low Water
- MHW Mean High Water

### 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




N

## Order Details

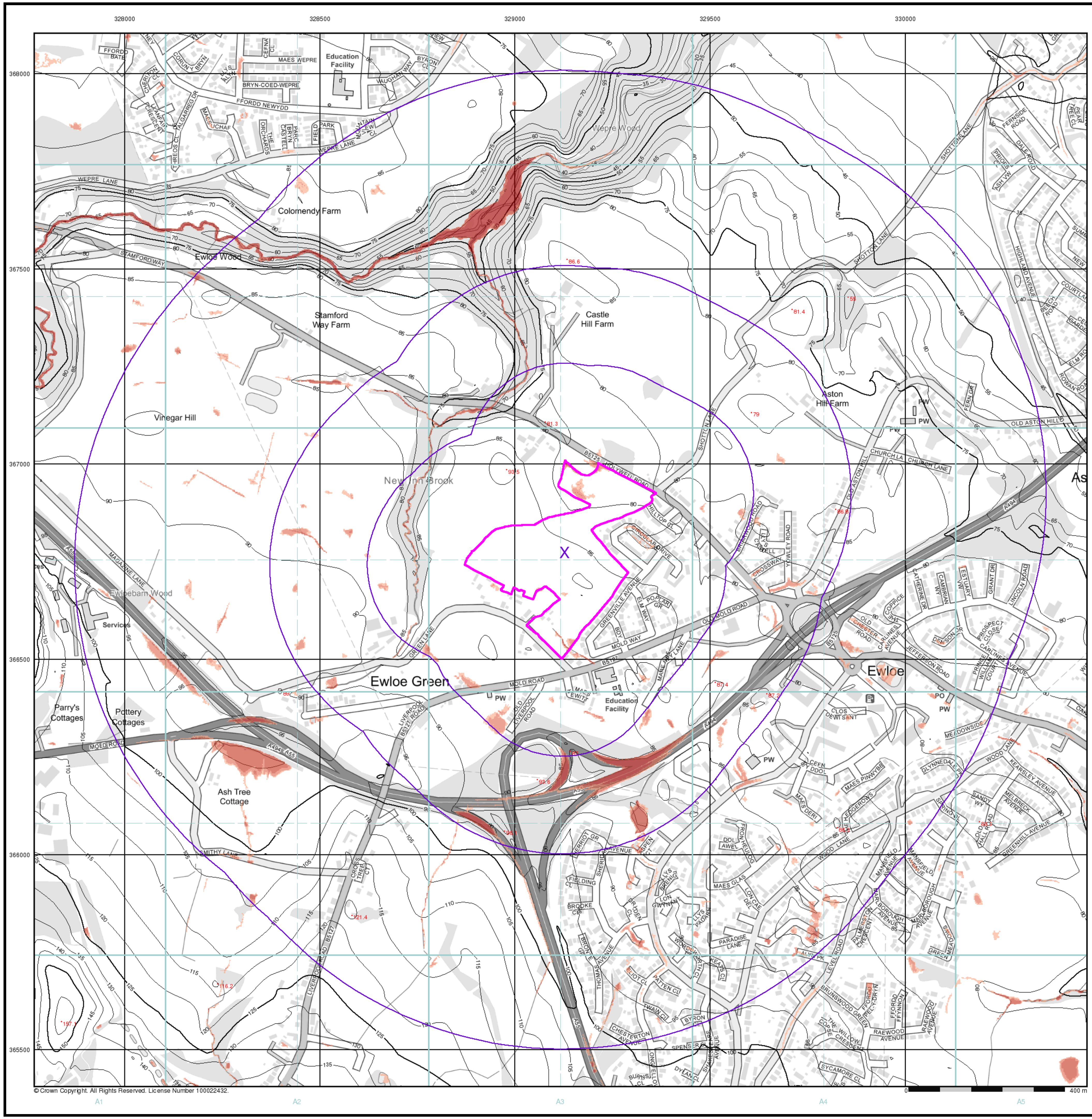
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# Envirocheck®

LANDMARK INFORMATION GROUP®

## 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)

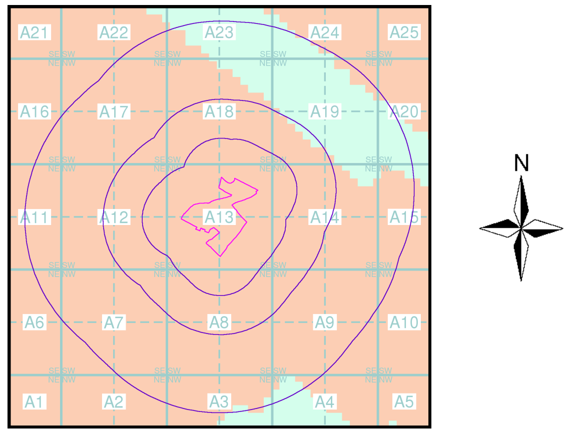
- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

### 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

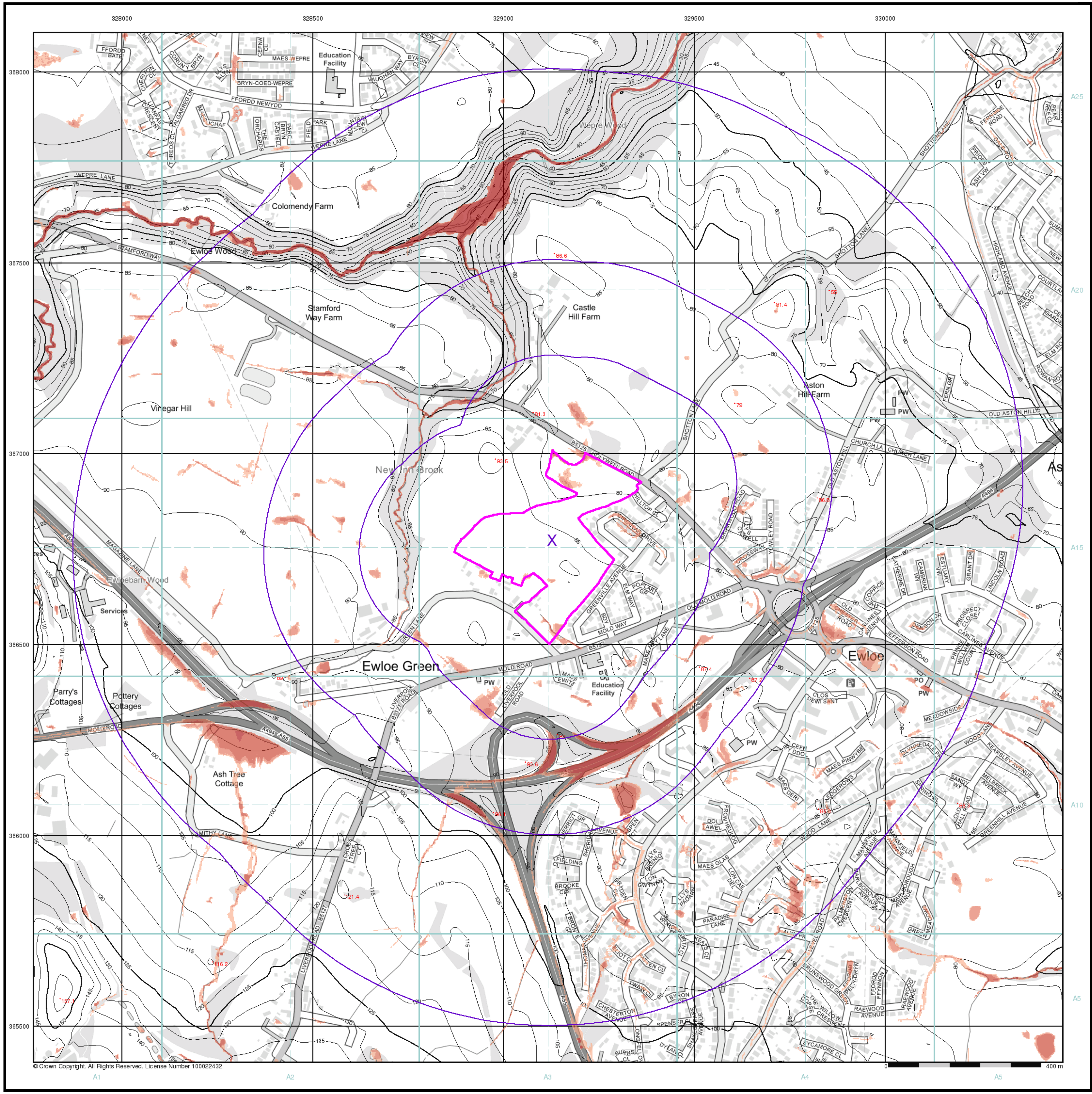
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# Envirocheck®

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)

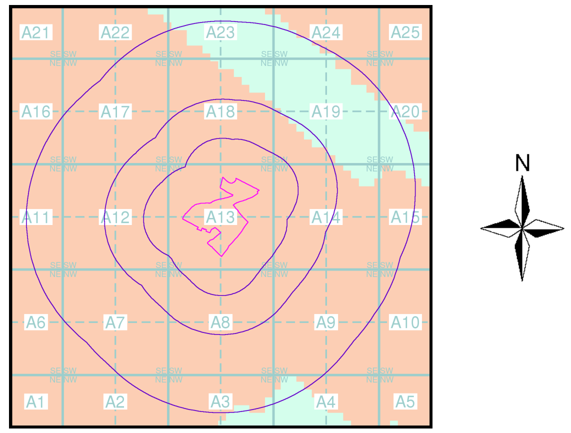
- Standard Contour
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

### 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

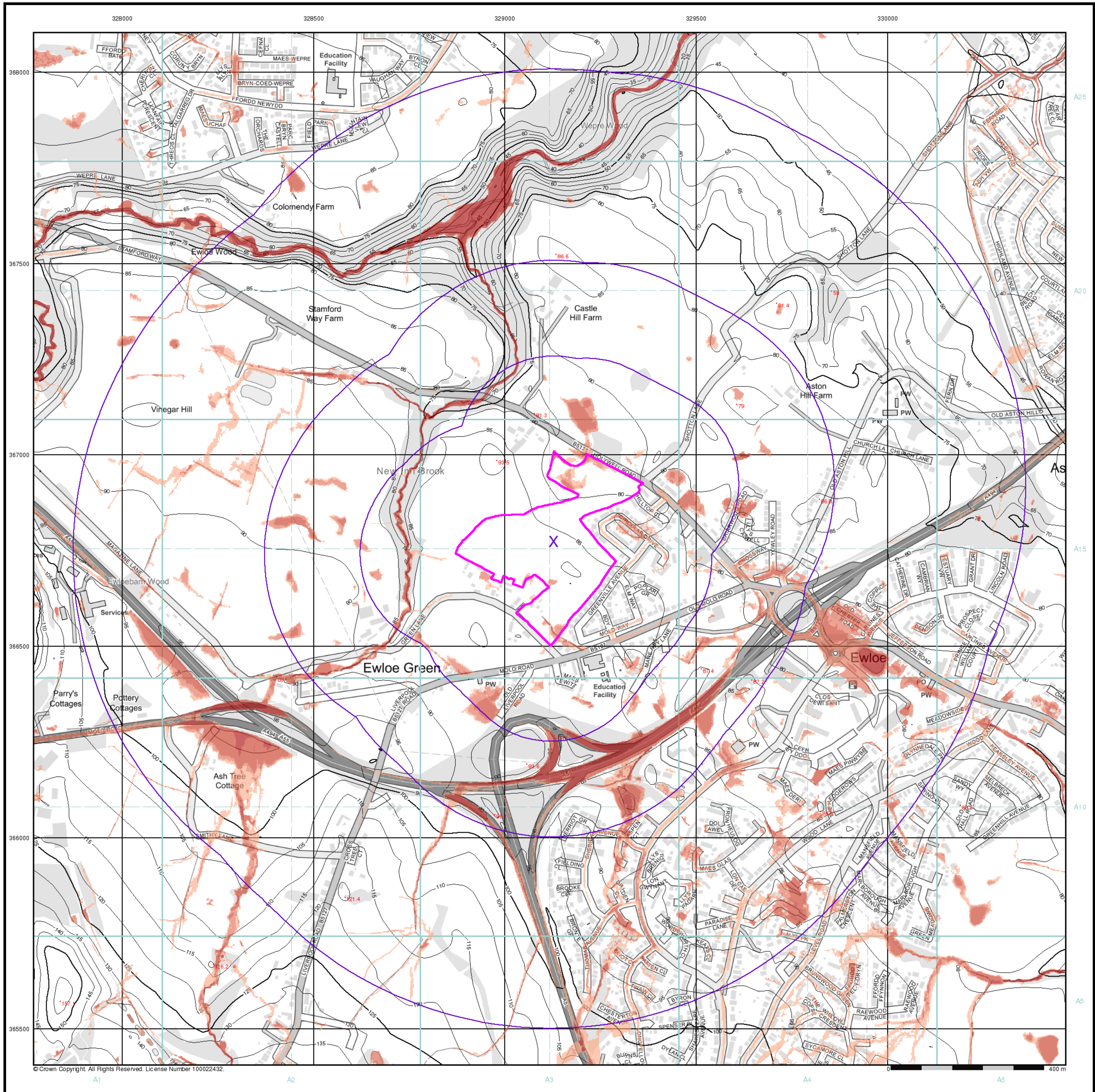
Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark® INFORMATION GROUP

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




# Envirocheck

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)

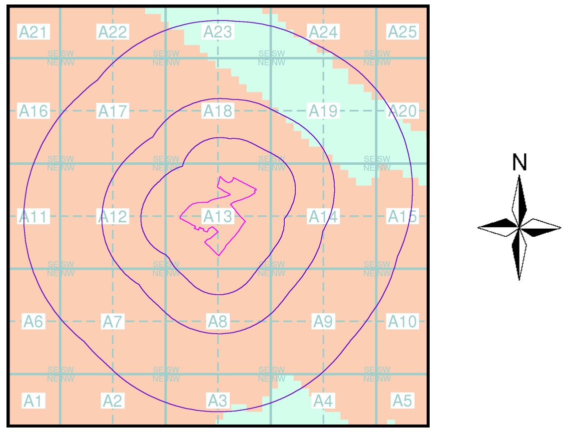
Standard Contour
Master Contour
Spot Height
Mean Low Water
Mean High Water

### 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

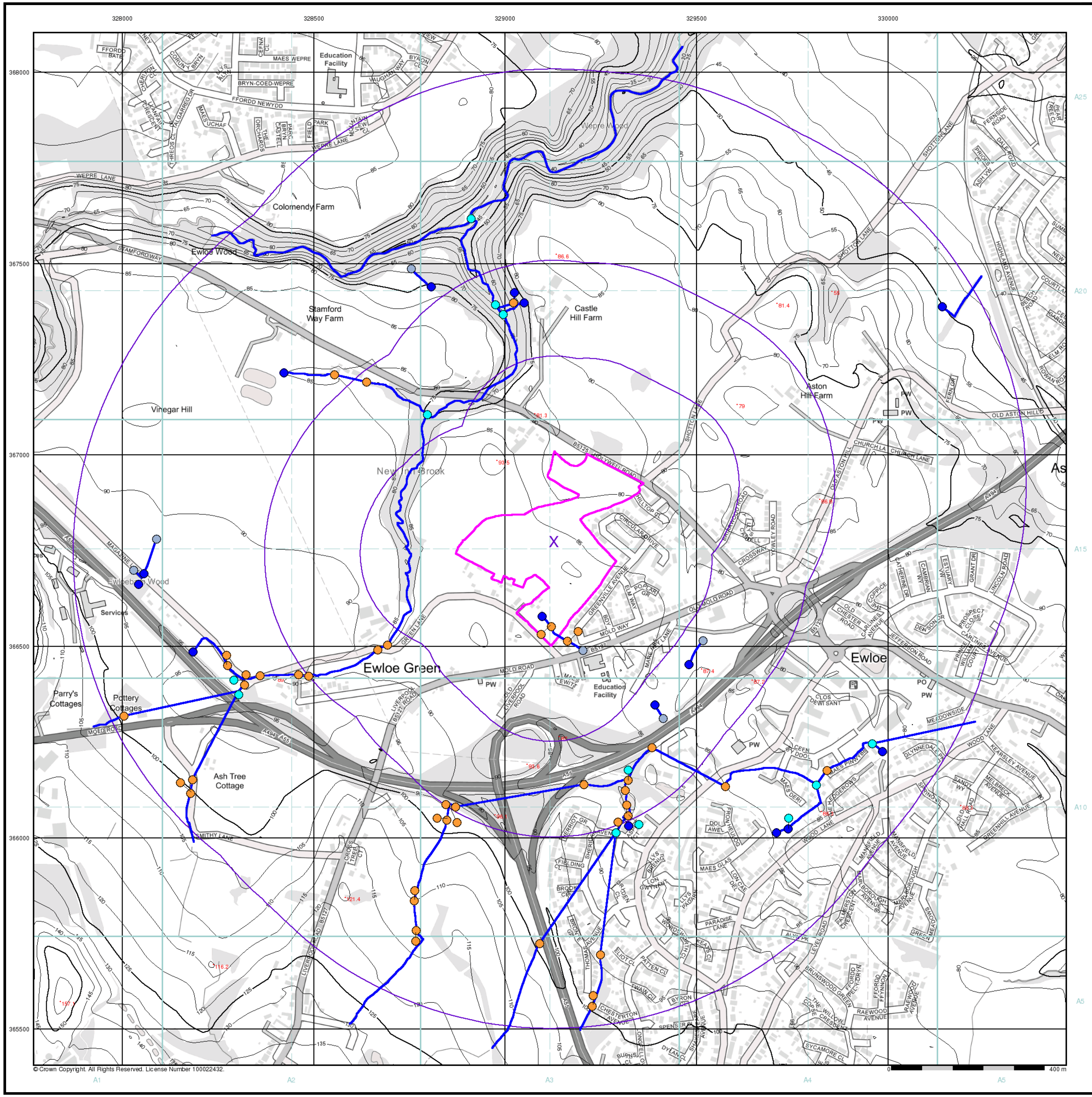
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA


Landmark INFORMATION GROUP

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





# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

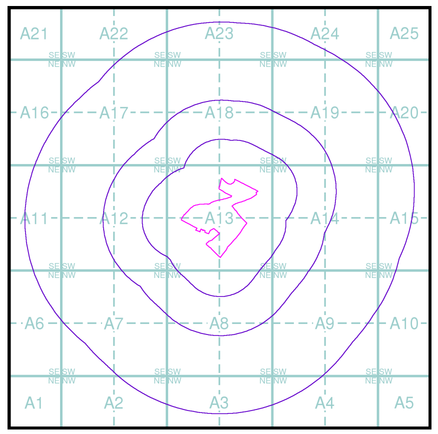
### OS Water Network Data

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

### Contours (height in meters)

- Standard Contour
- Master Contour
- Spot Height
- Mean Low Water
- Mean High Water

## OS Water Network Map - Slice A




N

## Order Details

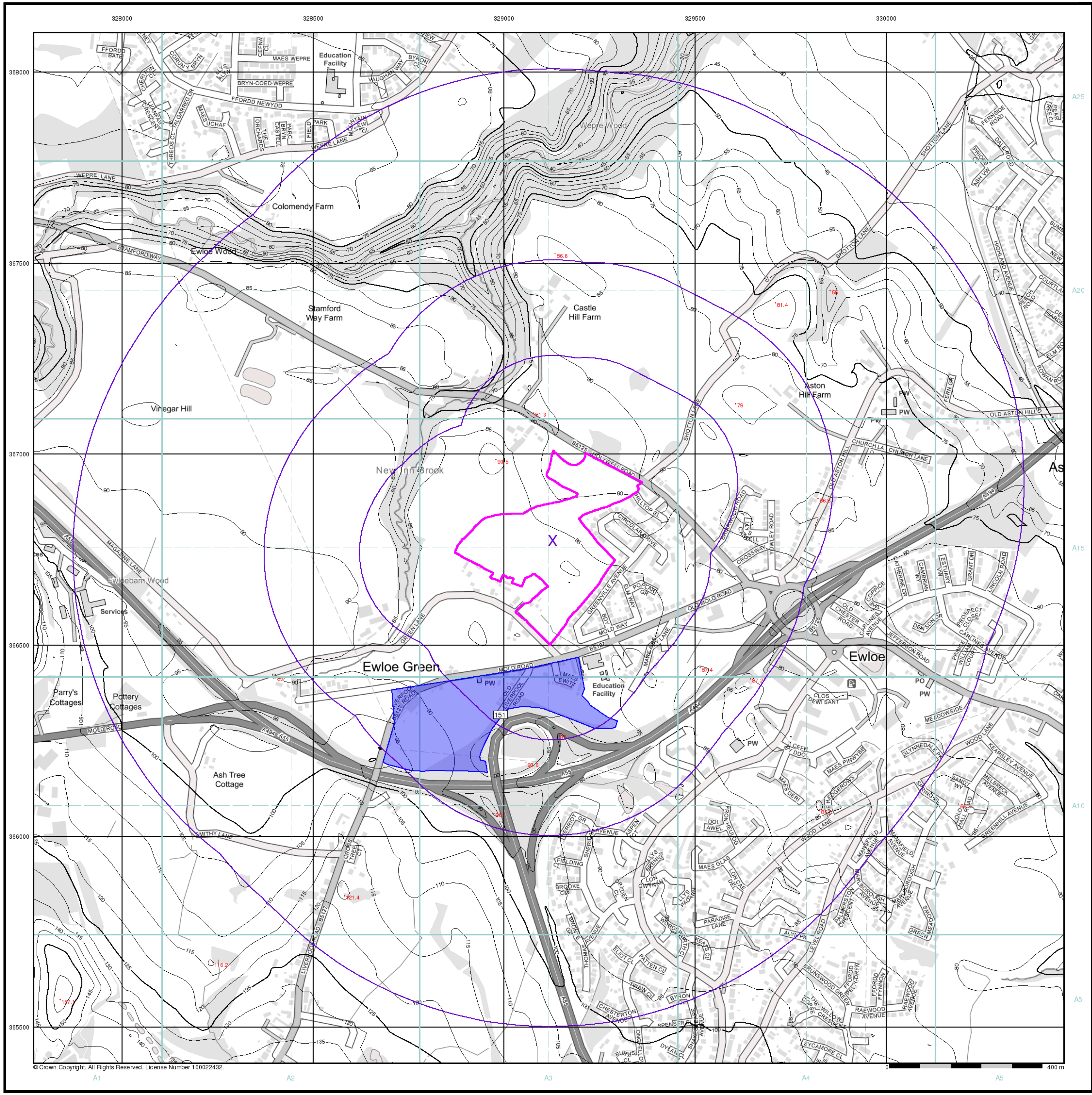
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

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

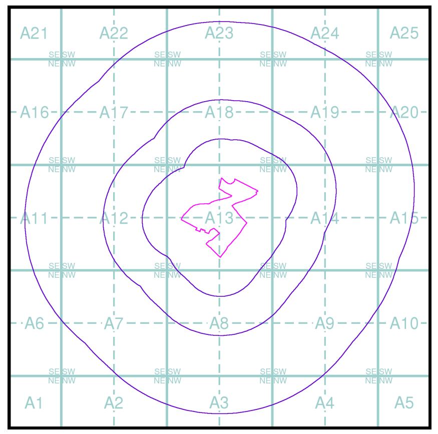
### Historic Flood Events Data

- 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
- Master Contour
- Spot Height
- MLW Mean Low Water
- MHW Mean High Water

## EA/NRW Historic Flood Map - Slice A




N

## Order Details

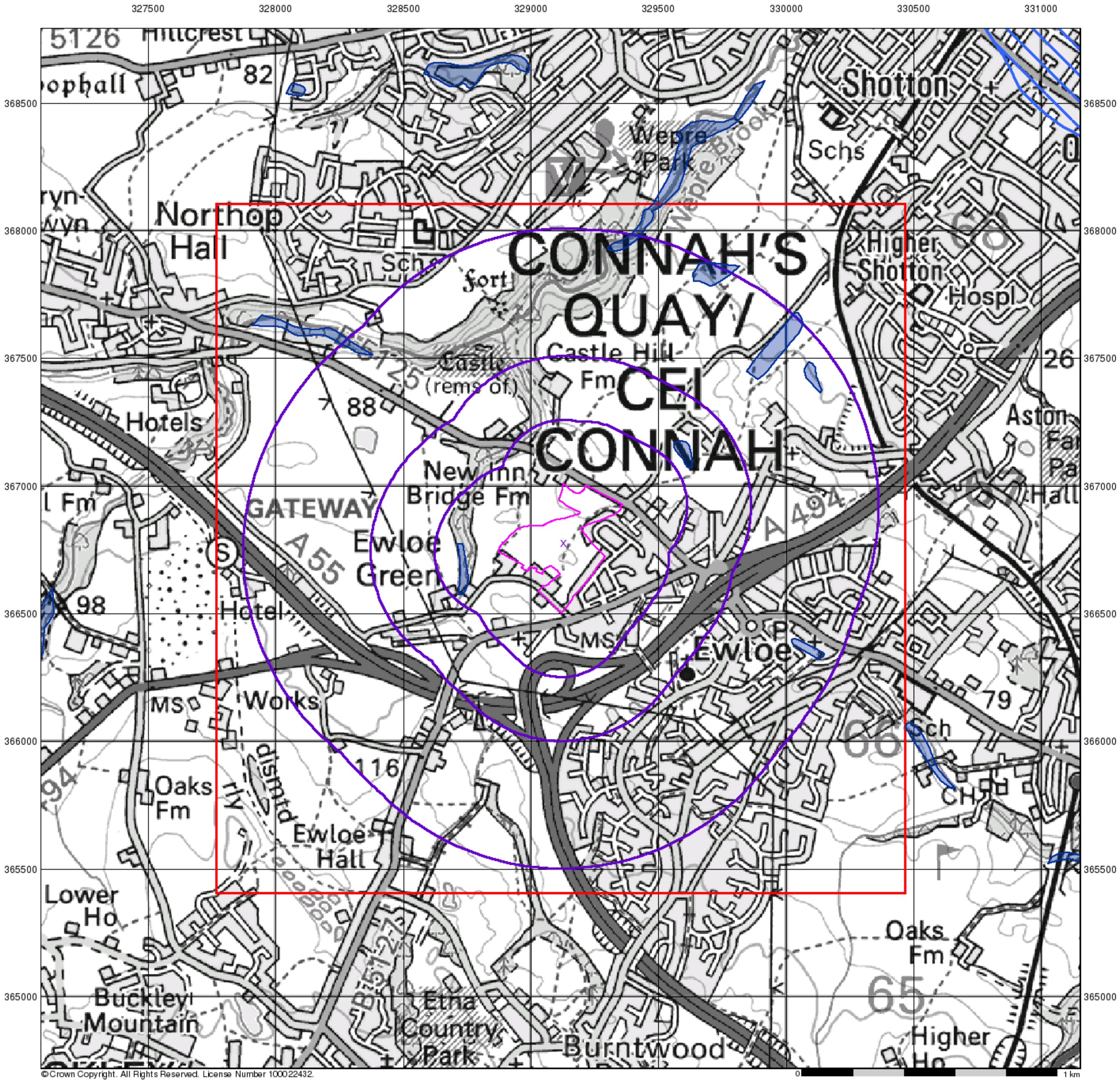
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark INFORMATION GROUP

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




# Envirocheck®

LANDMARK INFORMATION GROUP®

## BGS Flood Data (1:50,000)

### General

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

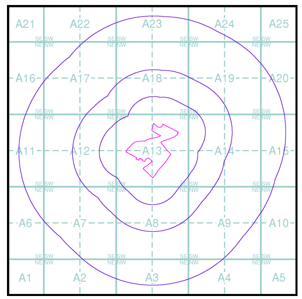
### BGS Geological Indicators of Flooding

Coastal

Inland

Bodies of Water

### BGS Flood Data Map - Slice A

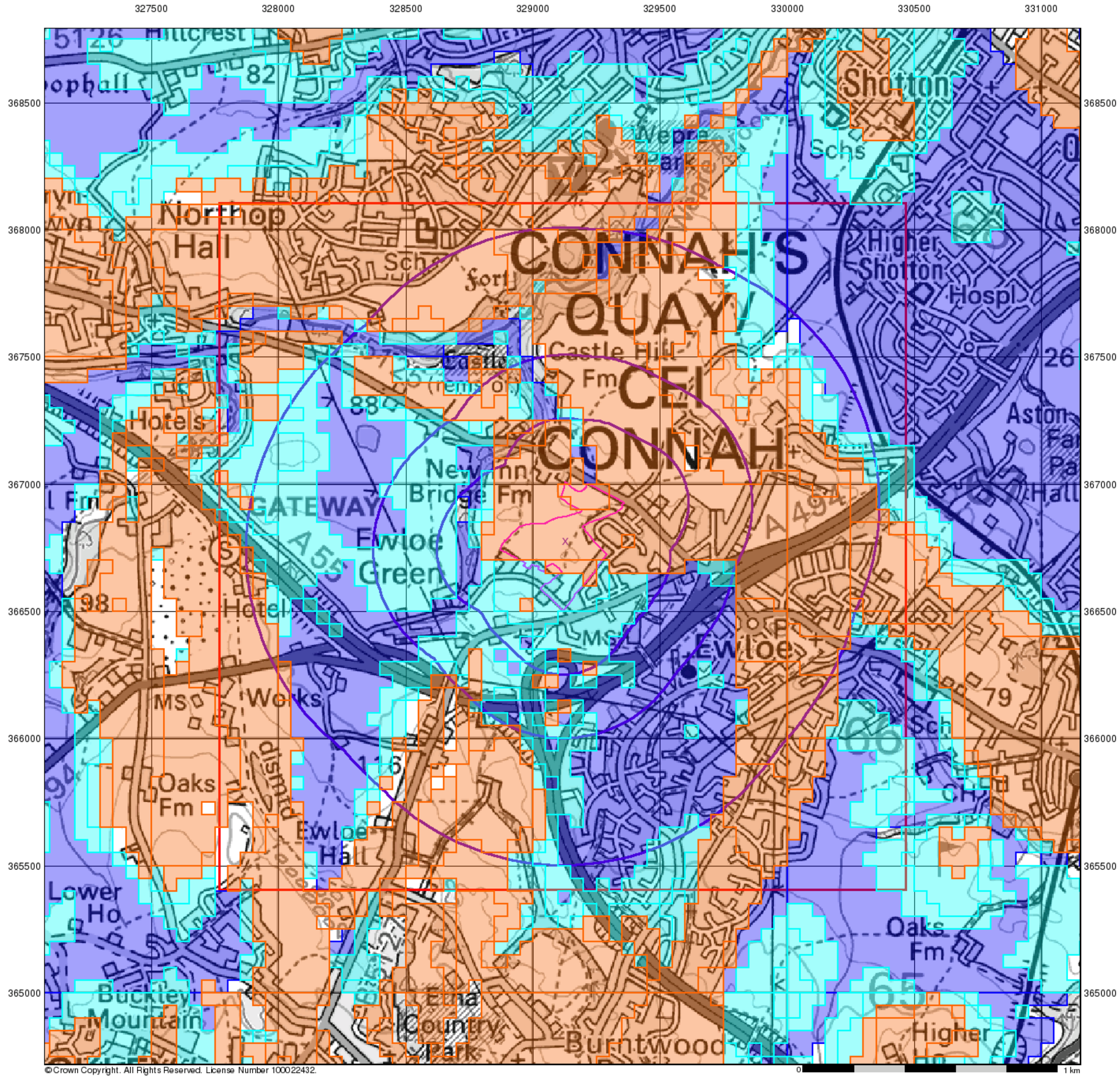



### Order Details

Order Number: 335307975_1_1
Customer Ref: 8352
National Grid Reference: 329130, 366770
Slice: A
Site Area (Ha): 10.01
Search Buffer (m): 1000

### Site Details

Gree Lane, Ewloe, CH5 3DA




# Envirocheck®

LANDMARK INFORMATION GROUP®

## BGS Flood Data (1:50,000)

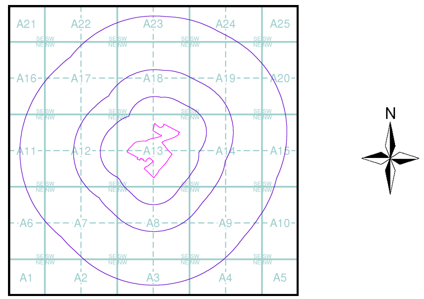
### General

- 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




### Order Details

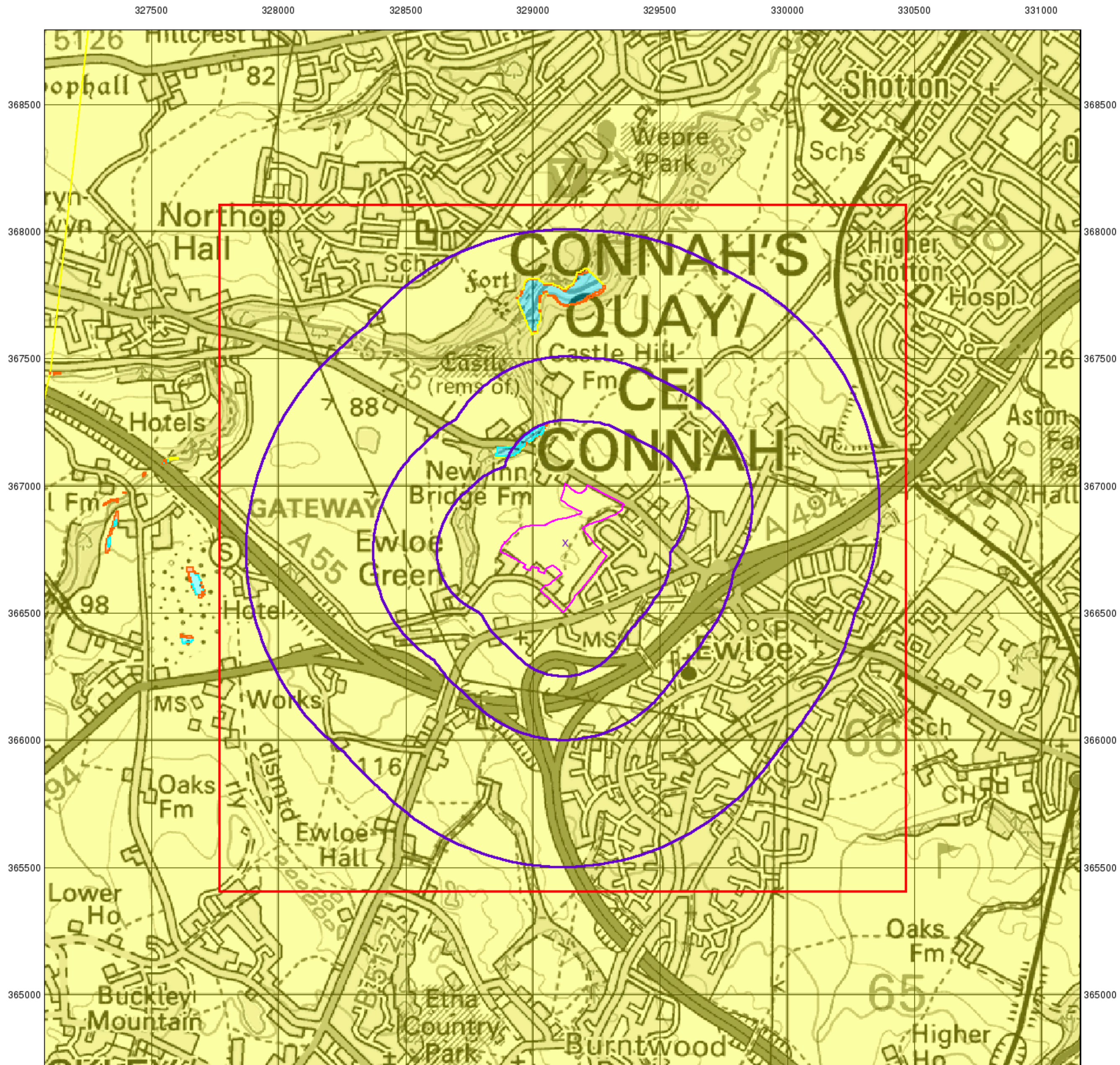
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

### Site Details

Gree Lane, Ewloe, CH5 3DA


Landmark® INFORMATION GROUP

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






0 1 km

# Envirocheck®

LANDMARK INFORMATION GROUP®

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

### General

Specified Site

Specified Buffer(s)

Bearing Reference Point

Slice

### GeoSmart Information Groundwater Flooding Risk

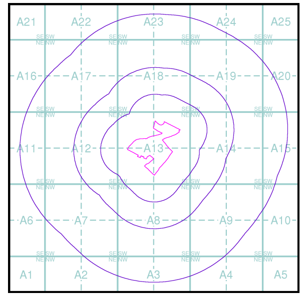
High Risk

Moderate Risk

Low Risk

Negligible Risk

## GeoSmart Information Groundwater Flood Map - Slice A




N

## Order Details

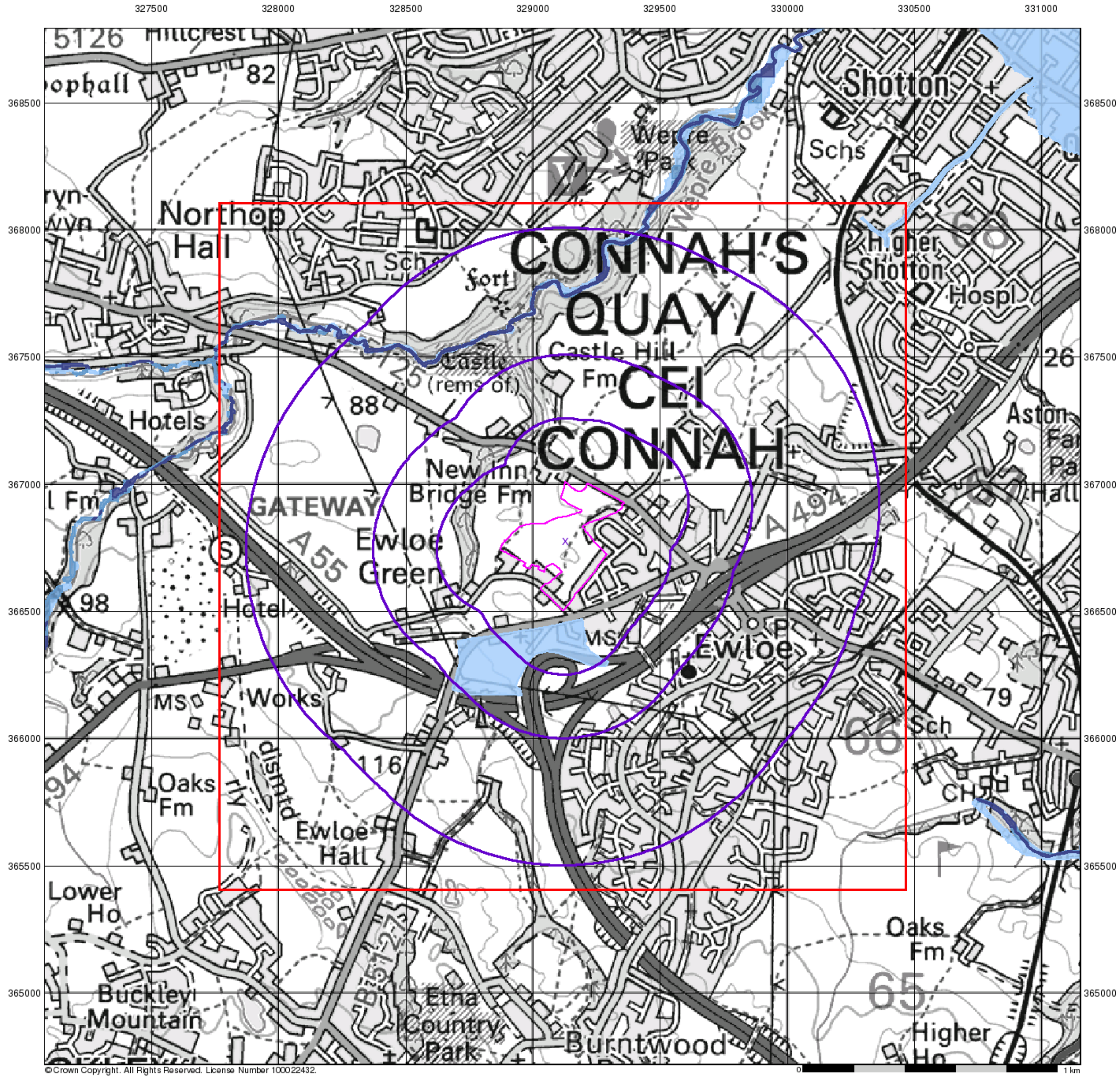
| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

## Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark® INFORMATION GROUP

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





# Envirocheck®

LANDMARK INFORMATION GROUP®

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

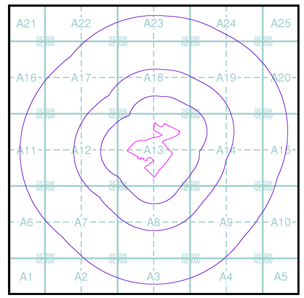
### General

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




### Order Details

| | |
|---|---|
| Order Number: | 335307975_1_1 |
| Customer Ref: | 8352 |
| National Grid Reference: | 329130, 366770 |
| Slice: | A |
| Site Area (Ha): | 10.01 |
| Search Buffer (m): | 1000 |

### Site Details

Gree Lane, Ewloe, CH5 3DA

Landmark® INFORMATION GROUP

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

**Appendix 3**

**Infiltration Consideration**

*Infiltration Testing Summary Report*

*Ref:8255ITS dated 17 January 2024*

coopers

chartered consulting engineers

# Infiltration Testing Summary

| | |
|---|---|
| Site: | Land at Green Lane, Ewloe Green |
| Client: | Castle Green Homes |
| Coopers Ref.: | 8255ITS |
| Date: | 17 January 2024. |
| By: | Ben Hill, BSc (Hons), CSci, MIEnvSc, FGS - Senior Engineering Geologist |

## Data Enclosed:

The following information is enclosed and to be read in conjunction with the infiltration summary:

- Coopers Small Diameter Borehole Logs, WS1001 to WS1009, drilled on 8 and 9 January 2024.
- Coopers Drawing No. 8255/01 – Site Plan.
- Coopers Infiltration Test Results WS1001 to WS1009, undertaken on 10 January 2024.

## Test Methodology

The proposed BRE 365 infiltration testing was not deemed possible due to the boggy surface conditions limiting access across the site for necessary equipment. Testing was undertaken within monitoring wells installed by Coopers within small diameter boreholes. These differ from falling head tests (where casing holds water and is lifted at prescribed depths to allow water to be released). Casing was not able to be driven due to shallow water within the sand, and the boreholes could only be drilled with progressive reduction in diameter with depth. Each monitoring well was installed with a geosoc and gravel surround to prevent sediment infilling of the tube. Following installation the wells were left for 1 day for groundwater to stabilise. Coopers then returned to monitor the water level prior to adding water 40 litres of water or stopping when close to the surface. The water levels were subsequently monitored with a dip meter until the additional water drained or stabilised.

## Calculation of Infiltration Rates

The infiltration rates were calculated based upon the time taken for water to drain between a 25% and 75% of the total water volume, through a calculated area of surrounding soil, following the same method used for BRE 365 infiltration tests.

The volume of water was calculated for each 1m depth, based upon volume of the 50mm diameter pipe (open), the diameter of the surrounding borehole (minus the volume of the pipe), and multiplied by 0.3 (to account for stone filled gravel). The surface area was calculated was based the surrounding soil and where the borehole was dry included the base sections. The concentric diameters of the boreholes were 0-1m = 102mm, 1-2m = 87mm, 2-3m = 77mm, 3-4m 67mm, 4-4.45m (SPT) = 62mm.

Infiltration Testing Summary

Example Water Volumes and Areas:

*Table1: Borehole water volumes ($d\pi r^2$) if filled from surface with no water table ($d2\pi r$), all units in m, $m^2$ or $m^3$.*

| | | | |
|---|---|---|---|
| 0-1m | Pipe vol. | 1 x π x $0.025^2$ | 0.001963 $m^3$ |
| | Surround vol. | (1x (1 x π x $0.051^2$) – (1 x π x $0.025^2$)) x 0.3 | 0.001862 $m^3$ |
| | Surface area (side) | 1 x 2 x π x 0.051 | 0.320442 $m^2$ |
| 1-2m | Pipe vol. | 1 x π x $0.025^2$ | 0.001963 $m^3$ |
| | Surround vol. | (1x (1 x π x $0.0435^2$) – (1 x π x $0.025^2$)) x 0.3 | 0.001194 $m^3$ |
| | Surface area (side) | 1 x 2 x π x 0.0435 | 0.2722319 $m^2$ |
| 2-3m | Pipe vol. | 1 x π x $0.025^2$ | 0.001963 $m^3$ |
| | Surround vol. | (1x (1 x π x $0.0385^2$) – (1 x π x $0.025^2$)) x 0.3 | 0.000808 $m^3$ |
| | Surface area (side) | 1 x 2 x π x 0.0385 | 0.241903 $m^2$ |
| 3-4m | Pipe vol. | 1 x π x $0.025^2$ | 0.001963 $m^3$ |
| | Surround vol. | (1x (1 x π x $0.0335^2$) – (1 x π x $0.025^2$)) x 0.3 | 0.000469 $m^3$ |
| | Surface area (side) | 1 x 2 x π x 0.0335 | 0.210487 $m^2$ |
| 4-4.45m | Pipe vol. | None | 0 $m^3$ |
| | Surround vol. | 0.45 x π x $0.031^2$ | 0.001359 $m^3$ |
| | Surface area (side) | 0.45 x 2 x π x 0.031 | 0.08765 $m^2$ |
| | | TOTAL Water Volume | 0.013544$m^3$ |
| | | TOTAL Surface Area | 1.133531 $m^2$ |

The volume at 25% loss of water ($v_{25}$) is calculated at 0.75 x 0.013544 = 0.010158 $m^3$
The volume at 75% loss of water ($v_{75}$) is calculated at 0.25 x 0.013544 = 0.003386 $m^3$

The depths of 25% loss of volume ($d_{25}$) and 75% loss of water ($d_{75}$) is calculated based upon straight line calculations (Pythagoras theorem), using the cumulative volume of water at given depths relative to $v_{25}$ and $v_{75}$.

*Table 2: Cumulative Water Volumes with Depth.*

| Depth | | Cumulative Volume | | |
|---|---|---|---|---|
| 0m | $d_0$ | 0.001963 + 0.001862 + 0.009719 | 0.013544 $m^3$ | $v_0$ |
| 1m | $d_1$ | 0.001963 + 0.001194 + 0.006562 | 0.009719 $m^3$ | $v_1$ |
| 2m | $d_2$ | 0.001963 + 0.000808 + 0.003791 | 0.006562 $m^3$ | $v_2$ |
| 3m | $d_3$ | 0.001963 + 0.000469 + 0.001359 | 0.003791 $m^3$ | $v_3$ |
| 4m | $d_4$ | 0.001359 $m^3$ | 0.001359 $m^3$ | $v_4$ |

$v_{25}$ is between $v_0$ and $v_1$, thus:
$d_{25} = d_1 + ((v_{25}-v_1)/(v_0-v_1)) \times (d_0-d_1) = 1 + ((0.010158-0.009719))/(0.013544-0.009719) \times (0-1) = 0.885m$

$v_{75}$ is between $v_3$ and $v_4$, thus:
$d_{75} = d_4 + ((v_{75}-v_4)/(v_3-v_4)) \times (d_3-d_4) = 4 + ((0.003386-0.001359))/(0.003791-0.001359) \times (3-4) = 3.167m$

Infiltration Testing Summary

The soil infiltration rate in m/sec is calculated based upon the time taken for the volume of water (termed free volume) to drain between $d_{25}$ and $d_{75}$, through the calculated surface area between $d_{25}$ and $d_{75}$. Where infiltration rates do not achieve the 75% empty the lines are projected based upon an average of a straight line from the final 3 No. readings (using Pythagoras).

The free volume for the worked example is $v_{25}$ - $v_{75}$ = 0.010158 - 0.003386 = 0.006772$m^3$

The calculated surface area for the worked example is as follows:

*Table 3: Calculated surface area of test depths.*

| Depth | Calculation | Total |
|---|---|---|
| 0.885-1m | 0.115 x 0.320442 | 0.03685083 $m^2$ |
| 1-2m | 1 x 0.2722319 | 0.2722319 $m^2$ |
| 2-3m | 1 x 0.241903 | 0.241903 $m^2$ |
| 3-3.167m | 0.167 x 0.210487 | 0.035151329 $m^2$ |
| Surface area from $D_{25}$ to $D_{75}$ | | 0.586137059 $m^2$ |

The soil infiltration rate in m/sec is based upon:

- Free Volume (m3) / (surface area (m2) x time of outflow between $d_{25}$ and $d_{75}$ (sec))

For the worked example a 600 second time of outflow is used:

- 0.006772 / (0.586137059 x 600) = 0.000019256 (1.9256E-05) m/s

**Test Results**

The following discussions of the test results consider the results in the context of the strata encountered and the groundwater conditions. The results showed the site as a whole had highly variable rates, reflective of changes in the drift geology and areas of variable perched shallow groundwater. It is considered likely that the rates achieved would be better than achieved within BRE365 test pits, as these saturated the ground around the pits via repeat testing. Where the borehole testing is showing unsuitable rates for design, it is unlikely that full BRE 365 testing would improve, although the inverse is not true.

Should proposals for traditional soakaways for surface water drainage be considered BRE365 compliant testing would need to be targeted towards shallow permeable strata, and areas with sufficient clearance relative to ground water.

**Infiltration Test Hole WS1001:** drilled through a fine to coarse sand from below topsoil at 0.3m to >4m. The calculated infiltration rates of 1.33E-05 m/sec was applicable to the ground between 1.125m to 2.643m. The 4m installation was dipped prior to filling which identified sediment at 3.52m, indicative of up flow of sediment from the base (potentially running sand), but no water present at the base. The water drained significantly slower below 2.5m and effectively ceased to drain below 3.38m, commonly caused by perched waters below this depth.

Infiltration Testing Summary

**Infiltration Test Hole WS1002:** drilled through a glacial clay below topsoil at 0.6m on to a fine to coarse sand at 2.2m continuing to >4.0m The borehole log described the clay as damp at 1.1m and groundwater identified at the top of the sand at 2.2m. The 4m installation was dipped prior to water filling which identified groundwater at 2.60m. The infiltration test did not drain to the 75% effective depth within a period of 2 hours and 21 minutes, with a projected outflow used to calculate the inferred infiltration rate of 1.34E-06 m/sec of the ground between 0.947m to 2.041m.

**Infiltration Test Hole WS1003**: drilled through a glacial clay below topsoil at 0.5m on to a fine to coarse sand at 2.2m continuing to >4.0m The borehole log described the clay as damp at 1.6m and groundwater identified at the top of the sand at 2.2m. The 4m installation was dipped prior to water filling which identified groundwater at 0.94m. The soil infiltration rate of 1.61E-05 m/sec was applied to a narrow band above the water table between 0.685m and 0.855m.

**Infiltration Test Hole WS1004:** drilled through a fine to coarse sand below topsoil at 0.3m on to a sand and gravel at 2.0m, continuing to >4.0m. The borehole log described groundwater at 2.1m. The 4m installation was dipped prior to water filling which identified the well to be dry. 40 litres of water were poured into the monitoring well which drained faster than the inflow of water, indicative that the sands and gravels in dry conditions had high infiltration rates. A BRE 365 compliant infiltration test pit would be required to determine the infiltration rates.

**Infiltration Test Hole WS1005**: drilled through a fine to coarse sand below topsoil at 0.4m, continuing to >4.0m. Occasional bands of gravel were identified between 1.8m to 3.0m and pockets of clayey sand between 3.0m and 4.0m. The borehole log described groundwater at 2.1m. The 4m installation was dipped prior to water filling which identified groundwater at 1.75m. The soil infiltration rate of 1.32E-04 m/sec was applied to a narrow band above the water table between 0.707m and 1.378m, with significantly slower infiltration below 1.5m.

**Infiltration Test Hole WS1006**: drilled through a glacial clay below topsoil at 0.5m on to a fine to coarse sand at 1.8m, continuing to >4.0m. The borehole log described a groundwater seepage at 1.4m and groundwater at 3.2m. The 4m installation was dipped prior to water filling which identified the well to be dry. The infiltration test did not drain to the 75% effective depth within a period of 4 hours and 34 minutes, with a projected outflow used to calculate the inferred infiltration rate of 4.87E-07 m/sec of the ground between 1.32m to 3.38m.

**Infiltration Test Hole WS1007**: drilled through a glacial clay below topsoil at 0.4m on to a fine to coarse sand at 1.1m, continuing to >4.0m. The borehole log described the recovered soil samples as damp at 1.1m and identified groundwater at 2.4m during drilling. The borehole log referenced the side walls collapsed below 3m during drilling, limiting the installation to 3m. The installation was dipped prior to water filling which identified groundwater at 2.2m. The soil infiltration rate of 1.35E-04 m/sec was applied to a narrow band above the water table between 0.791m and 1.71m, although negligible drainage rates were evident below 2m, nearing the water table.

**Infiltration Test Hole WS1008**: drilled through a fine to coarse sand below topsoil at 0.3m on to a sand and gravel at 2.2m, continuing to >4m. The borehole log described groundwater at 2.5m during drilling. The installation was dipped prior to water filling which identified groundwater at 2.48m. 40 litres of water were added however the water levels did not rise above 1.23m at which point the monitoring commenced. The soil infiltration rate of 6.74E-05 m/sec was applied to a narrow band 1.528m and 2.141m , with negligible rates below 2.45m, close to the water table.

**Infiltration Test Hole WS1009**: drilled through a glacial clay below topsoil at 0.3m onto a fine to coarse sand at 1.4m, continuing to 4.0m. The borehole log described groundwater at 2.2m during drilling. Upon arrival to commence testing groundwater was at surface and unable to be tested.

**Conclusions and Recommendations**

The infiltration testing undertaken is not compliant with BRE 365 and full testing would be required for infiltration designs and assessments.

The investigation has identified areas of shallow perched groundwater and slower anticipated infiltration rates, reflective of the drift geology, where traditional soakaways would not typically be considered feasible. Parts of the site indicate the potential higher drainage rates where infiltration testing may determine soakaways are viable, however we recommend considering the heterogeneity of the drift strata and the implications of the designs.

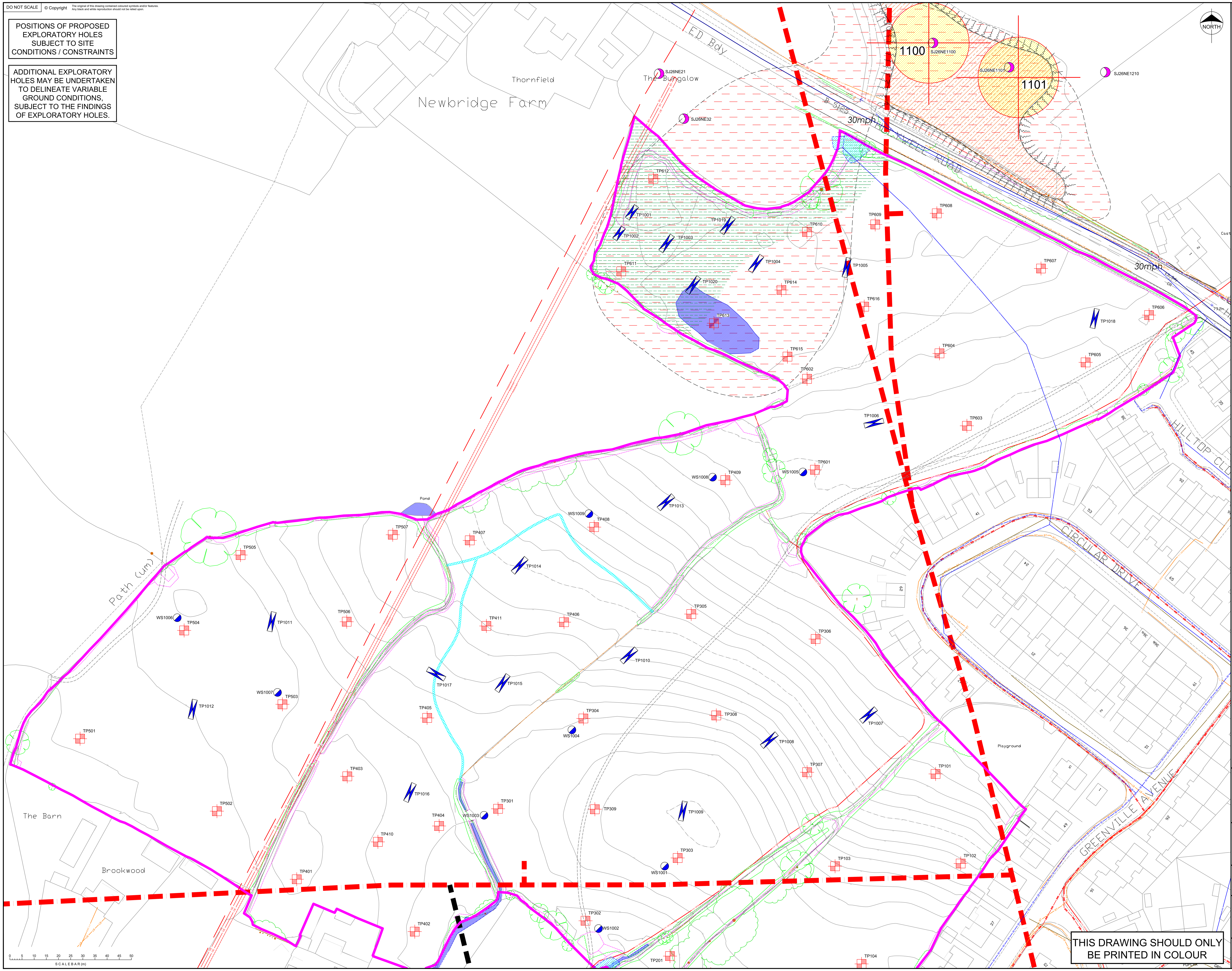
| Prepared by | Checked and Approved by |
| --- | --- |
| *B W Hill* | *P R Sykes* |
| **BSc(Hons), CSci, MIEnvSc, FGS** | **BSc(Hons), MSc (Eng), CGeol, FGS** |
| | THE GEOLOGICAL SOCIETY CGeol CHARTERED GEOLOGIST Fellow No. 17046 |

DO NOT SCALE

© Copyright

POSITIONS OF PROPOSED EXPLORATORY HOLES SUBJECT TO SITE CONDITIONS / CONSTRAINTS

ADDITIONAL EXPLORATORY HOLES MAY BE UNDERTAKEN TO DELINEATE VARIABLE GROUND CONDITIONS, SUBJECT TO THE FINDINGS OF EXPLORATORY HOLES.




NORTH

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

- Surveyed trees (taken from ref. a)
- Surveyed hedges (taken from ref. a)
- Surveyed fenceline (taken from ref. a)
- Surveyed banks (taken from ref. a)
- Surveyed pond / waterway (taken from ref. a)
- Current pond as shown on OS tile (taken from ref. a)
- Topographical contours (taken from ref. a)
- Approximate site boundary (taken from ref. a)

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

- Trial pits TP1001 - TP1020 excavated by Coopers between 08 & 09 January 2024
- Trial pits excavated by ID GeoEnvironemntal Ltd [July 2020] (taken from ref. i)
- Window sample boreholes WS1001 - WS1009 drilled for Coopers between 08 & 09 January 2024
- BGS boreholes (taken from ref. h)

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

- Former hedgeline / fenceline (taken from ref. h)
- Former pond (taken from ref. h)
- Former marsh land (taken from ref. h)
- Former path (taken from ref. h)

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

- BT lines (taken from ref. c)
- High voltage electricity lines (taken from ref. d)
- High voltage overhead electricity lines (taken from ref. d)
- Low voltage electricity lines (taken from ref. d)
- Gas lines (taken from ref. b)
- Potable water lines (taken from ref. e)
- Surface water lines (taken from ref. e)
- Foul sewer line (taken from ref. e)
- Zayo Media (taken from ref. f)

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

## KEY TO SURVEYED OVERHEAD SERVICES
(All positions are approximate unless otherwise stated)

- Surveyed overhead power lines (taken from ref. a)
- Surveyed overhead BT lines (taken from ref. a)

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

- Geological fault lines with downthrow (taken from ref. g)
- Coal seam (taken from ref. g)
- Head deposit (taken from ref. g)

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

- Mine shafts (taken from ref. g)
- Former earthworks associated with old colliery (taken from ref. h)

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

a) DWG File [Topogrpahical Survey], ref, 'Ewloe Green Site Topo Feb 2022', received by Coopers on 14 December 2023.

b) Wales & West, ref. 192855002, dated 03.July 2020.

c) BT Openreach utilities map, ref. CDG09542M, dated 19 July 2023.

d) SP Energy, map ref. 329,098 366,746, dated 20 July 2020.

e) Welsh Water, map ref. 329270,366700, dated 15 February 2019.

f) Zayo Group, ref. 30216190, dated 19 July 2023.

g) British Geological Survey, 1:10000 series, ref. SJ 26 NE, dated 28 January 1994.

h) ID GeoEnviromental, Holywell Road, Ewloe Green, Preliminary Geo-Enviromental Apraisal, ref. 5022-G-R001, dated August 2019.

i) ID GeoEnviromental, Holywell Road, Ewloe Green, Geo-Enviromental Apraisal, ref. 5022-G-R002, dated August 2020.


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


THIS DRAWING SHOULD ONLY BE PRINTED IN COLOUR

Client: Castle Green

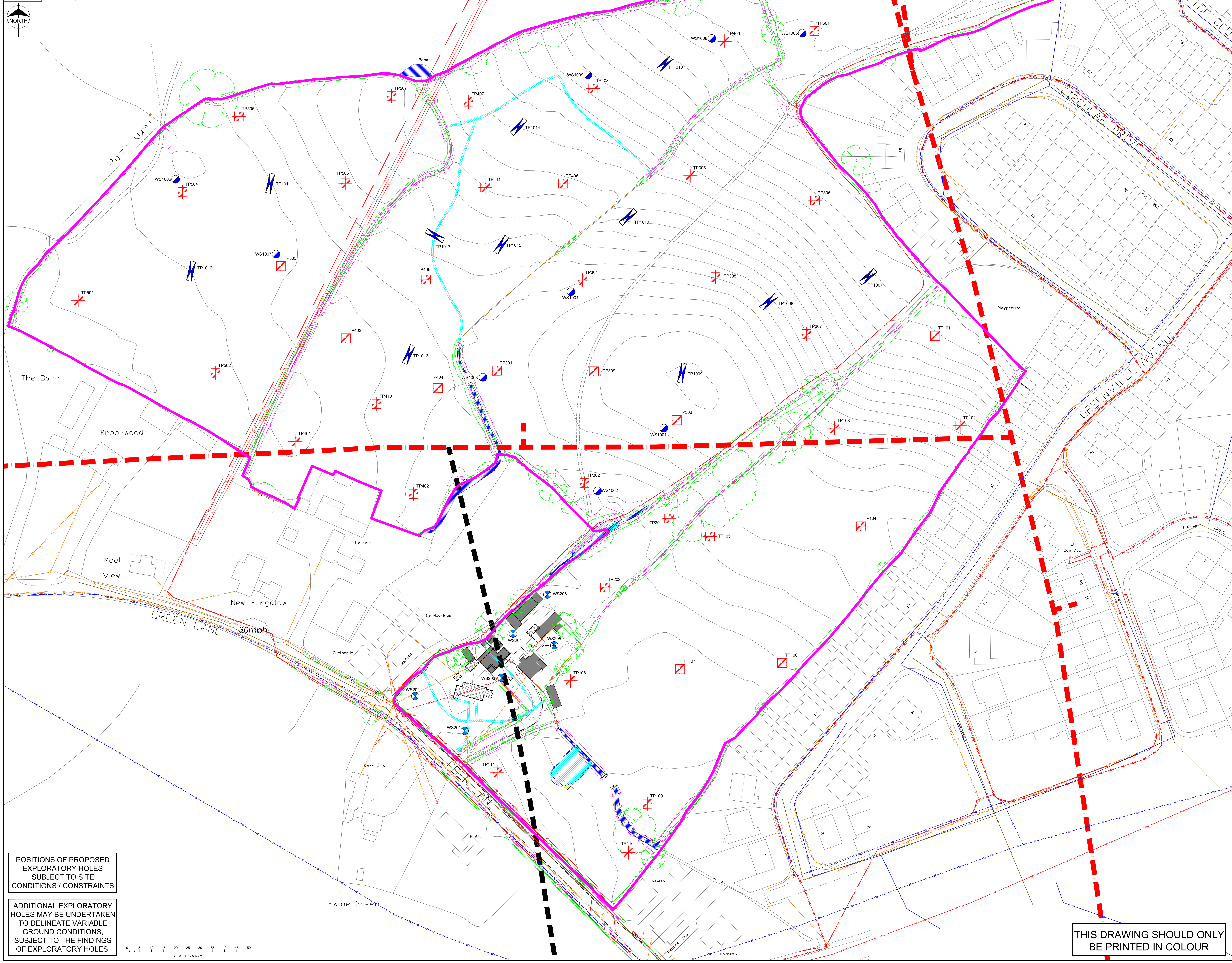
Project: Green Lane, Ewloe Green

Title: SITE PLAN
SHEET 1 OF 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | REVISION |
|---|---|---|---|
| 8255 / 01 / 1 | DATE | 17.01.24 | - |
| | DRAWN | AH / OS | |
| | CHECKED | SD | |

DO NOT SCALE






POSITIONS OF PROPOSED EXPLORATORY HOLES SUBJECT TO SITE CONDITIONS / CONSTRAINTS

ADDITIONAL EXPLORATORY HOLES MAY BE UNDERTAKEN TO DELINEATE VARIABLE GROUND CONDITIONS, SUBJECT TO THE FINDINGS OF EXPLORATORY HOLES.

THIS DRAWING SHOULD ONLY BE PRINTED IN COLOUR

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

- Surveyed trees (taken from ref. a)
- Surveyed hedges (taken from ref. a)
- Surveyed buildings (taken from ref. a)
- Surveyed fenceline (taken from ref. a)
- Surveyed banks (taken from ref. a)
- Surveyed pond / waterway (taken from ref. a)
- Pond — Current pond as shown on OS tile (taken from ref. a)
- Topographical contours (taken from ref. a)
- Approximate site boundary (taken from ref. a)

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

- Trial pits TP1001 - TP1020 excavated by Coopers between 08 & 09 January 2024
- Trial pits excavated by ID GeoEnvironemntal Ltd [July 2020] (taken from ref. i)
- Window sample boreholes by ID GeoEnvironemntal Ltd [July 2020] (taken from ref. i)

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

- Former buildings (taken from ref. h)
- Former hedgeline / fenceline (taken from ref. h)
- Former pond (taken from ref. h)
- Former path (taken from ref. h)

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

- BT — BT — BT — BT: BT lines (taken from ref. c)
- ELEC. H.V.: High voltage electricity lines (taken from ref. d)
- High voltage overhead electricity lines (taken from ref. d)
- ELEC. L.V.: Low voltage electricity lines (taken from ref. d)
- GAS — GAS — GAS: Gas lines (taken from ref. b)
- W — W — W — W: Potable water lines (taken from ref. e)
- SW: Surface water lines (taken from ref. e)
- COMBINED: Foul (combined) water (taken from ref. e)
- FW: Foul sewer line (taken from ref. e)

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

## KEY TO SURVEYED OVERHEAD SERVICES
(All positions are approximate unless otherwise stated)

- Surveyed overhead power lines (taken from ref. a)
- BT: Surveyed overhead BT lines (taken from ref. a)

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

- Geological fault lines with downthrow (taken from ref. g)
- Coal seam (taken from ref. g)

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

a) DWG File [Topogrpahical Survey], ref, 'Ewloe Green Site Topo Feb 2022', received by Coopers on 14 December 2023.
b) Wales & West, ref. 192855002, dated 03.July 2020.
c) BT Openreach utilities map, ref. CDG09542M, dated 19 July 2023.
d) SP Energy, map ref. 329,098 366,746, dated 20 July 2020.
e) Welsh Water, map ref. 329270,366700, dated 15 February 2019.
f) Zayo Group, ref. 30216190, dated 19 July 2023.
g) British Geological Survey, 1:10000 series, ref. SJ 26 NE, dated 28 January 1994.
h) ID GeoEnviromental, Holywell Road, Ewloe Green, Preliminary Geo-Enviromental Apraisal, ref. 5022-G-R001, dated August 2019.
i) ID GeoEnviromental, Holywell Road, Ewloe Green, Geo-Enviromental Apraisal, ref. 5022-G-R002, dated August 2020.

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

Client
Castle Green

Project
Green Lane, Ewloe Green

Title
SITE PLAN
SHEET 2 OF 2

| DRAWING NUMBER | SCALE at A0 | 1:500 | |
|---|---|---|---|
| 8255 / 01 / 2 | DATE | 17.01.24 | REVISION |
| | DRAWN | AH / OS | - |
| | CHECKED | SD | |

| | | | |
|---|---|---|---|
| Coopers (Chester) Ltd<br>tel: 01244 684 910<br>web: www.coopers.co.uk<br>email: admin@coopers.co.uk<br>chartered consulting engineers | **Site**<br>GREEN LANE, EWLOE GREEN | | **Number**<br>**WS1001** |
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions**<br>102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client**<br>Castle Green Homes Ltd | **Job Number**<br>8255 |
| | **Location** (Observed measurements) | **Dates**<br>08/01/2024 | **Engineer**<br>Coopers (Chester) Ltd | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.30 | B | | | | (0.30)<br>0.30 | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.30-1.00 | B | | | | | Medium dense, light brown, slightly silty, slightly gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 1.00-1.45<br>1.00-2.00 | SPT N=12<br>B | | 1,2/3,3,3,3 | | | | | |
| 2.00-2.45<br>2.00-3.00 | SPT N=12<br>B | | 1,3/3,3,3,3 | | (3.70) | | | |
| 3.00-3.45<br>3.00-4.00 | SPT N=15<br>B | | 1,2/3,4,4,4 | | | | | |
| 4.00-4.45 | SPT N=22 | | 4,4/5,5,6,6 | | 4.00 | Complete at 4.00m | | |

| | | |
|---|---|---|
| **Remarks**<br>Location CAT scanned prior to drilling. No groundwater during drilling.<br>WS location completed to undertake infiltration tests.<br>No casing used during drilling.<br>Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.<br>Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239. | **Scale (approx)**<br>1:40 | **Logged By**<br>SD |
| | **Checked By** PRS | |

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

chartered consulting engineers

| Site | Number |
|---|---|
| GREEN LANE, EWLOE GREEN | **WS1002** |

**Machine :** Archway Dart 239
**Method :** Drive-in Windowless Sampler

**Dimensions**
102mm to 1.00m 67mm to 4.00m
87mm to 2.00m
77mm to 3.00m

**Ground Level (mOD)**

**Client:** Castle Green Homes Ltd

**Job Number:** 8255

**Location** (Observed measurements)

**Dates:** 08/01/2024

**Engineer:** Coopers (Chester) Ltd

**Sheet:** 1/1

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.60 | B | | | | (0.60) | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.60-1.00<br>0.70<br>0.90<br>1.00-1.45<br>1.00-2.00<br>1.20<br>1.50<br>1.80<br>2.00-2.45 | B<br>SV 76kPa<br>SV 88kPa<br>SPT N=11<br>B<br>SV 72kPa<br>SV 54kPa<br>SV 58kPa<br>SPT N=10 | | 2,2/3,3,3,2<br>Damp(1) at 1.10m.<br>1,1/2,3,2,3 | | 0.60<br>(1.60) | Firm, high strength, orangish brown mottled grey, slightly silty, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone and occasional coal fragments.<br>From 1.10m: Clay damp, becoming firm and medium strength | | ∇1 |
| 2.20-3.00<br>3.00-3.45<br>3.00-4.00 | B<br>SPT N=19<br>B | | Groundwater(2) at 2.20m.<br>1,3/4,4,5,6 | | 2.20<br>(1.80) | Medium dense, light brown, slightly silty, slightly gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of natural stone.<br>From 3.00m - 4.00m: Occasional pockets of clay | | ∇2 |
| 4.00-4.45 | SPT N=12 | | 4,4/2,3,4,3 | | 4.00 | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Damp at 1.10m. Groundwater at 2.20m.
WS location completed to undertake infiltration tests.
No casing used during drilling.
Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |

**Checked By** PRS

| coopers chartered consulting engineers | Coopers (Chester) Ltd<br>tel: 01244 684 910<br>web: www.coopers.co.uk<br>email: admin@coopers.co.uk | Site<br>GREEN LANE, EWLOE GREEN | Number<br>**WS1003** |
|---|---|---|---|

| | | | | | |
|---|---|---|---|---|---|
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions**<br>102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | | **Client**<br>Castle Green Homes Ltd | **Job Number**<br>8255 |
| | **Location** (Observed measurements) | **Dates**<br>08/01/2024 | | **Engineer**<br>Coopers (Chester) Ltd | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.50 | B | | | | (0.50) | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| | | | | | 0.50 | | | |
| 0.50-1.00 | B | | | | | Firm, medium to high strength, orangish brown mottled grey, slightly silty, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone with occasional coal fragments. | | |
| 0.60 | SV 70kPa | | | | | | | |
| 0.80 | SV 86kPa | | | | | | | |
| 1.00-1.45 | SPT N=11 | | 2,2/3,2,3,3 | | | | | |
| 1.00-2.00 | B | | | | (1.70) | | | |
| 1.60 | SV 68kPa | | Damp(1) at 1.60m. | | | | | ∇1 |
| 1.80 | SV 68kPa | | | | | | | |
| 2.00-2.45 | SPT N=5 | | 0,0/2,1,1,1 | | | | | |
| | | | | | 2.20 | | | ∇2 |
| 2.20-3.00 | B | | Groundwater(2) at 2.20m. | | | Medium dense, light brown, slightly silty, slightly gravelly, slightly clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 3.00-3.45 | SPT N=17 | | 3,4/5,4,4,4 | | | | | |
| 3.00-4.00 | B | | | | (1.80) | | | |
| | | | | | 4.00 | Complete at 4.00m | | |
| 4.00-4.45 | SPT N=30 | | 5,5/6,6,9,9 | | | | | |

**Remarks**
Location CAT scanned prior to drilling. Damp at 1.60m. Groundwater at 2.20m.
WS location completed to undertake infiltration tests.
No casing used during drilling. Poor recovery from 3.00m - 4.00m: 30% recovery.
Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** PRS | |

| Coopers (Chester) Ltd<br>tel: 01244 684 910<br>web: www.coopers.co.uk<br>email: admin@coopers.co.uk | Site<br>GREEN LANE, EWLOE GREEN | Number<br>**WS1004** |
|---|---|---|

chartered consulting engineers

| | | | | |
|---|---|---|---|---|
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions**<br>102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client**<br>Castle Green Homes Ltd | **Job Number**<br>8255 |
| | **Location** (Observed measurements) | **Dates**<br>08/01/2024 | **Engineer**<br>Coopers (Chester) Ltd | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.30 | B | | | | (0.30)<br>0.30 | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.30-1.00 | B | | | | | Medium dense, orangish brown, slightly silty, slightly gravelly, slightly clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone and coal fragments. | | |
| 1.00-1.45<br>1.00-2.00 | SPT N=13<br>B | | 4,3/4,3,2,4 | | (1.70)<br>2.00 | From 1.00 - 2.00m: Occasional small pockets of sandy Clay. Medium dense | | |
| 2.00-2.45<br>2.00-3.00 | SPT N=12<br>B | | 1,1/3,4,3,2<br>Groundwater(1) at 2.10m. | | | Loose, brown, slightly silty, fine to coarse SAND and angular to sub-angular, fine to coarse GRAVEL. | | ∇1 |
| 3.00-3.45<br>3.00-4.00 | SPT N=8<br>B | | 3,2/1,2,2,3 | | (2.00) | From 3.00m: Loose | | |
| 4.00-4.45 | SPT N=21 | | 4,3/4,5,6,6 | | 4.00 | From 4.00m: Becoming medium dense | | |
| | | | | | | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Groundwater at 2.10m.
WS location completed to undertake infiltration tests.
Collapse following drilling from 3.00m - 4.00m.
No casing used during drilling. Poor recovery from 3.00m - 4.00m: 25% recovery. From 2.00m - 3.00m: 80% recovery.
Location installed with 3.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** | PRS |

| Coopers (Chester) Ltd tel: 01244 684 910 web: www.coopers.co.uk email: admin@coopers.co.uk | Site: GREEN LANE, EWLOE GREEN | Number: WS1005 |
|---|---|---|

chartered consulting engineers

| Machine : Archway Dart 239 | Dimensions | Ground Level (mOD) | Client | Job Number |
|---|---|---|---|---|
| Method : Drive-in Windowless Sampler | 102mm to 1.00m 67mm to 4.00m 87mm to 2.00m 77mm to 3.00m | | Castle Green Homes Ltd | 8255 |
| | **Location** (Observed measurements) | **Dates** 08/01/2024 | **Engineer** Coopers (Chester) Ltd | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.40 | B | | | | (0.40) 0.40 | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.40-1.00 | B | | | | | Medium dense, light brown, slightly silty, gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 1.00-1.45<br>1.00-2.00 | SPT N=14<br>B | | 3,4/5,3,3,3 | | | | | |
| | | | | | | From 1.50m: Occasional fragments of coal | | |
| | | | | | | From 1.80m - 3.00m: Occasional bands of gravel | | |
| 2.00-2.45<br>2.00-3.00 | SPT N=6<br>B | | 2,1/2,1,1,2<br>Groundwater(1) at 2.10m. | | (3.60) | From 2.00m - 4.00m: Loose | | ∇1 |
| 3.00-3.45<br>3.00-4.00 | SPT N=7<br>B | | 1,2/2,1,2,2 | | | From 3.00m - 4.00m: Occasional small pockets of clayey sand | | |
| 4.00-4.45 | SPT N=21 | | 4,3/4,5,6,6 | | 4.00 | From 4.00m: Medium dense | | |
| | | | | | | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Groundwater at 2.10m.
WS location completed to undertake infiltration tests.
No casing used during drilling. Collapse following drilling from 3.00m - 4.00m.
Location installed with 3.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** | PRS |

coopers
chartered consulting engineers

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

| | | | |
|---|---|---|---|
| **Site** GREEN LANE, EWLOE GREEN | | | **Number** WS1006 |
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions** 102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client** Castle Green Homes Ltd | 
| | **Location** (Observed measurements) | **Dates** 09/01/2024 | **Engineer** Coopers (Chester) Ltd |

| | |
|---|---|
| **Job Number** | 8255 |
| **Sheet** | 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.50 | B | | | | (0.50)<br>0.50 | Grass over dark brown, slightly silty, slightly gravelly, slightly clayey, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.50-1.00<br>0.60<br>0.70<br>0.90<br>1.00-1.45<br>1.00-1.80<br>1.20<br>1.50<br>1.70 | B<br>SV 66kPa<br>SV 68kPa<br>SV 72kPa<br>SPT N=11<br>B<br>SV 68kPa<br>SV 48kPa<br>SV 72kPa | | 2,3/2,3,3,3<br>Seepage(1) at 1.40m. | | (1.30)<br>1.80 | Medium strength, firm, orangish brown, slightly silty, slightly gravelly, sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone.<br>From 1.30m: Pockets of sand<br>From 1.30m - 1.50m: Softer band due to water seepage | | ∇1 |
| 2.00-2.45<br>2.00-2.70 | SPT N=13<br>B | | 2,1/2,3,4,4 | | (0.90)<br>2.70 | Medium dense, orangish brown, slightly silty, slightly gravelly, clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of natural stone. | | |
| 2.70-3.00<br>3.00-3.45<br>3.00-4.00 | B<br>SPT N=16<br>B | | 3,3/3,4,4,5<br>Groundwater(2) at 3.20m. | | (1.30)<br>4.00 | Medium dense, light brown, slightly silty, slightly gravelly, fine to coarse SAND. Gravel is angular to sub-rounded, fine to coarse of natural stone. | | ∇2 |
| 4.00-4.45 | SPT N=17 | | 0,2/4,4,4,5 | | | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Seepage at 1.40m. Groundwater at 3.20m.
WS location completed to undertake infiltration tests.
No casing used during drilling.
Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** | PRS |

| | | | |
|---|---|---|---|
| Coopers (Chester) Ltd<br>tel: 01244 684 910<br>web: www.coopers.co.uk<br>email: admin@coopers.co.uk<br>chartered consulting engineers | | **Site**<br>GREEN LANE, EWLOE GREEN | **Number**<br>**WS1007** |
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions**<br>102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client**<br>Castle Green Homes Ltd | **Job Number**<br>8255 |
| | **Location** (Observed measurements) | **Dates**<br>09/01/2024 | **Engineer**<br>Coopers (Chester) Ltd | **Sheet**<br>1/1 |

| Depth (m) | Sample / Tests | Field Records | Depth (m) (Thickness) | Description | Water |
|---|---|---|---|---|---|
| 0.00-0.40 | B | | (0.40)<br>0.40 | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | |
| 0.40-1.00 | B | | | Medium strength, orangish brown, slightly silty, gravelly, sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | |
| 0.60 | SV 52kPa | | (0.70) | From 0.60m: Shear vanes breaking up due to sand and gravel content | |
| 0.80 | SV 56kPa | | | | |
| 1.00-1.45<br>1.10-2.00 | SPT N=3<br>B | 1,1/1,1,0,1<br>Damp(1) at 1.10m. | 1.10 | Loose, orangish brown, slightly silty, slightly clayey, gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of natural stone. | ∇1 |
| 2.00-2.45<br>2.00-3.00 | SPT N=8<br>B | 2,2/1,2,2,3 | | | |
| | | Groundwater(2) at 2.40m. | (2.90) | | ∇2 |
| 3.00-3.45<br>3.00-4.00 | SPT N=12<br>B | 1,1/3,2,3,4 | | From 3.00m: Becoming medium dense | |
| 4.00-4.45 | SPT N=39 | 7,7/9,9,10,11 | 4.00 | From 4.00m: Becoming dense | |
| | | | | Complete at 4.00m | |

**Remarks**
Location CAT scanned prior to drilling. Damp at 1.10m. Groundwater at 2.40m.
WS location completed to undertake infiltration tests.
No casing used during drilling. Sands damp from 1.10m.
Location collapsed from 3.00m - 4.00m.
From 1.00m - 2.00m: 80% recovery. From 2.00m - 3.00m: 90% recovery. From 3.00m - 4.00m: 70% recovery.
Location installed with 3.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** | PRS |

coopers
chartered consulting engineers

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

| | | | | |
|---|---|---|---|---|
| **Site** GREEN LANE, EWLOE GREEN | | | | **Number** WS1008 |
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions** 102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client** Castle Green Homes Ltd | **Job Number** 8255 |
| | **Location** (Observed measurements) | **Dates** 09/01/2024 | **Engineer** Coopers (Chester) Ltd | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.30 | B | | | | (0.30) 0.30 | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.30-1.00 | B | | | | (1.00) 1.30 | Medium dense, orangish brown, slightly silty, gravelly, clayey, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 1.00-1.45 | SPT N=13 | | 2,3/3,3,3,4 | | | | | |
| 1.00-1.30 | B | | | | | | | |
| 1.30-2.00 | B | | | | (0.90) 2.20 | Medium dense, orangish brown, slightly silty, slightly gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to medium of natural stone and occasional coal fragments. | | |
| 2.00-2.45 | SPT N=11 | | 2,3/3,3,3,2 | | | | | |
| 2.20-3.00 | B | | | | (1.80) 4.00 | Medium dense, orangish brown, slightly silty, fine to coarse SAND and sub-angular to sub-rounded, fine to coarse GRAVEL of natural stone. | | ∇1 |
| | | | Groundwater(1) at 2.50m. | | | | | |
| 3.00-3.45 | SPT N=17 | | 3,4/6,4,4,3 | | | | | |
| 3.00-4.00 | B | | | | | | | |
| 4.00-4.45 | SPT N=13 | | 3,2/3,2,2,6 | | | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Groundwater at 2.50m.
WS location completed to undertake infiltration tests.
No casing used during drilling.
From 2.00m - 3.00m: 80% recovery. From 3.00m - 4.00m: 50% recovery.
Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** PRS | |

coopers chartered consulting engineers

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

| | | | | |
|---|---|---|---|---|
| **Site** GREEN LANE, EWLOE GREEN | | | | **Number** WS1009 |
| **Machine :** Archway Dart 239<br>**Method :** Drive-in Windowless Sampler | **Dimensions** 102mm to 1.00m 67mm to 4.00m<br>87mm to 2.00m<br>77mm to 3.00m | **Ground Level (mOD)** | **Client** Castle Green Homes Ltd | **Job Number** 8255 |
| | **Location** (Observed measurements) | **Dates** 09/01/2024 | **Engineer** Coopers (Chester) Ltd | **Sheet** 1/1 |

| Depth (m) | Sample / Tests | Water Depth (m) | Field Records | Level (mOD) | Depth (m) (Thickness) | Description | Legend | Water |
|---|---|---|---|---|---|---|---|---|
| 0.00-0.30 | B | | | | (0.30) | Grass over dark brown, slightly silty, slightly gravelly, sandy TOPSOIL with occasional rootlets. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.30-1.00 | B | | | | 0.30 | | | |
| 0.40 | SV 66kPa | | | | | Medium strength, orangish brown, slightly silty, gravelly, sandy CLAY. Sand is fine to coarse. Gravel is sub-angular to sub-rounded, fine to medium of natural stone. | | |
| 0.60 | SV 68kPa | | | | | | | |
| 0.80 | SV 70kPa | | | | (1.10) | | | |
| 1.00-1.45 | SPT N=11 | | 2,2/3,2,3,3 | | | | | |
| 1.00-1.40 | B | | | | | | | |
| 1.20 | SV 72kPa | | | | | | | |
| 1.40-2.00 | B | | | | 1.40 | Medium dense, orangish brown, slightly silty, slightly clayey, gravelly, fine to coarse SAND. Gravel is sub-angular to sub-rounded, fine to coarse of natural stone. | | |
| 2.00-2.45 | SPT N=11 | | 2,2/4,2,2,3 | | | | | |
| 2.00-3.00 | B | | Groundwater(1) at 2.20m. | | | | | ∇1 |
| | | | | | (2.60) | | | |
| 3.00-3.45 | SPT N=30 | | 3,4/6,7,8,9 | | | From 3.00m: Occasional bands of gravel. Becoming dense | | |
| 3.00-4.00 | B | | | | | | | |
| 4.00-4.45 | SPT N=45 | | 9,10/12,11,10,12 | | 4.00 | Complete at 4.00m | | |

**Remarks**
Location CAT scanned prior to drilling. Groundwater at 2.20m.
WS location completed to undertake infiltration tests.
No casing used during drilling.
Location installed with 4.00m of slotted pipe surrounded by gravel for infiltration tests.
From 3.00m - 4.00m: 70% recovery.
Borehole drilled by GP Drilling Contractors Ltd. SPT Energy Ratio = 62%. Rig Ref: Archway Dart 239.

| Scale (approx) | Logged By |
|---|---|
| 1:40 | SD |
| **Checked By** PRS | |

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1001

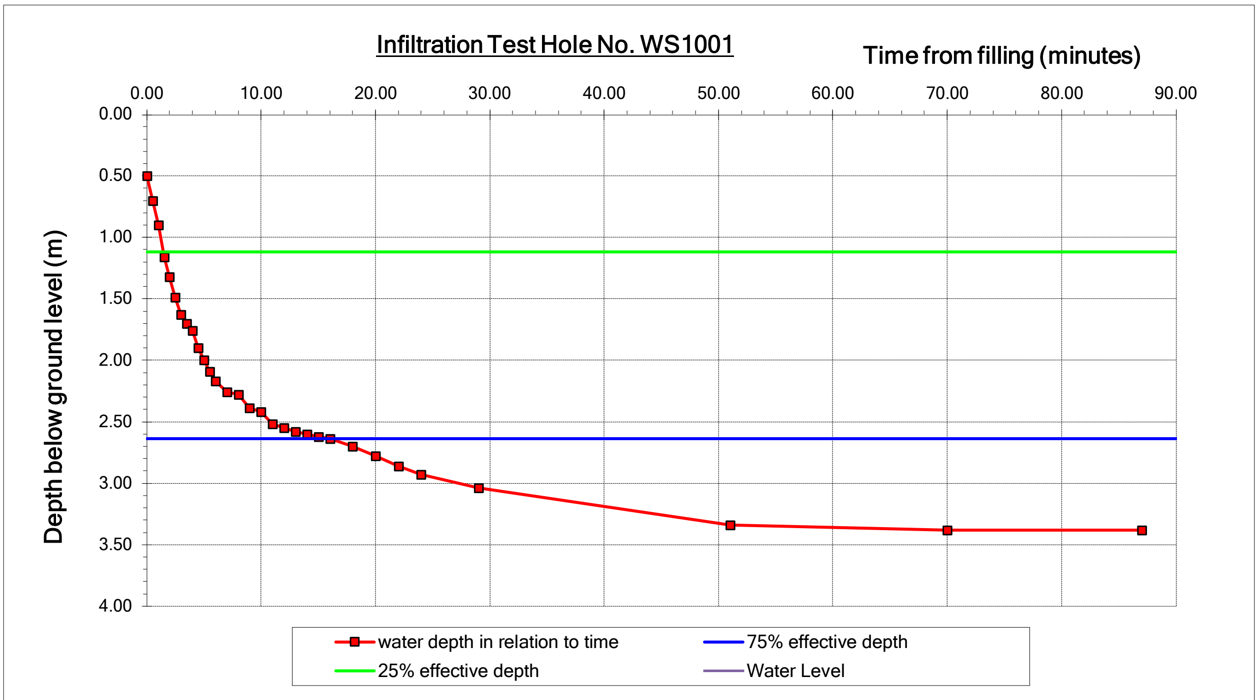
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.50 |
| 0 | 00 | 30 | 0.50 | 0.70 |
| 0 | 01 | 00 | 1.00 | 0.90 |
| 0 | 01 | 30 | 1.50 | 1.16 |
| 0 | 02 | 00 | 2.00 | 1.32 |
| 0 | 02 | 30 | 2.50 | 1.49 |
| 0 | 03 | 00 | 3.00 | 1.63 |
| 0 | 03 | 30 | 3.50 | 1.70 |
| 0 | 04 | 00 | 4.00 | 1.76 |
| 0 | 04 | 30 | 4.50 | 1.90 |
| 0 | 05 | 00 | 5.00 | 2.00 |
| 0 | 05 | 30 | 5.50 | 2.09 |
| 0 | 06 | 00 | 6.00 | 2.17 |
| 0 | 07 | 00 | 7.00 | 2.26 |
| 0 | 08 | 00 | 8.00 | 2.28 |
| 0 | 09 | 00 | 9.00 | 2.39 |
| 0 | 10 | 00 | 10.00 | 2.42 |
| 0 | 11 | 00 | 11.00 | 2.52 |
| 0 | 12 | 00 | 12.00 | 2.55 |
| 0 | 13 | 00 | 13.00 | 2.58 |
| 0 | 14 | 00 | 14.00 | 2.60 |
| 0 | 15 | 00 | 15.00 | 2.62 |
| 0 | 16 | 00 | 16.00 | 2.64 |
| 0 | 18 | 00 | 18.00 | 2.70 |
| 0 | 20 | 00 | 20.00 | 2.78 |
| 0 | 22 | 00 | 22.00 | 2.86 |
| 0 | 24 | 00 | 24.00 | 2.93 |
| 0 | 29 | 00 | 29.00 | 3.04 |
| 0 | 51 | 00 | 51.00 | 3.34 |
| 1 | 10 | 00 | 70.00 | 3.38 |
| 1 | 27 | 00 | 87.00 | 3.38 |

## Test Pit Dimensions

| | | |
|---|---|---|
| Test Holes Diameter (0-1m) | 0.102 | m |
| Test Holes Diameter (1-2m) | 0.087 | m |
| Test Holes Diameter (2-3m) | 0.077 | m |
| Test Holes Diameter (3-4m) | 0.067 | m |
| SPT diameter | 0.063 | m |
| Pipe Diameter | 0.050 | m |
| Install Depth | 3.52 | m |
| Standing Water Level | | m |

## Infiltration Parameters

| | | |
|---|---|---|
| Total Depth | 3.520 | m |
| Total Effective Depth | 3.020 | m |
| 25% Depth | 1.115 | m |
| 75% Depth | 2.635 | m |
| 25% Time | 1.41 | min |
| 75% Time | 15.74 | min |
| Free Volume | 0.004553 | cu.m |
| Surface Area | 0.397257 | sq.m |
| Time of Outflow | 14.33 | min |




| | | |
|---|---|---|
| **Soil infiltration Rate** | **4.80E-02** | **m/hr** |
| | **1.33E-05** | **m/sec** |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024

Produced by: BH

Coopers

Consulting Engineers

Green Lane, Ewloe Green

Infiltration Test Hole No. WS1002

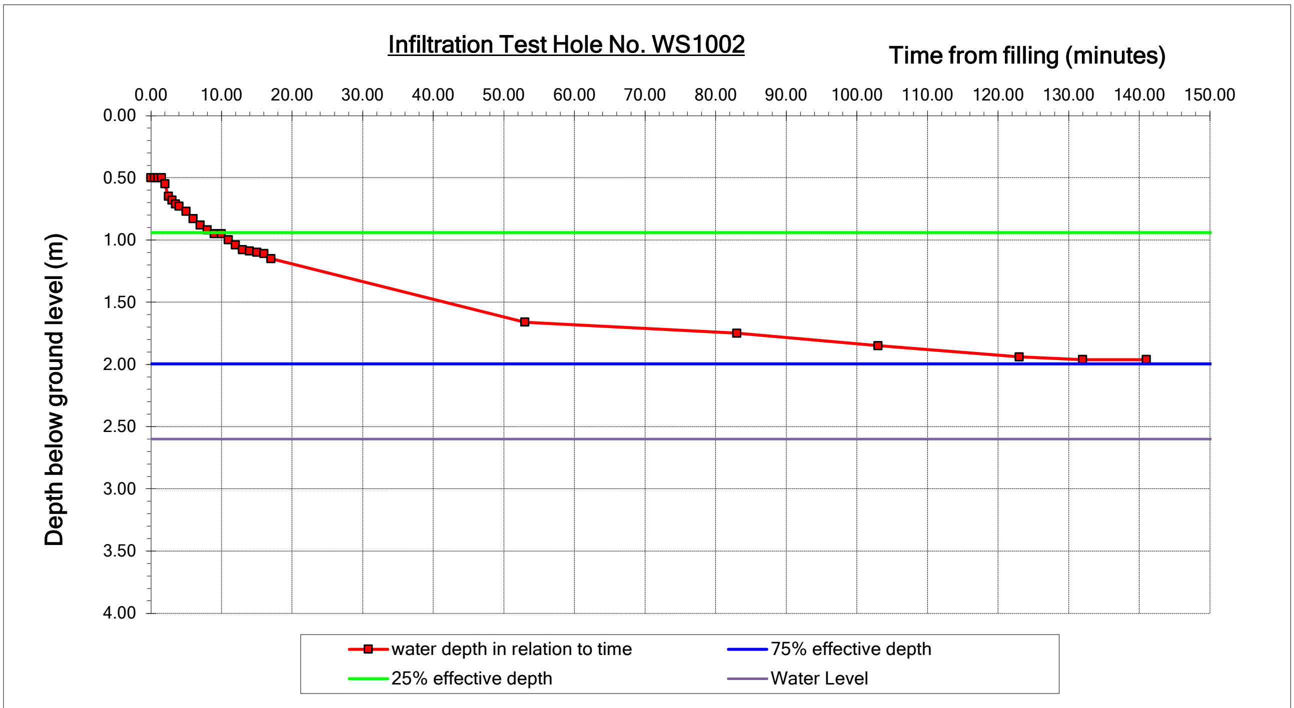
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.50 |
| 0 | 00 | 30 | 0.50 | 0.50 |
| 0 | 01 | 00 | 1.00 | 0.50 |
| 0 | 01 | 30 | 1.50 | 0.50 |
| 0 | 02 | 00 | 2.00 | 0.55 |
| 0 | 02 | 30 | 2.50 | 0.65 |
| 0 | 03 | 00 | 3.00 | 0.68 |
| 0 | 03 | 30 | 3.50 | 0.71 |
| 0 | 04 | 00 | 4.00 | 0.73 |
| 0 | 05 | 00 | 5.00 | 0.77 |
| 0 | 06 | 00 | 6.00 | 0.83 |
| 0 | 07 | 00 | 7.00 | 0.88 |
| 0 | 08 | 00 | 8.00 | 0.92 |
| 0 | 09 | 00 | 9.00 | 0.95 |
| 0 | 10 | 00 | 10.00 | 0.95 |
| 0 | 11 | 00 | 11.00 | 1.00 |
| 0 | 12 | 00 | 12.00 | 1.04 |
| 0 | 13 | 00 | 13.00 | 1.08 |
| 0 | 14 | 00 | 14.00 | 1.09 |
| 0 | 15 | 00 | 15.00 | 1.10 |
| 0 | 16 | 00 | 16.00 | 1.11 |
| 0 | 17 | 00 | 17.00 | 1.15 |
| 0 | 53 | 00 | 53.00 | 1.66 |
| 1 | 23 | 00 | 83.00 | 1.75 |
| 1 | 43 | 00 | 103.00 | 1.85 |
| 2 | 03 | 00 | 123.00 | 1.94 |
| 2 | 12 | 00 | 132.00 | 1.96 |
| 2 | 21 | 00 | 141.00 | 1.96 |
| | | | | |
| | | | | |
| | | | | |

## Test Pit Dimensions

| | |
|---|---|
| Test Holes Diameter (0-1m) | 0.102 m |
| Test Holes Diameter (1-2m) | 0.087 m |
| Test Holes Diameter (2-3m) | 0.077 m |
| Test Holes Diameter (3-4m) | 0.067 m |
| SPT diameter | 0.063 m |
| Pipe Diameter | 0.050 m |
| Install Depth | 4.00 m |
| Standing Water Level | 2.60 m |

## Infiltration Parameters

| | |
|---|---|
| Total Depth | 2.600 m |
| Total Effective Depth | 2.100 m |
| 25% Depth | 0.940 m |
| 75% Depth | 1.993 m |
| 25% Time | 9.33 min |
| 75% Time | 152.87 min |
| Free Volume | 0.003367 cu.m |
| Surface Area | 0.292310 sq.m |
| Time of Outflow | 143.53 min |




| | | |
|---|---|---|
| **Soil infiltration Rate** | **4.81E-03** | **m/hr** |
| | **1.34E-06** | **m/sec** |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1003

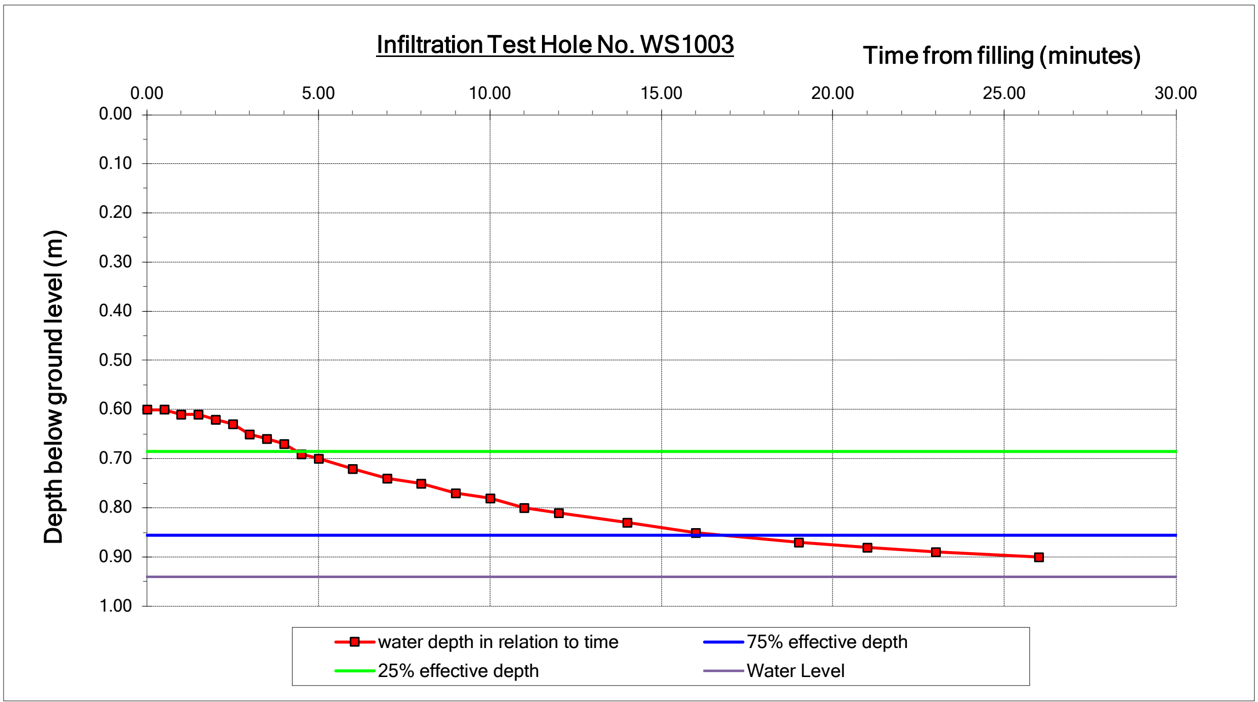
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.60 |
| 0 | 00 | 30 | 0.50 | 0.60 |
| 0 | 01 | 00 | 1.00 | 0.61 |
| 0 | 01 | 30 | 1.50 | 0.61 |
| 0 | 02 | 00 | 2.00 | 0.62 |
| 0 | 02 | 30 | 2.50 | 0.63 |
| 0 | 03 | 00 | 3.00 | 0.65 |
| 0 | 03 | 30 | 3.50 | 0.66 |
| 0 | 04 | 00 | 4.00 | 0.67 |
| 0 | 04 | 30 | 4.50 | 0.69 |
| 0 | 05 | 00 | 5.00 | 0.70 |
| 0 | 06 | 00 | 6.00 | 0.72 |
| 0 | 07 | 00 | 7.00 | 0.74 |
| 0 | 08 | 00 | 8.00 | 0.75 |
| 0 | 09 | 00 | 9.00 | 0.77 |
| 0 | 10 | 00 | 10.00 | 0.78 |
| 0 | 11 | 00 | 11.00 | 0.80 |
| 0 | 12 | 00 | 12.00 | 0.81 |
| 0 | 14 | 00 | 14.00 | 0.83 |
| 0 | 16 | 00 | 16.00 | 0.85 |
| 0 | 19 | 00 | 19.00 | 0.87 |
| 0 | 21 | 00 | 21.00 | 0.88 |
| 0 | 23 | 00 | 23.00 | 0.89 |
| 0 | 26 | 00 | 26.00 | 0.90 |

## Test Pit Dimensions

| | |
|---|---|
| Test Holes Diameter (0-1m) | 0.102 m |
| Test Holes Diameter (1-2m) | 0.087 m |
| Test Holes Diameter (2-3m) | 0.077 m |
| Test Holes Diameter (3-4m) | 0.067 m |
| SPT diameter | 0.063 m |
| Pipe Diameter | 0.050 m |
| Install Depth | 4.00 m |
| Standing Water Level | 0.94 m |

## Infiltration Parameters

| | |
|---|---|
| Total Depth | 0.940 m |
| Total Effective Depth | 0.340 m |
| 25% Depth | 0.685 m |
| 75% Depth | 0.855 m |
| 25% Time | 4.38 min |
| 75% Time | 16.75 min |
| Free Volume | 0.000650 cu.m |
| Surface Area | 0.054475 sq.m |
| Time of Outflow | 12.38 min |




| | | |
|---|---|---|
| **Soil infiltration Rate** | **5.79E-02** | **m/hr** |
| | **1.61E-05** | **m/sec** |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1004

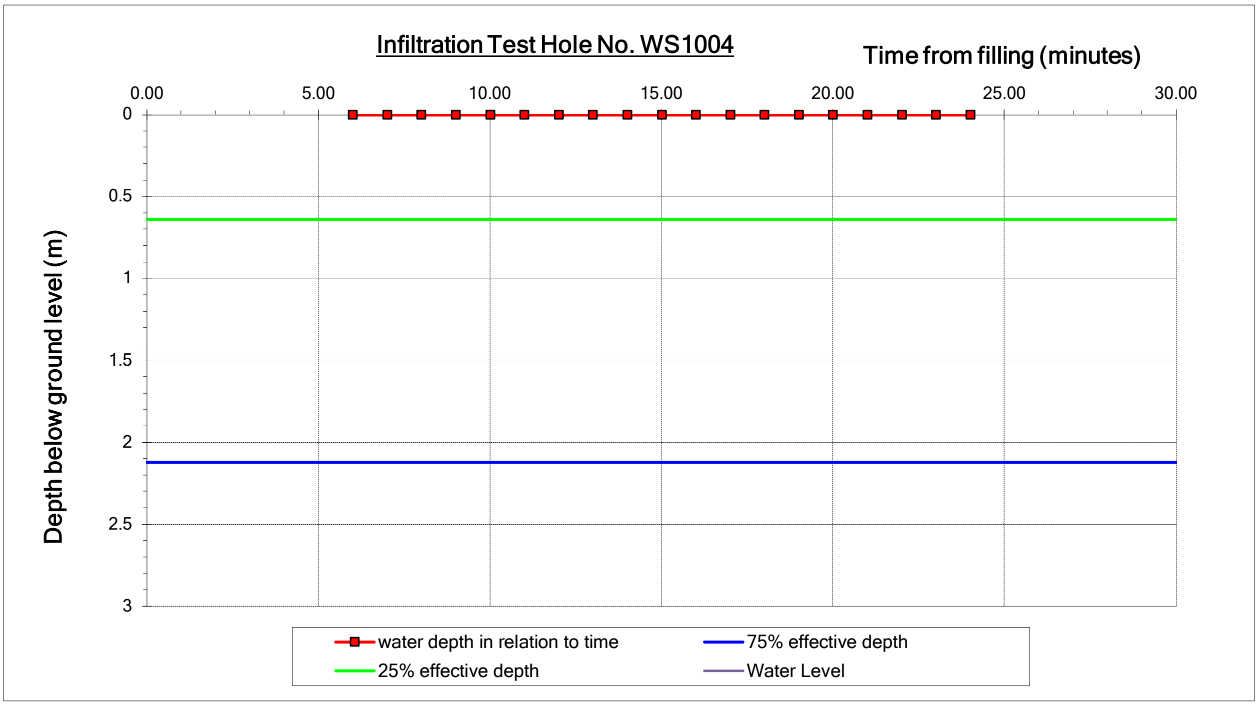
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| **Unable to fill - drained faster than filling.** | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

## Test Pit Dimensions

| | | |
|---|---|---|
| Test Holes Diameter (0-1m) | 0.102 | m |
| Test Holes Diameter (1-2m) | 0.087 | m |
| Test Holes Diameter (2-3m) | 0.077 | m |
| Test Holes Diameter (3-4m) | 0.067 | m |
| SPT diameter | 0.063 | m |
| Pipe Diameter | 0.050 | m |
| Install Depth | 3.00 | m |
| Standing Water Level | | m |

## Infiltration Parameters

| | | |
|---|---|---|
| Total Depth | 3.000 | m |
| Total Effective Depth | | m |
| 25% Depth | 0.637 | m |
| 75% Depth | 2.120 | 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** |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1005

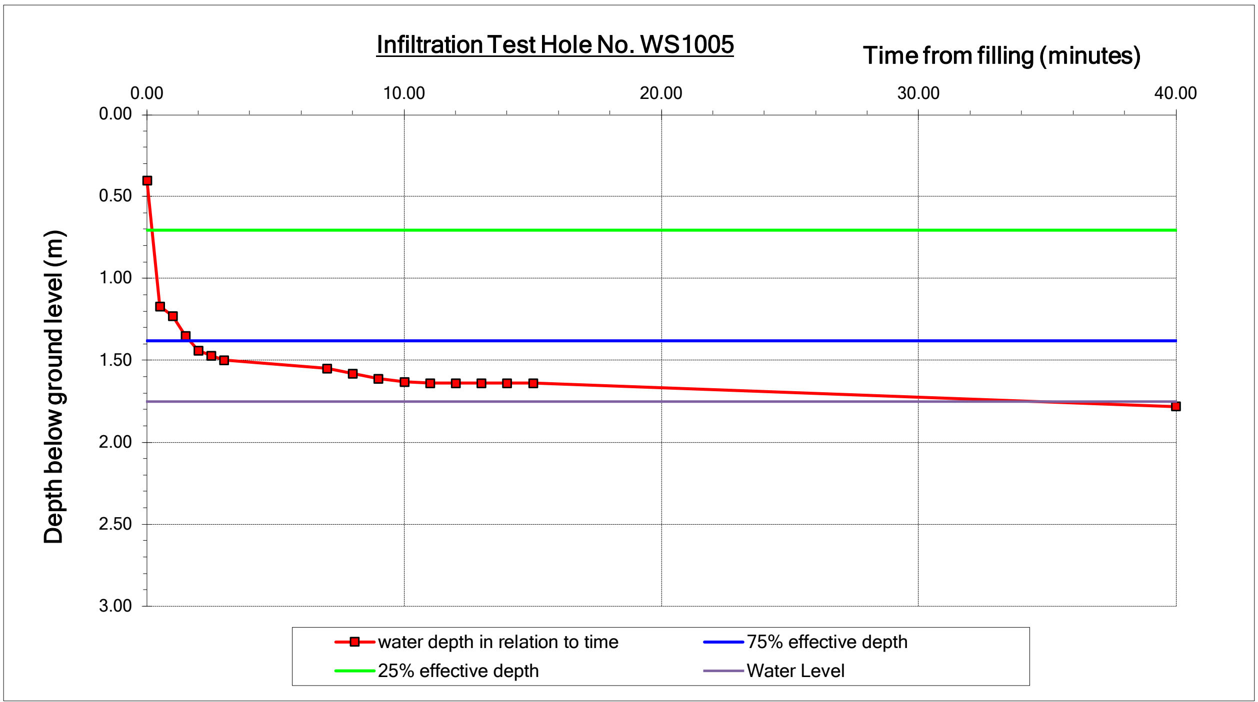
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.40 |
| 0 | 00 | 30 | 0.50 | 1.17 |
| 0 | 01 | 00 | 1.00 | 1.23 |
| 0 | 01 | 30 | 1.50 | 1.35 |
| 0 | 02 | 00 | 2.00 | 1.44 |
| 0 | 02 | 30 | 2.50 | 1.47 |
| 0 | 03 | 00 | 3.00 | 1.50 |
| 0 | 07 | 00 | 7.00 | 1.55 |
| 0 | 08 | 00 | 8.00 | 1.58 |
| 0 | 09 | 00 | 9.00 | 1.61 |
| 0 | 10 | 00 | 10.00 | 1.63 |
| 0 | 11 | 00 | 11.00 | 1.64 |
| 0 | 12 | 00 | 12.00 | 1.64 |
| 0 | 13 | 00 | 13.00 | 1.64 |
| 0 | 14 | 00 | 14.00 | 1.64 |
| 0 | 15 | 00 | 15.00 | 1.64 |
| 0 | 40 | 00 | 40.00 | 1.78 |

## Test Pit Dimensions

| | |
|---|---|
| Test Holes Diameter (0-1m) | 0.102 m |
| Test Holes Diameter (1-2m) | 0.087 m |
| Test Holes Diameter (2-3m) | 0.077 m |
| Test Holes Diameter (3-4m) | 0.067 m |
| SPT diameter | 0.063 m |
| Pipe Diameter | 0.050 m |
| Install Depth | 3.00 m |
| Standing Water Level | 1.75 m |

## Infiltration Parameters

| | |
|---|---|
| Total Depth | 1.750 m |
| Total Effective Depth | 1.350 m |
| 25% Depth | 0.705 m |
| 75% Depth | 1.381 m |
| 25% Time | 0.20 min |
| 75% Time | 1.67 min |
| Free Volume | 0.002332 cu.m |
| Surface Area | 0.199774 sq.m |
| Time of Outflow | 1.47 min |




| Soil infiltration Rate | 4.75E-01 | m/hr |
|---|---|---|
| | 1.32E-04 | m/sec |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1006

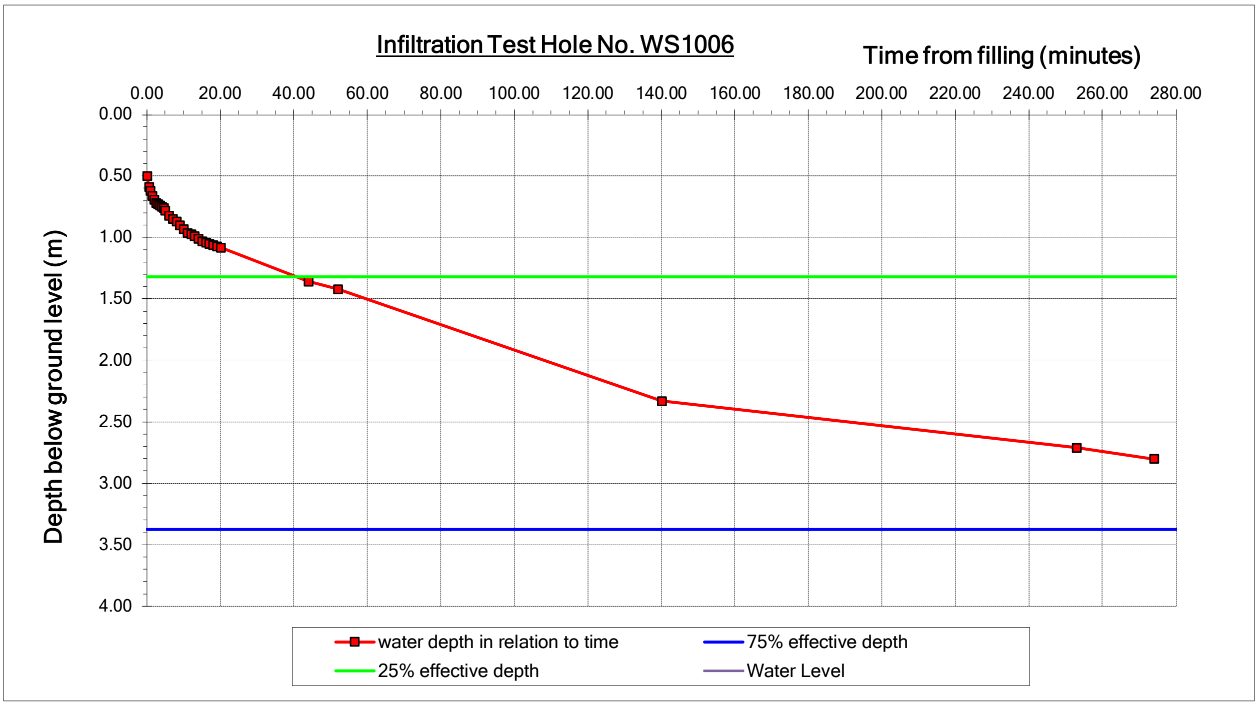
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.50 |
| 0 | 00 | 30 | 0.50 | 0.59 |
| 0 | 01 | 00 | 1.00 | 0.62 |
| 0 | 01 | 30 | 1.50 | 0.66 |
| 0 | 02 | 00 | 2.00 | 0.69 |
| 0 | 02 | 30 | 2.50 | 0.72 |
| 0 | 03 | 00 | 3.00 | 0.73 |
| 0 | 03 | 30 | 3.50 | 0.74 |
| 0 | 04 | 00 | 4.00 | 0.75 |
| 0 | 04 | 30 | 4.50 | 0.76 |
| 0 | 05 | 00 | 5.00 | 0.78 |
| 0 | 06 | 00 | 6.00 | 0.82 |
| 0 | 07 | 00 | 7.00 | 0.85 |
| 0 | 08 | 00 | 8.00 | 0.87 |
| 0 | 09 | 00 | 9.00 | 0.90 |
| 0 | 10 | 00 | 10.00 | 0.93 |
| 0 | 11 | 00 | 11.00 | 0.96 |
| 0 | 12 | 00 | 12.00 | 0.97 |
| 0 | 13 | 00 | 13.00 | 0.99 |
| 0 | 14 | 00 | 14.00 | 1.01 |
| 0 | 15 | 00 | 15.00 | 1.03 |
| 0 | 16 | 00 | 16.00 | 1.04 |
| 0 | 17 | 00 | 17.00 | 1.05 |
| 0 | 18 | 00 | 18.00 | 1.06 |
| 0 | 19 | 00 | 19.00 | 1.07 |
| 0 | 20 | 00 | 20.00 | 1.08 |
| 0 | 44 | 00 | 44.00 | 1.36 |
| 0 | 52 | 00 | 52.00 | 1.42 |
| 2 | 20 | 00 | 140.00 | 2.33 |
| 4 | 13 | 00 | 253.00 | 2.71 |
| 4 | 34 | 00 | 274.00 | 2.80 |

## Test Pit Dimensions

| | | |
|---|---|---|
| Test Holes Diameter (0-1m) | 0.102 | m |
| Test Holes Diameter (1-2m) | 0.087 | m |
| Test Holes Diameter (2-3m) | 0.077 | m |
| Test Holes Diameter (3-4m) | 0.067 | m |
| SPT diameter | 0.063 | m |
| Pipe Diameter | 0.050 | m |
| Install Depth | 4.00 | m |
| Standing Water Level | | m |

## Infiltration Parameters

| | | |
|---|---|---|
| Total Depth | 4.000 | m |
| Total Effective Depth | 3.500 | m |
| 25% Depth | 1.319 | m |
| 75% Depth | 3.376 | m |
| 25% Time | 40.46 | min |
| 75% Time | 432.68 | min |
| Free Volume | 0.005839 | cu.m |
| Surface Area | 0.509523 | sq.m |
| Time of Outflow | 392.23 | min |




| | | |
|---|---|---|
| **Soil infiltration Rate** | **1.75E-03** | **m/hr** |
| | **4.87E-07** | **m/sec** |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1007

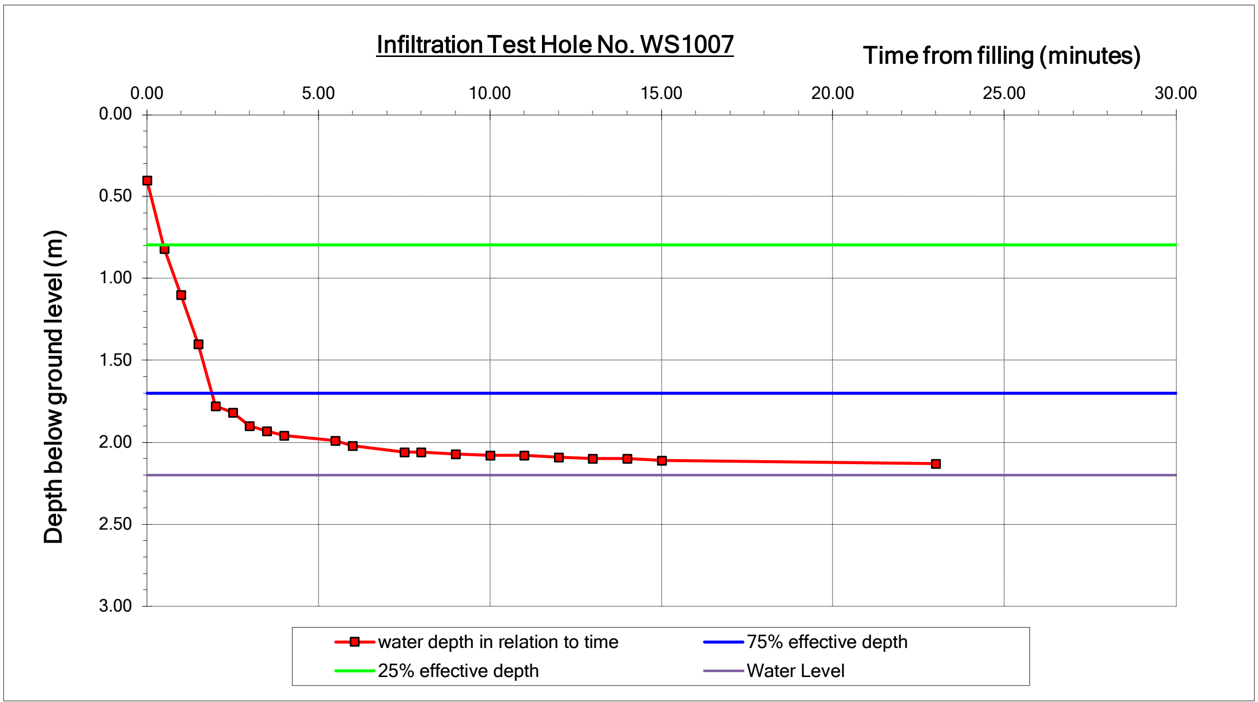
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 0.40 |
| 0 | 00 | 30 | 0.50 | 0.82 |
| 0 | 01 | 00 | 1.00 | 1.10 |
| 0 | 01 | 30 | 1.50 | 1.40 |
| 0 | 02 | 00 | 2.00 | 1.78 |
| 0 | 02 | 30 | 2.50 | 1.82 |
| 0 | 03 | 00 | 3.00 | 1.90 |
| 0 | 03 | 30 | 3.50 | 1.93 |
| 0 | 04 | 00 | 4.00 | 1.96 |
| 0 | 05 | 30 | 5.50 | 1.99 |
| 0 | 06 | 00 | 6.00 | 2.02 |
| 0 | 07 | 30 | 7.50 | 2.06 |
| 0 | 08 | 00 | 8.00 | 2.06 |
| 0 | 09 | 00 | 9.00 | 2.07 |
| 0 | 10 | 00 | 10.00 | 2.08 |
| 0 | 11 | 00 | 11.00 | 2.08 |
| 0 | 12 | 00 | 12.00 | 2.09 |
| 0 | 13 | 00 | 13.00 | 2.10 |
| 0 | 14 | 00 | 14.00 | 2.10 |
| 0 | 15 | 00 | 15.00 | 2.11 |
| 0 | 23 | 00 | 23.00 | 2.13 |

## Test Pit Dimensions

| | | |
|---|---|---|
| Test Holes Diameter (0-1m) | 0.102 | m |
| Test Holes Diameter (1-2m) | 0.087 | m |
| Test Holes Diameter (2-3m) | 0.077 | m |
| Test Holes Diameter (3-4m) | 0.067 | m |
| SPT diameter | 0.063 | m |
| Pipe Diameter | 0.050 | m |
| Install Depth | 3.00 | m |
| Standing Water Level | 2.20 | m |

## Infiltration Parameters

| | | |
|---|---|---|
| Total Depth | 2.200 | m |
| Total Effective Depth | 1.800 | m |
| 25% Depth | 0.793 | m |
| 75% Depth | 1.700 | m |
| 25% Time | 0.47 | min |
| 75% Time | 1.89 | min |
| Free Volume | 0.003004 | cu.m |
| Surface Area | 0.259440 | sq.m |
| Time of Outflow | 1.43 | min |




| Soil infiltration Rate | 4.87E-01 | m/hr |
|---|---|---|
| | 1.35E-04 | m/sec |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Date of Test: 10 January 2024
Produced by: BH

Coopers
Consulting Engineers

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1008

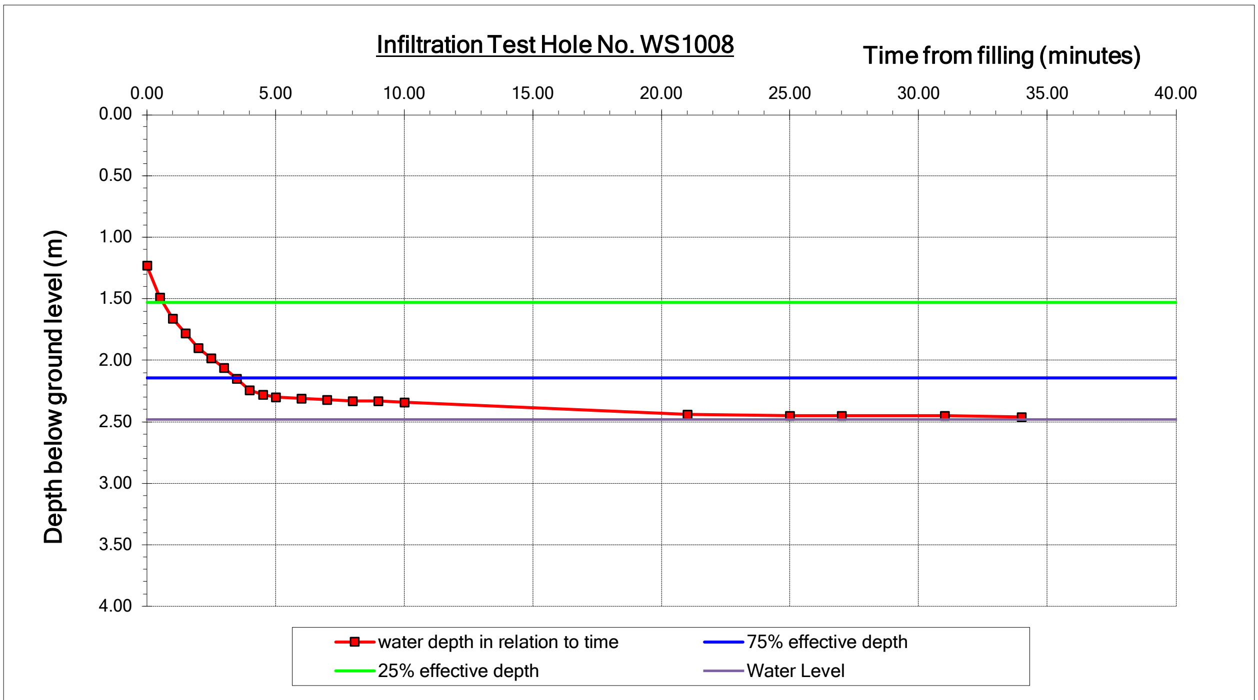
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| 0 | 00 | 00 | 0.00 | 1.23 |
| 0 | 00 | 30 | 0.50 | 1.49 |
| 0 | 01 | 00 | 1.00 | 1.66 |
| 0 | 01 | 30 | 1.50 | 1.78 |
| 0 | 02 | 00 | 2.00 | 1.90 |
| 0 | 02 | 30 | 2.50 | 1.98 |
| 0 | 03 | 00 | 3.00 | 2.06 |
| 0 | 03 | 30 | 3.50 | 2.15 |
| 0 | 04 | 00 | 4.00 | 2.24 |
| 0 | 04 | 30 | 4.50 | 2.28 |
| 0 | 05 | 00 | 5.00 | 2.30 |
| 0 | 06 | 00 | 6.00 | 2.31 |
| 0 | 07 | 00 | 7.00 | 2.32 |
| 0 | 08 | 00 | 8.00 | 2.33 |
| 0 | 09 | 00 | 9.00 | 2.33 |
| 0 | 10 | 00 | 10.00 | 2.34 |
| 0 | 21 | 00 | 21.00 | 2.44 |
| 0 | 25 | 00 | 25.00 | 2.45 |
| 0 | 27 | 00 | 27.00 | 2.45 |
| 0 | 31 | 00 | 31.00 | 2.45 |
| 0 | 34 | 00 | 34.00 | 2.46 |

## Test Pit Dimensions

| | |
|---|---|
| Test Holes Diameter (0-1m) | 0.102 m |
| Test Holes Diameter (1-2m) | 0.087 m |
| Test Holes Diameter (2-3m) | 0.077 m |
| Test Holes Diameter (3-4m) | 0.067 m |
| SPT diameter | 0.063 m |
| Pipe Diameter | 0.050 m |
| Install Depth | 4.00 m |
| Standing Water Level | 2.48 m |

## Infiltration Parameters

| | |
|---|---|
| Total Depth | 2.480 m |
| Total Effective Depth | 1.250 m |
| 25% Depth | 1.528 m |
| 75% Depth | 2.141 m |
| 25% Time | 0.61 min |
| 75% Time | 3.45 min |
| Free Volume | 0.001881 cu.m |
| Surface Area | 0.163873 sq.m |
| Time of Outflow | 2.84 min |




| Soil infiltration Rate | 2.43E-01 | m/hr |
|---|---|---|
| | 6.74E-05 | m/sec |

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

Green Lane, Ewloe Green
Infiltration Test Hole No. WS1009

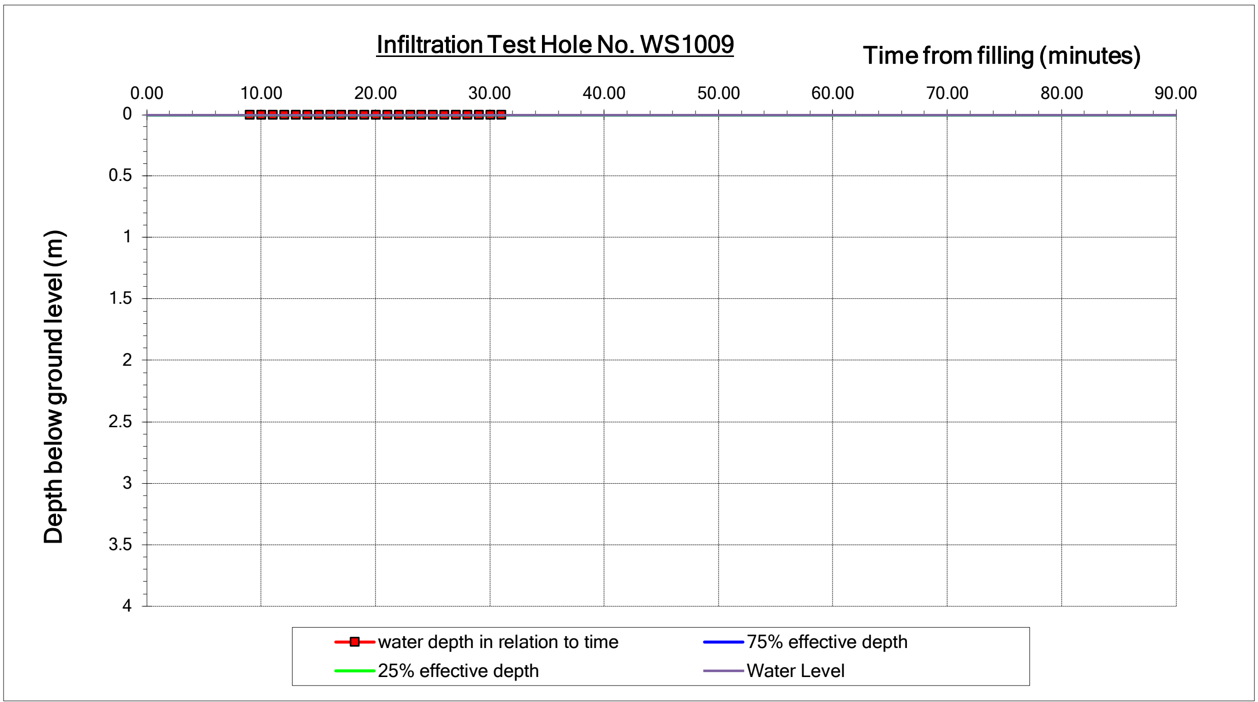
| Time of reading | | | Absolute Time | Depth below Ground level |
|---|---|---|---|---|
| hrs | min | sec | mins | m |
| **Groundwater at surface at time of testing** | | | | |

## Test Pit Dimensions

| | | |
|---|---|---|
| Test Holes Diameter (0-1m) | 0.102 | m |
| Test Holes Diameter (1-2m) | 0.087 | m |
| Test Holes Diameter (2-3m) | 0.077 | m |
| Test Holes Diameter (3-4m) | 0.067 | m |
| SPT diameter | 0.063 | m |
| Pipe Diameter | 0.050 | m |
| Install Depth | 4.00 | m |
| Standing Water Level | 0.00 | m |

## Infiltration Parameters

| | | |
|---|---|---|
| Total Depth | FAIL | m |
| Total Effective Depth | FAIL | m |
| 25% Depth | FAIL | m |
| 75% Depth | FAIL | m |
| 25% Time | FAIL | min |
| 75% Time | FAIL | min |
| Free Volume | 0.00 | cu.m |
| Surface Area | FAIL | sq.m |
| Time of Outflow | FAIL | min |




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

*NOTE - Borehole testing is not BRE 365 compliant, caution advised on use of infiltration rates and further testing required.*

**Appendix 4**

**Correspondence**

*Dwr Cymru Welsh Water*

*Flintshire County Council*

*Natural Resources Wales*

Dŵr Cymru
Welsh Water

Developer Services
PO Box 3146
Cardiff
CF30 0EH

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

Gwasanaethau Datblygu
Blwch Post 3146
Caerdydd
CF30 0EH

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

Mr Mark Fitzsimons
Castle Green Homes
Bridgemere House
Chester Road
Preston Brook
Halton
WA7 3BD

**Date: 09/08/2023**
**Our Ref: PPA0008080**

Dear Mr Fitzsimons,

**Grid Ref: 329131 366768**
**Site Address: Land off Holywell Road, Ewloe, Deeside**
**Development: 298 Residential Units**

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

**APPRAISAL**

Firstly, we note that the proposal relates to a residential development comprising of 298 units on land off Holywell Road, Ewloe, and acknowledge that the site is allocated within the Flintshire Local Development Plan (LDP) for 298 units. In reference to our representations during the LDP consultation process, namely the 'Statement of Common Ground', we can confirm that an assessment has been undertaken of the public sewerage and watermains systems to accommodate 298 units and informs our appraisal as follows.

**PUBLIC SEWERAGE NETWORK**

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

This site is crossed by a public sewer with the approximate position being marked on the attached Statutory Public Sewer Record. In accordance with the Water Industry Act 1991, Dwr Cymru Welsh Water requires access to its apparatus at all times in order to carry out maintenance and repairs. No part of any building will be permitted within the protection zone of the public sewer measured 3 metres either side of the centreline of the 300mm surface water sewer. Our strong recommendation is that your site layout takes into account the location of the assets crossing the site and should be referred to in any master-planning exercises or site layout plans submitted as part of any subsequent planning application. Further information regarding Asset Protection is provided in the attached Advice & Guidance note.

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

**SURFACE WATER DRAINAGE**

As of 7th January 2019, this proposed development is subject to Schedule 3 of the Flood and Water Management Act 2010. The development therefore requires approval of Sustainable Drainage Systems (SuDS) features, in accordance with the 'Statutory standards for sustainable drainage systems – designing, constructing, operating and maintaining surface water drainage systems'. As highlighted in these standards, the developer is required to explore and fully exhaust all surface water drainage options in accordance with a hierarchy which states that discharge to a combined sewer shall only be made as a last resort. Disposal should be made through the hierarchical approach, preferring infiltration and, where infiltration is not possible, disposal to a surface water drainage body in liaison with the Land Drainage Authority and/or Natural Resources Wales.

It is therefore recommended that the developer consult with Flintshire Council, as the determining SuDS Approval Body (SAB), in relation to their proposals for SuDS features. Please note, DCWW is a statutory consultee to the SAB application process and will provide comments to any SuDS proposals by response to SAB consultation. Please refer to further detailed advice relating to surface water management included in our attached Advice & Guidance note.

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

## FOUL WATER DRAINAGE – SEWERAGE NETWORK

We have considered the impact of foul flows generated by the proposed development and concluded it is unlikely that sufficient capacity exists to accommodate your development without causing detriment to the existing services we provide to our customers, or in regard to the protection of the environment. There are no planned reinforcement works within Dwr Cymru Welsh Water's Capital Investment Programme and therefore, at this stage, we are unable to provide you with a point of adequacy on the network.

In light of the above our recommendation is that you instruct us to undertake a Hydraulic Modelling Assessment (HMA) which is at the developer's expense and will examine the impact of the introduction of flows from your development upon the performance of the existing network and consider. Where required and appropriate, the HMA will then identify solutions and points of communication to ensure that your site can be accommodated within the system. For the developer to obtain a quotation for the HMA, we will require a fee of £250 + VAT. Please note that we will seek to control the outcomes of the HMA via appropriate planning conditions. However, in the absence of known solutions to accommodate your site we will not be able to support your development through the planning process. We therefore recommend that the HMA is undertaken in advance of a planning application being submitted, in order to avoid any subsequent delays. Further information on Hydraulic Modelling Assessments as well as any implications on the planning process is provided in the attached Advice & Guidance note.

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

## FOUL WATER DRAINAGE – SEWAGE TREATMENT

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

**POTABLE WATER SUPPLY**

Capacity is currently available in the water supply system to accommodate the development. Initial indications are that a connection can be made from the 12” diameter watermain in 329142, 366477 location. We reserve the right however to reassess our position as part of the formal application for the provision of new water mains under Section 41 and Section 51 of the Water Industry Act (1991) to ensure there is sufficient capacity available to serve the development without causing detriment to existing customers’ supply as demands upon our water systems change continually.

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

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

Please quote our reference number in all communications and correspondence.

Yours faithfully,

**Owain George**
**Planning Liaison Manager**
**Developer Services**

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

## Andy Jones

**From:** Neil L Parry (S&T - Drainage) <Neil.L.Parry@Flintshire.Gov.UK>
**Sent:** 01 March 2024 16:41
**To:** Andy Jones
**Cc:** Flood Risk Management
**Subject:** RE: FCA Historical Flood Information



Hi Andy

Many thanks for your appended enquiry.

The land in question is mainly Agricultural and I have looked on NRWs Flood Risk Maps there is no flooding indicated to the adjacent properties in Circular Drive although there are some hotspots to the rear of properties on Green Lane and at the North of the site adjacent to the B5125.

I have no recollection / records of any reported flooding from this area which may assist with the production of your FCA.

Should you have any further queries please do not hesitate to contact me.

Regards

Neil.

---

**From:** Andy Jones <ajones@coopers.co.uk>
**Sent:** Thursday, February 29, 2024 5:12 PM
**To:** Neil L Parry (S&T - Drainage) <Neil.L.Parry@Flintshire.Gov.UK>
**Cc:** Flood Risk Management <FloodRiskManagement@flintshire.gov.uk>
**Subject:** FCA Historical Flood Information



**8352 Land off Holywell Road & Green Lane, Ewloe**
**SJ291667**
**FCA Historical Flood Information**

Hi Neil

We are undertaking a Flood Consequences Assessment for a proposed residential development on greenfield agricultural land at Ewloe, CH5 3DA. (see Location Plan below) 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.

**From:** Data Distribution
**To:** Andy Jones
**Subject:** RE: FCA Historical Flood Information
**Date:** 01 March 2024 08:54:05
**Attachments:** image001.png
image002.png
NRW Flood Product Descriptions.pdf
Briefing Note Flood Products - External.pdf
Flood Products FAQs V3.pdf

---

Dear Mr Jones,

Thank you for your email which has now been passed to our data team.

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

We can provide if the data is available, the flood model report, (old product 5), which is free of charge. Also, the raw flood model output data, (old product 6), if available, which is also free of charge. You would need the appropriate software to analyse the results, more information on this is in the attached. We could also provide product 7, which is the full flood model, for a fee of £180.00 inclusive of VAT.

Please also accept this as an acknowledgement that your request has been received.

It can take up to 20 working days to supply data that is not available online, therefore if you have any queries on your data request, please contact us.

For further information on what you can expect from us, please visit our website:

Natural Resources Wales / Contact us or call the Customer Hub on 0300 065 3000 (open 9am-5pm, Monday to Friday).

We will therefore be in touch in due course and provide if available, products 5 & 6 and advise on product 7.

Yours sincerely,

**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



---

**From:** Andy Jones <ajones@coopers.co.uk>
**Sent:** 29 February 2024 17:16
**To:** Data Distribution <datadistribution@cyfoethnaturiolcymru.gov.uk>
**Subject:** FCA Historical Flood Information



**8352 Land off Holywell Road & Green Lane, Ewloe**
**SJ291667**
**FCA Historical Flood Information**

To whom it may concern

We are undertaking a Flood Consequences Assessment for a proposed residential development on greenfield agricultural land at Ewloe, CH5 3DA. (see Location Plan below) and request any information you may have in relation to historical flooding or any

## Appendix 5

## Calculations

*Source Control Greenfield Run-off Calculation*

*Surface Water Design - MicroDrainage Calculations*

*Network 1*

*Network 2*

*Network 3*

*Network 4*

*Network 5*

*Network 6*

# Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

| | |
|---|---|
| **Calculated by:** | Patrick Walsh |
| **Site name:** | |
| **Site location:** | |

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:** | 53.19253° N |
| **Longitude:** | 3.06149° W |
| **Reference:** | 340267521 |
| **Date:** | Feb 21 2024 09:07 |

## Runoff estimation approach

IH124

## Site characteristics

**Total site area (ha):** 8.7

## 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):** | 744 | 744 |
| **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): | 45.11 | 45.11 |
| 1 in 1 year (l/s): | 39.69 | 39.69 |
| 1 in 30 years (l/s): | 80.29 | 80.29 |
| 1 in 100 year (l/s): | 98.33 | 98.33 |
| 1 in 200 years (l/s): | 110.96 | 110.96 |

## Design Settings

| | |
|---|---|
| Rainfall Methodology | FSR |
| Return Period (years) | 100 |
| Additional Flow (%) | 0 |
| FSR Region | England and Wales |
| M5-60 (mm) | 17.000 |
| Ratio-R | 0.300 |
| CV | 0.750 |
| Time of Entry (mins) | 5.00 |
| Maximum Time of Concentration (mins) | 30.00 |
| Maximum Rainfall (mm/hr) | 50.0 |
| Minimum Velocity (m/s) | 1.00 |
| Connection Type | Level Soffits |
| Minimum Backdrop Height (m) | 0.200 |
| Preferred Cover Depth (m) | 1.200 |
| Include Intermediate Ground | ✓ |
| 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 | 0.057 | 5.00 | 89.649 | 1500 | 328946.200 | 366819.225 | 1.425 |
| 102 | 0.057 | 5.00 | 89.936 | 1500 | 328959.657 | 366800.325 | 1.848 |
| 103 | 0.057 | 5.00 | 89.921 | 1500 | 328970.033 | 366791.467 | 1.913 |
| 104 | 0.057 | 5.00 | 89.072 | 1500 | 329003.208 | 366773.905 | 1.350 |
| 105 | 0.057 | 5.00 | 89.511 | 1500 | 328987.608 | 366781.963 | 2.040 |
| 106 | 0.057 | 5.00 | 88.717 | 1500 | 328896.011 | 366767.639 | 1.425 |
| 107 | 0.057 | 5.00 | 89.267 | 1500 | 328933.278 | 366744.976 | 2.232 |
| 108 | 0.057 | 5.00 | 89.654 | 1500 | 328961.088 | 366730.566 | 2.803 |
| 109 | 0.057 | 5.00 | 89.299 | 1500 | 328973.588 | 366755.229 | 2.686 |
| 110 | 0.057 | 5.00 | 88.930 | 1500 | 328986.990 | 366747.638 | 2.756 |
| 111 | 0.057 | 5.00 | 88.494 | 1500 | 329027.414 | 366724.168 | 2.476 |
| 112 | 0.057 | 5.00 | 89.153 | 1500 | 329006.187 | 366710.941 | 2.880 |
| 113 | 0.057 | 5.00 | 88.828 | 1500 | 329022.079 | 366710.143 | 2.649 |
| 114 | 0.057 | 5.00 | 88.639 | 1500 | 329030.892 | 366712.048 | 2.663 |
| 115 | 0.057 | 5.00 | 88.382 | 1500 | 329041.567 | 366718.870 | 2.523 |
| 116 | 0.057 | 5.00 | 88.058 | 1500 | 329051.584 | 366734.205 | 2.245 |
| 117 | 0.057 | 5.00 | 89.700 | 1500 | 329153.090 | 366739.925 | 2.125 |
| 118 | 0.057 | 5.00 | 90.172 | 1500 | 329162.980 | 366727.849 | 2.689 |
| 119 | 0.057 | 5.00 | 90.148 | 1500 | 329143.413 | 366712.062 | 2.813 |
| 120 | 0.057 | 5.00 | 89.641 | 1500 | 329132.249 | 366702.018 | 2.394 |
| 121 | 0.057 | 5.00 | 88.675 | 1500 | 329131.618 | 366684.630 | 1.522 |
| 122 | 0.056 | 5.00 | 89.100 | 1500 | 329122.787 | 366693.985 | 2.001 |
| 123 | 0.056 | 5.00 | 89.343 | 1500 | 329108.521 | 366705.701 | 2.321 |
| 124 | 0.056 | 5.00 | 89.077 | 1500 | 329098.543 | 366713.576 | 2.183 |
| 125 | 0.056 | 5.00 | 88.735 | 1500 | 329088.509 | 366725.028 | 1.904 |
| 126 | 0.056 | 5.00 | 88.217 | 2100 | 329068.679 | 366748.644 | 2.460 |
| 127 | 0.089 | 5.00 | 87.716 | 1500 | 329092.002 | 366767.730 | 2.136 |
| 128 | 0.089 | 5.00 | 85.157 | 1500 | 329064.317 | 366844.986 | 2.557 |
| 129 | 0.089 | 5.00 | 85.385 | 1500 | 329071.164 | 366833.571 | 2.863 |
| 130 | 0.089 | 5.00 | 85.715 | 1500 | 329082.146 | 366816.813 | 3.386 |
| 131 | 0.089 | 5.00 | 86.555 | 1500 | 329109.998 | 366782.437 | 4.485 |
| 132 | 0.089 | 5.00 | 84.552 | 1500 | 329140.937 | 366807.854 | 2.615 |
| 133 | 0.089 | 5.00 | 88.108 | 1500 | 329225.126 | 366678.227 | 1.350 |
| 134 | 0.089 | 5.00 | 87.257 | 1500 | 329235.414 | 366691.753 | 1.425 |
| 135 | 0.089 | 5.00 | 85.893 | 1500 | 329256.760 | 366715.915 | 1.500 |
| 136 | 0.089 | 5.00 | 84.664 | 1500 | 329234.635 | 366735.568 | 1.650 |
| 137 | 0.090 | 5.00 | 84.479 | 1500 | 329208.278 | 366767.787 | 1.638 |
| 138 | 0.090 | 5.00 | 83.649 | 1500 | 329175.479 | 366807.955 | 1.713 |
| 139 | 0.090 | 5.00 | 83.210 | 1800 | 329161.767 | 366824.836 | 3.335 |
| 140 | 0.090 | 5.00 | 81.171 | 1800 | 329162.502 | 366846.314 | 1.650 |
| 141 | | | 80.500 | 1800 | 329171.739 | 366869.910 | 1.603 |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 142 | 0.090 | 5.00 | 81.353 | 1800 | 329194.533 | 366846.237 | 2.490 |
| 143 | 0.090 | 5.00 | 80.876 | 2100 | 329206.956 | 366864.613 | 2.068 |
| 144 | 0.090 | 5.00 | 80.678 | 2100 | 329219.028 | 366873.528 | 2.633 |
| 145 | 0.090 | 5.00 | 80.159 | 2100 | 329257.201 | 366889.203 | 2.217 |
| 146 | 0.090 | 5.00 | 79.969 | 2400 | 329266.838 | 366896.637 | 2.057 |
| 147 | | | 79.725 | 1500 | 329272.842 | 366905.349 | 1.875 |

## 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 | 101 | 102 | 23.201 | 0.600 | 88.224 | 88.088 | 0.136 | 170.0 | 225 | 5.39 | 50.0 |
| 1.001 | 102 | 103 | 13.643 | 0.600 | 88.088 | 88.008 | 0.080 | 170.0 | 225 | 5.61 | 50.0 |
| 1.002 | 103 | 105 | 19.980 | 0.600 | 88.008 | 87.471 | 0.537 | 37.2 | 225 | 5.77 | 50.0 |
| 2.000 | 104 | 105 | 17.558 | 0.600 | 87.722 | 87.546 | 0.176 | 100.0 | 150 | 5.29 | 50.0 |
| 1.003 | 105 | 109 | 30.187 | 0.600 | 87.471 | 86.688 | 0.783 | 38.6 | 225 | 6.01 | 50.0 |
| 3.000 | 106 | 107 | 43.617 | 0.600 | 87.292 | 87.035 | 0.257 | 170.0 | 225 | 5.73 | 50.0 |
| 3.001 | 107 | 108 | 31.322 | 0.600 | 87.035 | 86.851 | 0.184 | 170.0 | 225 | 6.25 | 50.0 |
| 3.002 | 108 | 109 | 27.650 | 0.600 | 86.851 | 86.688 | 0.163 | 170.0 | 225 | 6.71 | 50.0 |
| 1.004 | 109 | 110 | 15.402 | 0.600 | 86.613 | 86.549 | 0.064 | 240.0 | 300 | 6.96 | 50.0 |
| 1.005 | 110 | 111 | 46.743 | 0.600 | 86.174 | 86.018 | 0.156 | 300.0 | 375 | 7.71 | 50.0 |
| 1.006 | 111 | 114 | 12.609 | 0.600 | 86.018 | 85.976 | 0.042 | 300.0 | 375 | 7.92 | 50.0 |
| 4.000 | 112 | 113 | 15.912 | 0.600 | 86.273 | 86.179 | 0.094 | 170.0 | 225 | 5.27 | 50.0 |
| 4.001 | 113 | 114 | 9.017 | 0.600 | 86.179 | 86.126 | 0.053 | 170.0 | 225 | 5.42 | 50.0 |
| 1.007 | 114 | 115 | 12.669 | 0.600 | 85.976 | 85.934 | 0.042 | 300.0 | 375 | 8.12 | 50.0 |
| 1.008 | 115 | 116 | 18.317 | 0.600 | 85.859 | 85.813 | 0.046 | 400.0 | 450 | 8.42 | 50.0 |
| 1.009 | 116 | 126 | 22.377 | 0.600 | 85.813 | 85.757 | 0.056 | 400.0 | 450 | 8.79 | 50.0 |
| 5.000 | 117 | 118 | 15.609 | 0.600 | 87.575 | 87.483 | 0.092 | 170.0 | 225 | 5.26 | 50.0 |
| 5.001 | 118 | 119 | 25.142 | 0.600 | 87.483 | 87.335 | 0.148 | 170.0 | 225 | 5.68 | 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 | 1.000 | 39.7 | 7.7 | 1.200 | 1.623 | 0.057 | 0.0 | 67 | 0.779 |
| 1.001 | 1.000 | 39.7 | 15.4 | 1.623 | 1.688 | 0.114 | 0.0 | 97 | 0.937 |
| 1.002 | 2.151 | 85.5 | 23.2 | 1.688 | 1.815 | 0.171 | 0.0 | 80 | 1.833 |
| 2.000 | 1.005 | 17.8 | 7.7 | 1.200 | 1.815 | 0.057 | 0.0 | 69 | 0.972 |
| 1.003 | 2.113 | 84.0 | 38.6 | 1.815 | 2.386 | 0.285 | 0.0 | 107 | 2.067 |
| 3.000 | 1.000 | 39.7 | 7.7 | 1.200 | 2.007 | 0.057 | 0.0 | 67 | 0.779 |
| 3.001 | 1.000 | 39.7 | 15.4 | 2.007 | 2.578 | 0.114 | 0.0 | 97 | 0.937 |
| 3.002 | 1.000 | 39.7 | 23.2 | 2.578 | 2.386 | 0.171 | 0.0 | 123 | 1.037 |
| 1.004 | 1.010 | 71.4 | 69.5 | 2.386 | 2.081 | 0.513 | 0.0 | 241 | 1.145 |
| 1.005 | 1.041 | 114.9 | 77.2 | 2.381 | 2.101 | 0.570 | 0.0 | 225 | 1.113 |
| 1.006 | 1.041 | 114.9 | 85.0 | 2.101 | 2.288 | 0.627 | 0.0 | 241 | 1.135 |
| 4.000 | 1.000 | 39.7 | 7.7 | 2.655 | 2.424 | 0.057 | 0.0 | 67 | 0.779 |
| 4.001 | 1.000 | 39.7 | 15.4 | 2.424 | 2.288 | 0.114 | 0.0 | 97 | 0.937 |
| 1.007 | 1.041 | 114.9 | 108.1 | 2.288 | 2.073 | 0.798 | 0.0 | 291 | 1.177 |
| 1.008 | 1.010 | 160.7 | 115.9 | 2.073 | 1.795 | 0.855 | 0.0 | 284 | 1.096 |
| 1.009 | 1.010 | 160.7 | 123.6 | 1.795 | 2.010 | 0.912 | 0.0 | 298 | 1.110 |
| 5.000 | 1.000 | 39.7 | 7.7 | 1.900 | 2.464 | 0.057 | 0.0 | 67 | 0.779 |
| 5.001 | 1.000 | 39.7 | 15.4 | 2.464 | 2.588 | 0.114 | 0.0 | 97 | 0.937 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 119 | 120 | 15.017 | 0.600 | 87.335 | 87.247 | 0.088 | 170.0 | 225 | 5.93 | 50.0 |
| 5.003 | 120 | 122 | 12.412 | 0.600 | 87.247 | 87.174 | 0.073 | 170.0 | 225 | 6.14 | 50.0 |
| 6.000 | 121 | 122 | 12.865 | 0.600 | 87.153 | 87.099 | 0.054 | 240.0 | 300 | 5.21 | 50.0 |
| 5.004 | 122 | 123 | 18.460 | 0.600 | 87.099 | 87.022 | 0.077 | 240.0 | 300 | 6.44 | 50.0 |
| 5.005 | 123 | 124 | 12.711 | 0.600 | 87.022 | 86.969 | 0.053 | 240.0 | 300 | 6.65 | 50.0 |
| 5.006 | 124 | 125 | 15.226 | 0.600 | 86.894 | 86.831 | 0.063 | 240.0 | 375 | 6.87 | 50.0 |
| 5.007 | 125 | 126 | 30.837 | 0.600 | 86.831 | 85.757 | 1.074 | 28.7 | 375 | 7.02 | 50.0 |
| 1.010 | 126 | 127 | 30.137 | 0.600 | 85.757 | 85.580 | 0.177 | 170.3 | 225 | 9.29 | 50.0 |
| 1.011 | 127 | 131 | 23.241 | 0.600 | 85.580 | 83.945 | 1.635 | 14.2 | 300 | 9.38 | 50.0 |
| 7.000 | 128 | 129 | 13.311 | 0.600 | 82.600 | 82.522 | 0.078 | 170.0 | 225 | 5.22 | 50.0 |
| 7.001 | 129 | 130 | 20.036 | 0.600 | 82.522 | 82.404 | 0.118 | 170.0 | 225 | 5.56 | 50.0 |
| 7.002 | 130 | 131 | 44.243 | 0.600 | 82.329 | 82.145 | 0.184 | 240.0 | 300 | 6.29 | 50.0 |
| 1.012 | 131 | 132 | 40.041 | 0.600 | 82.070 | 81.937 | 0.133 | 300.0 | 375 | 10.03 | 50.0 |
| 1.013 | 132 | 139 | 26.875 | 0.600 | 81.937 | 81.560 | 0.377 | 71.3 | 450 | 10.21 | 50.0 |
| 8.000 | 133 | 134 | 16.994 | 0.600 | 86.758 | 85.907 | 0.851 | 20.0 | 225 | 5.10 | 50.0 |
| 8.001 | 134 | 135 | 32.241 | 0.600 | 85.832 | 84.468 | 1.364 | 23.6 | 225 | 5.30 | 50.0 |
| 8.002 | 135 | 136 | 29.593 | 0.600 | 84.393 | 83.014 | 1.379 | 21.5 | 300 | 5.44 | 50.0 |
| 8.003 | 136 | 137 | 41.626 | 0.600 | 83.014 | 82.841 | 0.173 | 240.0 | 300 | 6.13 | 50.0 |
| 8.004 | 137 | 138 | 51.858 | 0.600 | 82.841 | 82.011 | 0.830 | 62.5 | 300 | 6.56 | 50.0 |
| 8.005 | 138 | 139 | 21.748 | 0.600 | 81.936 | 81.560 | 0.376 | 57.8 | 375 | 6.71 | 50.0 |
| 1.014 | 139 | 140 | 21.491 | 0.600 | 79.875 | 79.821 | 0.054 | 400.0 | 450 | 10.57 | 50.0 |
| 1.015 | 140 | 141 | 25.340 | 0.600 | 79.521 | 78.897 | 0.624 | 40.6 | 450 | 10.70 | 50.0 |
| 1.016 | 141 | 143 | 35.613 | 0.600 | 78.897 | 78.808 | 0.089 | 400.0 | 450 | 11.29 | 50.0 |
| 9.000 | 142 | 143 | 22.181 | 0.600 | 78.863 | 78.808 | 0.055 | 400.0 | 450 | 5.37 | 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) |
|---|---|---|---|---|---|---|---|---|---|
| 5.002 | 1.000 | 39.7 | 23.2 | 2.588 | 2.169 | 0.171 | 0.0 | 123 | 1.037 |
| 5.003 | 1.000 | 39.7 | 30.9 | 2.169 | 1.701 | 0.228 | 0.0 | 150 | 1.102 |
| 6.000 | 1.010 | 71.4 | 7.7 | 1.222 | 1.701 | 0.057 | 0.0 | 67 | 0.668 |
| 5.004 | 1.010 | 71.4 | 46.2 | 1.701 | 2.021 | 0.341 | 0.0 | 176 | 1.073 |
| 5.005 | 1.010 | 71.4 | 53.8 | 2.021 | 1.808 | 0.397 | 0.0 | 195 | 1.106 |
| 5.006 | 1.165 | 128.7 | 61.4 | 1.808 | 1.529 | 0.453 | 0.0 | 183 | 1.153 |
| 5.007 | 3.392 | 374.6 | 69.0 | 1.529 | 2.085 | 0.509 | 0.0 | 108 | 2.608 |
| 1.010 | 0.999 | 39.7 | 200.2 | 2.235 | 1.911 | 1.477 | 0.0 | 225 | 1.017 |
| 1.011 | 4.191 | 296.2 | 212.2 | 1.836 | 2.310 | 1.566 | 0.0 | 188 | 4.541 |
| 7.000 | 1.000 | 39.7 | 12.1 | 2.332 | 2.638 | 0.089 | 0.0 | 85 | 0.879 |
| 7.001 | 1.000 | 39.7 | 24.1 | 2.638 | 3.086 | 0.178 | 0.0 | 127 | 1.048 |
| 7.002 | 1.010 | 71.4 | 36.2 | 3.086 | 4.110 | 0.267 | 0.0 | 151 | 1.014 |
| 1.012 | 1.041 | 114.9 | 260.5 | 4.110 | 2.240 | 1.922 | 0.0 | 375 | 1.054 |
| 1.013 | 2.410 | 383.3 | 272.5 | 2.165 | 1.200 | 2.011 | 0.0 | 282 | 2.607 |
| 8.000 | 2.941 | 116.9 | 12.1 | 1.125 | 1.125 | 0.089 | 0.0 | 49 | 1.920 |
| 8.001 | 2.702 | 107.4 | 24.1 | 1.200 | 1.200 | 0.178 | 0.0 | 73 | 2.196 |
| 8.002 | 3.408 | 240.9 | 36.2 | 1.200 | 1.350 | 0.267 | 0.0 | 78 | 2.478 |
| 8.003 | 1.010 | 71.4 | 48.2 | 1.350 | 1.338 | 0.356 | 0.0 | 181 | 1.082 |
| 8.004 | 1.992 | 140.8 | 60.4 | 1.338 | 1.338 | 0.446 | 0.0 | 137 | 1.920 |
| 8.005 | 2.386 | 263.5 | 72.6 | 1.338 | 1.275 | 0.536 | 0.0 | 134 | 2.052 |
| 1.014 | 1.010 | 160.7 | 357.4 | 2.885 | 0.900 | 2.637 | 0.0 | 450 | 1.023 |
| 1.015 | 3.197 | 508.5 | 369.6 | 1.200 | 1.153 | 2.727 | 0.0 | 285 | 3.471 |
| 1.016 | 1.010 | 160.7 | 369.6 | 1.153 | 1.618 | 2.727 | 0.0 | 450 | 1.023 |
| 9.000 | 1.010 | 160.7 | 12.2 | 2.040 | 1.618 | 0.090 | 0.0 | 83 | 0.604 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1.018 | 143 | 144 | 15.007 | 0.600 | 78.808 | 78.720 | 0.088 | 170.5 | 225 | 11.54 | 50.0 |
| 1.019 | 144 | 145 | 41.266 | 0.600 | 78.045 | 77.942 | 0.103 | 400.0 | 900 | 11.98 | 50.0 |
| 1.020 | 145 | 146 | 12.171 | 0.600 | 77.942 | 77.912 | 0.030 | 400.0 | 900 | 12.11 | 50.0 |
| 1.021 | 146 | 147 | 10.580 | 0.600 | 77.912 | 77.850 | 0.062 | 170.6 | 225 | 12.28 | 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) |
|---|---|---|---|---|---|---|---|---|---|
| 1.018 | 0.998 | 39.7 | 394.0 | 1.843 | 1.733 | 2.907 | 0.0 | 225 | 1.017 |
| 1.019 | 1.560 | 992.5 | 406.2 | 1.733 | 1.317 | 2.997 | 0.0 | 400 | 1.486 |
| 1.020 | 1.560 | 992.5 | 418.4 | 1.317 | 1.157 | 3.087 | 0.0 | 407 | 1.497 |
| 1.021 | 0.998 | 39.7 | 430.6 | 1.832 | 1.650 | 3.177 | 0.0 | 225 | 1.016 |

## 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 | 23.201 | 170.0 | 225 | Circular_Default Sewer Type | 89.649 | 88.224 | 1.200 | 89.936 | 88.088 | 1.623 |
| 1.001 | 13.643 | 170.0 | 225 | Circular_Default Sewer Type | 89.936 | 88.088 | 1.623 | 89.921 | 88.008 | 1.688 |
| 1.002 | 19.980 | 37.2 | 225 | Circular_Default Sewer Type | 89.921 | 88.008 | 1.688 | 89.511 | 87.471 | 1.815 |
| 2.000 | 17.558 | 100.0 | 150 | Circular_Default Sewer Type | 89.072 | 87.722 | 1.200 | 89.511 | 87.546 | 1.815 |
| 1.003 | 30.187 | 38.6 | 225 | Circular_Default Sewer Type | 89.511 | 87.471 | 1.815 | 89.299 | 86.688 | 2.386 |
| 3.000 | 43.617 | 170.0 | 225 | Circular_Default Sewer Type | 88.717 | 87.292 | 1.200 | 89.267 | 87.035 | 2.007 |
| 3.001 | 31.322 | 170.0 | 225 | Circular_Default Sewer Type | 89.267 | 87.035 | 2.007 | 89.654 | 86.851 | 2.578 |
| 3.002 | 27.650 | 170.0 | 225 | Circular_Default Sewer Type | 89.654 | 86.851 | 2.578 | 89.299 | 86.688 | 2.386 |
| 1.004 | 15.402 | 240.0 | 300 | Circular_Default Sewer Type | 89.299 | 86.613 | 2.386 | 88.930 | 86.549 | 2.081 |
| 1.005 | 46.743 | 300.0 | 375 | Circular_Default Sewer Type | 88.930 | 86.174 | 2.381 | 88.494 | 86.018 | 2.101 |
| 1.006 | 12.609 | 300.0 | 375 | Circular_Default Sewer Type | 88.494 | 86.018 | 2.101 | 88.639 | 85.976 | 2.288 |
| 4.000 | 15.912 | 170.0 | 225 | Circular_Default Sewer Type | 89.153 | 86.273 | 2.655 | 88.828 | 86.179 | 2.424 |
| 4.001 | 9.017 | 170.0 | 225 | Circular_Default Sewer Type | 88.828 | 86.179 | 2.424 | 88.639 | 86.126 | 2.288 |
| 1.007 | 12.669 | 300.0 | 375 | Circular_Default Sewer Type | 88.639 | 85.976 | 2.288 | 88.382 | 85.934 | 2.073 |
| 1.008 | 18.317 | 400.0 | 450 | Circular_Default Sewer Type | 88.382 | 85.859 | 2.073 | 88.058 | 85.813 | 1.795 |
| 1.009 | 22.377 | 400.0 | 450 | Circular_Default Sewer Type | 88.058 | 85.813 | 1.795 | 88.217 | 85.757 | 2.010 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 101 | 1500 | Manhole | Adoptable | 102 | 1500 | Manhole | Adoptable |
| 1.001 | 102 | 1500 | Manhole | Adoptable | 103 | 1500 | Manhole | Adoptable |
| 1.002 | 103 | 1500 | Manhole | Adoptable | 105 | 1500 | Manhole | Adoptable |
| 2.000 | 104 | 1500 | Manhole | Adoptable | 105 | 1500 | Manhole | Adoptable |
| 1.003 | 105 | 1500 | Manhole | Adoptable | 109 | 1500 | Manhole | Adoptable |
| 3.000 | 106 | 1500 | Manhole | Adoptable | 107 | 1500 | Manhole | Adoptable |
| 3.001 | 107 | 1500 | Manhole | Adoptable | 108 | 1500 | Manhole | Adoptable |
| 3.002 | 108 | 1500 | Manhole | Adoptable | 109 | 1500 | Manhole | Adoptable |
| 1.004 | 109 | 1500 | Manhole | Adoptable | 110 | 1500 | Manhole | Adoptable |
| 1.005 | 110 | 1500 | Manhole | Adoptable | 111 | 1500 | Manhole | Adoptable |
| 1.006 | 111 | 1500 | Manhole | Adoptable | 114 | 1500 | Manhole | Adoptable |
| 4.000 | 112 | 1500 | Manhole | Adoptable | 113 | 1500 | Manhole | Adoptable |
| 4.001 | 113 | 1500 | Manhole | Adoptable | 114 | 1500 | Manhole | Adoptable |
| 1.007 | 114 | 1500 | Manhole | Adoptable | 115 | 1500 | Manhole | Adoptable |
| 1.008 | 115 | 1500 | Manhole | Adoptable | 116 | 1500 | Manhole | Adoptable |
| 1.009 | 116 | 1500 | Manhole | Adoptable | 126 | 2100 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| 5.000 | 15.609 | 170.0 | 225 | Circular_Default Sewer Type | 89.700 | 87.575 | 1.900 | 90.172 | 87.483 | 2.464 |
| 5.001 | 25.142 | 170.0 | 225 | Circular_Default Sewer Type | 90.172 | 87.483 | 2.464 | 90.148 | 87.335 | 2.588 |
| 5.002 | 15.017 | 170.0 | 225 | Circular_Default Sewer Type | 90.148 | 87.335 | 2.588 | 89.641 | 87.247 | 2.169 |
| 5.003 | 12.412 | 170.0 | 225 | Circular_Default Sewer Type | 89.641 | 87.247 | 2.169 | 89.100 | 87.174 | 1.701 |
| 6.000 | 12.865 | 240.0 | 300 | Circular_Default Sewer Type | 88.675 | 87.153 | 1.222 | 89.100 | 87.099 | 1.701 |
| 5.004 | 18.460 | 240.0 | 300 | Circular_Default Sewer Type | 89.100 | 87.099 | 1.701 | 89.343 | 87.022 | 2.021 |
| 5.005 | 12.711 | 240.0 | 300 | Circular_Default Sewer Type | 89.343 | 87.022 | 2.021 | 89.077 | 86.969 | 1.808 |
| 5.006 | 15.226 | 240.0 | 375 | Circular_Default Sewer Type | 89.077 | 86.894 | 1.808 | 88.735 | 86.831 | 1.529 |
| 5.007 | 30.837 | 28.7 | 375 | Circular_Default Sewer Type | 88.735 | 86.831 | 1.529 | 88.217 | 85.757 | 2.085 |
| 1.010 | 30.137 | 170.3 | 225 | Circular_Default Sewer Type | 88.217 | 85.757 | 2.235 | 87.716 | 85.580 | 1.911 |
| 1.011 | 23.241 | 14.2 | 300 | Circular_Default Sewer Type | 87.716 | 85.580 | 1.836 | 86.555 | 83.945 | 2.310 |
| 7.000 | 13.311 | 170.0 | 225 | Circular_Default Sewer Type | 85.157 | 82.600 | 2.332 | 85.385 | 82.522 | 2.638 |
| 7.001 | 20.036 | 170.0 | 225 | Circular_Default Sewer Type | 85.385 | 82.522 | 2.638 | 85.715 | 82.404 | 3.086 |
| 7.002 | 44.243 | 240.0 | 300 | Circular_Default Sewer Type | 85.715 | 82.329 | 3.086 | 86.555 | 82.145 | 4.110 |
| 1.012 | 40.041 | 300.0 | 375 | Circular_Default Sewer Type | 86.555 | 82.070 | 4.110 | 84.552 | 81.937 | 2.240 |
| 1.013 | 26.875 | 71.3 | 450 | Circular_Default Sewer Type | 84.552 | 81.937 | 2.165 | 83.210 | 81.560 | 1.200 |
| 8.000 | 16.994 | 20.0 | 225 | Circular_Default Sewer Type | 88.108 | 86.758 | 1.125 | 87.257 | 85.907 | 1.125 |
| 8.001 | 32.241 | 23.6 | 225 | Circular_Default Sewer Type | 87.257 | 85.832 | 1.200 | 85.893 | 84.468 | 1.200 |
| 8.002 | 29.593 | 21.5 | 300 | Circular_Default Sewer Type | 85.893 | 84.393 | 1.200 | 84.664 | 83.014 | 1.350 |
| 8.003 | 41.626 | 240.0 | 300 | Circular_Default Sewer Type | 84.664 | 83.014 | 1.350 | 84.479 | 82.841 | 1.338 |
| 8.004 | 51.858 | 62.5 | 300 | Circular_Default Sewer Type | 84.479 | 82.841 | 1.338 | 83.649 | 82.011 | 1.338 |
| 8.005 | 21.748 | 57.8 | 375 | Circular_Default Sewer Type | 83.649 | 81.936 | 1.338 | 83.210 | 81.560 | 1.275 |
| 1.014 | 21.491 | 400.0 | 450 | Circular_Default Sewer Type | 83.210 | 79.875 | 2.885 | 81.171 | 79.821 | 0.900 |
| 1.015 | 25.340 | 40.6 | 450 | Circular_Default Sewer Type | 81.171 | 79.521 | 1.200 | 80.500 | 78.897 | 1.153 |
| 1.016 | 35.613 | 400.0 | 450 | Circular_Default Sewer Type | 80.500 | 78.897 | 1.153 | 80.876 | 78.808 | 1.618 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 5.000 | 117 | 1500 | Manhole | Adoptable | 118 | 1500 | Manhole | Adoptable |
| 5.001 | 118 | 1500 | Manhole | Adoptable | 119 | 1500 | Manhole | Adoptable |
| 5.002 | 119 | 1500 | Manhole | Adoptable | 120 | 1500 | Manhole | Adoptable |
| 5.003 | 120 | 1500 | Manhole | Adoptable | 122 | 1500 | Manhole | Adoptable |
| 6.000 | 121 | 1500 | Manhole | Adoptable | 122 | 1500 | Manhole | Adoptable |
| 5.004 | 122 | 1500 | Manhole | Adoptable | 123 | 1500 | Manhole | Adoptable |
| 5.005 | 123 | 1500 | Manhole | Adoptable | 124 | 1500 | Manhole | Adoptable |
| 5.006 | 124 | 1500 | Manhole | Adoptable | 125 | 1500 | Manhole | Adoptable |
| 5.007 | 125 | 1500 | Manhole | Adoptable | 126 | 2100 | Manhole | Adoptable |
| 1.010 | 126 | 2100 | Manhole | Adoptable | 127 | 1500 | Manhole | Adoptable |
| 1.011 | 127 | 1500 | Manhole | Adoptable | 131 | 1500 | Manhole | Adoptable |
| 7.000 | 128 | 1500 | Manhole | Adoptable | 129 | 1500 | Manhole | Adoptable |
| 7.001 | 129 | 1500 | Manhole | Adoptable | 130 | 1500 | Manhole | Adoptable |
| 7.002 | 130 | 1500 | Manhole | Adoptable | 131 | 1500 | Manhole | Adoptable |
| 1.012 | 131 | 1500 | Manhole | Adoptable | 132 | 1500 | Manhole | Adoptable |
| 1.013 | 132 | 1500 | Manhole | Adoptable | 139 | 1800 | Manhole | Adoptable |
| 8.000 | 133 | 1500 | Manhole | Adoptable | 134 | 1500 | Manhole | Adoptable |
| 8.001 | 134 | 1500 | Manhole | Adoptable | 135 | 1500 | Manhole | Adoptable |
| 8.002 | 135 | 1500 | Manhole | Adoptable | 136 | 1500 | Manhole | Adoptable |
| 8.003 | 136 | 1500 | Manhole | Adoptable | 137 | 1500 | Manhole | Adoptable |
| 8.004 | 137 | 1500 | Manhole | Adoptable | 138 | 1500 | Manhole | Adoptable |
| 8.005 | 138 | 1500 | Manhole | Adoptable | 139 | 1800 | Manhole | Adoptable |
| 1.014 | 139 | 1800 | Manhole | Adoptable | 140 | 1800 | Manhole | Adoptable |
| 1.015 | 140 | 1800 | Manhole | Adoptable | 141 | 1800 | Manhole | Adoptable |
| 1.016 | 141 | 1800 | Manhole | Adoptable | 143 | 2100 | 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) |
|---|---|---|---|---|---|---|---|---|---|---|
| 9.000 | 22.181 | 400.0 | 450 | Circular_Default Sewer Type | 81.353 | 78.863 | 2.040 | 80.876 | 78.808 | 1.618 |
| 1.018 | 15.007 | 170.5 | 225 | Circular_Default Sewer Type | 80.876 | 78.808 | 1.843 | 80.678 | 78.720 | 1.733 |
| 1.019 | 41.266 | 400.0 | 900 | Circular_Default Sewer Type | 80.678 | 78.045 | 1.733 | 80.159 | 77.942 | 1.317 |
| 1.020 | 12.171 | 400.0 | 900 | Circular_Default Sewer Type | 80.159 | 77.942 | 1.317 | 79.969 | 77.912 | 1.157 |
| 1.021 | 10.580 | 170.6 | 225 | Circular_Default Sewer Type | 79.969 | 77.912 | 1.832 | 79.725 | 77.850 | 1.650 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 9.000 | 142 | 1800 | Manhole | Adoptable | 143 | 2100 | Manhole | Adoptable |
| 1.018 | 143 | 2100 | Manhole | Adoptable | 144 | 2100 | Manhole | Adoptable |
| 1.019 | 144 | 2100 | Manhole | Adoptable | 145 | 2100 | Manhole | Adoptable |
| 1.020 | 145 | 2100 | Manhole | Adoptable | 146 | 2400 | Manhole | Adoptable |
| 1.021 | 146 | 2400 | Manhole | Adoptable | 147 | 1500 | Manhole | Adoptable |

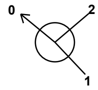
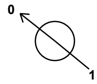
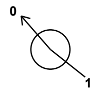
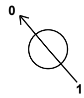
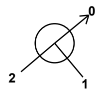
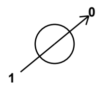
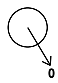
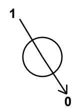
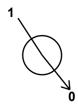
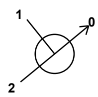
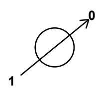
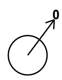
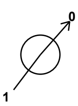
## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 101 | 328946.200 | 366819.225 | 89.649 | 1.425 | 1500 | 0 | 1.000 | 88.224 | 225 |
| 102 | 328959.657 | 366800.325 | 89.936 | 1.848 | 1500 | 1 | 1.000 | 88.088 | 225 |
| | | | | | | 0 | 1.001 | 88.088 | 225 |
| 103 | 328970.033 | 366791.467 | 89.921 | 1.913 | 1500 | 1 | 1.001 | 88.008 | 225 |
| | | | | | | 0 | 1.002 | 88.008 | 225 |
| 104 | 329003.208 | 366773.905 | 89.072 | 1.350 | 1500 | 0 | 2.000 | 87.722 | 150 |
| 105 | 328987.608 | 366781.963 | 89.511 | 2.040 | 1500 | 1 | 2.000 | 87.546 | 150 |
| | | | | | | 2 | 1.002 | 87.471 | 225 |
| | | | | | | 0 | 1.003 | 87.471 | 225 |
| 106 | 328896.011 | 366767.639 | 88.717 | 1.425 | 1500 | 0 | 3.000 | 87.292 | 225 |
| 107 | 328933.278 | 366744.976 | 89.267 | 2.232 | 1500 | 1 | 3.000 | 87.035 | 225 |
| | | | | | | 0 | 3.001 | 87.035 | 225 |
| 108 | 328961.088 | 366730.566 | 89.654 | 2.803 | 1500 | 1 | 3.001 | 86.851 | 225 |
| | | | | | | 0 | 3.002 | 86.851 | 225 |

**Manhole Schedule**

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 109 | 328973.588 | 366755.229 | 89.299 | 2.686 | 1500 | 1 | 3.002 | 86.688 | 225 |
| | | | | | | 2 | 1.003 | 86.688 | 225 |
| | | | | | | 0 | 1.004 | 86.613 | 300 |
| 110 | 328986.990 | 366747.638 | 88.930 | 2.756 | 1500 | 1 | 1.004 | 86.549 | 300 |
| | | | | | | 0 | 1.005 | 86.174 | 375 |
| 111 | 329027.414 | 366724.168 | 88.494 | 2.476 | 1500 | 1 | 1.005 | 86.018 | 375 |
| | | | | | | 0 | 1.006 | 86.018 | 375 |
| 112 | 329006.187 | 366710.941 | 89.153 | 2.880 | 1500 | | | | |
| | | | | | | 0 | 4.000 | 86.273 | 225 |
| 113 | 329022.079 | 366710.143 | 88.828 | 2.649 | 1500 | 1 | 4.000 | 86.179 | 225 |
| | | | | | | 0 | 4.001 | 86.179 | 225 |
| 114 | 329030.892 | 366712.048 | 88.639 | 2.663 | 1500 | 1 | 4.001 | 86.126 | 225 |
| | | | | | | 2 | 1.006 | 85.976 | 375 |
| | | | | | | 0 | 1.007 | 85.976 | 375 |
| 115 | 329041.567 | 366718.870 | 88.382 | 2.523 | 1500 | 1 | 1.007 | 85.934 | 375 |
| | | | | | | 0 | 1.008 | 85.859 | 450 |
| 116 | 329051.584 | 366734.205 | 88.058 | 2.245 | 1500 | 1 | 1.008 | 85.813 | 450 |
| | | | | | | 0 | 1.009 | 85.813 | 450 |
| 117 | 329153.090 | 366739.925 | 89.700 | 2.125 | 1500 | | | | |
| | | | | | | 0 | 5.000 | 87.575 | 225 |
| 118 | 329162.980 | 366727.849 | 90.172 | 2.689 | 1500 | 1 | 5.000 | 87.483 | 225 |
| | | | | | | 0 | 5.001 | 87.483 | 225 |
| 119 | 329143.413 | 366712.062 | 90.148 | 2.813 | 1500 | 1 | 5.001 | 87.335 | 225 |
| | | | | | | 0 | 5.002 | 87.335 | 225 |
| 120 | 329132.249 | 366702.018 | 89.641 | 2.394 | 1500 | 1 | 5.002 | 87.247 | 225 |
| | | | | | | 0 | 5.003 | 87.247 | 225 |
| 121 | 329131.618 | 366684.630 | 88.675 | 1.522 | 1500 | | | | |
| | | | | | | 0 | 6.000 | 87.153 | 300 |

**Manhole Schedule**

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 122 | 329122.787 | 366693.985 | 89.100 | 2.001 | 1500 |  | 1 | 6.000 | 87.099 | 300 |
| | | | | | | | 2 | 5.003 | 87.174 | 225 |
| | | | | | | | 0 | 5.004 | 87.099 | 300 |
| 123 | 329108.521 | 366705.701 | 89.343 | 2.321 | 1500 |  | 1 | 5.004 | 87.022 | 300 |
| | | | | | | | 0 | 5.005 | 87.022 | 300 |
| 124 | 329098.543 | 366713.576 | 89.077 | 2.183 | 1500 |  | 1 | 5.005 | 86.969 | 300 |
| | | | | | | | 0 | 5.006 | 86.894 | 375 |
| 125 | 329088.509 | 366725.028 | 88.735 | 1.904 | 1500 |  | 1 | 5.006 | 86.831 | 375 |
| | | | | | | | 0 | 5.007 | 86.831 | 375 |
| 126 | 329068.679 | 366748.644 | 88.217 | 2.460 | 2100 |  | 1 | 5.007 | 85.757 | 375 |
| | | | | | | | 2 | 1.009 | 85.757 | 450 |
| | | | | | | | 0 | 1.010 | 85.757 | 225 |
| 127 | 329092.002 | 366767.730 | 87.716 | 2.136 | 1500 |  | 1 | 1.010 | 85.580 | 225 |
| | | | | | | | 0 | 1.011 | 85.580 | 300 |
| 128 | 329064.317 | 366844.986 | 85.157 | 2.557 | 1500 |  | 0 | 7.000 | 82.600 | 225 |
| 129 | 329071.164 | 366833.571 | 85.385 | 2.863 | 1500 |  | 1 | 7.000 | 82.522 | 225 |
| | | | | | | | 0 | 7.001 | 82.522 | 225 |
| 130 | 329082.146 | 366816.813 | 85.715 | 3.386 | 1500 |  | 1 | 7.001 | 82.404 | 225 |
| | | | | | | | 0 | 7.002 | 82.329 | 300 |
| 131 | 329109.998 | 366782.437 | 86.555 | 4.485 | 1500 |  | 1 | 7.002 | 82.145 | 300 |
| | | | | | | | 2 | 1.011 | 83.945 | 300 |
| | | | | | | | 0 | 1.012 | 82.070 | 375 |
| 132 | 329140.937 | 366807.854 | 84.552 | 2.615 | 1500 |  | 1 | 1.012 | 81.937 | 375 |
| | | | | | | | 0 | 1.013 | 81.937 | 450 |
| 133 | 329225.126 | 366678.227 | 88.108 | 1.350 | 1500 |  | 0 | 8.000 | 86.758 | 225 |
| 134 | 329235.414 | 366691.753 | 87.257 | 1.425 | 1500 |  | 1 | 8.000 | 85.907 | 225 |
| | | | | | | | 0 | 8.001 | 85.832 | 225 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 135 | 329256.760 | 366715.915 | 85.893 | 1.500 | 1500 | 1 | 8.001 | 84.468 | 225 |
| | | | | | | 0 | 8.002 | 84.393 | 300 |
| 136 | 329234.635 | 366735.568 | 84.664 | 1.650 | 1500 | 1 | 8.002 | 83.014 | 300 |
| | | | | | | 0 | 8.003 | 83.014 | 300 |
| 137 | 329208.278 | 366767.787 | 84.479 | 1.638 | 1500 | 1 | 8.003 | 82.841 | 300 |
| | | | | | | 0 | 8.004 | 82.841 | 300 |
| 138 | 329175.479 | 366807.955 | 83.649 | 1.713 | 1500 | 1 | 8.004 | 82.011 | 300 |
| | | | | | | 0 | 8.005 | 81.936 | 375 |
| 139 | 329161.767 | 366824.836 | 83.210 | 3.335 | 1800 | 1 | 8.005 | 81.560 | 375 |
| | | | | | | 2 | 1.013 | 81.560 | 450 |
| | | | | | | 0 | 1.014 | 79.875 | 450 |
| 140 | 329162.502 | 366846.314 | 81.171 | 1.650 | 1800 | 1 | 1.014 | 79.821 | 450 |
| | | | | | | 0 | 1.015 | 79.521 | 450 |
| 141 | 329171.739 | 366869.910 | 80.500 | 1.603 | 1800 | 1 | 1.015 | 78.897 | 450 |
| | | | | | | 0 | 1.016 | 78.897 | 450 |
| 142 | 329194.533 | 366846.237 | 81.353 | 2.490 | 1800 | 0 | 9.000 | 78.863 | 450 |
| 143 | 329206.956 | 366864.613 | 80.876 | 2.068 | 2100 | 1 | 9.000 | 78.808 | 450 |
| | | | | | | 2 | 1.016 | 78.808 | 450 |
| | | | | | | 0 | 1.018 | 78.808 | 225 |
| 144 | 329219.028 | 366873.528 | 80.678 | 2.633 | 2100 | 1 | 1.018 | 78.720 | 225 |
| | | | | | | 0 | 1.019 | 78.045 | 900 |
| 145 | 329257.201 | 366889.203 | 80.159 | 2.217 | 2100 | 1 | 1.019 | 77.942 | 900 |
| | | | | | | 0 | 1.020 | 77.942 | 900 |
| 146 | 329266.838 | 366896.637 | 79.969 | 2.057 | 2400 | 1 | 1.020 | 77.912 | 900 |
| | | | | | | 0 | 1.021 | 77.912 | 225 |
| 147 | 329272.842 | 366905.349 | 79.725 | 1.875 | 1500 | 1 | 1.021 | 77.850 | 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 | 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 126 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 85.757 | Product Number | CTL-SHE-0134-1000-1800-1000 |
| Design Depth (m) | 1.800 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 10.0 | Min Node Diameter (mm) | 1500 |

## Node 146 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 77.912 | Product Number | CTL-SHE-0182-2000-2100-2000 |
| Design Depth (m) | 2.100 | Min Outlet Diameter (m) | 0.225 |
| Design Flow (l/s) | 20.0 | Min Node Diameter (mm) | 1800 |

## Node 143 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 78.808 | Product Number | CTL-SHE-0134-1000-1800-1000 |
| Design Depth (m) | 1.800 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 10.0 | Min Node Diameter (mm) | 1500 |

## Node 111 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 86.018 |
| 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) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 600.0 | 0.0 | 0.600 | 662.0 | 0.0 | 1.200 | 725.0 | 0.0 | 1.800 | 790.0 | 0.0 |
| 0.200 | 621.0 | 0.0 | 0.800 | 683.0 | 0.0 | 1.400 | 746.0 | 0.0 | 2.000 | 813.0 | 0.0 |
| 0.400 | 641.0 | 0.0 | 1.000 | 704.0 | 0.0 | 1.600 | 768.0 | 0.0 | | | |

## Node 141 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.24264 | Safety Factor | 2.0 | Invert Level (m) | 78.897 |
| Side Inf Coefficient (m/hr) | 0.24264 | 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) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 554.0 | 295.0 | 0.600 | 615.0 | 336.0 | 1.200 | 679.0 | 379.0 | 1.800 | 745.0 | 425.0 |
| 0.200 | 574.0 | 308.0 | 0.800 | 636.0 | 350.0 | 1.400 | 701.0 | 394.0 | 2.000 | 768.0 | 441.0 |
| 0.400 | 594.0 | 322.0 | 1.000 | 658.0 | 364.0 | 1.600 | 723.0 | 410.0 | | | |

## Node 144 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 78.610 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 108 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 25.0 | 0.0 | 0.800 | 25.0 | 0.0 | 0.801 | 0.0 | 0.0 |

## Other (defaults)

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 101 | 10 | 88.283 | 0.059 | 6.2 | 0.1512 | 0.0000 | OK |
| 15 minute winter | 102 | 11 | 88.176 | 0.088 | 12.2 | 0.2099 | 0.0000 | OK |
| 15 minute winter | 103 | 11 | 88.078 | 0.070 | 18.0 | 0.1644 | 0.0000 | OK |
| 15 minute winter | 104 | 10 | 87.784 | 0.062 | 6.2 | 0.1623 | 0.0000 | OK |
| 15 minute winter | 105 | 11 | 87.563 | 0.092 | 29.8 | 0.2145 | 0.0000 | OK |
| 15 minute winter | 106 | 11 | 87.350 | 0.058 | 6.2 | 0.1497 | 0.0000 | OK |
| 15 minute winter | 107 | 11 | 87.118 | 0.083 | 12.1 | 0.1898 | 0.0000 | OK |
| 15 minute winter | 108 | 11 | 86.956 | 0.105 | 17.6 | 0.2289 | 0.0000 | OK |
| 15 minute winter | 109 | 11 | 86.822 | 0.209 | 53.4 | 0.4590 | 0.0000 | OK |
| 15 minute winter | 110 | 10 | 86.727 | 0.553 | 60.2 | 1.2052 | 0.0000 | SURCHARGED |
| 360 minute winter | 111 | 264 | 86.196 | 0.178 | 20.4 | 108.9545 | 0.0000 | OK |
| 15 minute winter | 112 | 13 | 86.338 | 0.065 | 6.2 | 0.1401 | 0.0000 | OK |
| 15 minute winter | 113 | 12 | 86.352 | 0.173 | 12.3 | 0.3799 | 0.0000 | OK |
| 15 minute winter | 114 | 12 | 86.345 | 0.369 | 74.5 | 0.8096 | 0.0000 | OK |
| 15 minute winter | 115 | 12 | 86.356 | 0.497 | 55.3 | 1.1036 | 0.0000 | SURCHARGED |
| 15 minute winter | 116 | 12 | 86.360 | 0.547 | 50.0 | 1.2442 | 0.0000 | SURCHARGED |
| 15 minute winter | 117 | 10 | 87.634 | 0.059 | 6.2 | 0.1360 | 0.0000 | OK |
| 15 minute winter | 118 | 11 | 87.567 | 0.084 | 12.3 | 0.1835 | 0.0000 | OK |
| 15 minute winter | 119 | 11 | 87.449 | 0.114 | 18.1 | 0.2476 | 0.0000 | OK |
| 15 minute winter | 120 | 11 | 87.382 | 0.135 | 23.8 | 0.3032 | 0.0000 | OK |
| 15 minute winter | 121 | 11 | 87.263 | 0.110 | 6.2 | 0.2756 | 0.0000 | OK |
| 15 minute winter | 122 | 11 | 87.261 | 0.162 | 35.1 | 0.3781 | 0.0000 | OK |
| 15 minute winter | 123 | 11 | 87.195 | 0.173 | 40.5 | 0.3897 | 0.0000 | OK |
| 15 minute winter | 124 | 11 | 87.048 | 0.154 | 45.6 | 0.3515 | 0.0000 | OK |
| 15 minute winter | 125 | 11 | 86.923 | 0.092 | 51.0 | 0.2171 | 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 | 1.000 | 102 | 6.0 | 0.536 | 0.151 | 0.2624 | |
| 15 minute winter | 102 | 1.001 | 103 | 12.0 | 0.969 | 0.302 | 0.1692 | |
| 15 minute winter | 103 | 1.002 | 105 | 17.9 | 1.398 | 0.210 | 0.2570 | |
| 15 minute winter | 104 | 2.000 | 105 | 6.0 | 0.894 | 0.336 | 0.1178 | |
| 15 minute winter | 105 | 1.003 | 109 | 29.9 | 1.693 | 0.356 | 0.6043 | |
| 15 minute winter | 106 | 3.000 | 107 | 5.9 | 0.564 | 0.150 | 0.4689 | |
| 15 minute winter | 107 | 3.001 | 108 | 11.8 | 0.749 | 0.297 | 0.4945 | |
| 15 minute winter | 108 | 3.002 | 109 | 17.7 | 0.866 | 0.445 | 0.5939 | |
| 15 minute winter | 109 | 1.004 | 110 | 54.4 | 1.120 | 0.761 | 0.7470 | |
| 15 minute winter | 110 | 1.005 | 111 | 86.0 | 1.967 | 0.749 | 2.6253 | |
| 360 minute winter | 111 | 1.006 | 114 | 9.2 | 0.530 | 0.080 | 0.7487 | |
| 15 minute winter | 112 | 4.000 | 113 | 7.5 | 0.528 | 0.189 | 0.3320 | |
| 15 minute winter | 113 | 4.001 | 114 | 13.6 | 0.839 | 0.343 | 0.3253 | |
| 15 minute winter | 114 | 1.007 | 115 | -57.4 | 0.642 | -0.499 | 1.3946 | |
| 15 minute winter | 115 | 1.008 | 116 | -51.8 | 0.487 | -0.323 | 2.9022 | |
| 15 minute winter | 116 | 1.009 | 126 | -45.9 | 0.309 | -0.286 | 3.5455 | |
| 15 minute winter | 117 | 5.000 | 118 | 6.1 | 0.562 | 0.153 | 0.1694 | |
| 15 minute winter | 118 | 5.001 | 119 | 11.9 | 0.717 | 0.301 | 0.4227 | |
| 15 minute winter | 119 | 5.002 | 120 | 18.0 | 0.798 | 0.452 | 0.3385 | |
| 15 minute winter | 120 | 5.003 | 122 | 23.8 | 1.006 | 0.599 | 0.2939 | |
| 15 minute winter | 121 | 6.000 | 122 | 5.6 | 0.259 | 0.079 | 0.4001 | |
| 15 minute winter | 122 | 5.004 | 123 | 34.8 | 0.859 | 0.488 | 0.7483 | |
| 15 minute winter | 123 | 5.005 | 124 | 39.9 | 1.019 | 0.558 | 0.4991 | |
| 15 minute winter | 124 | 5.006 | 125 | 45.3 | 1.447 | 0.352 | 0.4844 | |
| 15 minute winter | 125 | 5.007 | 126 | 50.6 | 0.659 | 0.135 | 2.0241 | |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 126 | 12 | 86.363 | 0.606 | 56.3 | 2.3740 | 0.0000 | SURCHARGED |
| 15 minute winter | 127 | 10 | 85.633 | 0.053 | 19.6 | 0.1386 | 0.0000 | OK |
| 15 minute winter | 128 | 10 | 82.675 | 0.075 | 9.7 | 0.1852 | 0.0000 | OK |
| 15 minute winter | 129 | 11 | 82.636 | 0.114 | 19.2 | 0.2718 | 0.0000 | OK |
| 15 minute winter | 130 | 11 | 82.463 | 0.134 | 28.2 | 0.3069 | 0.0000 | OK |
| 15 minute winter | 131 | 11 | 82.256 | 0.186 | 56.3 | 0.4027 | 0.0000 | OK |
| 15 minute winter | 132 | 11 | 82.069 | 0.132 | 65.5 | 0.3225 | 0.0000 | OK |
| 15 minute winter | 133 | 10 | 86.803 | 0.045 | 9.7 | 0.1379 | 0.0000 | OK |
| 15 minute winter | 134 | 10 | 85.897 | 0.065 | 19.2 | 0.1970 | 0.0000 | OK |
| 15 minute winter | 135 | 10 | 84.462 | 0.069 | 28.6 | 0.2040 | 0.0000 | OK |
| 15 minute winter | 136 | 11 | 83.173 | 0.159 | 38.0 | 0.4513 | 0.0000 | OK |
| 15 minute winter | 137 | 11 | 82.962 | 0.121 | 47.0 | 0.3482 | 0.0000 | OK |
| 15 minute winter | 138 | 11 | 82.060 | 0.124 | 55.6 | 0.3483 | 0.0000 | OK |
| 15 minute winter | 139 | 11 | 80.181 | 0.306 | 129.5 | 0.9422 | 0.0000 | OK |
| 15 minute summer | 140 | 9 | 79.818 | 0.297 | 131.0 | 1.0789 | 0.0000 | OK |
| 240 minute winter | 141 | 188 | 79.112 | 0.215 | 43.0 | 122.2093 | 0.0000 | OK |
| 240 minute winter | 142 | 188 | 79.112 | 0.249 | 2.4 | 0.8133 | 0.0000 | OK |
| 240 minute winter | 143 | 188 | 79.112 | 0.304 | 9.8 | 1.3171 | 0.0000 | SURCHARGED |
| 30 minute winter | 144 | 24 | 78.194 | 0.149 | 15.8 | 0.6199 | 0.0000 | OK |
| 30 minute winter | 145 | 23 | 78.192 | 0.250 | 21.1 | 1.0683 | 0.0000 | OK |
| 30 minute winter | 146 | 23 | 78.192 | 0.280 | 20.5 | 1.5104 | 0.0000 | SURCHARGED |
| 15 minute summer | 147 | 1 | 77.850 | 0.000 | 17.5 | 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 | 126 | Hydro-Brake® | 127 | 10.0 | | | | |
| 15 minute winter | 127 | 1.011 | 131 | 19.5 | 2.356 | 0.066 | 0.1920 | |
| 15 minute winter | 128 | 7.000 | 129 | 9.5 | 0.604 | 0.240 | 0.2108 | |
| 15 minute winter | 129 | 7.001 | 130 | 18.9 | 0.969 | 0.475 | 0.3902 | |
| 15 minute winter | 130 | 7.002 | 131 | 28.0 | 0.948 | 0.392 | 1.3062 | |
| 15 minute winter | 131 | 1.012 | 132 | 56.4 | 1.270 | 0.491 | 1.7828 | |
| 15 minute winter | 132 | 1.013 | 139 | 65.1 | 1.763 | 0.170 | 0.9930 | |
| 15 minute winter | 133 | 8.000 | 134 | 9.6 | 1.752 | 0.082 | 0.0927 | |
| 15 minute winter | 134 | 8.001 | 135 | 18.9 | 2.017 | 0.176 | 0.3021 | |
| 15 minute winter | 135 | 8.002 | 136 | 28.3 | 1.171 | 0.118 | 0.7379 | |
| 15 minute winter | 136 | 8.003 | 137 | 37.8 | 1.174 | 0.530 | 1.3427 | |
| 15 minute winter | 137 | 8.004 | 138 | 46.4 | 1.776 | 0.329 | 1.3552 | |
| 15 minute winter | 138 | 8.005 | 139 | 55.2 | 1.833 | 0.210 | 0.6551 | |
| 15 minute winter | 139 | 1.014 | 140 | 127.9 | 1.253 | 0.796 | 2.2035 | |
| 15 minute summer | 140 | 1.015 | 141 | 134.8 | 3.577 | 0.265 | 1.4183 | |
| 240 minute winter | 141 | 1.016 | 143 | 9.0 | 0.251 | 0.056 | 3.3625 | |
| 240 minute winter | 141 | Infiltration | | 10.4 | | | | |
| 240 minute winter | 142 | 9.000 | 143 | 2.0 | 0.149 | 0.013 | 2.2605 | |
| 240 minute winter | 143 | Hydro-Brake® | 144 | 9.5 | | | | |
| 30 minute winter | 144 | 1.019 | 145 | 14.0 | 0.343 | 0.014 | 4.3675 | |
| 30 minute winter | 145 | 1.020 | 146 | 15.7 | 0.211 | 0.016 | 1.8935 | |
| 30 minute winter | 146 | Hydro-Brake® | 147 | 18.0 | | | | 88.3 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 101 | 10 | 88.318 | 0.094 | 15.0 | 0.2417 | 0.0000 | OK |
| 15 minute winter | 102 | 10 | 88.237 | 0.149 | 29.7 | 0.3551 | 0.0000 | OK |
| 15 minute winter | 103 | 10 | 88.123 | 0.115 | 44.1 | 0.2720 | 0.0000 | OK |
| 15 minute winter | 104 | 10 | 87.833 | 0.111 | 15.0 | 0.2896 | 0.0000 | OK |
| 15 minute winter | 105 | 11 | 87.661 | 0.190 | 73.3 | 0.4409 | 0.0000 | OK |
| 15 minute winter | 106 | 10 | 87.385 | 0.093 | 15.0 | 0.2399 | 0.0000 | OK |
| 15 minute winter | 107 | 12 | 87.359 | 0.324 | 29.6 | 0.7372 | 0.0000 | SURCHARGED |
| 15 minute winter | 108 | 12 | 87.263 | 0.412 | 38.5 | 0.8960 | 0.0000 | SURCHARGED |
| 15 minute winter | 109 | 11 | 87.086 | 0.473 | 123.7 | 1.0361 | 0.0000 | SURCHARGED |
| 15 minute summer | 110 | 9 | 86.886 | 0.712 | 131.2 | 1.5532 | 0.0000 | SURCHARGED |
| 360 minute winter | 111 | 352 | 86.602 | 0.584 | 54.6 | 369.3770 | 0.0000 | SURCHARGED |
| 15 minute winter | 112 | 11 | 86.761 | 0.488 | 20.6 | 1.0553 | 0.0000 | SURCHARGED |
| 15 minute winter | 113 | 11 | 86.740 | 0.561 | 30.0 | 1.2324 | 0.0000 | SURCHARGED |
| 15 minute winter | 114 | 10 | 86.690 | 0.714 | 204.8 | 1.5681 | 0.0000 | SURCHARGED |
| 15 minute winter | 115 | 11 | 86.804 | 0.945 | 157.5 | 2.0973 | 0.0000 | SURCHARGED |
| 15 minute winter | 116 | 11 | 86.857 | 1.044 | 142.1 | 2.3743 | 0.0000 | SURCHARGED |
| 15 minute winter | 117 | 12 | 87.777 | 0.202 | 15.0 | 0.4662 | 0.0000 | OK |
| 15 minute winter | 118 | 12 | 87.767 | 0.284 | 29.4 | 0.6223 | 0.0000 | SURCHARGED |
| 15 minute winter | 119 | 12 | 87.698 | 0.363 | 40.3 | 0.7895 | 0.0000 | SURCHARGED |
| 15 minute winter | 120 | 12 | 87.598 | 0.351 | 48.5 | 0.7872 | 0.0000 | SURCHARGED |
| 15 minute winter | 121 | 11 | 87.454 | 0.301 | 15.0 | 0.7585 | 0.0000 | SURCHARGED |
| 15 minute winter | 122 | 11 | 87.451 | 0.352 | 74.7 | 0.8194 | 0.0000 | SURCHARGED |
| 15 minute winter | 123 | 11 | 87.337 | 0.315 | 88.1 | 0.7097 | 0.0000 | SURCHARGED |
| 15 minute winter | 124 | 11 | 87.142 | 0.248 | 101.6 | 0.5652 | 0.0000 | OK |
| 15 minute winter | 125 | 11 | 87.017 | 0.186 | 114.8 | 0.4387 | 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 | 1.000 | 102 | 14.7 | 0.674 | 0.371 | 0.5060 | |
| 15 minute winter | 102 | 1.001 | 103 | 29.1 | 1.216 | 0.733 | 0.3296 | |
| 15 minute winter | 103 | 1.002 | 105 | 43.8 | 1.588 | 0.512 | 0.5585 | |
| 15 minute winter | 104 | 2.000 | 105 | 14.6 | 1.068 | 0.823 | 0.2475 | |
| 15 minute winter | 105 | 1.003 | 109 | 72.6 | 1.841 | 0.864 | 1.1392 | |
| 15 minute winter | 106 | 3.000 | 107 | 14.6 | 0.683 | 0.367 | 1.2046 | |
| 15 minute winter | 107 | 3.001 | 108 | 28.5 | 0.828 | 0.718 | 1.2457 | |
| 15 minute winter | 108 | 3.002 | 109 | 39.2 | 0.992 | 0.986 | 1.0997 | |
| 15 minute winter | 109 | 1.004 | 110 | 122.8 | 1.747 | 1.720 | 1.0846 | |
| 15 minute summer | 110 | 1.005 | 111 | 148.3 | 2.002 | 1.290 | 3.1302 | |
| 360 minute winter | 111 | 1.006 | 114 | -26.8 | -0.363 | -0.233 | 1.3907 | |
| 15 minute winter | 112 | 4.000 | 113 | 16.0 | 0.617 | 0.403 | 0.6328 | |
| 15 minute winter | 113 | 4.001 | 114 | 31.9 | 0.871 | 0.804 | 0.3586 | |
| 15 minute winter | 114 | 1.007 | 115 | -161.1 | -1.461 | -1.402 | 1.3974 | |
| 15 minute winter | 115 | 1.008 | 116 | -145.7 | -0.920 | -0.907 | 2.9022 | |
| 15 minute winter | 116 | 1.009 | 126 | -130.3 | -0.823 | -0.811 | 3.5455 | |
| 15 minute winter | 117 | 5.000 | 118 | 14.4 | 0.677 | 0.362 | 0.6042 | |
| 15 minute winter | 118 | 5.001 | 119 | 26.4 | 0.799 | 0.663 | 0.9999 | |
| 15 minute winter | 119 | 5.002 | 120 | 36.7 | 0.923 | 0.924 | 0.5972 | |
| 15 minute winter | 120 | 5.003 | 122 | 49.0 | 1.233 | 1.233 | 0.4936 | |
| 15 minute winter | 121 | 6.000 | 122 | 13.8 | 0.283 | 0.193 | 0.9057 | |
| 15 minute winter | 122 | 5.004 | 123 | 74.3 | 1.055 | 1.040 | 1.2999 | |
| 15 minute winter | 123 | 5.005 | 124 | 87.7 | 1.303 | 1.229 | 0.8173 | |
| 15 minute winter | 124 | 5.006 | 125 | 100.9 | 1.773 | 0.784 | 1.0042 | |
| 15 minute winter | 125 | 5.007 | 126 | 116.9 | 1.255 | 0.312 | 2.5427 | |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 126 | 11 | 86.905 | 1.148 | 128.4 | 4.4989 | 0.0000 | SURCHARGED |
| 15 minute winter | 127 | 10 | 85.648 | 0.068 | 31.6 | 0.1769 | 0.0000 | OK |
| 15 minute winter | 128 | 11 | 82.785 | 0.185 | 23.5 | 0.4562 | 0.0000 | OK |
| 15 minute winter | 129 | 11 | 82.761 | 0.239 | 45.1 | 0.5698 | 0.0000 | SURCHARGED |
| 15 minute winter | 130 | 11 | 82.571 | 0.242 | 66.3 | 0.5559 | 0.0000 | OK |
| 15 minute winter | 131 | 11 | 82.366 | 0.296 | 119.2 | 0.6413 | 0.0000 | OK |
| 15 minute winter | 132 | 11 | 82.142 | 0.205 | 141.7 | 0.5022 | 0.0000 | OK |
| 15 minute winter | 133 | 10 | 86.829 | 0.071 | 23.5 | 0.2198 | 0.0000 | OK |
| 15 minute winter | 134 | 10 | 85.939 | 0.107 | 46.7 | 0.3231 | 0.0000 | OK |
| 15 minute winter | 135 | 10 | 84.502 | 0.109 | 69.6 | 0.3225 | 0.0000 | OK |
| 15 minute winter | 136 | 11 | 83.386 | 0.371 | 92.6 | 1.0573 | 0.0000 | SURCHARGED |
| 15 minute winter | 137 | 11 | 83.052 | 0.211 | 112.5 | 0.6046 | 0.0000 | OK |
| 15 minute winter | 138 | 11 | 82.144 | 0.208 | 132.9 | 0.5856 | 0.0000 | OK |
| 15 minute winter | 139 | 11 | 80.480 | 0.605 | 296.5 | 1.8665 | 0.0000 | SURCHARGED |
| 15 minute winter | 140 | 8 | 80.268 | 0.747 | 318.0 | 2.7167 | 0.0000 | SURCHARGED |
| 360 minute winter | 141 | 304 | 79.510 | 0.613 | 67.1 | 359.8025 | 0.0000 | SURCHARGED |
| 360 minute winter | 142 | 304 | 79.509 | 0.646 | 4.1 | 2.1119 | 0.0000 | SURCHARGED |
| 360 minute winter | 143 | 304 | 79.509 | 0.701 | 11.1 | 3.0392 | 0.0000 | SURCHARGED |
| 60 minute winter | 144 | 48 | 78.601 | 0.556 | 22.9 | 2.3046 | 0.0000 | OK |
| 60 minute winter | 145 | 49 | 78.599 | 0.657 | 26.9 | 2.8102 | 0.0000 | OK |
| 60 minute winter | 146 | 49 | 78.599 | 0.687 | 25.4 | 3.7099 | 0.0000 | SURCHARGED |
| 15 minute summer | 147 | 1 | 77.850 | 0.000 | 19.8 | 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 | 126 | Hydro-Brake® | 127 | 10.0 | | | | |
| 15 minute winter | 127 | 1.011 | 131 | 31.6 | 2.703 | 0.107 | 0.2714 | |
| 15 minute winter | 128 | 7.000 | 129 | 22.1 | 0.662 | 0.557 | 0.4975 | |
| 15 minute winter | 129 | 7.001 | 130 | 44.2 | 1.155 | 1.111 | 0.7319 | |
| 15 minute winter | 130 | 7.002 | 131 | 66.3 | 1.161 | 0.929 | 2.5821 | |
| 15 minute winter | 131 | 1.012 | 132 | 119.6 | 1.528 | 1.041 | 3.1050 | |
| 15 minute winter | 132 | 1.013 | 139 | 142.1 | 2.148 | 0.371 | 1.7782 | |
| 15 minute winter | 133 | 8.000 | 134 | 23.2 | 2.234 | 0.199 | 0.1769 | |
| 15 minute winter | 134 | 8.001 | 135 | 46.1 | 2.547 | 0.429 | 0.5834 | |
| 15 minute winter | 135 | 8.002 | 136 | 69.2 | 1.384 | 0.287 | 1.3846 | |
| 15 minute winter | 136 | 8.003 | 137 | 90.1 | 1.359 | 1.262 | 2.5675 | |
| 15 minute winter | 137 | 8.004 | 138 | 110.5 | 2.173 | 0.785 | 2.6476 | |
| 15 minute winter | 138 | 8.005 | 139 | 132.0 | 2.265 | 0.501 | 1.2694 | |
| 15 minute winter | 139 | 1.014 | 140 | 295.6 | 1.881 | 1.840 | 3.4023 | |
| 15 minute winter | 140 | 1.015 | 141 | 321.0 | 3.987 | 0.631 | 2.1425 | |
| 360 minute winter | 141 | 1.016 | 143 | 9.9 | 0.237 | 0.061 | 5.6426 | |
| 360 minute winter | 141 | Infiltration | | 11.4 | | | | |
| 360 minute winter | 142 | 9.000 | 143 | 3.5 | 0.155 | 0.022 | 3.5144 | |
| 360 minute winter | 143 | Hydro-Brake® | 144 | 10.0 | | | | |
| 60 minute winter | 144 | 1.019 | 145 | 15.2 | 0.344 | 0.015 | 18.7160 | |
| 60 minute winter | 145 | 1.020 | 146 | 18.4 | 0.221 | 0.019 | 6.1806 | |
| 60 minute winter | 146 | Hydro-Brake® | 147 | 19.9 | | | | 224.7 |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 101 | 10 | 88.333 | 0.109 | 19.3 | 0.2787 | 0.0000 | OK |
| 15 minute winter | 102 | 12 | 88.300 | 0.212 | 38.3 | 0.5056 | 0.0000 | OK |
| 15 minute winter | 103 | 12 | 88.237 | 0.229 | 55.4 | 0.5415 | 0.0000 | SURCHARGED |
| 15 minute winter | 104 | 12 | 88.196 | 0.474 | 19.3 | 1.2374 | 0.0000 | SURCHARGED |
| 15 minute winter | 105 | 12 | 88.027 | 0.556 | 83.0 | 1.2937 | 0.0000 | SURCHARGED |
| 15 minute winter | 106 | 12 | 87.628 | 0.336 | 19.3 | 0.8624 | 0.0000 | SURCHARGED |
| 15 minute winter | 107 | 12 | 87.582 | 0.547 | 35.1 | 1.2467 | 0.0000 | SURCHARGED |
| 15 minute winter | 108 | 12 | 87.452 | 0.601 | 46.4 | 1.3055 | 0.0000 | SURCHARGED |
| 15 minute winter | 109 | 12 | 87.186 | 0.573 | 141.1 | 1.2570 | 0.0000 | SURCHARGED |
| 15 minute winter | 110 | 8 | 86.938 | 0.764 | 158.3 | 1.6665 | 0.0000 | SURCHARGED |
| 480 minute winter | 111 | 464 | 86.854 | 0.836 | 59.9 | 539.8792 | 0.0000 | SURCHARGED |
| 15 minute winter | 112 | 10 | 86.908 | 0.635 | 19.3 | 1.3728 | 0.0000 | SURCHARGED |
| 15 minute winter | 113 | 10 | 86.878 | 0.699 | 38.9 | 1.5362 | 0.0000 | SURCHARGED |
| 480 minute winter | 114 | 464 | 86.854 | 0.878 | 30.1 | 1.9277 | 0.0000 | SURCHARGED |
| 15 minute winter | 115 | 11 | 86.933 | 1.074 | 187.2 | 2.3832 | 0.0000 | SURCHARGED |
| 15 minute winter | 116 | 11 | 87.006 | 1.193 | 173.4 | 2.7132 | 0.0000 | SURCHARGED |
| 15 minute winter | 117 | 12 | 88.126 | 0.551 | 19.3 | 1.2697 | 0.0000 | SURCHARGED |
| 15 minute winter | 118 | 12 | 88.111 | 0.627 | 32.2 | 1.3749 | 0.0000 | SURCHARGED |
| 15 minute winter | 119 | 12 | 88.019 | 0.684 | 45.9 | 1.4847 | 0.0000 | SURCHARGED |
| 15 minute winter | 120 | 12 | 87.881 | 0.634 | 60.2 | 1.4218 | 0.0000 | SURCHARGED |
| 15 minute winter | 121 | 12 | 87.669 | 0.516 | 19.3 | 1.2980 | 0.0000 | SURCHARGED |
| 15 minute winter | 122 | 12 | 87.664 | 0.565 | 88.4 | 1.3153 | 0.0000 | SURCHARGED |
| 15 minute winter | 123 | 12 | 87.496 | 0.474 | 104.0 | 1.0676 | 0.0000 | SURCHARGED |
| 15 minute winter | 124 | 11 | 87.325 | 0.431 | 120.3 | 0.9816 | 0.0000 | SURCHARGED |
| 15 minute winter | 125 | 11 | 87.248 | 0.417 | 137.7 | 0.9826 | 0.0000 | SURCHARGED |

| 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 | 1.000 | 102 | 19.0 | 0.702 | 0.478 | 0.6434 | |
| 15 minute winter | 102 | 1.001 | 103 | 36.1 | 1.222 | 0.908 | 0.5362 | |
| 15 minute winter | 103 | 1.002 | 105 | 52.2 | 1.586 | 0.611 | 0.7946 | |
| 15 minute winter | 104 | 2.000 | 105 | 16.9 | 1.117 | 0.952 | 0.3091 | |
| 15 minute winter | 105 | 1.003 | 109 | 79.5 | 1.998 | 0.946 | 1.2006 | |
| 15 minute winter | 106 | 3.000 | 107 | 16.9 | 0.706 | 0.425 | 1.7347 | |
| 15 minute winter | 107 | 3.001 | 108 | 30.6 | 0.810 | 0.771 | 1.2457 | |
| 15 minute winter | 108 | 3.002 | 109 | 46.3 | 1.165 | 1.166 | 1.0997 | |
| 15 minute winter | 109 | 1.004 | 110 | 141.4 | 2.009 | 1.981 | 1.0846 | |
| 15 minute winter | 110 | 1.005 | 111 | 165.3 | 2.154 | 1.438 | 4.2527 | |
| 480 minute winter | 111 | 1.006 | 114 | -29.9 | 0.383 | -0.260 | 1.3907 | |
| 15 minute winter | 112 | 4.000 | 113 | 20.7 | 0.611 | 0.521 | 0.6328 | |
| 15 minute winter | 113 | 4.001 | 114 | 41.4 | 1.042 | 1.042 | 0.3586 | |
| 480 minute winter | 114 | 1.007 | 115 | -22.2 | 0.501 | -0.193 | 1.3974 | |
| 15 minute winter | 115 | 1.008 | 116 | -176.1 | -1.112 | -1.096 | 2.9022 | |
| 15 minute winter | 116 | 1.009 | 126 | -162.3 | -1.025 | -1.010 | 3.5455 | |
| 15 minute winter | 117 | 5.000 | 118 | 15.2 | 0.681 | 0.381 | 0.6208 | |
| 15 minute winter | 118 | 5.001 | 119 | 29.8 | 0.810 | 0.751 | 0.9999 | |
| 15 minute winter | 119 | 5.002 | 120 | 44.9 | 1.128 | 1.129 | 0.5972 | |
| 15 minute winter | 120 | 5.003 | 122 | 60.3 | 1.517 | 1.518 | 0.4936 | |
| 15 minute winter | 121 | 6.000 | 122 | 16.8 | 0.300 | 0.235 | 0.9059 | |
| 15 minute winter | 122 | 5.004 | 123 | 91.7 | 1.303 | 1.284 | 1.2999 | |
| 15 minute winter | 123 | 5.005 | 124 | 106.5 | 1.515 | 1.492 | 0.8951 | |
| 15 minute winter | 124 | 5.006 | 125 | 123.5 | 1.765 | 0.960 | 1.6794 | |
| 15 minute winter | 125 | 5.007 | 126 | 153.0 | 1.420 | 0.408 | 3.4012 | |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 126 | 11 | 87.072 | 1.315 | 163.9 | 5.1518 | 0.0000 | SURCHARGED |
| 15 minute winter | 127 | 10 | 85.656 | 0.076 | 38.7 | 0.1963 | 0.0000 | OK |
| 15 minute winter | 128 | 11 | 83.031 | 0.431 | 30.2 | 1.0626 | 0.0000 | SURCHARGED |
| 15 minute winter | 129 | 11 | 82.986 | 0.464 | 55.9 | 1.1089 | 0.0000 | SURCHARGED |
| 15 minute winter | 130 | 11 | 82.734 | 0.405 | 81.4 | 0.9297 | 0.0000 | SURCHARGED |
| 15 minute winter | 131 | 11 | 82.470 | 0.400 | 144.1 | 0.8649 | 0.0000 | SURCHARGED |
| 15 minute winter | 132 | 11 | 82.167 | 0.230 | 172.0 | 0.5633 | 0.0000 | OK |
| 15 minute winter | 133 | 10 | 86.840 | 0.082 | 30.2 | 0.2526 | 0.0000 | OK |
| 15 minute winter | 134 | 10 | 85.957 | 0.125 | 60.1 | 0.3776 | 0.0000 | OK |
| 15 minute winter | 135 | 10 | 84.518 | 0.125 | 89.5 | 0.3697 | 0.0000 | OK |
| 15 minute winter | 136 | 11 | 83.596 | 0.582 | 119.2 | 1.6556 | 0.0000 | SURCHARGED |
| 15 minute winter | 137 | 11 | 83.110 | 0.269 | 143.1 | 0.7697 | 0.0000 | OK |
| 15 minute winter | 138 | 11 | 82.182 | 0.246 | 169.9 | 0.6937 | 0.0000 | OK |
| 15 minute winter | 139 | 11 | 80.651 | 0.776 | 368.5 | 2.3941 | 0.0000 | SURCHARGED |
| 15 minute winter | 140 | 7 | 80.391 | 0.870 | 395.5 | 3.1625 | 0.0000 | SURCHARGED |
| 360 minute winter | 141 | 344 | 79.738 | 0.841 | 84.2 | 504.2155 | 0.0000 | SURCHARGED |
| 360 minute winter | 142 | 344 | 79.738 | 0.875 | 5.4 | 2.8602 | 0.0000 | SURCHARGED |
| 360 minute winter | 143 | 344 | 79.738 | 0.930 | 11.2 | 4.0315 | 0.0000 | SURCHARGED |
| 120 minute winter | 144 | 92 | 78.820 | 0.775 | 21.5 | 8.4818 | 0.0000 | OK |
| 120 minute winter | 145 | 92 | 78.822 | 0.880 | 24.0 | 3.7639 | 0.0000 | OK |
| 120 minute winter | 146 | 92 | 78.822 | 0.910 | 24.2 | 4.9154 | 0.0000 | SURCHARGED |
| 15 minute summer | 147 | 1 | 77.850 | 0.000 | 19.9 | 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 | 126 | Hydro-Brake® | 127 | 10.0 | | | | |
| 15 minute winter | 127 | 1.011 | 131 | 38.4 | 2.847 | 0.130 | 0.3133 | |
| 15 minute winter | 128 | 7.000 | 129 | 26.7 | 0.672 | 0.673 | 0.5294 | |
| 15 minute winter | 129 | 7.001 | 130 | 53.4 | 1.342 | 1.343 | 0.7969 | |
| 15 minute winter | 130 | 7.002 | 131 | 79.7 | 1.200 | 1.117 | 3.1156 | |
| 15 minute winter | 131 | 1.012 | 132 | 143.6 | 1.596 | 1.249 | 3.6273 | |
| 15 minute winter | 132 | 1.013 | 139 | 170.7 | 2.240 | 0.445 | 2.0487 | |
| 15 minute winter | 133 | 8.000 | 134 | 29.9 | 2.385 | 0.256 | 0.2131 | |
| 15 minute winter | 134 | 8.001 | 135 | 59.3 | 2.701 | 0.552 | 0.7074 | |
| 15 minute winter | 135 | 8.002 | 136 | 89.0 | 1.552 | 0.369 | 1.4536 | |
| 15 minute winter | 136 | 8.003 | 137 | 114.5 | 1.627 | 1.603 | 2.8502 | |
| 15 minute winter | 137 | 8.004 | 138 | 141.2 | 2.231 | 1.003 | 3.4907 | |
| 15 minute winter | 138 | 8.005 | 139 | 169.1 | 2.382 | 0.642 | 1.5432 | |
| 15 minute winter | 139 | 1.014 | 140 | 366.8 | 2.317 | 2.283 | 3.4051 | |
| 15 minute winter | 140 | 1.015 | 141 | 398.7 | 3.948 | 0.784 | 2.6178 | |
| 360 minute winter | 141 | 1.016 | 143 | 9.8 | 0.237 | 0.061 | 5.6426 | |
| 360 minute winter | 141 | Infiltration | | 11.9 | | | | |
| 360 minute winter | 142 | 9.000 | 143 | 5.0 | 0.165 | 0.031 | 3.5144 | |
| 360 minute winter | 143 | Hydro-Brake® | 144 | 10.0 | | | | |
| 120 minute winter | 144 | 1.019 | 145 | 16.6 | 0.344 | 0.017 | 24.9885 | |
| 120 minute winter | 145 | 1.020 | 146 | 18.9 | 0.206 | 0.019 | 7.6922 | |
| 120 minute winter | 146 | Hydro-Brake® | 147 | 19.9 | | | | 294.9 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 101 | 13 | 89.203 | 0.979 | 29.0 | 2.5139 | 0.0000 | SURCHARGED |
| 15 minute winter | 102 | 13 | 89.163 | 1.075 | 44.9 | 2.5627 | 0.0000 | SURCHARGED |
| 15 minute winter | 103 | 13 | 89.060 | 1.052 | 62.3 | 2.4856 | 0.0000 | SURCHARGED |
| 15 minute winter | 104 | 13 | 89.006 | 1.284 | 29.0 | 3.3525 | 0.0000 | FLOOD RISK |
| 15 minute winter | 105 | 12 | 88.753 | 1.282 | 98.5 | 2.9813 | 0.0000 | SURCHARGED |
| 15 minute winter | 106 | 12 | 88.405 | 1.113 | 29.0 | 2.8577 | 0.0000 | SURCHARGED |
| 15 minute winter | 107 | 12 | 88.320 | 1.285 | 46.5 | 2.9269 | 0.0000 | SURCHARGED |
| 15 minute winter | 108 | 12 | 88.066 | 1.215 | 67.2 | 2.6407 | 0.0000 | SURCHARGED |
| 15 minute winter | 109 | 12 | 87.540 | 0.927 | 183.1 | 2.0330 | 0.0000 | SURCHARGED |
| 720 minute winter | 110 | 690 | 87.379 | 1.205 | 30.8 | 2.6284 | 0.0000 | SURCHARGED |
| 720 minute winter | 111 | 690 | 87.379 | 1.361 | 68.3 | 915.7278 | 0.0000 | SURCHARGED |
| 720 minute winter | 112 | 690 | 87.379 | 1.106 | 3.1 | 2.3920 | 0.0000 | SURCHARGED |
| 720 minute winter | 113 | 690 | 87.379 | 1.200 | 6.0 | 2.6361 | 0.0000 | SURCHARGED |
| 720 minute winter | 114 | 690 | 87.379 | 1.403 | 35.9 | 3.0792 | 0.0000 | SURCHARGED |
| 720 minute winter | 115 | 690 | 87.379 | 1.520 | 27.3 | 3.3722 | 0.0000 | SURCHARGED |
| 15 minute winter | 116 | 11 | 87.400 | 1.587 | 219.7 | 3.6115 | 0.0000 | SURCHARGED |
| 15 minute winter | 117 | 13 | 89.220 | 1.645 | 29.0 | 3.7895 | 0.0000 | SURCHARGED |
| 15 minute winter | 118 | 13 | 89.194 | 1.711 | 42.2 | 3.7487 | 0.0000 | SURCHARGED |
| 15 minute winter | 119 | 13 | 89.043 | 1.708 | 57.2 | 3.7108 | 0.0000 | SURCHARGED |
| 15 minute winter | 120 | 13 | 88.818 | 1.571 | 73.5 | 3.5232 | 0.0000 | SURCHARGED |
| 15 minute winter | 121 | 12 | 88.503 | 1.350 | 29.0 | 3.3963 | 0.0000 | FLOOD RISK |
| 15 minute winter | 122 | 12 | 88.496 | 1.397 | 112.7 | 3.2498 | 0.0000 | SURCHARGED |
| 15 minute winter | 123 | 12 | 88.239 | 1.217 | 133.8 | 2.7372 | 0.0000 | SURCHARGED |
| 15 minute winter | 124 | 12 | 87.958 | 1.064 | 155.5 | 2.4250 | 0.0000 | SURCHARGED |
| 15 minute winter | 125 | 12 | 87.810 | 0.979 | 177.9 | 2.3062 | 0.0000 | SURCHARGED |

| 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 | 1.000 | 102 | 21.0 | 0.729 | 0.529 | 0.9227 | |
| 15 minute winter | 102 | 1.001 | 103 | 39.1 | 1.162 | 0.984 | 0.5426 | |
| 15 minute winter | 103 | 1.002 | 105 | 58.3 | 1.571 | 0.682 | 0.7946 | |
| 15 minute winter | 104 | 2.000 | 105 | 19.8 | 1.160 | 1.117 | 0.3091 | |
| 15 minute winter | 105 | 1.003 | 109 | 97.1 | 2.442 | 1.156 | 1.2006 | |
| 15 minute winter | 106 | 3.000 | 107 | 22.1 | 0.720 | 0.556 | 1.7347 | |
| 15 minute winter | 107 | 3.001 | 108 | 43.7 | 1.098 | 1.098 | 1.2457 | |
| 15 minute winter | 108 | 3.002 | 109 | 65.1 | 1.638 | 1.639 | 1.0997 | |
| 15 minute winter | 109 | 1.004 | 110 | 183.4 | 2.604 | 2.568 | 1.0846 | |
| 720 minute winter | 110 | 1.005 | 111 | 30.3 | 0.877 | 0.264 | 5.1556 | |
| 720 minute winter | 111 | 1.006 | 114 | -35.7 | 0.395 | -0.311 | 1.3907 | |
| 720 minute winter | 112 | 4.000 | 113 | 2.9 | 0.380 | 0.073 | 0.6328 | |
| 720 minute winter | 113 | 4.001 | 114 | 5.8 | 0.530 | 0.145 | 0.3586 | |
| 720 minute winter | 114 | 1.007 | 115 | -27.1 | 0.512 | -0.235 | 1.3974 | |
| 720 minute winter | 115 | 1.008 | 116 | -24.2 | 0.274 | -0.151 | 2.9022 | |
| 15 minute winter | 116 | 1.009 | 126 | -201.1 | -1.270 | -1.252 | 3.5455 | |
| 15 minute winter | 117 | 5.000 | 118 | 19.8 | 0.689 | 0.498 | 0.6208 | |
| 15 minute winter | 118 | 5.001 | 119 | 39.0 | 0.981 | 0.981 | 0.9999 | |
| 15 minute winter | 119 | 5.002 | 120 | 58.1 | 1.461 | 1.462 | 0.5972 | |
| 15 minute winter | 120 | 5.003 | 122 | 77.4 | 1.947 | 1.948 | 0.4936 | |
| 15 minute winter | 121 | 6.000 | 122 | 21.8 | 0.325 | 0.305 | 0.9059 | |
| 15 minute winter | 122 | 5.004 | 123 | 119.7 | 1.700 | 1.677 | 1.2999 | |
| 15 minute winter | 123 | 5.005 | 124 | 139.9 | 1.987 | 1.959 | 0.8951 | |
| 15 minute winter | 124 | 5.006 | 125 | 161.6 | 1.723 | 1.256 | 1.6794 | |
| 15 minute winter | 125 | 5.007 | 126 | 184.2 | 1.670 | 0.492 | 3.4012 | |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.69%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 126 | 11 | 87.510 | 1.753 | 201.9 | 6.8689 | 0.0000 | SURCHARGED |
| 15 minute winter | 127 | 10 | 85.671 | 0.091 | 54.9 | 0.2369 | 0.0000 | OK |
| 15 minute winter | 128 | 12 | 83.924 | 1.324 | 45.3 | 3.2622 | 0.0000 | SURCHARGED |
| 15 minute winter | 129 | 12 | 83.826 | 1.304 | 78.2 | 3.1147 | 0.0000 | SURCHARGED |
| 15 minute winter | 130 | 11 | 83.294 | 0.965 | 114.7 | 2.2136 | 0.0000 | SURCHARGED |
| 15 minute winter | 131 | 11 | 82.754 | 0.684 | 207.3 | 1.4807 | 0.0000 | SURCHARGED |
| 15 minute winter | 132 | 11 | 82.232 | 0.295 | 248.9 | 0.7228 | 0.0000 | OK |
| 15 minute winter | 133 | 10 | 86.862 | 0.104 | 45.3 | 0.3200 | 0.0000 | OK |
| 15 minute winter | 134 | 11 | 86.000 | 0.168 | 90.1 | 0.5056 | 0.0000 | OK |
| 15 minute winter | 135 | 12 | 85.070 | 0.677 | 136.1 | 1.9984 | 0.0000 | SURCHARGED |
| 15 minute winter | 136 | 12 | 84.664 | 1.650 | 159.7 | 4.6959 | 0.5592 | FLOOD |
| 15 minute winter | 137 | 12 | 83.831 | 0.990 | 186.0 | 2.8366 | 0.0000 | SURCHARGED |
| 15 minute winter | 138 | 11 | 82.242 | 0.306 | 222.3 | 0.8614 | 0.0000 | OK |
| 15 minute winter | 139 | 11 | 81.274 | 1.399 | 512.5 | 4.3151 | 0.0000 | SURCHARGED |
| 15 minute winter | 140 | 7 | 80.674 | 1.153 | 553.6 | 4.1914 | 0.0000 | SURCHARGED |
| 480 minute winter | 141 | 464 | 80.275 | 1.378 | 101.1 | 864.5173 | 0.0000 | FLOOD RISK |
| 480 minute winter | 142 | 464 | 80.274 | 1.411 | 6.5 | 4.6116 | 0.0000 | SURCHARGED |
| 480 minute winter | 143 | 464 | 80.274 | 1.466 | 12.6 | 6.3544 | 0.0000 | SURCHARGED |
| 180 minute winter | 144 | 124 | 79.946 | 1.901 | 27.1 | 27.9095 | 0.0000 | SURCHARGED |
| 180 minute winter | 145 | 124 | 79.945 | 2.003 | 24.0 | 8.5656 | 0.0000 | FLOOD RISK |
| 180 minute winter | 146 | 124 | 79.947 | 2.035 | 25.5 | 10.9850 | 0.0000 | FLOOD RISK |
| 15 minute summer | 147 | 1 | 77.850 | 0.000 | 19.9 | 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 | 126 | Hydro-Brake® | 127 | 10.0 | | | | |
| 15 minute winter | 127 | 1.011 | 131 | 54.5 | 3.130 | 0.184 | 0.4050 | |
| 15 minute winter | 128 | 7.000 | 129 | 38.0 | 0.956 | 0.957 | 0.5294 | |
| 15 minute winter | 129 | 7.001 | 130 | 76.2 | 1.916 | 1.916 | 0.7969 | |
| 15 minute winter | 130 | 7.002 | 131 | 114.9 | 1.632 | 1.610 | 3.1156 | |
| 15 minute winter | 131 | 1.012 | 132 | 206.3 | 1.913 | 1.795 | 4.0719 | |
| 15 minute winter | 132 | 1.013 | 139 | 248.2 | 2.428 | 0.648 | 2.7458 | |
| 15 minute winter | 133 | 8.000 | 134 | 44.9 | 2.637 | 0.384 | 0.2892 | |
| 15 minute winter | 134 | 8.001 | 135 | 90.8 | 2.864 | 0.846 | 1.1527 | |
| 15 minute winter | 135 | 8.002 | 136 | 117.1 | 1.849 | 0.486 | 2.0839 | |
| 15 minute winter | 136 | 8.003 | 137 | 143.4 | 2.037 | 2.008 | 2.9313 | |
| 15 minute winter | 137 | 8.004 | 138 | 181.4 | 2.577 | 1.288 | 3.6149 | |
| 15 minute winter | 138 | 8.005 | 139 | 221.1 | 2.497 | 0.839 | 1.9237 | |
| 15 minute winter | 139 | 1.014 | 140 | 510.5 | 3.222 | 3.178 | 3.4051 | |
| 15 minute winter | 140 | 1.015 | 141 | 556.3 | 4.090 | 1.094 | 3.7126 | |
| 480 minute winter | 141 | 1.016 | 143 | 8.9 | 0.229 | 0.056 | 5.6426 | |
| 480 minute winter | 141 | Infiltration | | 13.2 | | | | |
| 480 minute winter | 142 | 9.000 | 143 | 6.1 | 0.160 | 0.038 | 3.5144 | |
| 480 minute winter | 143 | Hydro-Brake® | 144 | 10.0 | | | | |
| 180 minute winter | 144 | 1.019 | 145 | 16.7 | 0.345 | 0.017 | 26.1533 | |
| 180 minute winter | 145 | 1.020 | 146 | 18.8 | 0.209 | 0.019 | 7.7137 | |
| 180 minute winter | 146 | Hydro-Brake® | 147 | 19.9 | | | | 366.8 |

## 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) |
|---|---|---|---|---|---|---|---|
| 201 | 0.058 | 5.00 | 88.804 | 1800 | 329188.494 | 366636.559 | 2.546 |
| 202 | 0.058 | 5.00 | 88.364 | 1800 | 329144.181 | 366643.129 | 2.068 |
| 203 | 0.058 | 5.00 | 88.189 | 1800 | 329155.628 | 366635.193 | 1.928 |
| 204 | 0.058 | 5.00 | 88.052 | 1800 | 329173.622 | 366619.642 | 2.000 |
| 205 | 0.057 | 5.00 | 87.851 | 2100 | 329137.562 | 366578.593 | 1.936 |
| 206 | 0.057 | 5.00 | 87.741 | 2100 | 329131.805 | 366570.550 | 1.851 |
| 207 | 0.057 | 5.00 | 87.774 | 2400 | 329124.880 | 366559.325 | 1.917 |
| 208 | 0.057 | 5.00 | 87.943 | 1500 | 329090.543 | 366553.368 | 1.686 |
| 209 | 0.057 | 5.00 | 88.000 | 1500 | 329096.706 | 366551.348 | 2.070 |
| 210 | 0.057 | 5.00 | 88.000 | 1500 | 329107.278 | 366549.639 | 2.115 |
| 211 | 0.057 | 5.00 | 87.682 | 1500 | 329122.075 | 366518.021 | 1.632 |
| 212 | 0.057 | 5.00 | 87.923 | 1500 | 329119.140 | 366537.915 | 1.991 |
| 213 | 0.057 | 5.00 | 87.861 | 1500 | 329116.428 | 366552.388 | 2.016 |
| 214 | 0.000 | 5.00 | 87.716 | 1200 | 329120.496 | 366554.420 | 1.898 |
| 215 | 0.000 | | 86.400 | 1200 | 329122.592 | 366547.871 | 0.610 |

## 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 | 204 | 22.525 | 0.600 | 86.258 | 86.202 | 0.056 | 400.0 | 600 | 5.31 | 50.0 |
| 2.000 | 202 | 203 | 13.929 | 0.600 | 86.296 | 86.261 | 0.035 | 400.0 | 600 | 5.19 | 50.0 |
| 2.001 | 203 | 204 | 23.783 | 0.600 | 86.261 | 86.202 | 0.059 | 403.1 | 600 | 5.52 | 50.0 |
| 1.001 | 204 | 205 | 54.638 | 0.600 | 86.052 | 85.915 | 0.137 | 398.8 | 750 | 6.17 | 50.0 |
| 1.002 | 205 | 206 | 9.891 | 0.600 | 85.915 | 85.890 | 0.025 | 395.6 | 750 | 6.29 | 50.0 |
| 1.003 | 206 | 207 | 13.189 | 0.600 | 85.890 | 85.857 | 0.033 | 399.7 | 750 | 6.45 | 50.0 |
| 1.004 | 207 | 214 | 6.579 | 0.600 | 85.857 | 85.818 | 0.039 | 168.7 | 225 | 6.56 | 50.0 |
| 3.000 | 208 | 209 | 6.486 | 0.600 | 86.257 | 86.230 | 0.027 | 240.0 | 300 | 5.11 | 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 | 7.9 | 1.946 | 1.250 | 0.058 | 0.0 | 62 | 0.511 |
| 2.000 | 1.211 | 342.4 | 7.9 | 1.468 | 1.328 | 0.058 | 0.0 | 62 | 0.511 |
| 2.001 | 1.206 | 341.1 | 15.7 | 1.328 | 1.250 | 0.116 | 0.0 | 86 | 0.626 |
| 1.001 | 1.395 | 616.2 | 31.4 | 1.250 | 1.186 | 0.232 | 0.0 | 113 | 0.747 |
| 1.002 | 1.400 | 618.7 | 39.2 | 1.186 | 1.101 | 0.289 | 0.0 | 126 | 0.801 |
| 1.003 | 1.393 | 615.5 | 46.9 | 1.101 | 1.167 | 0.346 | 0.0 | 138 | 0.839 |
| 1.004 | 1.004 | 39.9 | 54.6 | 1.692 | 1.673 | 0.403 | 0.0 | 225 | 1.022 |
| 3.000 | 1.010 | 71.4 | 7.7 | 1.386 | 1.470 | 0.057 | 0.0 | 67 | 0.668 |

## 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) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 3.001 | 209 | 210 | 10.709 | 0.600 | 85.930 | 85.885 | 0.045 | 240.0 | 300 | 5.28 | 50.0 |
| 3.002 | 210 | 213 | 9.554 | 0.600 | 85.885 | 85.845 | 0.040 | 238.9 | 300 | 5.44 | 50.0 |
| 4.000 | 211 | 212 | 20.109 | 0.600 | 86.050 | 85.932 | 0.118 | 170.0 | 300 | 5.28 | 50.0 |
| 4.001 | 212 | 213 | 14.725 | 0.600 | 85.932 | 85.845 | 0.087 | 170.0 | 300 | 5.48 | 50.0 |
| 3.003 | 213 | 214 | 4.547 | 0.600 | 85.845 | 85.818 | 0.027 | 168.4 | 225 | 5.56 | 50.0 |
| 1.005 | 214 | 215 | 6.876 | 0.600 | 85.818 | 85.790 | 0.028 | 245.6 | 225 | 6.70 | 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) |
|---|---|---|---|---|---|---|---|---|---|
| 3.001 | 1.010 | 71.4 | 15.4 | 1.770 | 1.815 | 0.114 | 0.0 | 95 | 0.812 |
| 3.002 | 1.013 | 71.6 | 23.2 | 1.815 | 1.716 | 0.171 | 0.0 | 117 | 0.906 |
| 4.000 | 1.203 | 85.0 | 7.7 | 1.332 | 1.691 | 0.057 | 0.0 | 61 | 0.754 |
| 4.001 | 1.203 | 85.0 | 15.4 | 1.691 | 1.716 | 0.114 | 0.0 | 86 | 0.921 |
| 3.003 | 1.004 | 39.9 | 46.3 | 1.791 | 1.673 | 0.342 | 0.0 | 225 | 1.023 |
| 1.005 | 0.830 | 33.0 | 101.0 | 1.673 | 0.385 | 0.745 | 0.0 | 225 | 0.845 |

## Pipeline Schedule

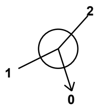
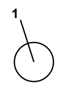
| Link | Length (m) | Slope (1:X) | Dia (mm) | Link Type | US CL (m) | US IL (m) | US Depth (m) | DS CL (m) | DS IL (m) | DS Depth (m) |
|---|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 22.525 | 400.0 | 600 | Circular_Default Sewer Type | 88.804 | 86.258 | 1.946 | 88.052 | 86.202 | 1.250 |
| 2.000 | 13.929 | 400.0 | 600 | Circular_Default Sewer Type | 88.364 | 86.296 | 1.468 | 88.189 | 86.261 | 1.328 |
| 2.001 | 23.783 | 403.1 | 600 | Circular_Default Sewer Type | 88.189 | 86.261 | 1.328 | 88.052 | 86.202 | 1.250 |
| 1.001 | 54.638 | 398.8 | 750 | Circular_Default Sewer Type | 88.052 | 86.052 | 1.250 | 87.851 | 85.915 | 1.186 |
| 1.002 | 9.891 | 395.6 | 750 | Circular_Default Sewer Type | 87.851 | 85.915 | 1.186 | 87.741 | 85.890 | 1.101 |
| 1.003 | 13.189 | 399.7 | 750 | Circular_Default Sewer Type | 87.741 | 85.890 | 1.101 | 87.774 | 85.857 | 1.167 |
| 1.004 | 6.579 | 168.7 | 225 | Circular_Default Sewer Type | 87.774 | 85.857 | 1.692 | 87.716 | 85.818 | 1.673 |
| 3.000 | 6.486 | 240.0 | 300 | Circular_Default Sewer Type | 87.943 | 86.257 | 1.386 | 88.000 | 86.230 | 1.470 |
| 3.001 | 10.709 | 240.0 | 300 | Circular_Default Sewer Type | 88.000 | 85.930 | 1.770 | 88.000 | 85.885 | 1.815 |
| 3.002 | 9.554 | 238.9 | 300 | Circular_Default Sewer Type | 88.000 | 85.885 | 1.815 | 87.861 | 85.845 | 1.716 |
| 4.000 | 20.109 | 170.0 | 300 | Circular_Default Sewer Type | 87.682 | 86.050 | 1.332 | 87.923 | 85.932 | 1.691 |
| 4.001 | 14.725 | 170.0 | 300 | Circular_Default Sewer Type | 87.923 | 85.932 | 1.691 | 87.861 | 85.845 | 1.716 |
| 3.003 | 4.547 | 168.4 | 225 | Circular_Default Sewer Type | 87.861 | 85.845 | 1.791 | 87.716 | 85.818 | 1.673 |
| 1.005 | 6.876 | 245.6 | 225 | Circular_Default Sewer Type | 87.716 | 85.818 | 1.673 | 86.400 | 85.790 | 0.385 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 201 | 1800 | Manhole | Adoptable | 204 | 1800 | Manhole | Adoptable |
| 2.000 | 202 | 1800 | Manhole | Adoptable | 203 | 1800 | Manhole | Adoptable |
| 2.001 | 203 | 1800 | Manhole | Adoptable | 204 | 1800 | Manhole | Adoptable |
| 1.001 | 204 | 1800 | Manhole | Adoptable | 205 | 2100 | Manhole | Adoptable |
| 1.002 | 205 | 2100 | Manhole | Adoptable | 206 | 2100 | Manhole | Adoptable |
| 1.003 | 206 | 2100 | Manhole | Adoptable | 207 | 2400 | Manhole | Adoptable |
| 1.004 | 207 | 2400 | Manhole | Adoptable | 214 | 1200 | Manhole | Adoptable |
| 3.000 | 208 | 1500 | Manhole | Adoptable | 209 | 1500 | Manhole | Adoptable |
| 3.001 | 209 | 1500 | Manhole | Adoptable | 210 | 1500 | Manhole | Adoptable |
| 3.002 | 210 | 1500 | Manhole | Adoptable | 213 | 1500 | Manhole | Adoptable |
| 4.000 | 211 | 1500 | Manhole | Adoptable | 212 | 1500 | Manhole | Adoptable |
| 4.001 | 212 | 1500 | Manhole | Adoptable | 213 | 1500 | Manhole | Adoptable |
| 3.003 | 213 | 1500 | Manhole | Adoptable | 214 | 1200 | Manhole | Adoptable |
| 1.005 | 214 | 1200 | Manhole | Adoptable | 215 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 201 | 329188.494 | 366636.559 | 88.804 | 2.546 | 1800 | 0 | 1.000 | 86.258 | 600 |
| 202 | 329144.181 | 366643.129 | 88.364 | 2.068 | 1800 | 0 | 2.000 | 86.296 | 600 |
| 203 | 329155.628 | 366635.193 | 88.189 | 1.928 | 1800 | 1 | 2.000 | 86.261 | 600 |
| | | | | | | 0 | 2.001 | 86.261 | 600 |
| 204 | 329173.622 | 366619.642 | 88.052 | 2.000 | 1800 | 1 | 2.001 | 86.202 | 600 |
| | | | | | | 2 | 1.000 | 86.202 | 600 |
| | | | | | | 0 | 1.001 | 86.052 | 750 |
| 205 | 329137.562 | 366578.593 | 87.851 | 1.936 | 2100 | 1 | 1.001 | 85.915 | 750 |
| | | | | | | 0 | 1.002 | 85.915 | 750 |
| 206 | 329131.805 | 366570.550 | 87.741 | 1.851 | 2100 | 1 | 1.002 | 85.890 | 750 |
| | | | | | | 0 | 1.003 | 85.890 | 750 |
| 207 | 329124.880 | 366559.325 | 87.774 | 1.917 | 2400 | 1 | 1.003 | 85.857 | 750 |
| | | | | | | 0 | 1.004 | 85.857 | 225 |
| 208 | 329090.543 | 366553.368 | 87.943 | 1.686 | 1500 | 0 | 3.000 | 86.257 | 300 |
| 209 | 329096.706 | 366551.348 | 88.000 | 2.070 | 1500 | 1 | 3.000 | 86.230 | 300 |
| | | | | | | 0 | 3.001 | 85.930 | 300 |
| 210 | 329107.278 | 366549.639 | 88.000 | 2.115 | 1500 | 1 | 3.001 | 85.885 | 300 |
| | | | | | | 0 | 3.002 | 85.885 | 300 |
| 211 | 329122.075 | 366518.021 | 87.682 | 1.632 | 1500 | 0 | 4.000 | 86.050 | 300 |
| 212 | 329119.140 | 366537.915 | 87.923 | 1.991 | 1500 | 1 | 4.000 | 85.932 | 300 |
| | | | | | | 0 | 4.001 | 85.932 | 300 |
| 213 | 329116.428 | 366552.388 | 87.861 | 2.016 | 1500 | 1 | 4.001 | 85.845 | 300 |
| | | | | | | 2 | 3.002 | 85.845 | 300 |
| | | | | | | 0 | 3.003 | 85.845 | 225 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 214 | 329120.496 | 366554.420 | 87.716 | 1.898 | 1200 |  | 1 | 3.003 | 85.818 | 225 |
| | | | | | | | 2 | 1.004 | 85.818 | 225 |
| | | | | | | | 0 | 1.005 | 85.818 | 225 |
| 215 | 329122.592 | 366547.871 | 86.400 | 0.610 | 1200 |  | 1 | 1.005 | 85.790 | 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 | 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 207 Online Hydro-Brake® Control**

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 85.857 | Product Number | CTL-SHE-0094-5000-1800-5000 |
| Design Depth (m) | 1.800 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 5.0 | Min Node Diameter (mm) | 1200 |

**Node 213 Online Hydro-Brake® Control**

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 85.845 | Product Number | CTL-SHE-0098-5000-1500-5000 |
| Design Depth (m) | 1.500 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 5.0 | Min Node Diameter (mm) | 1200 |

**Node 207 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 85.857 |
| 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 | 120.0 | 0.0 | 1.200 | 120.0 | 0.0 | 1.201 | 0.0 | 0.0 |

**Node 210 Depth/Area Storage Structure**

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 85.885 |
| 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) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 0.000 | 62.0 | 0.0 | 0.600 | 81.0 | 0.0 | 1.200 | 102.0 | 0.0 | 1.800 | 126.0 | 0.0 |
| 0.200 | 68.0 | 0.0 | 0.800 | 88.0 | 0.0 | 1.400 | 110.0 | 0.0 | 2.000 | 134.0 | 0.0 |
| 0.400 | 74.0 | 0.0 | 1.000 | 95.0 | 0.0 | 1.600 | 118.0 | 0.0 | | | |

**Other (defaults)**

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.81%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 201 | 11 | 86.315 | 0.057 | 6.3 | 0.1699 | 0.0000 | OK |
| 15 minute winter | 202 | 10 | 86.352 | 0.056 | 6.3 | 0.1726 | 0.0000 | OK |
| 15 minute winter | 203 | 11 | 86.339 | 0.078 | 12.3 | 0.2467 | 0.0000 | OK |
| 15 minute winter | 204 | 11 | 86.150 | 0.098 | 24.0 | 0.3062 | 0.0000 | OK |
| 240 minute winter | 205 | 176 | 86.083 | 0.168 | 7.5 | 0.6800 | 0.0000 | OK |
| 240 minute winter | 206 | 176 | 86.083 | 0.193 | 8.2 | 0.7864 | 0.0000 | OK |
| 240 minute winter | 207 | 176 | 86.083 | 0.226 | 9.2 | 28.2514 | 0.0000 | SURCHARGED |
| 15 minute winter | 208 | 10 | 86.320 | 0.063 | 6.2 | 0.1529 | 0.0000 | OK |
| 120 minute winter | 209 | 88 | 86.133 | 0.203 | 4.6 | 0.4701 | 0.0000 | OK |
| 120 minute winter | 210 | 88 | 86.133 | 0.248 | 7.9 | 16.8574 | 0.0000 | OK |
| 120 minute winter | 211 | 90 | 86.133 | 0.083 | 2.3 | 0.2057 | 0.0000 | OK |
| 120 minute winter | 212 | 88 | 86.133 | 0.201 | 4.6 | 0.4699 | 0.0000 | OK |
| 120 minute winter | 213 | 88 | 86.133 | 0.288 | 6.1 | 0.6714 | 0.0000 | SURCHARGED |
| 180 minute winter | 214 | 132 | 85.901 | 0.083 | 8.5 | 0.0936 | 0.0000 | OK |
| 180 minute winter | 215 | 132 | 85.865 | 0.075 | 8.5 | 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 | 204 | 6.1 | 0.514 | 0.018 | 0.2678 | |
| 15 minute winter | 202 | 2.000 | 203 | 6.1 | 0.361 | 0.018 | 0.2405 | |
| 15 minute winter | 203 | 2.001 | 204 | 12.1 | 0.619 | 0.035 | 0.4632 | |
| 15 minute winter | 204 | 1.001 | 205 | 23.6 | 0.609 | 0.038 | 2.1243 | |
| 240 minute winter | 205 | 1.002 | 206 | 6.7 | 0.365 | 0.011 | 0.8048 | |
| 240 minute winter | 206 | 1.003 | 207 | 7.7 | 0.557 | 0.013 | 1.3244 | |
| 240 minute winter | 207 | Hydro-Brake® | 214 | 3.9 | | | | |
| 15 minute winter | 208 | 3.000 | 209 | 6.1 | 0.601 | 0.085 | 0.0654 | |
| 120 minute winter | 209 | 3.001 | 210 | 4.2 | 0.579 | 0.059 | 0.6047 | |
| 120 minute winter | 210 | 3.002 | 213 | 3.6 | 0.128 | 0.050 | 0.6292 | |
| 120 minute winter | 211 | 4.000 | 212 | 2.3 | 0.366 | 0.027 | 0.6644 | |
| 120 minute winter | 212 | 4.001 | 213 | 3.8 | 0.208 | 0.045 | 0.8805 | |
| 120 minute winter | 213 | Hydro-Brake® | 214 | 4.6 | | | | |
| 180 minute winter | 214 | 1.005 | 215 | 8.5 | 0.685 | 0.257 | 0.0852 | 96.9 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.81%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 201 | 280 | 86.394 | 0.136 | 2.7 | 0.4076 | 0.0000 | OK |
| 360 minute winter | 202 | 272 | 86.394 | 0.098 | 2.7 | 0.3040 | 0.0000 | OK |
| 360 minute winter | 203 | 272 | 86.394 | 0.133 | 5.4 | 0.4180 | 0.0000 | OK |
| 360 minute winter | 204 | 272 | 86.394 | 0.342 | 10.8 | 1.0683 | 0.0000 | OK |
| 360 minute winter | 205 | 280 | 86.394 | 0.479 | 11.7 | 1.9406 | 0.0000 | OK |
| 360 minute winter | 206 | 280 | 86.394 | 0.504 | 12.3 | 2.0555 | 0.0000 | OK |
| 360 minute winter | 207 | 280 | 86.394 | 0.537 | 14.0 | 67.1788 | 0.0000 | SURCHARGED |
| 240 minute winter | 208 | 192 | 86.650 | 0.393 | 3.5 | 0.9591 | 0.0000 | SURCHARGED |
| 240 minute winter | 209 | 192 | 86.650 | 0.720 | 6.8 | 1.6680 | 0.0000 | SURCHARGED |
| 240 minute winter | 210 | 192 | 86.650 | 0.765 | 13.5 | 58.2680 | 0.0000 | SURCHARGED |
| 240 minute winter | 211 | 192 | 86.650 | 0.599 | 3.5 | 1.4784 | 0.0000 | SURCHARGED |
| 240 minute winter | 212 | 192 | 86.650 | 0.718 | 6.4 | 1.6790 | 0.0000 | SURCHARGED |
| 240 minute winter | 213 | 192 | 86.649 | 0.804 | 9.5 | 1.8769 | 0.0000 | SURCHARGED |
| 480 minute winter | 214 | 488 | 85.905 | 0.087 | 9.3 | 0.0984 | 0.0000 | OK |
| 480 minute winter | 215 | 488 | 85.869 | 0.079 | 9.3 | 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) |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 201 | 1.000 | 204 | 2.7 | 0.407 | 0.008 | 1.4116 | |
| 360 minute winter | 202 | 2.000 | 203 | 2.7 | 0.281 | 0.008 | 0.5300 | |
| 360 minute winter | 203 | 2.001 | 204 | 5.4 | 0.498 | 0.016 | 1.4725 | |
| 360 minute winter | 204 | 1.001 | 205 | 9.1 | 0.327 | 0.015 | 13.4442 | |
| 360 minute winter | 205 | 1.002 | 206 | 9.7 | 0.328 | 0.016 | 3.0237 | |
| 360 minute winter | 206 | 1.003 | 207 | 11.4 | 0.628 | 0.018 | 4.2991 | |
| 360 minute winter | 207 | Hydro-Brake® | 214 | 4.4 | | | | |
| 240 minute winter | 208 | 3.000 | 209 | 3.4 | 0.513 | 0.048 | 0.4567 | |
| 240 minute winter | 209 | 3.001 | 210 | 6.3 | 0.599 | 0.088 | 0.7541 | |
| 240 minute winter | 210 | 3.002 | 213 | 4.5 | 0.098 | 0.063 | 0.6728 | |
| 240 minute winter | 211 | 4.000 | 212 | 3.0 | 0.295 | 0.035 | 1.4161 | |
| 240 minute winter | 212 | 4.001 | 213 | 6.0 | 0.199 | 0.071 | 1.0369 | |
| 240 minute winter | 213 | Hydro-Brake® | 214 | 4.9 | | | | |
| 480 minute winter | 214 | 1.005 | 215 | 9.3 | 0.701 | 0.282 | 0.0911 | 299.1 |

**Results for 100 year Critical Storm Duration. Lowest mass balance: 99.81%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute winter | 201 | 232 | 86.571 | 0.313 | 4.6 | 0.9384 | 0.0000 | OK |
| 240 minute winter | 202 | 232 | 86.571 | 0.275 | 4.6 | 0.8534 | 0.0000 | OK |
| 240 minute winter | 203 | 232 | 86.571 | 0.310 | 9.2 | 0.9745 | 0.0000 | OK |
| 240 minute winter | 204 | 232 | 86.571 | 0.519 | 18.4 | 1.6212 | 0.0000 | OK |
| 240 minute winter | 205 | 232 | 86.571 | 0.656 | 19.2 | 2.6578 | 0.0000 | OK |
| 240 minute winter | 206 | 232 | 86.571 | 0.681 | 19.9 | 2.7775 | 0.0000 | OK |
| 240 minute winter | 207 | 232 | 86.571 | 0.714 | 22.6 | 89.3254 | 0.0000 | SURCHARGED |
| 240 minute winter | 208 | 228 | 86.964 | 0.707 | 4.6 | 1.7267 | 0.0000 | SURCHARGED |
| 240 minute winter | 209 | 228 | 86.964 | 1.034 | 8.4 | 2.3963 | 0.0000 | SURCHARGED |
| 240 minute winter | 210 | 228 | 86.964 | 1.079 | 19.7 | 87.9795 | 0.0000 | SURCHARGED |
| 240 minute winter | 211 | 228 | 86.964 | 0.914 | 4.6 | 2.2532 | 0.0000 | SURCHARGED |
| 240 minute winter | 212 | 228 | 86.964 | 1.032 | 8.6 | 2.4142 | 0.0000 | SURCHARGED |
| 240 minute winter | 213 | 228 | 86.964 | 1.119 | 12.7 | 2.6099 | 0.0000 | SURCHARGED |
| 240 minute winter | 214 | 476 | 85.905 | 0.087 | 9.3 | 0.0984 | 0.0000 | OK |
| 240 minute winter | 215 | 476 | 85.869 | 0.079 | 9.3 | 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 | 201 | 1.000 | 204 | 4.6 | 0.473 | 0.013 | 3.7186 | |
| 240 minute winter | 202 | 2.000 | 203 | 4.6 | 0.338 | 0.013 | 1.8975 | |
| 240 minute winter | 203 | 2.001 | 204 | 9.2 | 0.563 | 0.027 | 3.9045 | |
| 240 minute winter | 204 | 1.001 | 205 | 14.7 | 0.364 | 0.024 | 20.0337 | |
| 240 minute winter | 205 | 1.002 | 206 | 15.4 | 0.372 | 0.025 | 4.0968 | |
| 240 minute winter | 206 | 1.003 | 207 | 18.1 | 0.713 | 0.029 | 5.6219 | |
| 240 minute winter | 207 | Hydro-Brake® | 214 | 4.4 | | | | |
| 240 minute winter | 208 | 3.000 | 209 | 3.9 | 0.526 | 0.055 | 0.4567 | |
| 240 minute winter | 209 | 3.001 | 210 | 7.9 | 0.612 | 0.110 | 0.7541 | |
| 240 minute winter | 210 | 3.002 | 213 | -7.3 | -0.104 | -0.102 | 0.6728 | |
| 240 minute winter | 211 | 4.000 | 212 | 4.0 | 0.296 | 0.047 | 1.4161 | |
| 240 minute winter | 212 | 4.001 | 213 | 8.1 | 0.213 | 0.095 | 1.0369 | |
| 240 minute winter | 213 | Hydro-Brake® | 214 | 4.9 | | | | |
| 240 minute winter | 214 | 1.005 | 215 | 9.3 | 0.701 | 0.282 | 0.0911 | 224.5 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.81%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 201 | 344 | 87.552 | 1.294 | 5.2 | 3.8830 | 0.0000 | SURCHARGED |
| 360 minute winter | 202 | 344 | 87.552 | 1.256 | 5.2 | 3.8999 | 0.0000 | SURCHARGED |
| 360 minute winter | 203 | 344 | 87.552 | 1.291 | 9.4 | 4.0609 | 0.0000 | SURCHARGED |
| 360 minute winter | 204 | 344 | 87.552 | 1.500 | 16.6 | 4.6890 | 0.0000 | SURCHARGED |
| 360 minute winter | 205 | 344 | 87.554 | 1.639 | 16.7 | 6.6410 | 0.0000 | FLOOD RISK |
| 360 minute winter | 206 | 344 | 87.554 | 1.664 | 18.3 | 6.7880 | 0.0000 | FLOOD RISK |
| 360 minute winter | 207 | 344 | 87.554 | 1.697 | 21.9 | 152.7484 | 0.0000 | FLOOD RISK |
| 240 minute winter | 208 | 232 | 87.532 | 1.275 | 6.8 | 3.1151 | 0.0000 | SURCHARGED |
| 240 minute winter | 209 | 232 | 87.532 | 1.602 | 12.8 | 3.7137 | 0.0000 | SURCHARGED |
| 240 minute winter | 210 | 232 | 87.532 | 1.647 | 32.7 | 150.9961 | 0.0000 | SURCHARGED |
| 240 minute winter | 211 | 232 | 87.532 | 1.482 | 6.8 | 3.6544 | 0.0000 | FLOOD RISK |
| 240 minute winter | 212 | 232 | 87.532 | 1.600 | 12.8 | 3.7439 | 0.0000 | SURCHARGED |
| 240 minute winter | 213 | 232 | 87.532 | 1.687 | 18.8 | 3.9356 | 0.0000 | SURCHARGED |
| 360 minute winter | 214 | 344 | 85.909 | 0.091 | 10.0 | 0.1024 | 0.0000 | OK |
| 360 minute winter | 215 | 344 | 85.872 | 0.082 | 10.0 | 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) |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 201 | 1.000 | 204 | 4.0 | 0.446 | 0.012 | 6.3448 | |
| 360 minute winter | 202 | 2.000 | 203 | 4.4 | 0.329 | 0.013 | 3.9235 | |
| 360 minute winter | 203 | 2.001 | 204 | 8.1 | 0.523 | 0.024 | 6.6991 | |
| 360 minute winter | 204 | 1.001 | 205 | 12.4 | 0.355 | 0.020 | 24.0473 | |
| 360 minute winter | 205 | 1.002 | 206 | 14.5 | 0.385 | 0.023 | 4.3532 | |
| 360 minute winter | 206 | 1.003 | 207 | 17.4 | 0.686 | 0.028 | 5.8048 | |
| 360 minute winter | 207 | Hydro-Brake® | 214 | 4.8 | | | | |
| 240 minute winter | 208 | 3.000 | 209 | 6.0 | 0.542 | 0.084 | 0.4567 | |
| 240 minute winter | 209 | 3.001 | 210 | 12.0 | 0.682 | 0.168 | 0.7541 | |
| 240 minute winter | 210 | 3.002 | 213 | -13.9 | -0.198 | -0.194 | 0.6728 | |
| 240 minute winter | 211 | 4.000 | 212 | 6.0 | 0.335 | 0.070 | 1.4161 | |
| 240 minute winter | 212 | 4.001 | 213 | 12.0 | 0.243 | 0.141 | 1.0369 | |
| 240 minute winter | 213 | Hydro-Brake® | 214 | 5.2 | | | | |
| 360 minute winter | 214 | 1.005 | 215 | 10.0 | 0.715 | 0.303 | 0.0960 | 290.7 |

## 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) |
|---|---|---|---|---|---|---|---|
| 301 | 0.043 | 5.00 | 88.150 | 1800 | 329132.010 | 366628.841 | 1.943 |
| 302 | 0.043 | 5.00 | 88.000 | 1800 | 329116.257 | 366615.832 | 1.844 |
| 303 | 0.043 | 5.00 | 88.000 | 1800 | 329104.255 | 366606.492 | 1.882 |
| 304 | 0.042 | 5.00 | 88.109 | 1800 | 329089.795 | 366589.263 | 2.047 |
| 305 | 0.000 | | 88.253 | 1200 | 329088.305 | 366587.003 | 2.239 |

## 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 | 20.430 | 0.600 | 86.207 | 86.156 | 0.051 | 400.0 | 600 | 5.28 | 50.0 |
| 1.001 | 302 | 303 | 15.208 | 0.600 | 86.156 | 86.118 | 0.038 | 400.2 | 600 | 5.49 | 50.0 |
| 1.002 | 303 | 304 | 22.493 | 0.600 | 86.118 | 86.062 | 0.056 | 401.7 | 600 | 5.80 | 50.0 |
| 1.003 | 304 | 305 | 8.228 | 0.600 | 86.062 | 86.014 | 0.048 | 171.4 | 225 | 5.94 | 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 | 5.8 | 1.343 | 1.244 | 0.043 | 0.0 | 54 | 0.467 |
| 1.001 | 1.211 | 342.3 | 11.7 | 1.244 | 1.282 | 0.086 | 0.0 | 75 | 0.575 |
| 1.002 | 1.209 | 341.7 | 17.5 | 1.282 | 1.447 | 0.129 | 0.0 | 91 | 0.647 |
| 1.003 | 0.995 | 39.6 | 23.2 | 1.822 | 2.014 | 0.171 | 0.0 | 123 | 1.033 |

## 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 | 20.430 | 400.0 | 600 | Circular_Default Sewer Type | 88.150 | 86.207 | 1.343 | 88.000 | 86.156 | 1.244 |
| 1.001 | 15.208 | 400.2 | 600 | Circular_Default Sewer Type | 88.000 | 86.156 | 1.244 | 88.000 | 86.118 | 1.282 |
| 1.002 | 22.493 | 401.7 | 600 | Circular_Default Sewer Type | 88.000 | 86.118 | 1.282 | 88.109 | 86.062 | 1.447 |
| 1.003 | 8.228 | 171.4 | 225 | Circular_Default Sewer Type | 88.109 | 86.062 | 1.822 | 88.253 | 86.014 | 2.014 |

| 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 | 303 | 1800 | Manhole | Adoptable |
| 1.002 | 303 | 1800 | Manhole | Adoptable | 304 | 1800 | Manhole | Adoptable |
| 1.003 | 304 | 1800 | Manhole | Adoptable | 305 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 301 | 329132.010 | 366628.841 | 88.150 | 1.943 | 1800 | 0 | 1.000 | 86.207 | 600 |
| 302 | 329116.257 | 366615.832 | 88.000 | 1.844 | 1800 | 1 | 1.000 | 86.156 | 600 |
| | | | | | | 0 | 1.001 | 86.156 | 600 |
| 303 | 329104.255 | 366606.492 | 88.000 | 1.882 | 1800 | 1 | 1.001 | 86.118 | 600 |
| | | | | | | 0 | 1.002 | 86.118 | 600 |
| 304 | 329089.795 | 366589.263 | 88.109 | 2.047 | 1800 | 1 | 1.002 | 86.062 | 600 |
| | | | | | | 0 | 1.003 | 86.062 | 225 |
| 305 | 329088.305 | 366587.003 | 88.253 | 2.239 | 1200 | 1 | 1.003 | 86.014 | 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 304 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 86.062 | Product Number | CTL-SHE-0094-5000-1800-5000 |
| Design Depth (m) | 1.800 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 5.0 | Min Node Diameter (mm) | 1200 |

## Node 303 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 86.850 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 128 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|---|---|---|
| 0.000 | 35.0 | 0.0 | 0.800 | 35.0 | 0.0 | 0.801 | 0.0 | 0.0 |

## Other (defaults)

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 98.77%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute winter | 301 | 26 | 86.324 | 0.117 | 3.7 | 0.3490 | 0.0000 | OK |
| 30 minute winter | 302 | 26 | 86.323 | 0.167 | 7.1 | 0.5023 | 0.0000 | OK |
| 30 minute winter | 303 | 25 | 86.323 | 0.205 | 8.0 | 0.6162 | 0.0000 | OK |
| 30 minute winter | 304 | 25 | 86.323 | 0.261 | 8.0 | 0.7716 | 0.0000 | SURCHARGED |
| 15 minute summer | 305 | 1 | 86.014 | 0.000 | 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) |
|---|---|---|---|---|---|---|---|---|
| 30 minute winter | 301 | 1.000 | 302 | 3.4 | 0.286 | 0.010 | 1.0457 | |
| 30 minute winter | 302 | 1.001 | 303 | 4.4 | 0.326 | 0.013 | 1.1279 | |
| 30 minute winter | 303 | 1.002 | 304 | 4.4 | 0.200 | 0.013 | 2.2807 | |
| 30 minute winter | 304 | Hydro-Brake® | 305 | 4.2 | | | | 11.6 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 98.77%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 60 minute winter | 301 | 59 | 86.842 | 0.635 | 6.4 | 1.8956 | 0.0000 | SURCHARGED |
| 60 minute winter | 302 | 58 | 86.843 | 0.687 | 9.3 | 2.0695 | 0.0000 | SURCHARGED |
| 60 minute winter | 303 | 59 | 86.840 | 0.722 | 10.1 | 2.1670 | 0.0000 | SURCHARGED |
| 60 minute winter | 304 | 58 | 86.840 | 0.778 | 9.5 | 2.2990 | 0.0000 | SURCHARGED |
| 15 minute summer | 305 | 1 | 86.014 | 0.000 | 4.4 | 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) |
|---|---|---|---|---|---|---|---|---|
| 60 minute winter | 301 | 1.000 | 302 | 3.1 | 0.234 | 0.009 | 5.7547 | |
| 60 minute winter | 302 | 1.001 | 303 | 4.5 | 0.307 | 0.013 | 4.2837 | |
| 60 minute winter | 303 | 1.002 | 304 | 4.9 | 0.215 | 0.014 | 6.3358 | |
| 60 minute winter | 304 | Hydro-Brake® | 305 | 4.4 | | | | 37.4 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.77%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | 301 | 148 | 87.904 | 1.697 | 6.2 | 5.0678 | 0.0000 | FLOOD RISK |
| 180 minute winter | 302 | 148 | 87.904 | 1.748 | 11.7 | 5.2623 | 0.0000 | FLOOD RISK |
| 180 minute winter | 303 | 148 | 87.904 | 1.786 | 17.5 | 33.3978 | 0.0000 | FLOOD RISK |
| 180 minute winter | 304 | 144 | 87.907 | 1.845 | 7.3 | 5.4528 | 0.0000 | FLOOD RISK |
| 15 minute summer | 305 | 1 | 86.014 | 0.000 | 4.4 | 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) |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | 301 | 1.000 | 302 | 5.5 | 0.218 | 0.016 | 5.7547 | |
| 180 minute winter | 302 | 1.001 | 303 | 10.7 | 0.289 | 0.031 | 4.2837 | |
| 180 minute winter | 303 | 1.002 | 304 | 5.3 | 0.193 | 0.016 | 6.3358 | |
| 180 minute winter | 304 | Hydro-Brake® | 305 | 5.1 | | | | 103.5 |

## Design Settings

| | |
|---|---|
| Rainfall Methodology | FSR |
| Return Period (years) | 100 |
| Additional Flow (%) | 0 |
| FSR Region | England and Wales |
| M5-60 (mm) | 17.000 |
| Ratio-R | 0.300 |
| CV | 0.750 |
| Time of Entry (mins) | 5.00 |

| | |
|---|---|
| Maximum Time of Concentration (mins) | 30.00 |
| Maximum Rainfall (mm/hr) | 50.0 |
| Minimum Velocity (m/s) | 1.00 |
| Connection Type | Level Soffits |
| Minimum Backdrop Height (m) | 0.200 |
| Preferred Cover Depth (m) | 1.200 |
| Include Intermediate Ground | ✓ |
| Enforce best practice design rules | ✓ |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) |
|---|---|---|---|---|---|---|---|
| 401 | 0.061 | 5.00 | 79.205 | 1800 | 329339.606 | 366929.782 | 2.185 |
| 402 | 0.061 | 5.00 | 79.000 | 1800 | 329320.552 | 366939.989 | 2.034 |
| 403 | 0.060 | 5.00 | 78.900 | 2100 | 329296.824 | 366946.797 | 1.996 |
| 404 | | | 78.849 | 1200 | 329295.009 | 366955.348 | 1.996 |

## 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 | 401 | 402 | 21.616 | 0.600 | 77.020 | 76.966 | 0.054 | 400.0 | 750 | 5.26 | 50.0 |
| 1.001 | 402 | 403 | 24.685 | 0.600 | 76.966 | 76.904 | 0.062 | 400.0 | 750 | 5.55 | 50.0 |
| 1.002 | 403 | 404 | 8.742 | 0.600 | 76.904 | 76.853 | 0.051 | 171.4 | 225 | 5.70 | 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 | 1.393 | 615.3 | 8.3 | 1.435 | 1.284 | 0.061 | 0.0 | 60 | 0.503 |
| 1.001 | 1.393 | 615.3 | 16.5 | 1.284 | 1.246 | 0.122 | 0.0 | 83 | 0.619 |
| 1.002 | 0.995 | 39.6 | 24.7 | 1.771 | 1.771 | 0.182 | 0.0 | 129 | 1.048 |

## 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 | 21.616 | 400.0 | 750 | Circular_Default Sewer Type | 79.205 | 77.020 | 1.435 | 79.000 | 76.966 | 1.284 |
| 1.001 | 24.685 | 400.0 | 750 | Circular_Default Sewer Type | 79.000 | 76.966 | 1.284 | 78.900 | 76.904 | 1.246 |
| 1.002 | 8.742 | 171.4 | 225 | Circular_Default Sewer Type | 78.900 | 76.904 | 1.771 | 78.849 | 76.853 | 1.771 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 401 | 1800 | Manhole | Adoptable | 402 | 1800 | Manhole | Adoptable |
| 1.001 | 402 | 1800 | Manhole | Adoptable | 403 | 2100 | Manhole | Adoptable |
| 1.002 | 403 | 2100 | Manhole | Adoptable | 404 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 401 | 329339.606 | 366929.782 | 79.205 | 2.185 | 1800 | | | | |
| | | | | | | 0 | 1.000 | 77.020 | 750 |
| 402 | 329320.552 | 366939.989 | 79.000 | 2.034 | 1800 | 1 | 1.000 | 76.966 | 750 |
| | | | | | | 0 | 1.001 | 76.966 | 750 |
| 403 | 329296.824 | 366946.797 | 78.900 | 1.996 | 2100 | 1 | 1.001 | 76.904 | 750 |
| | | | | | | 0 | 1.002 | 76.904 | 225 |
| 404 | 329295.009 | 366955.348 | 78.849 | 1.996 | 1200 | 1 | 1.002 | 76.853 | 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 ($m^3$/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 ($m^3$) | |
| 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 403 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 76.904 | Product Number | CTL-SHE-0070-3000-2100-3000 |
| Design Depth (m) | 2.100 | Min Outlet Diameter (m) | 0.100 |
| Design Flow (l/s) | 3.0 | Min Node Diameter (mm) | 1200 |

## Node 403 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 76.904 |
| 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 | 50.0 | 0.0 | 1.200 | 50.0 | 0.0 | 1.201 | 0.0 | 0.0 |

## Other (defaults)

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 99.38%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol ($m^3$) | Flood ($m^3$) | Status |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | 401 | 92 | 77.093 | 0.073 | 2.5 | 0.2257 | 0.0000 | OK |
| 120 minute winter | 402 | 92 | 77.093 | 0.127 | 5.0 | 0.3986 | 0.0000 | OK |
| 120 minute winter | 403 | 92 | 77.093 | 0.189 | 6.5 | 10.2072 | 0.0000 | OK |
| 15 minute summer | 404 | 1 | 76.853 | 0.000 | 1.8 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Velocity (m/s) | Flow/Cap | Link Vol ($m^3$) | Discharge Vol ($m^3$) |
|---|---|---|---|---|---|---|---|---|
| 120 minute winter | 401 | 1.000 | 402 | 2.5 | 0.262 | 0.004 | 0.7655 | |
| 120 minute winter | 402 | 1.001 | 403 | 4.2 | 0.409 | 0.007 | 1.6764 | |
| 120 minute winter | 403 | Hydro-Brake® | 404 | 2.1 | | | | 20.8 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 99.38%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 240 minute winter | 401 | 196 | 77.394 | 0.374 | 3.7 | 1.1620 | 0.0000 | OK |
| 240 minute winter | 402 | 196 | 77.394 | 0.428 | 6.5 | 1.3471 | 0.0000 | OK |
| 240 minute winter | 403 | 196 | 77.394 | 0.490 | 8.3 | 26.5143 | 0.0000 | SURCHARGED |
| 15 minute summer | 404 | 1 | 76.853 | 0.000 | 2.1 | 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 | 401 | 1.000 | 402 | 2.8 | 0.230 | 0.004 | 5.1837 | |
| 240 minute winter | 402 | 1.001 | 403 | 4.7 | 0.417 | 0.008 | 6.9728 | |
| 240 minute winter | 403 | Hydro-Brake® | 404 | 2.1 | | | | 53.5 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 99.38%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 401 | 336 | 78.636 | 1.616 | 5.5 | 5.0132 | 0.0000 | SURCHARGED |
| 360 minute winter | 402 | 336 | 78.636 | 1.670 | 9.3 | 5.2509 | 0.0000 | SURCHARGED |
| 360 minute winter | 403 | 328 | 78.637 | 1.733 | 12.5 | 67.0707 | 0.0000 | FLOOD RISK |
| 15 minute summer | 404 | 1 | 76.853 | 0.000 | 2.1 | 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) |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 401 | 1.000 | 402 | 3.9 | 0.207 | 0.006 | 9.5136 | |
| 360 minute winter | 402 | 1.001 | 403 | 7.9 | 0.450 | 0.013 | 10.8644 | |
| 360 minute winter | 403 | Hydro-Brake® | 404 | 2.8 | | | | 74.0 |

## 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) |
|---|---|---|---|---|---|---|---|
| 501 | 0.032 | 5.00 | 79.400 | 1800 | 329270.837 | 366924.013 | 2.338 |
| 502 | | | 79.227 | 1200 | 329277.742 | 366920.419 | 2.211 |

## 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 | 501 | 502 | 7.784 | 0.600 | 77.062 | 77.016 | 0.046 | 170.0 | 225 | 5.13 | 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 | 1.000 | 39.7 | 4.3 | 2.113 | 1.986 | 0.032 | 0.0 | 50 | 0.657 |

## 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 | 7.784 | 170.0 | 225 | Circular_Default Sewer Type | 79.400 | 77.062 | 2.113 | 79.227 | 77.016 | 1.986 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 501 | 1800 | Manhole | Adoptable | 502 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 501 | 329270.837 | 366924.013 | 79.400 | 2.338 | 1800 | 0 | 1.000 | 77.062 | 225 |
| 502 | 329277.742 | 366920.419 | 79.227 | 2.211 | 1200 | 1 | 1.000 | 77.016 | 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 501 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 77.062 | Product Number | CTL-SHE-0061-2000-1500-2000 |
| Design Depth (m) | 1.500 | Min Outlet Diameter (m) | 0.075 |
| Design Flow (l/s) | 2.0 | Min Node Diameter (mm) | 1200 |

## Other (defaults)

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 98.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 501 | 14 | 77.319 | 0.257 | 3.5 | 0.7232 | 0.0000 | SURCHARGED |
| 15 minute summer | 502 | 1 | 77.016 | 0.000 | 1.6 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|---|
| 15 minute winter | 501 | Hydro-Brake® | 502 | 1.6 | 1.6 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 98.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 30 minute winter | 501 | 26 | 78.153 | 1.091 | 6.8 | 3.0756 | 0.0000 | SURCHARGED |
| 15 minute summer | 502 | 1 | 77.016 | 0.000 | 1.6 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|---|
| 30 minute winter | 501 | Hydro-Brake® | 502 | 1.7 | 5.3 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 98.26%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 60 minute winter | 501 | 39 | 79.400 | 2.338 | 9.4 | 6.5885 | 1.4355 | FLOOD |
| 15 minute summer | 502 | 1 | 77.016 | 0.000 | 2.2 | 0.0000 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | DS Node | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|---|
| 60 minute winter | 501 | Hydro-Brake® | 502 | 2.5 | 12.5 |

## Design Settings

| | |
|---|---|
| Rainfall Methodology | FSR |
| Return Period (years) | 100 |
| Additional Flow (%) | 0 |
| FSR Region | England and Wales |
| M5-60 (mm) | 17.000 |
| Ratio-R | 0.300 |
| CV | 0.750 |
| Time of Entry (mins) | 5.00 |

| | |
|---|---|
| Maximum Time of Concentration (mins) | 30.00 |
| Maximum Rainfall (mm/hr) | 50.0 |
| Minimum Velocity (m/s) | 1.00 |
| Connection Type | Level Soffits |
| Minimum Backdrop Height (m) | 0.200 |
| Preferred Cover Depth (m) | 1.200 |
| Include Intermediate Ground | ✓ |
| 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) |
|---|---|---|---|---|---|---|---|
| 601 | 0.046 | 5.00 | 78.764 | 1500 | 329289.326 | 366950.491 | 2.038 |
| 602 | 0.046 | 5.00 | 78.841 | 1500 | 329277.007 | 366956.553 | 2.149 |
| 603 | 0.046 | 5.00 | 78.965 | 1500 | 329263.657 | 366967.272 | 2.316 |
| 604 | 0.046 | 5.00 | 78.806 | 1500 | 329245.352 | 366976.846 | 2.209 |
| 605 | 0.046 | 5.00 | 78.768 | 1500 | 329210.826 | 366961.590 | 2.161 |
| 606 | 0.046 | 5.00 | 78.525 | 1500 | 329224.075 | 366984.799 | 1.985 |
| 607 | 0.046 | 5.00 | 78.430 | 2100 | 329217.401 | 366987.968 | 1.908 |
| 608 | 0.000 | | 77.235 | 1200 | 329214.598 | 366994.629 | 0.756 |

## 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 | 601 | 602 | 13.730 | 0.600 | 76.726 | 76.692 | 0.034 | 400.0 | 750 | 5.16 | 50.0 |
| 1.001 | 602 | 603 | 17.121 | 0.600 | 76.692 | 76.649 | 0.043 | 400.0 | 750 | 5.37 | 50.0 |
| 1.002 | 603 | 604 | 20.658 | 0.600 | 76.649 | 76.597 | 0.052 | 400.0 | 750 | 5.62 | 50.0 |
| 1.003 | 604 | 606 | 22.715 | 0.600 | 76.597 | 76.540 | 0.057 | 400.0 | 750 | 5.89 | 50.0 |
| 2.000 | 605 | 606 | 26.724 | 0.600 | 76.607 | 76.540 | 0.067 | 400.0 | 750 | 5.32 | 50.0 |
| 1.004 | 606 | 607 | 7.388 | 0.600 | 76.540 | 76.522 | 0.018 | 400.0 | 750 | 5.98 | 50.0 |
| 1.005 | 607 | 608 | 7.227 | 0.600 | 76.522 | 76.479 | 0.043 | 168.1 | 225 | 6.10 | 50.0 |

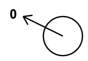
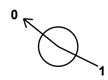
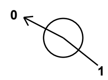
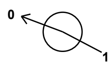
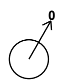
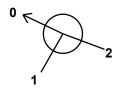
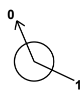
| Name | Vel (m/s) | Cap (l/s) | Flow (l/s) | US Depth (m) | DS Depth (m) | Σ Area (ha) | Σ Add Inflow (l/s) | Pro Depth (mm) | Pro Velocity (m/s) |
|---|---|---|---|---|---|---|---|---|---|
| 1.000 | 1.393 | 615.3 | 6.2 | 1.288 | 1.399 | 0.046 | 0.0 | 52 | 0.463 |
| 1.001 | 1.393 | 615.3 | 12.5 | 1.399 | 1.566 | 0.092 | 0.0 | 73 | 0.571 |
| 1.002 | 1.393 | 615.3 | 18.7 | 1.566 | 1.459 | 0.138 | 0.0 | 88 | 0.642 |
| 1.003 | 1.393 | 615.3 | 24.9 | 1.459 | 1.235 | 0.184 | 0.0 | 101 | 0.699 |
| 2.000 | 1.393 | 615.3 | 6.2 | 1.411 | 1.235 | 0.046 | 0.0 | 52 | 0.463 |
| 1.004 | 1.393 | 615.3 | 37.4 | 1.235 | 1.158 | 0.276 | 0.0 | 123 | 0.785 |
| 1.005 | 1.005 | 40.0 | 43.6 | 1.683 | 0.531 | 0.322 | 0.0 | 225 | 1.024 |

## 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 | 13.730 | 400.0 | 750 | Circular_Default Sewer Type | 78.764 | 76.726 | 1.288 | 78.841 | 76.692 | 1.399 |
| 1.001 | 17.121 | 400.0 | 750 | Circular_Default Sewer Type | 78.841 | 76.692 | 1.399 | 78.965 | 76.649 | 1.566 |
| 1.002 | 20.658 | 400.0 | 750 | Circular_Default Sewer Type | 78.965 | 76.649 | 1.566 | 78.806 | 76.597 | 1.459 |
| 1.003 | 22.715 | 400.0 | 750 | Circular_Default Sewer Type | 78.806 | 76.597 | 1.459 | 78.525 | 76.540 | 1.235 |
| 2.000 | 26.724 | 400.0 | 750 | Circular_Default Sewer Type | 78.768 | 76.607 | 1.411 | 78.525 | 76.540 | 1.235 |
| 1.004 | 7.388 | 400.0 | 750 | Circular_Default Sewer Type | 78.525 | 76.540 | 1.235 | 78.430 | 76.522 | 1.158 |
| 1.005 | 7.227 | 168.1 | 225 | Circular_Default Sewer Type | 78.430 | 76.522 | 1.683 | 77.235 | 76.479 | 0.531 |

| Link | US Node | Dia (mm) | Node Type | MH Type | DS Node | Dia (mm) | Node Type | MH Type |
|---|---|---|---|---|---|---|---|---|
| 1.000 | 601 | 1500 | Manhole | Adoptable | 602 | 1500 | Manhole | Adoptable |
| 1.001 | 602 | 1500 | Manhole | Adoptable | 603 | 1500 | Manhole | Adoptable |
| 1.002 | 603 | 1500 | Manhole | Adoptable | 604 | 1500 | Manhole | Adoptable |
| 1.003 | 604 | 1500 | Manhole | Adoptable | 606 | 1500 | Manhole | Adoptable |
| 2.000 | 605 | 1500 | Manhole | Adoptable | 606 | 1500 | Manhole | Adoptable |
| 1.004 | 606 | 1500 | Manhole | Adoptable | 607 | 2100 | Manhole | Adoptable |
| 1.005 | 607 | 2100 | Manhole | Adoptable | 608 | 1200 | Manhole | Adoptable |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|---|
| 601 | 329289.326 | 366950.491 | 78.764 | 2.038 | 1500 |  | 0 | 1.000 | 76.726 | 750 |
| 602 | 329277.007 | 366956.553 | 78.841 | 2.149 | 1500 |  | 1 | 1.000 | 76.692 | 750 |
| | | | | | | | 0 | 1.001 | 76.692 | 750 |
| 603 | 329263.657 | 366967.272 | 78.965 | 2.316 | 1500 |  | 1 | 1.001 | 76.649 | 750 |
| | | | | | | | 0 | 1.002 | 76.649 | 750 |
| 604 | 329245.352 | 366976.846 | 78.806 | 2.209 | 1500 |  | 1 | 1.002 | 76.597 | 750 |
| | | | | | | | 0 | 1.003 | 76.597 | 750 |
| 605 | 329210.826 | 366961.590 | 78.768 | 2.161 | 1500 |  | 0 | 2.000 | 76.607 | 750 |
| 606 | 329224.075 | 366984.799 | 78.525 | 1.985 | 1500 |  | 1 | 2.000 | 76.540 | 750 |
| | | | | | | | 2 | 1.003 | 76.540 | 750 |
| | | | | | | | 0 | 1.004 | 76.540 | 750 |
| 607 | 329217.401 | 366987.968 | 78.430 | 1.908 | 2100 |  | 1 | 1.004 | 76.522 | 750 |
| | | | | | | | 0 | 1.005 | 76.522 | 225 |

## Manhole Schedule

| Node | Easting (m) | Northing (m) | CL (m) | Depth (m) | Dia (mm) | Connections | Link | IL (m) | Dia (mm) |
|---|---|---|---|---|---|---|---|---|---|
| 608 | 329214.598 | 366994.629 | 77.235 | 0.756 | 1200 | 1  | 1.005 | 76.479 | 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 607 Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | ✓ | Sump Available | ✓ |
| Invert Level (m) | 76.522 | Product Number | CTL-SHE-0098-5000-1500-5000 |
| Design Depth (m) | 1.500 | Min Outlet Diameter (m) | 0.150 |
| Design Flow (l/s) | 5.0 | Min Node Diameter (mm) | 1200 |

## Node 605 Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 76.607 |
| 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 | 100.0 | 0.0 | 0.800 | 100.0 | 0.0 | 0.801 | 0.0 | 0.0 |

## Other (defaults)

| | | | | | |
|---|---|---|---|---|---|
| Entry Loss (manhole) | 0.250 | Entry Loss (junction) | 0.000 | Apply Recommended Losses | x |
| Exit Loss (manhole) | 0.250 | Exit Loss (junction) | 0.000 | Flood Risk (m) | 0.300 |

**Results for 1 year Critical Storm Duration. Lowest mass balance: 96.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 15 minute winter | 601 | 10 | 76.773 | 0.047 | 5.0 | 0.1044 | 0.0000 | OK |
| 15 minute winter | 602 | 11 | 76.757 | 0.065 | 9.9 | 0.1437 | 0.0000 | OK |
| 15 minute winter | 603 | 12 | 76.729 | 0.080 | 14.4 | 0.1720 | 0.0000 | OK |
| 15 minute winter | 604 | 12 | 76.725 | 0.128 | 19.2 | 0.2791 | 0.0000 | OK |
| 60 minute winter | 605 | 50 | 76.720 | 0.113 | 13.7 | 11.5369 | 0.0000 | OK |
| 15 minute winter | 606 | 12 | 76.723 | 0.183 | 21.8 | 0.4077 | 0.0000 | OK |
| 15 minute winter | 607 | 12 | 76.723 | 0.201 | 7.5 | 0.7927 | 0.0000 | OK |
| 15 minute summer | 608 | 1 | 76.479 | 0.000 | 4.4 | 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 | 601 | 1.000 | 602 | 4.9 | 0.330 | 0.008 | 0.2040 | |
| 15 minute winter | 602 | 1.001 | 603 | 9.7 | 0.454 | 0.016 | 0.3667 | |
| 15 minute winter | 603 | 1.002 | 604 | 14.2 | 0.503 | 0.023 | 0.7687 | |
| 15 minute winter | 604 | 1.003 | 606 | 17.1 | 0.382 | 0.028 | 1.5043 | |
| 60 minute winter | 605 | 2.000 | 606 | -10.9 | -0.303 | -0.018 | 1.6321 | |
| 15 minute winter | 606 | 1.004 | 607 | 4.5 | 0.189 | 0.007 | 0.6556 | |
| 15 minute winter | 607 | Hydro-Brake® | 608 | 4.4 | | | | 15.6 |

**Results for 30 year Critical Storm Duration. Lowest mass balance: 96.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | 601 | 144 | 76.955 | 0.229 | 3.4 | 0.5072 | 0.0000 | OK |
| 180 minute winter | 602 | 144 | 76.955 | 0.263 | 6.2 | 0.5764 | 0.0000 | OK |
| 180 minute winter | 603 | 144 | 76.955 | 0.306 | 8.6 | 0.6613 | 0.0000 | OK |
| 180 minute winter | 604 | 144 | 76.955 | 0.358 | 10.6 | 0.7810 | 0.0000 | OK |
| 180 minute winter | 605 | 144 | 76.955 | 0.348 | 11.5 | 35.5298 | 0.0000 | OK |
| 180 minute winter | 606 | 144 | 76.955 | 0.415 | 12.3 | 0.9251 | 0.0000 | OK |
| 180 minute winter | 607 | 144 | 76.955 | 0.433 | 5.5 | 1.7072 | 0.0000 | SURCHARGED |
| 15 minute summer | 608 | 1 | 76.479 | 0.000 | 4.7 | 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) |
|---|---|---|---|---|---|---|---|---|
| 180 minute winter | 601 | 1.000 | 602 | 3.0 | 0.279 | 0.005 | 1.7209 | |
| 180 minute winter | 602 | 1.001 | 603 | 5.5 | 0.362 | 0.009 | 2.6176 | |
| 180 minute winter | 603 | 1.002 | 604 | 7.3 | 0.330 | 0.012 | 3.8792 | |
| 180 minute winter | 604 | 1.003 | 606 | 8.9 | 0.249 | 0.015 | 5.1877 | |
| 180 minute winter | 605 | 2.000 | 606 | -8.1 | 0.188 | -0.013 | 6.0041 | |
| 180 minute winter | 606 | 1.004 | 607 | 4.7 | 0.164 | 0.008 | 1.8939 | |
| 180 minute winter | 607 | Hydro-Brake® | 608 | 4.9 | | | | 101.1 |

**Results for 100 year +50% CC Critical Storm Duration. Lowest mass balance: 96.15%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 601 | 288 | 78.299 | 1.573 | 6.0 | 3.4894 | 0.0000 | SURCHARGED |
| 360 minute winter | 602 | 288 | 78.297 | 1.605 | 7.3 | 3.5223 | 0.0000 | SURCHARGED |
| 360 minute winter | 603 | 288 | 78.297 | 1.648 | 9.7 | 3.5659 | 0.0000 | SURCHARGED |
| 360 minute winter | 604 | 288 | 78.292 | 1.695 | 11.8 | 3.7018 | 0.0000 | SURCHARGED |
| 360 minute winter | 605 | 288 | 78.294 | 1.687 | 13.6 | 83.7500 | 0.0000 | SURCHARGED |
| 360 minute winter | 606 | 312 | 78.343 | 1.803 | 13.8 | 4.0223 | 0.0000 | FLOOD RISK |
| 360 minute winter | 607 | 288 | 78.294 | 1.772 | 64.9 | 6.9904 | 0.0000 | FLOOD RISK |
| 15 minute summer | 608 | 1 | 76.479 | 0.000 | 4.9 | 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) |
|---|---|---|---|---|---|---|---|---|
| 360 minute winter | 601 | 1.000 | 602 | 3.6 | 0.247 | 0.006 | 6.0429 | |
| 360 minute winter | 602 | 1.001 | 603 | 8.0 | 0.307 | 0.013 | 7.5353 | |
| 360 minute winter | 603 | 1.002 | 604 | 7.7 | 0.304 | 0.013 | 9.0920 | |
| 360 minute winter | 604 | 1.003 | 606 | 9.7 | 0.272 | 0.016 | 9.9973 | |
| 360 minute winter | 605 | 2.000 | 606 | -9.8 | -0.068 | -0.016 | 11.7618 | |
| 360 minute winter | 606 | 1.004 | 607 | 64.9 | 0.148 | 0.105 | 3.2516 | |
| 360 minute winter | 607 | Hydro-Brake® | 608 | 5.4 | | | | 157.8 |