ROLTON GROUP
ENGINEERING THE FUTURE™

FLOOD RISK ASSESSMENT & DRAINAGE STRATEGY

FOR

LAND NORTH OF THAXTED ROAD, SAFFRON WALDEN

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PREFACE

a) The Flood Risk Assessment and Drainage Strategy and / or opinion has been prepared for the specific purpose stated therein.

b) The Flood Risk Assessment Drainage Strategy has been prepared for the exclusive use by: -

Kier Ventures Ltd

c) This document is issued only to the persons stated above and on the understanding that this Practice is not held responsible for the actions of others who obtain any unauthorised disclosure of its contents, or place reliance on any part of its findings, facts or opinions, be they specifically stated or implied.

d) This study is a risk-based assessment of potential flooding issues at the study site and the information presented and the conclusions drawn are for guidance only and provide no guarantee against flooding.

1.0 INTRODUCTION

This Flood Risk Assessment has been prepared on behalf of Kier Ventures Ltd in support of their outline planning application for development of the site for up to 55 dwellings, associated landscaping and open space, with access from Knight Park.

This report has been written and formatted generally in accordance with the requirements outlined in National Planning Policy Framework (NPPF) and its technical guidance.

This version of the report has been updated to suit comments raised by the Lead Local Flood Authority (LLFA) at Essex County Council (ECC) in their Consultation Response dated 8th February 2024 with regards to the restricted discharge rate and a clarification regarding soakaway structures on the drainage layout drawing (refer to Section 8.3.1).

2.0 SITE SUMMARY

The proposed site is situated to the north of Thaxted Road, Saffron Walden, and is centred approximately on National Grid Reference 555177, 237438.

To the south of the site is Knight Park, a retail park with a number of commercial units, a hotel and the Saffron Walden Recycling Centre. To the east of the site the area is agricultural land with a new housing development located to the north.

The planning application site boundary and the extent of development area is approximately 4.3 hectares with existing ground that slopes in a north westerly direction.

The site is bounded by existing hedge lines and field boundaries to most sides with a tributary of The Slade Systems along the northernmost boundary. The site is split into two sections separated by a Public Right of Way footpath maintained by Essex County Council.

The British Geological Survey (BGS) map for the area (Sheet 222 'Great Dunmow') and the BGS GeoIndex website show the site to be underlain by superficial deposits of the Lowestoft Formation (diamicton) at the far southeastern extent of the site. The underlying solid geology is indicated to comprise of the undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation of the White Chalk Subgroup. During on site investigation works this was confirmed with the exception of the northwestern end of the site, where the topsoil was underlain by Head deposits, recorded as stiff dark yellowish brown sandy clay.

A location plan of the site is included in **Appendix A.**

3.0 SITE LEVELS – EXISTING AND PROPOSED

3.1 EXISTING LEVELS

The general topography of the site, prior to development, consists of ground levels across the extent of the site varying quite sharply, falling from approximately 94mAOD in the southeast to 78mAOD in the northwest.

Drawing 220222-RGL-ZZ-XX-DR-C-120-0011 Proposed Drainage Strategy Layout in **Appendix B** indicates the existing levels of the proposed site in the background of the proposed layout.

A copy of the topographical survey drawings is included in **Appendix C** of this report.

3.2 PROPOSED LEVELS

The proposed development will mirror the existing site topography with the general fall across the site being maintained.

All levels are based on the Ordnance Datum, provided by Kier Group dated April 2022.

4.0 EXISTING SITE DRAINAGE SYSTEM

The overall site has no formal drainage system and therefore surface water run-off flows off of the site at the Greenfield run-off rate via overland flow routes to the existing field boundary and tributary located to the north and east along the boundaries of the site. These tributaries flow in a north westerly direction and ultimately connect into The Slade System main River, which is located beyond the northwestern boundary and on the western side of Thaxted Road.

5.0 HYDRAULIC INFLUENCES

The key features of the existing site drainage infrastructure, which influence the hydrology of the site, are detailed below.

5.1 FIELD DRAINAGE DITCHES

From the topographic survey of the site as well as mapping information for the site the location of the drainage ditches to the north and east of the site has been determined. This appears to be a combination of naturally occurring and purposefully constructed, which is fed by flows from the site, as well as offsite flows from the adjacent fields to the east of the site. As part of the proposed scheme, these ditches will remain unaffected and will therefore stay as currently surveyed or seen on the site.

It is not anticipated that the proposed levels adjacent to the ditches will be adjusted. As the proposed site levels to the northern site will remain as existing, any out of bank flooding would occur similarly to the existing scenario. As no plots will be located in this area of the site where the ditch is located there is no concern with regard to the plot floor levels and any potential flooding.

Plots will be located along the eastern boundary of the southern site. Consideration will be given to floor levels for these plots to ensure that in the event of any flooding from the eastern ditch the plots will remain unaffected.

5.2 GROUND CONDITIONS

As stated within the Phase 1 Geo-environmental Desk Study (report 220222-RGL-ZZ-XX-RP-G-0004 produced by Rolton Group in August 2023) the geology is described as:

The published British Geological Survey (BGS) map for the area (Sheet 222 'Great Dunmow') and the BGS GeoIndex website show the site to be underlain by superficial deposits of the Lowestoft Formation – Diamicton, a chalky till deposit which encroaches the south-eastern extent of the site. Superficial deposits are unmapped across the majority of the central portion of the site. Underlying bedrock is indicated to comprise of the undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation, typically consisting of hard nodular chalks, beneath the whole site and surrounding area.

Soakaway testing has been carried out by Rolton Group (RGL) in general accordance with BRE Digest 365. The locations of investigative positions were selected to target proposed locations of attenuation ponds and dwelling soakaway locations to get a picture of the site wide infiltration potential. A total of four pits were excavated, ref. SA01, SA02, SA03 and SA04, between the 4th and 5th of October 2023. The pits were formed using a backhoe excavator to depths between 2.45mbgl and 2.80mbgl. The excavations were recorded by a Rolton Group engineer and shown in document 220222-RGL-ZZ-XX-CO-Z-0009. This document is included with **Appendix D**.

Soil permeability tests were completed in all the pits in general accordance with BRE Digest DG 365: Soakaway design. The soakaway tests included each pit being partially filled with water, with the subsequent drop in water level measured at regular intervals. Depending on the rate of infiltration, where possible the test was repeated twice more.

For the preliminary drainage design seen in **Appendix B** and calculations included in **Appendix F**, an infiltration rate of 4.76x10^{-5}m/s has been used in the area surrounding SA03 as this is the only area of the site where infiltration was deemed to be suitable and where three tests were successfully undertaken.

6.0 IDENTIFICATION OF POTENTIAL FLOODING SOURCES

6.1 WATERCOURSES

The flood plain associated with the Slade System identifies that the site is located within flood zone 1, **Appendix E**. However, the tributaries upstream of the main River are not mapped as part of the main River modelling and therefore do not contribute to the flood zones. The surface water flooding map identifies that there is a risk of surface water flooding along the routes of the tributaries, particularly to the northern and eastern boundaries of the site where the ditches are located.

6.2 RAINFALL

As the site is currently agricultural fields with the majority of rainfall being absorbed into the ground, the proposed development will keep this status quo as far as practicable.

Infiltration rates calculated as part of the soakaway testing investigation showed only one area of the site that is suitable for infiltration, as such surface water run-off will be directed to this area and drained via infiltration where feasible, being cleaned along the way by utilising permeable paving, basins and the infiltration features themselves. Where infiltration can't be utilised for the surface water run-off, a connection will be provided into the ditch to the north of the site as per the existing scenario at a reduced rate.

Levels across the site will be designed to suit the existing levels, which fall from south to north to northwest, to ensure that surface water flows, as a result of rainfall, will flow away from the buildings and towards permeable paving and open areas to provide active drainage.

6.3 SEA

As the site is a significant distance from the sea and at a level significantly above sea level, the potential of flooding from the sea to affect the site is very low.

6.4 GROUND WATER

During the infiltration tests in October, no ground water was observed or reported. The infiltration pits were excavated to a depth between 2.45mbgl and 2.80mbgl.

According to BGS mapping accessed via the DEFRA online Magic Map application, the site ground conditions have EA aquifer classifications of Principal aquifer for Chalk bedrock and Secondary (Undifferentiated) aquifer for Till and Head superficial deposits. However, although the site is within a groundwater source protection zone 3, there are no recorded groundwater abstractions within 250m of the site. A Groundsure report contained within the Rolton Group Phase 1 Geo-environmental Report indicates that the nearest Active Groundwater Abstraction is located 1460m northwest of the site.

The site is indicated to have the High and Medium-High for Groundwater vulnerability as indicated on the Magic map extract below with a Soluble Rock Risk.

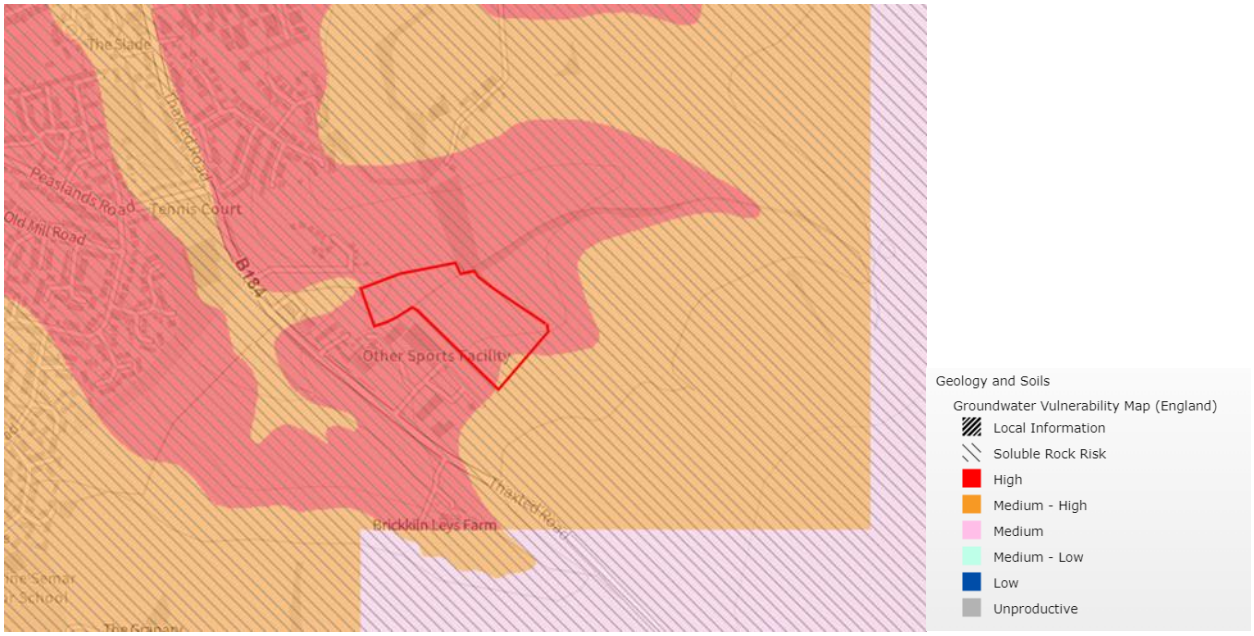

Figure 1 - Groundwater Vulnerability Map

6.5 SURFACE WATER RUN-OFF / SEWERS

The surface water run-off from the site will be directed towards and drained by areas of permeable paving, attenuation ponds and an infiltration basin as well as traditional drainage features where required.

The current surface water flood risk maps produced by the EA indicates that a small area proposed for residential development falls within an area of surface water flood risk. The EA surface water maps are derived from a rainfall event falling onto the land (not taking account any infiltration/permeability of the soils), and accumulating in low spots, hence why drainage channels/water courses are shown in dark blue and being at high risk. The surface water flood risk map (an extract covering the site is included below) shows the current flow route surface water takes around the site via the boundary ditches.

Reviewing the topographical survey of the site, surface water lands on the site and flows to the northeastern corner of the southern site and northwestern corners of the northern site where it flows into the boundary ditches.

Based on the surface water flood mapping and topographic survey of the site, there is an area behind the existing Knight Park where surface water will collect and flow in a northerly direction along the site boundary. Based on levels and the mapping, it appears that this area indicated as flooding will continue to flow with the site levels and onto the northern parcel and will continue north into the drainage ditch.

The area in the northern area of the southern parcel will drain via infiltration through permeable paving, located in private drives and shared driveways as well as private soakaway located in back gardens.

Surface water from the roofs of the plots not located in this area of the site and the run off from other impermeable surfaces will all drain into the proposed sewer network via permeable paving where possible, which will have an approximate subbase depth of 400mm, catering for the 100-year rainfall event including climate change and an allowance for urban creep, and making sure the surface water in this area is manged in a sustainable way.

A copy of the flood risk map for surface water flooding can be found below. The preliminary drainage layout (**Appendix B)** also has the EA surface water map extent shown on it.

Figure 2 - Surface Water Flood Risk Map

In the event of surface water flooding, as indicated in the above map, flood water will be routed through the development via designated flow route areas, conveyance swales and storage areas to the northernmost area of the site to where flood water currently flows and subsequently leaves the site. It is noted that the area of surface water flooding indicated on the surface water flood mapping will cross the proposed access road, this will be allowed to flow over the surface of the road or will be culverted under the road subject to the levels required to form the access.

Refer to drawing 220222-RGL-ZZ-XX-DR-D-120-0001 found in **Appendix B** of this report for areas designated as conveyance routes and arrows indicating the direction of overland flow routes.

6.6 RESERVOIRS

There are no reservoirs in the vicinity of the site, therefore, this risk is considered to be very low.

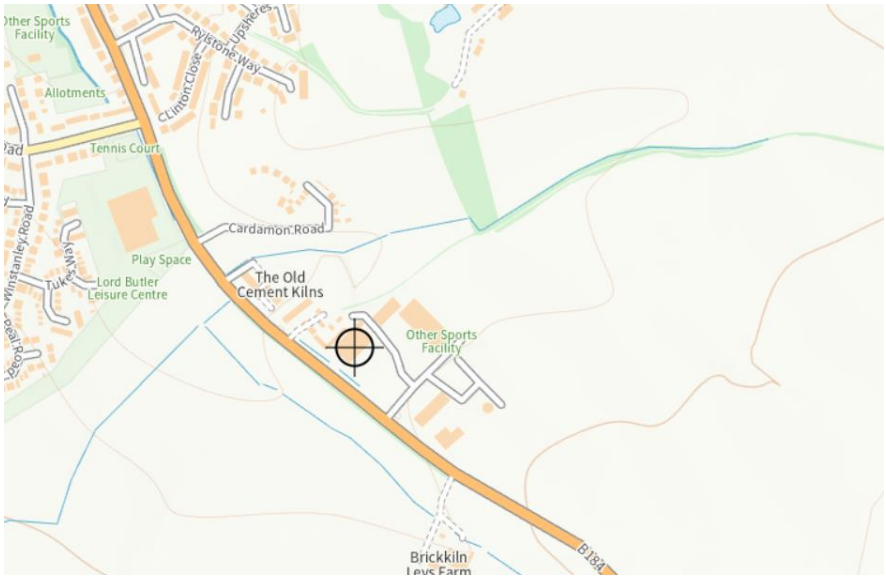

Figure 3 - Reservoir Flood Risk Map

6.7 ARTIFICIAL SOURCES

There are no other known artificial sources of potential flooding adjacent to the site.

7.0 EXISTING FLOOD RISKS

Included in **Appendix E** are the Environment Agency's Product 4 Information for the site including flood maps covering the site, which identifies the proposed area for residential development as being outside of any area at risk of flooding from rivers or the sea.

As stated in section 6.4 of this report, it is expected that potential of flooding from groundwater is considered to be very low due to no ground water being observed on site during the infiltration testing.

8.0 ANALYSIS OF PROPOSED DEVELOPMENT AND SURFACE WATER DRAINAGE SYSTEM

8.1 PROPOSED DEVELOPMENT

The proposed development is for a residential development for up to 55 dwellings, landscaping, including open spaces, SuDS features, parking and access.

A "Sketch Site Layout" of the proposed development can be found in **Appendix B**.

8.2 SURFACE WATER DRAINAGE

All developments should seek to dispose of surface water via infiltration before discharge to watercourses or local sewers. The site drainage strategy to dispose surface water has considered this concept and all surface water runoff will be discharged by direct infiltration where feasible. Where this is not feasible, the remaining surface water drainage will discharge into the existing ditch located to the north of the site where the current site discharges via overland flows. As indicated in section 5.2, the ground conditions are favourable for surface water infiltration in one area of the site, 4 No. infiltration tests were carried out by RGL in 2023, refer to **Appendix D** for exploratory hole layout and infiltration testing results.

It is proposed that in the north easternmost corner of the southern parcel, surface water from residential plots, private driveway will be drained via permeable paving where possible and discharged via infiltration within the permeable paving or conveyed to private individual infiltration tanks within rear gardens.

In the southern and western part of the southern site, including run off from adoptable highways will be conveyed via a piped sewer network and a dry basin where levels allow, and into the northern parcel where an attenuation basin will be provided. The attenuation basin will be sized to suit storm events up to and including the 1 in 100-year rainfall event including an allowance for climate change and urban creep. Water from this basin will then discharge into the northern ditch at a reduce flow rate equal to the greenfield run off rate.

The adoptable highways throughout the site will drain traditionally via gullies and will be conveyed towards the basin to then be discharged into the northern ditch.

Utilising permeable paving, both Type A and B (full infiltration or partial infiltration respectively), surface water will be cleaned prior to discharge to the ground and will also allow for some attenuation within the subbase. It is also proposed that during the detailed design, raingardens and tree pits are considered, to increase the benefits to the site.

In line with the updated 2020 Essex County Council SuDS Design Guide, rainwater re-use should be considered as part of any development. Discussions have considered using the attenuated surface water held in the ponds/basin for irrigation of the landscaped areas, which will require the use of pumping, this can be explored further in the detailed design stages. It is proposed that water butts be utilised for all residential units as part of the detailed design stage.

8.3 PRELIMINARY DRAINAGE / SUDS DESIGN

The preliminary drainage design below is split into quantity (flow and volume) and quality in accordance with the latest CIRIA, EA and ECC guidance. SuDS are an approach to managing rainwater and surface water that replicates natural drainage, the key objective being to manage flow rate and volume of runoff to reduce the risk of flooding.

Due to the high level of this outline design, it has not been possible to show exact locations of any of the drainage features.

8.3.1 DESIGN TO LIMIT FLOW AND VOLUME

The site has been split into two catchments based on where it is likely infiltration can be utilised:

- Southern and Western Catchment – Permeable Paving (Type B), traditional drainage and piped sewer network via basins where possible and into attenuation basin prior to discharge via gravity
- Northern Catchment - Individual Soakaways and permeable paving (Type A),

In addition to the above catchments, the area of proposed highway throughout the site will drain via traditional drainage and will be piped to an attenuation basin located within the area of public open space in the northern site. This will be incorporated with the private drainage and will be sized to accommodate surface water run off resulting from the 1 in 100-year rainfall event with an allowance for climate change.

The individual house soakaways have been designed based on a 60sqm roof area with an infiltration rate based on the value (4.76x10-5m/s), requiring a cellular soakaway size of 6.25sqm and 0.8m depth. Refer to **Appendix F** for calculations. These soakaways have been designed and modelled so that the half drain time for each soakaway is less than 24 hours. These private soakaways are indicated in rear gardens of plots on the drainage strategy layout drawing in **Appendix B**.

All of the private property driveways are proposed to be constructed using permeable paving or designed to fall towards shared permeable driveways, to allow any surface water run-off to be drained. Rainwater pipes from the plots themselves, will be drained into the porous subbase of the permeable paving where possible.

The surface water from the southern and western catchment as well as the highways will drain to the northern site where the attenuation basin will be located. This attenuation basin serving will be designed to be approximately 1.5m deep. In times of heavy rainfall events, surface water will back up within the drainage system and be attenuated in the areas of permeable paving and other smaller attenuation pond.

The drainage from the southern and western catchment will discharge into the northern ditch at a reduced greenfield run off rate. As the northern site is proposed to remain undeveloped and only be used for the attenuation basin for the development, calculations have been undertaken to estimate the greenfield run off rates on the existing southern site only. The calculations for the estimation can be found in **Appendix F** and are summarised below. For the discharge into the northern ditch, as requested by ECC, a flow rate of 1.0l/s is to be used as the closest practical flow rate to the existing greenfield run off rate without risk of blockage to the chosen flow control device.

RAINFALL EVENT	FLOW RATE (L/S)
QBar	0.41
1 in 1 Year	0.36
1 in 30 Year	1
1 in 100 Year	1.45

Table 1 – Greenfield Run Off Rates

The overall drainage strategy provides a solution that incorporates both above and below ground drainage system for conveying storm water. The storage requirements for the worst-case duration storm event (1 in 100-year rainfall event plus climate change and urban creep) identifies a solution for attenuation ponds with a combined storage volume requirement of approximately 1155m^3, maximum depth of 1.5m and 1 in 3 side slopes with a minimum freeboard of 300mm.

The final detailed design requirement for the scheme will need to provide storage through a mixture of attenuation ponds, permeable paving and other features to ensure the drainage can be adopted for future maintenance purposes. Storage will need to accommodate the worst case 1 in 100-year rainfall event including 40% climate change and a 10% allowance for urban creep. As per the ECC guidance, the roof areas have all had a 10% increase to account for this and attenuation estimation calculations have included an additional flow of 10%.

The preliminary drainage layout for the site can be found in **Appendix B**.

8.3.2 DESIGN TO ENSURE WATER QUALITY

The pollution hazard indices for different land use classifications, as identified in table 26.2 of the SuDS manual, are as follows:

LAND USE	POLLUTION HAZARD LEVEL	TOTAL SUSPENDED SOLIDS (TSS)	METALS	HYDROCARBONS
Residential Roofs	Very Low	0.2	0.2	0.05
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail), all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7

Table 2 – Pollution Hazard

Therefore, based on the use of permeable paving the indicative SuDS mitigation indices for the northern catchment of the site as identified in table 26.4 of the SuDS manual, for discharges to groundwater (together with totals) is as follows:

SUDS FEATURE	TSS	METALS	HYDROCARBONS
Permeable paving	0.7	0.6	0.7
TOTAL	0.7	0.6	0.7

Table 3 – SuDS Groundwater Discharge

The indicative SuDS mitigation indices for the southern and western catchment of the site as identified in table 26.3 of the SuDS manual, for discharges to surface water (together with totals) is as follows:

SUDS FEATURE	TSS	METALS	HYDROCARBONS
Permeable paving	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6
TOTAL (Index 1 + 0.5x Index 2)	0.95	0.85	1.0

Table 4 – SuDS Surface Water Discharge

For areas of proposed highway where additional SuDS features are not feasible prior to discharge into the infiltration basin, such as the northern most length of highway adjacent to the proposed basin, proprietary source control devices will be required to provide the necessary levels of treatment. This has been indicated on the preliminary drainage layout in **Appendix B** and will be subject to detailed design.

8.3.3 CLIMATE CHANGE AND DILAPIDATION

National Planning Policy Framework (which sets out the government requirements for the management and reduction of flood risk in the land use planning process) requires the investigation of climate change on the proposed development. The online climate change allowances indicate that up to 2115 the climate change allowance should be 25-40%.

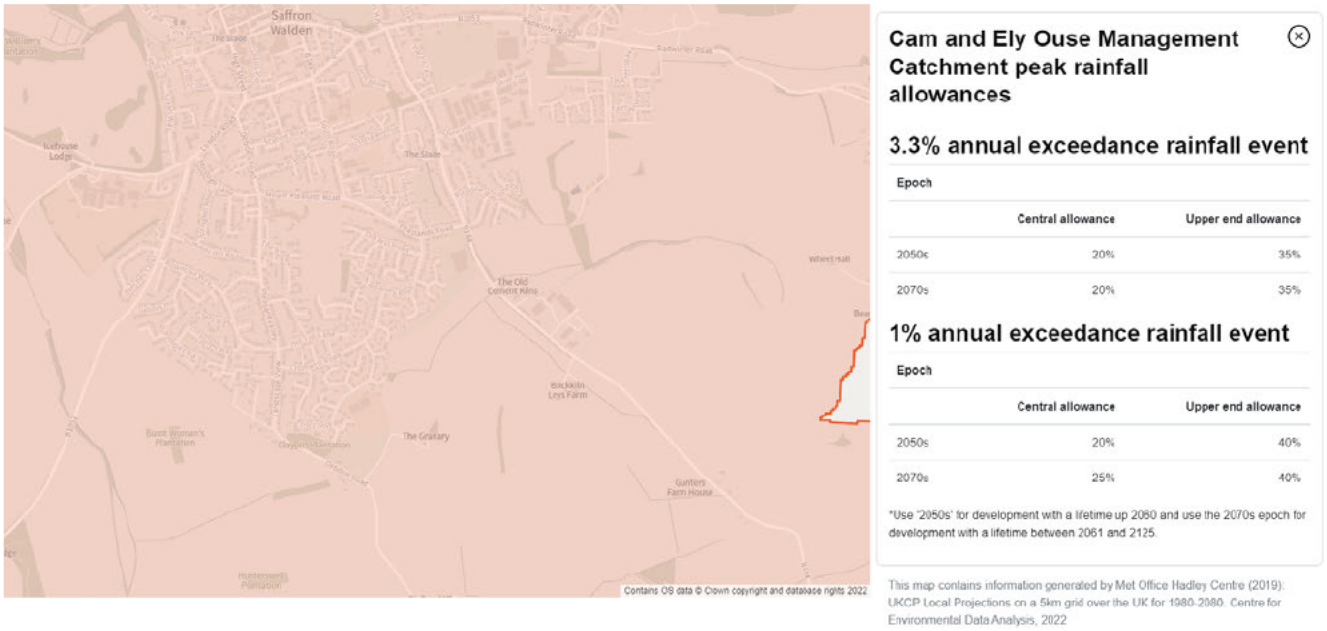

Figure 4 - Climate Change Allowance

The full 40% climate change allowance has been included in the proposed storage design and this should be retained through the detailed design.

8.3.4 MAINTENANCE OF DRAINAGE FEATURES

The proposed external drainage system will consist of a piped drainage network, soakaways, storage tanks (if required), flow control chambers, permeable paving and attenuation basins at a minimum. Subject to detailed design, it is recommended that the piped storage system including flow control should be adopted by Anglian Water under a S104 agreement and the estate roads should be adopted by ECC under a S38 agreement. The shared private drainage system, private storage and attenuation areas will be maintained by a management company and the individual private drainage and permeable paving would be maintained by the property owners.

The recommended maintenance regimes for the main surface water assets are set out in **Appendix G**.

9.0 ASSESSMENT, PROBABILITY AND RATE OF POTENTIAL FLOODING

As the development is a residential use, it is deemed a "more vulnerable" category to table 2 of the NPPF. Due to its location within flood zone 1 the development is appropriate in accordance with table 3 of the NPPF as indicated below:

Table 3: Flood risk vulnerability and flood zone 'compatibility'

Paragraph: 067 Reference ID: 7-067-20140306

Flood Zones	Flood Risk Vulnerability Classification				
	Essential infrastructure	Highly vulnerable	More vulnerable	Less vulnerable	Water compatible
Zone 1	✓	✓	✓	✓	✓
Zone 2	✓	Exception Test required	✓	✓	✓
Zone 3a †	Exception Test required †	✗	Exception Test required	✓	✓
Zone 3b *	Exception Test required *	✗	✗	✗	✓*

Key:

✓ Development is appropriate

✗ Development should not be permitted.

As the site is located within flood zone 1, the sequential test is not required as the site is sequentially preferable within flood zone 1. Also, in accordance with table 2 the exception test is not applicable.

10.0 FOUL WATER

The proposed below ground foul drainage system will be designed in accordance with the Building Regulations approved Document H and the Sewerage Sector Guidance Design and Construction Guide (2023).

Foul water, or effluent, flows from the site will be managed in a new sewer system which will connect to the existing public foul sewer network, which is understood to have been extended to serve the recent Bellway development to the east of the site and is also understood to have been designed to serve the development at Knights Park, **Appendix B.**

Foul drainage should be disposed of by connecting to the extended sewer in agreement with the relevant asset owner.

During the detailed design stage for the development this existing sewer will be investigated, and the invert levels surveyed. If the invert level of the existing sewer would not allow for a gravity connection, a pump station designed to adoptable standards would need to be considered.

11.0 CONCLUSION

In conclusion, this FRA and Drainage Strategy has been undertaken in accordance with National Planning Policy in relation to development and Flood Risk in respect of the proposed residential development at land north of Thaxted Road, Saffron Walden.

The ground conditions show infiltration will work on site to a limited extent. SuDS will be used throughout the proposed development to slow, clean and attenuate surface water, and surface water flood risk will be managed on site and not increase risk to the development or third parties.

12.0 REFERENCES

- National Planning Policy Framework (NPPF) dated July 2021 by Ministry of Housing, Communities and Local Government.
- Online Planning Practice Guidance to the National Planning Policy Framework dated June 2021 by Department for Communities and Local Government.
- FRA Guidance Note 1 by the EA.
- EA/DEFRA document W5-074/A/TR/1 revision E 'preliminary rainfall runoff management for new developments' dated January 2012.
- HR Wallingford UK SuDS Greenfield Run Off Rate Estimation tool.
- Ciria C753 SuDS Manual 2015.
- Department for Environment Food and Rural Affairs Climate Change Allowances.
- Online Gov.uk Long Term Flood Risk checking tool.
- Phase 1 Geo-environmental Desk Study report 220222-RGL-ZZ-XX-RP-G-0004 produced by Rolton Group in August 2023.

APPENDIX A – LOCATION PLAN

KIER

Client:	Drawing Title:					Omega Architects	Project No'	Class	Dwg No'	Status	Rev
Kier Group	Location Plan										
Project:	Scale:	Revision	Drawn	Check	Date	The Front Barn, 124 Manor Road North, Thames Ditton, KT7 0BH T: 01372 470 313 [redacted]	3119	A	1000	PR	C
Land South of Saffron Walden	1:1250 @ A2	A	RB	JH	04.07.23						
		B	RB	JH	12.07.23						
		C	MP	JH	17.11.23						

CLASS: C - COLOURED, A - BLACK & WHITE
STATUS: SK - SKETCH, PR - PRELIMINARY, PL - PLANNING, WD - WORKING DRAWING

APPENDIX B – PROPOSED DEVELOPMENT PLAN AND DRAINAGE LAYOUT

N

0 m 10 m 20 m 30 m 40 m 50 m

Scale

KIER

Client: KIER GROUP	Drawing Title: SKETCH SITE LAYOUT						
Project: LAND SOUTH OF SAFFRON WALDEN SITE	Scale: 1:500 @ A1	Revision	Drawn	Check	Date	Project No: 3119	Class: C	Dwg No: 1005	Status: SK	Rev: L

Omega Architects
The Front Barn, 124 Manor Road North,
Thames Ditton Surrey. KT7 0BH
T: 01372 470 313 W

CLASS: C - CONSUMER, A - BASIC & WHITE
STATUS: SK - SKETCH, W - PRELIMINARY, PL - PLANNING, WD - WORKING DRAWINGS

NOTE: Drainage shown is indicative only and subject to detailed design.

Proposed Hydrobrake chamber to restrict surface water discharge to the receiving watercourse at 1l/s

Attenuation basin designed to serve the development. Preliminary design based no infiltration possible due to low soakway testing results. Attenuation basin to consist of approx 1.5m deep basin. Estimated volume to be provided 1155m³. Basin to be designed to accommodate a 1 in 100 year rainfall event plus 40% climate change, including an allowance for 10% Urban Creep.

Private plot soakaway boundary. Plots located within Northern Catchment boundary to utilise private soakaways located in rear gardens and fully infiltrating permeable paving. Preliminary calculations indicate soakaways to be approximately 6.25m² in area and 0.8m deep in order to ensure properties are not subject to flooding.
Preliminary design infiltration rate: 4.26x10⁻⁵m/s (0.17m/hr)
Areas of permeable paving to consist of approx 250mm minimum depth of porous subbase at minimum 30% void ratio subject to detailed design

Northern catchment boundary

Proposed proprietary treatment device to treat highway surface water run off as required such as Full Retention Separator installed prior to discharge into attenuation basin. Necessity for treatment device and choice of device to be assessed and made during detailed design stage.

Southern and Western catchment boundary

Dry attenuation basin. Limited infiltration possible due to low soakaway test results. Basin has been shown as a flow through treatment structure and will only be used for attenuation in the event of exceedance rainfall events.

Potential surface water flooding route shown in EA flood mapping to be retained within boundary landscaping area to ensure continued conveyance to north of the site

For continuation, see inset

Existing foul water sewer serving properties on northern side of B 184 taken from record drawings. Details of existing sewer are to be confirmed prior to detailed design stage.

Invert levels of existing foul water sewer point of connection to be established prior to detailed design. If existing invert level does not allow for gravity connection, foul water pumping station is to be designed and installed to adoptable standards.

Knight Park

Public Recycling Facility

Notes

1. This drawing is to be read in conjunction with all the relevant contract documentation.
2. This drawing and its contents shall not be reproduced or reused in whole or in part without Rolton Group's express permission in writing and Rolton Group accepts no liability for any damages, costs, losses, claims, proceedings or expenses arising from such use.
3. All dimensions are in mm unless otherwise stated. Dimensions to be checked on site prior to construction and any discrepancies reported to the Rolton Group Engineer.
4. Only drawings that indicate CONSTRUCTION as the issue purpose should be used for construction.
5. Any CONSTRUCTION status issue does not provide or imply approval or validation of any third party information.
6. Revision clouds are shown for assistance only, the whole drawing is to be checked for new/amended information.
7. Not all hatches and linetypes shown on legends and keys may be present on this drawing. Drawings to be printed in colour by default, typical material colours are for clarity only.
8. Contours shown are existing levels shown for information and clarity regarding surface water flows.Site wide levels design is to be carried out at detailed design stage.

Standard construction hazards that a competent contractor would be aware of have not been identified on this drawing. Risks that may not be immediately apparent are listed below:

Status	Date	Description	Dwn	Eng	Chkd	Ver
S2-P01	17.11.23	Information issue	BH	BH	ARC	ARC
S2-P02	01.12.23	Updated to suit latest site layout	BH	BH	ARC	ARC
S2-P03	27.02.24	Updated to suit latest site layout	CBo	SPo	BHo	ARC

PROPOSED SEWER TYPE KEY
- Proposed Storm Water Gravity Sewer
- Proposed Foul Water Gravity Sewer
- Existing Storm Water Gravity Sewer
- Existing Foul Water Gravity Sewer
- Private Surface Water Sewer
- Private Foul Water Sewer
- Adoptable Road Gully
- Private Plot Soakaway Tank
- Type A Permeable Paving
- Type B Permeable Paving
- Retention Pond - No Infiltration
- Existing Surface Water Flood Risk Extent
- Surface Water Flooding and Run Off Flow Route Direction
- Headwall (shown NTS)
- Drainage Model Pipe Reference / Sewer Diameter / Sewer Gradient (1.000/600/1:50)

PROPOSED MANHOLE/INSPECTION CHAMBER TYPE KEY
- Adoptable
- Private
- Storm Water PPIC
- Foul Water PPIC
- Foul Water PCC MH
- Storm Water PCC MH/CP
- Surface Water Hydrobrake Chamber
- Surface Water PCC MH with Backdrop Connection
- Foul Water PPC MH with Backdrop Connection
- SUDS pond, location and size subject to final design

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[redacted] 01933 410909

Project:
Land South of Saffron Walden, off Thaxted Road

Drawing Title:
Preliminary Drainage Layout

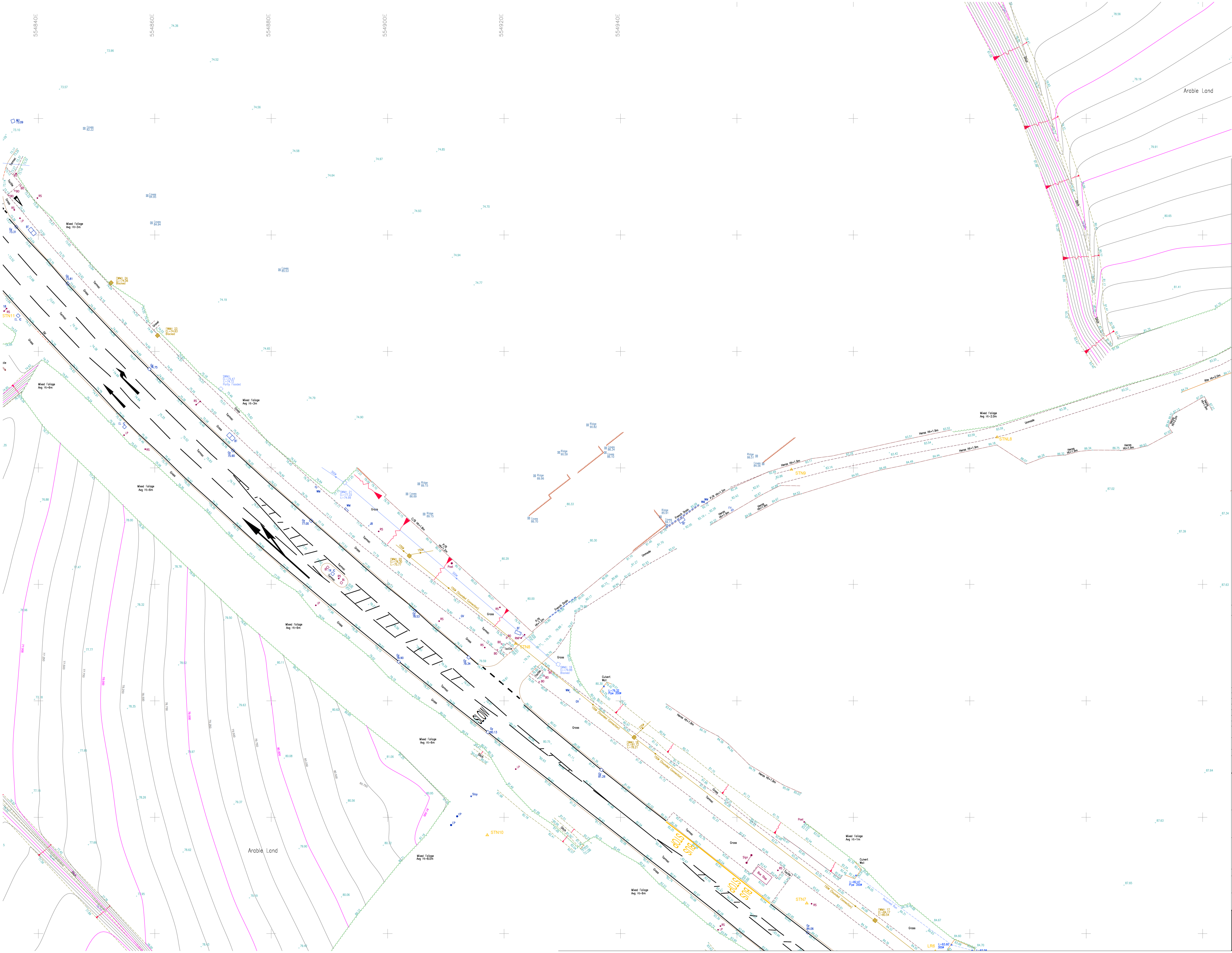
RGL Project Ref:	Scale@A1	Scale@A3
22-0222	1:1000	1:2000

Specification(s):

Drawing Number:
220222-RGL-ZZ-XX-DR-D-120-0011
Project-Originator-Zone-Level-Type-Role-Classification-Number

Issue Purpose: INFORMATION
Status: S2-P03 Suitability-Revision

APPENDIX C – TOPOGRAPHICAL SURVEY



Notes:

Whilst every effort has been made to correctly identify species of trees on the site, we advise that an arborologist be consulted before any final decisions are made.

All information contained in this drawing (including digital data) should be checked and verified prior to any fabrication or construction.

Grid coordinates are based on an OS GNSS system on a plane grid with a scale factor of 1.0000.

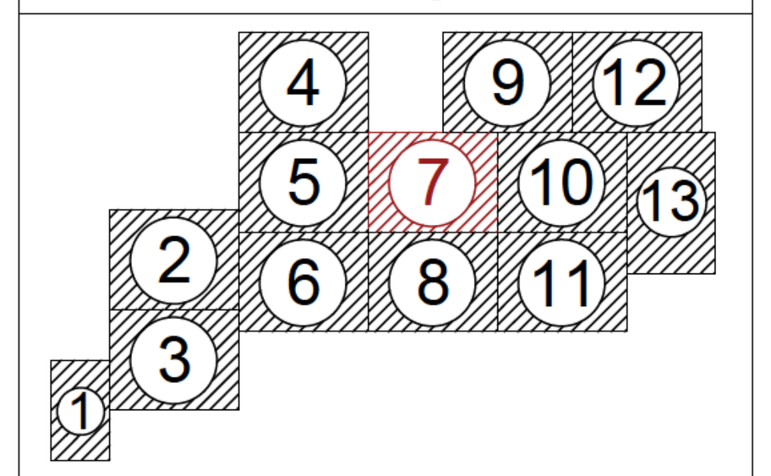
Contours only shown across open spaces.

2D survey data may differ slightly to 3D data due to edits made across the drawing within AutoCAD.

Drainage shown should be checked and verified as a high volume of manholes were flooded which proved difficult to establish accurate depths, pipe sizes and to sound connections.

Legend:

Sheet Layout



Rev. Suffix	Date	Initial	Revision Details

Surveyor	LH/LW	Verified By	LH/LW	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

KIER GROUP

Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey
Sheet 7 of 13

Job No. 2203015	Old Job No.
Drawing Number K/2203015/7	Revision Suffix
Scale 1:200m (A0)	Date April 2022

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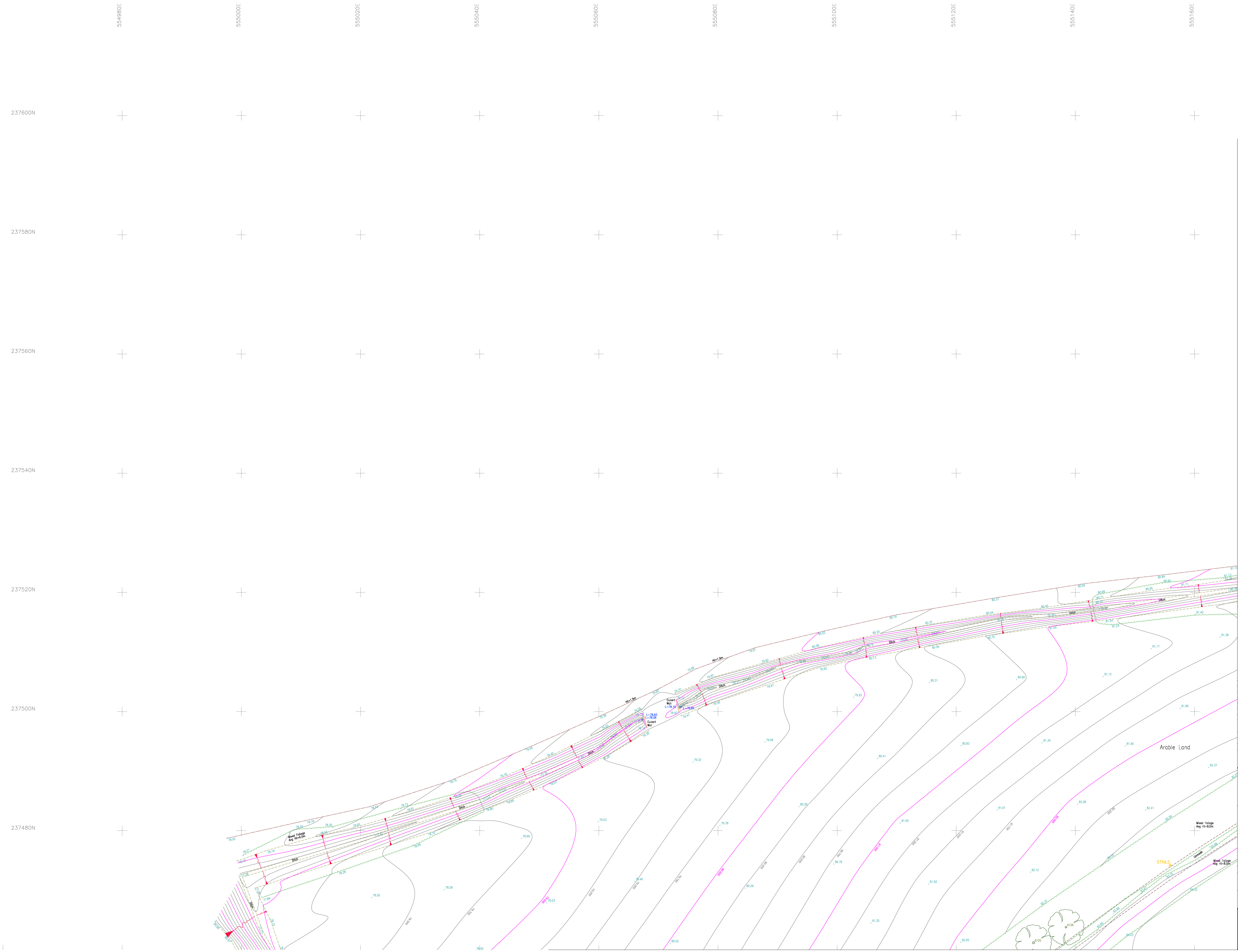
Email: [redacted]
Visit us at: [redacted]



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INDICATIVE

Legend:

Sheet Layout

4 9 12
5 7 10 13
2 6 8 11
1 3

Rev. Suffix	Date	Initial	Revision Details

Surveyor	LH, LW	Verified By	LH, LW	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

KIER GROUP

Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey
Sheet 9 of 13

Job No. 2203015	Old Job No.
Drawing Number MTP/2203015/9	Revision Suffix
Scale 1:200m (A0)	Date April 2022

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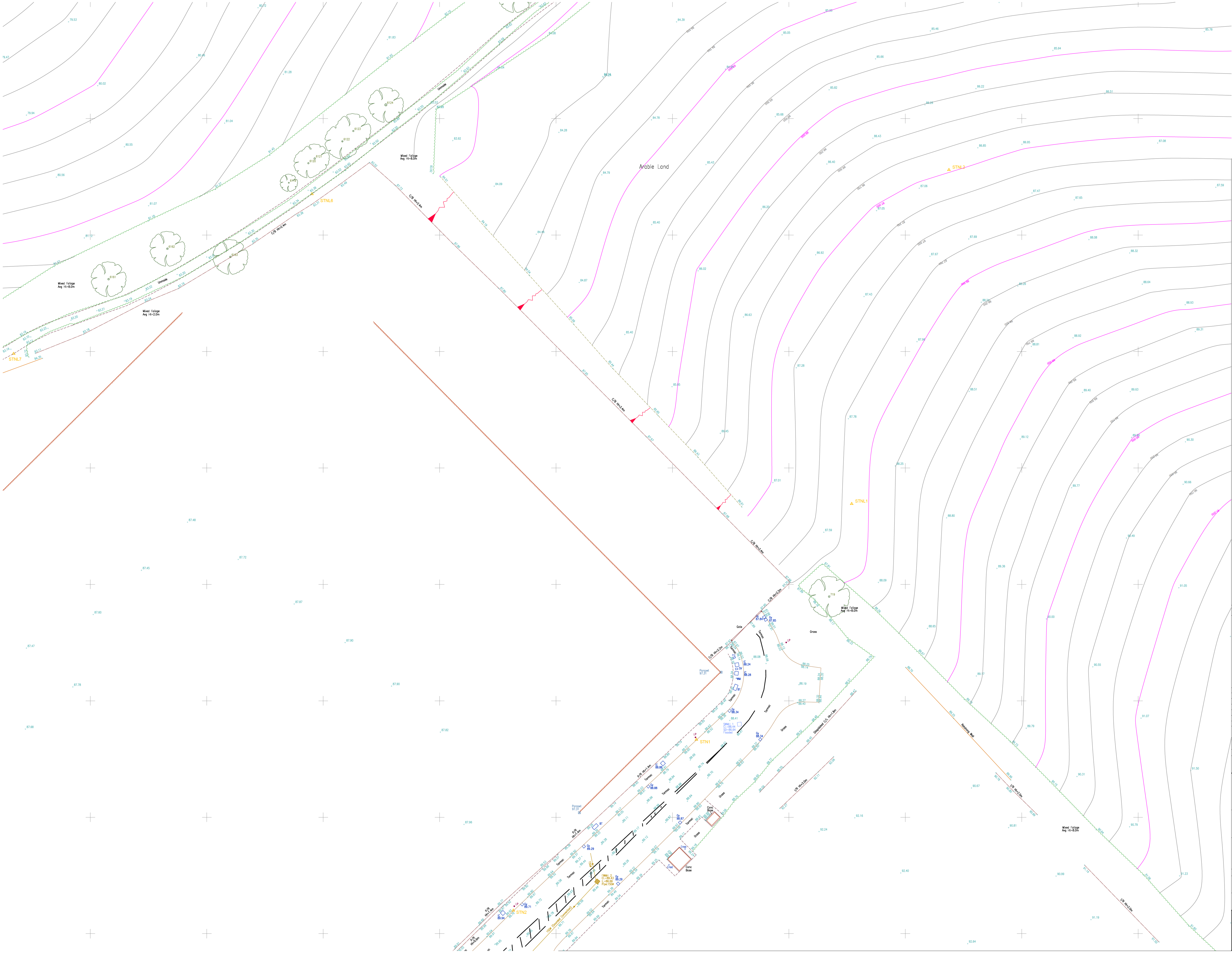
Fax (01932) 786419
Email: [redacted]



Notes:

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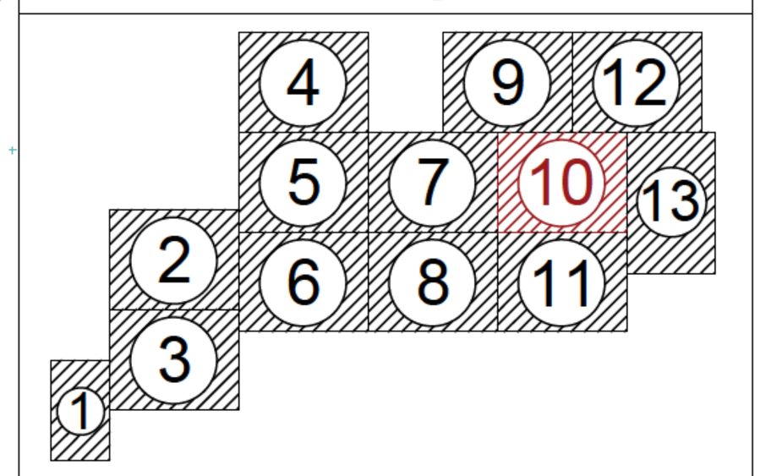
NDICATIVE

Legend:

Sheet Layout



Rev. Suffix	Date	Initial	Revision Details

Surveyor	LH, LW	Verified By	LH, LW	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

KIER GROUP

Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey
Sheet 10 of 13

Job No. 2203015	Old Job No.
Drawing Number K/2203015/10	Revision Suffix
Scale 1:200m (A0)	Date April 2022

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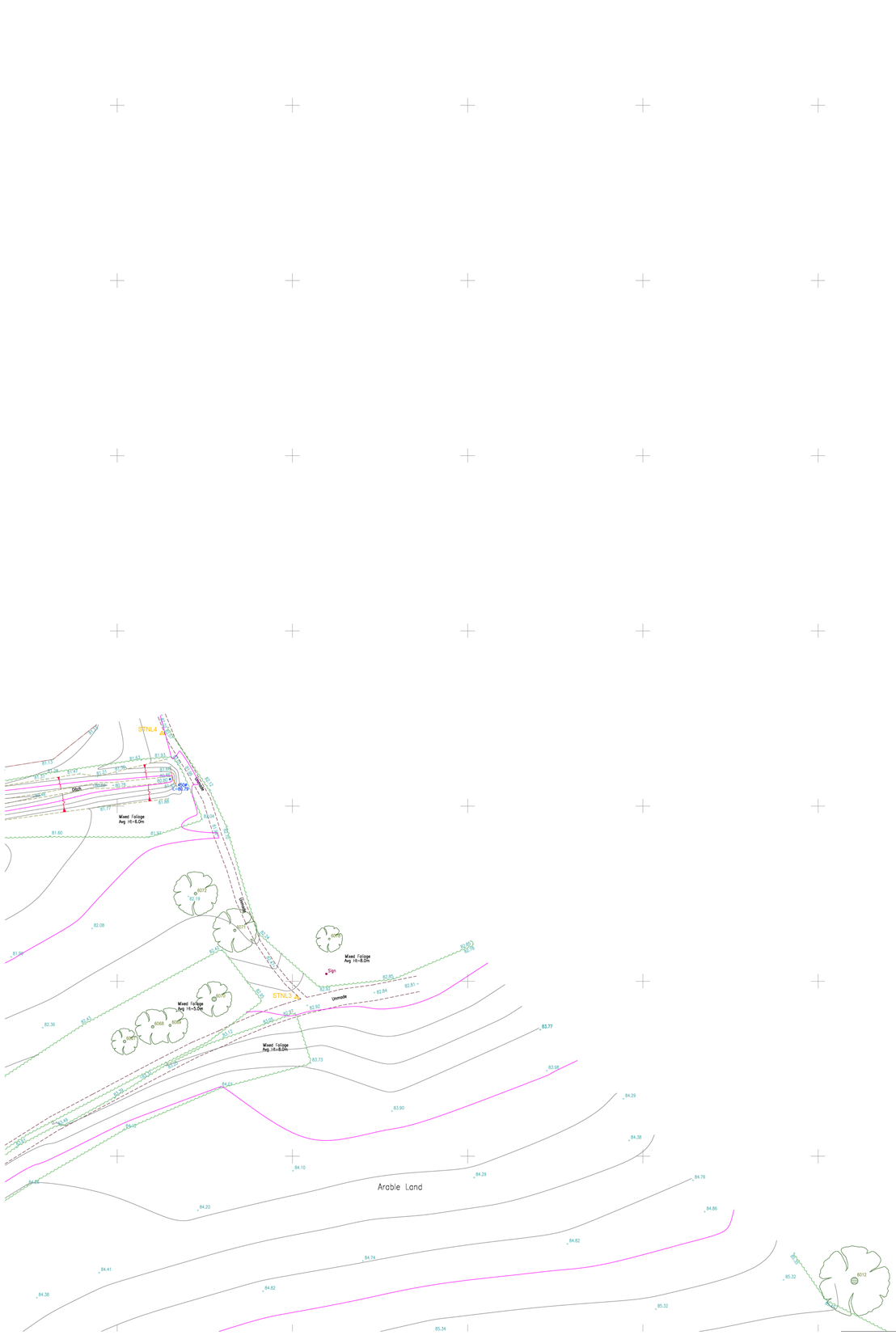
Visit [redacted]

555180E 555200E 555220E 555240E 555260E 555280E 555300E 555320E 555340E 555360E

237600N 237580N 237560N 237540N 237520N 237500N 237480N 237460N



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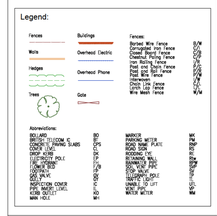
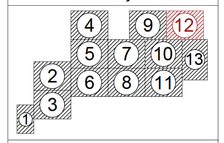
NOICATIVE

Legend:



Sheet Layout



Rev. Suffix	Date	Initial	Revision Details

Surveyor	J.H, L.W	Verified By	J.H, L.W	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

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Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey
Sheet 12 of 13

Job No. 2203015	Old Job No.
Drawing Number K/2203015/12	Revision Suffix
Scale 1:200m (A0)	Date April 2022

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Notes:

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NDICATIVE

Legend:

Fences · Walls · Hedges · Trees · Buildings · Overhead Electric · Overhead Phone · Gate

Fences:	
Barbed Wire Fence	B/W
Corrugated Iron Fence	C/I
Closed Board Fence	C/B
Chestnut Paling Fence	C/P
Iron Railing Fence	I/R
Post and Chain Fence	P/C
Post and Rail Fence	P/R
Post Wire Fence	P/W
Interwoven	I/W
Chain Link Fence	C/L
Larch Lap Fence	L/L
Wire Mesh Fence	W/M

Abbreviations:

BOLLARD	BO	MARKER	MK
BRITISH TELECOM IC	BT	PARKING METER	PM
CONCRETE PAVING SLABS	CPS	ROAD NAME PLATE	RNP
COVER LEVEL	CL	ROAD SIGN	RS
DROP KERB	DK	RODDING EYE	RE
ELECTRICITY POLE	EP	RETAINING WALL	Rtw
FIRE HYDRANT	FH	RAINWATER PIPE	RPW
FLOWER BED	F/B	SOIL VENT PIPE	SVP
FOOTPATH	FP	STOP VALVE	SV
GAS VALVE	GV	TELEGRAPH POLE	TP
GULLY	GY	TRAFFIC LIGHT	TL
INSPECTION COVER	IC	UNABLE TO LIFT	UTL
PIPE INVERT LEVEL	IL	VENT PIPE	VP
KERB OUTLET	KO	WATER METER	WM
MAN HOLE	MH		

Sheet Layout

1 2 3 4 5 6 7 8 9 10 11 12 13

Rev. Suffix	Date	Initial	Revision Details

Surveyor	LH, LW	Verified By	LH, LW	CAD Operator	AP	Approved By	AL	Date	07.04.22

Levelling GNSS Datum OSGB36

To an OS GNSS Datum

Client

KIER GROUP

Location

Thaxted Road
Saffron Walden

Drawing Title

Topographical Survey Sheet 13 of 13

Job No. 2203015	Old Job No.
Drawing Number K/2203015/13	Revision Suffix
Scale 1:200m (A0)	Date April 2022

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APPENDIX D – INFILTRATION TESTING REPORT

ROLTON GROUP
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[redacted]
Kier Ventures Ltd
Optimum House
Clippers Quay
Salfrod
England
M50 3XP

3 November 2023
Our Ref: 220222-RGL-ZZ-XX-CO-Z-0009

Via email – [redacted]

Dear [redacted],

SOAKAWAY TESTING AT LAND OFF THAXTED ROAD, SAFFRON WALDEN, CAMBRIDGESHIRE

1.0 INTRODUCTION

Kier Ventures (the Client) propose to develop a parcel of land south of Saffron Walden, Cambridgshire. It is understood that current proposals are to develop the site with approximately 68 residential properties consisting of apartments, terraced, semi-detached and detached dwellings with associated gardens, new access roads, and areas of Public Open Space (POS).

Rolton Group Ltd (RGL) was appointed by the client to undertake a preliminary ground investigation to establish provisional ground conditions and soil infiltration rates at the site. The soil infiltration testing (soakaway) has been undertaken in general accordance with BRE 365 guidelines.

Previous reports that should be read in conjunction with this report include:

- RGL, Phase 1 Geo-environmental Desk Study, report ref. 220222-RGL-ZZ-XX-RP-G-0004, S2-P01, Issued August 2023.

2.0 SITE DETAILS

The site is located on the southeastern edge of the urban extents of Saffron Waldon, to the east of Thaxted Road, approximately 1km south of the main town centre. A Site Location Plan is attached.

The site comprises two agricultural fields bounded by hedgerow with intermittent trees of mixed variety and maturity. The two fields are separated by Tiptofts Lane, a public footpath.

The overall site forms an irregular shape as shown on the 'Framework Indicative Layout' plans (Ref 3119-1003) provided by Kier. The site is up to approximately 300m long and between 140m and 200m wide, with and overall area of approximately 4.1 hectares. The approximate centre of the site has a grid reference of 555225E 237420N.

Ground levels across the site vary between approximately 93mAOD in the southeast to 77mAOD in the northwest.

The British Geological Survey (BGS) map for the area (Sheet 222 'Great Dunmow') and the BGS GeoIndex website show the site to be underlain by superficial deposits of the Lowestoft Formation (diamicton) at the far south eastern extent of the site. The underlying solid geology is indicated to comprise of the undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation of the White Chalk Subgroup.

3.0 FIELDWORK

The investigation positions were located in the approximate proposed locations of new drainage features (attenuation ponds, swales and soakaway systems).

Prior to excavaton, buried service plans were consulted and a cable avoidance tool (CAT) was used to confirm each location was clear of detectable services.

A total of four test pits (SA's 01 to 04) were excavated on 4th and 5th October 2023, with the infiltration tests also being performed on those days. The pits were excavated using a standard backhoe excavator to depths between 2.45mbgl and 2.80mbgl. The excavations were recorded by an RGL engineer.

Soil infiltration tests were undertaken in all four pits in general accordance with BRE Digest 365, Soakaway design. The soakaway tests are achieved by filling the test zone of each pit with potable water, the subsequent drop in water levels are then measured at suitable intervals. Where possible, the test was repeated at each location depending on the rate of dissipation, to a maximum of three cycles.

Following the completion of the tests, any excess water was removed and the trial pit was backfilled with arisings.

The soakaway test results, including soil descriptions, and an exploratory hole location plan are attached.

4.0 ENCOUNTERED GROUND CONDITIONS AND SOAKAWAY TEST RESULTS

The encountered ground conditions and soakaway test results are summarised and dicussed below.

4.1 ENCOUNTERED GROUND CONDITIONS

STRATA	LOCATIONS RECORDED	TOP (M BGL)	BASE (M BGL)
Topsoil	All	Surface	0.25 – 0.36
Head	SA04	0.30	2.55 (depth not proven)
Seaford/Lewis Nodular Chalk Formation.	SA's 01-03	0.25 – 0.36	2.80 (depth not proven)

Table 1 - Summary of Strata encountered

The encountered ground conditions recorded a surface layer of topsoil comprising soft locally firm greyish brown slightly sandy slightly gravelly organic silty CLAY with the gravel fraction being flint, chalk and limestone. The topsoil was recorded to depths of between 0.25m below ground level (bgl) and 0.36m bgl.

The topsoil was underlain by Head deposits at one location only (SA04), recorded as stiff dark yellowish brown sandy CLAY.

The undifferentiated Lewes Nodular Chalk Formation and Seaford Chalk Formation solid geology was encountered beneath the topsoil and/or superficial deposits and comprised structurless chalk composed of white slightly sandy low slightly cobbly density (chalk) gravel, with occasional flint gravels (CIRIA C574 Grade Dc). Staining and specking was noted on the outside faces of the gravel.

A band of greenish grey slightly gravelly slightly cobbly sand, was recorded within the chalk deposits, from 1.10m to 2.10m in trial pit SA02.

All of the pits remained dry during excavation.

The walls of trial pit SA02 collapsed during the infiltration test, in the zone where a layer of sand was present. The remaining trial pits were stable during their excavation and test periods.

4.2 SOAKAWAY TEST RESULTS

The results for the soakaway tests are summarised in Table 2 and discussed below..

LOCATION	STRATA TESTED	INFILTRATION RATE (M/S)		
		CYCLE 1	CYCLE 2	CYCLE 3
SA01	Chalk	$1.12x10^{-6}$	-	-
SA02	Chalk	$2.65x10^{-6}$	-	-
SA03	Chalk	$1.02x10^{-4}$	$9.13x10^{-5}$	$4.76x10^{-5}$
SA04	Head	Insufficient Soakage to calculate infiltration		

Table 2 - Summary of Soakaway Test Results

It should be noted that an initial test within SA02 failed, due to the collapse of the trial pit (and hence test zone), the test was re-run.

The tests indicated infiltration rates of between $2.65x10^{-6}$ m/s and $1.02x10^{-4}$ m/s within the chalk bedrock itself.

The test undertaken in trial pit SA04, located in Parcel 1, did not sufficiently dissipate in the test period, indicating that these soils are practically impermeable.

Based on the rest results, a conservative rate of infiltration of $2.65x10^{-6}$m/s for chalk may be adopted for soakaway design, however, this may be better locally.

Once soakaway locations are confirmed it is recommended that additional location and depth specific testing be completed to confirm the actual soil infiltration rate.

Soakaways in chalk should be positioned at least 10m from foundations or other structure/features and consideration should also be given to the use of silt traps along with interceptors for road and car park run-off.

No long term groundwater monitoring has been undertaken (it is outside the scope of this report). Groundwater levels may vary; consideration may be given to monitoring to confirm groundwater depths will not affect soakaway performance. Additional guidance is provided in BRE 365 and CIRIA C574. It is recommended that the Local Authority be contacted at an early stage to discuss drainage proposals.

Should you have any queries please do not hesitate to contact the undersigned.

Yours sincerely
for and on behalf of Rolton Group Ltd

[redacted]
Martin Gill | Project Engineer
[redacted]

[redacted]
Jim Poynton | Senior Engineer
[redacted]

Encs. Site Photographs
Site Location Plan
Soakaway Pit Location Layout
Infiltration Testing Results

Photo 1 – Example of Ground conditions in SA02

Photo 2 – Example of Ground conditions in SA04

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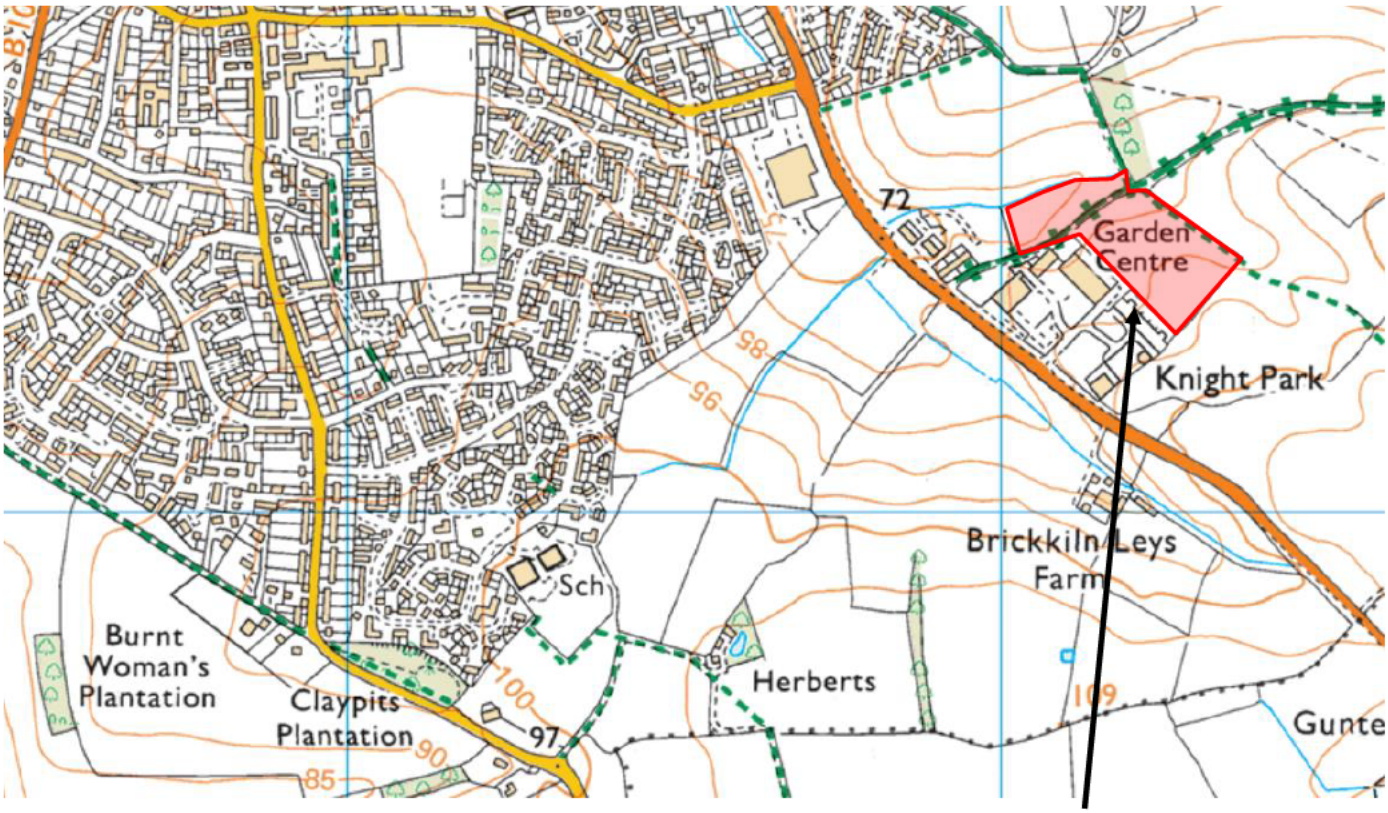
Project No.	Saffron Walden - Site 2
Figure No & Title	1. Site Location Plan
Date	May 2023
Scale	N.T.S.
Prepared by	TEM



Nearest Postcode CB10 2SG
Approx Grid Reference 555166 / 237452

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Tel 01933 410909 www.rolton.com

Standard construction hazards that a competent contractor would be aware of have not been identified on this drawing. Risks that may not be immediately apparent are listed below:

Status	Date	Description	Dwn	Eng	Chkd	Veri
S3-P01	19.10.23	Information	MG	MG	-	-

SA01 - 555294, 237382
SA02 - 555194, 237386
SA03 - 555192, 237477
SA04 - 555055, 237447

Exploratory Locations

Machine excavated trial pit utilised for infiltration testing

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ENGINEERING THE FUTURE™

Project:
Land East of Thaxted Road, Saffron Walden

Drawing Title:
Exploratory Hole Location Plan

RGL Project Ref: 22-0222 Geo 5
Scale@A0: NTS
Scale@A3: NTS

Specification(s):
N/A

Drawing Number: 220222-RGL-ZZ-XX-G-DR-900-0002
Project-Originator-Zone-Leve-Type-Role-Classification-Number

Status: S3-P01

Issue Purpose: Information

Suitability-Revision

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SOAKAWAY TESTING SCHEDULE

PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0001

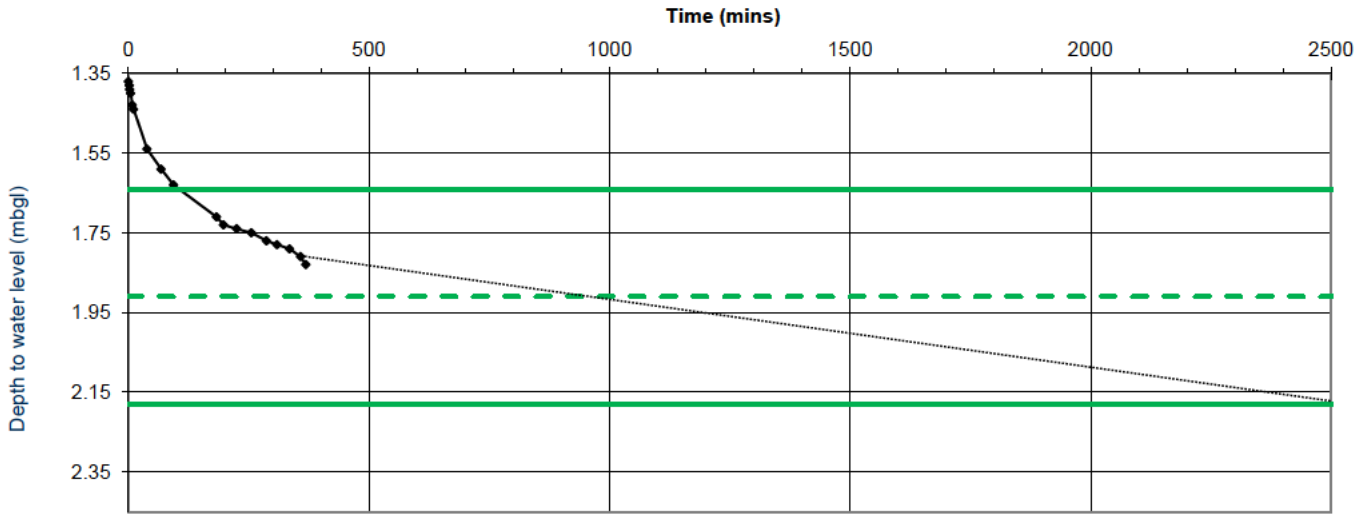
Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	2.70	2.45

Test Date 04/10/2023

Soakaway No. SA01 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.

SOAKAWAY TEST RESULTS



0.54	m	= Depth drop between 75% and 25% of maximum depth to final depth
2395	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	0.8019	m^3
ap50 =	4.995	m^2
tp75-25 =	2395.0	min

General Geological Profile :

0.00 - 0.25	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.25 - 2.45	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint.
	Black speckling is present noted on chalk faces below 1.80m.

SOIL INFILTRATION RATE EXTRAPOLATED ASSUMING LINEAR RATE OF DISSIPATION.

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**1.12E-06**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0002

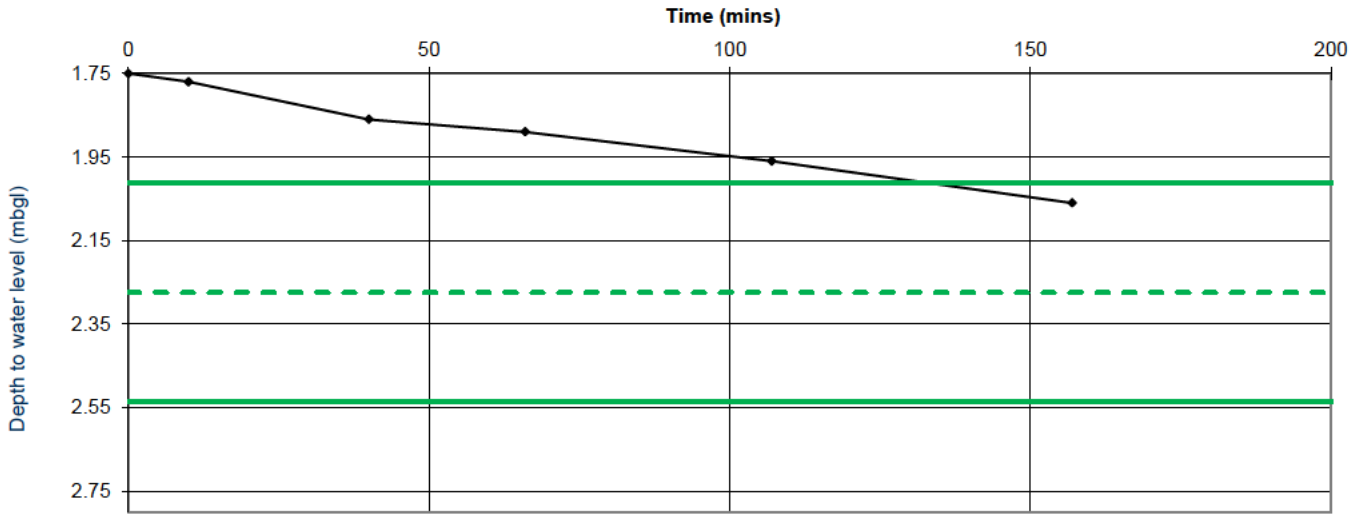
Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	2.40	2.80

Test Date 04/10/2023

Soakaway No. SA02 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.

SOAKAWAY TEST RESULTS



0.52	m	= Depth drop between 75% and 25% of maximum depth to final depth
N/A	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

VP75-25 =	0.693	m³
ap50 =	4.4175	m²
tp75-25 =	290.0	min

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

General Geological Profile :

0.00 - 0.35	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.35 - 1.10	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint.
1.10 - 2.10	Greenish grey slightly gravelly slightly cobbly SAND. Cobbles and gravel are fine to coarse well rounded flint cobbles.
2.10 - 2.80	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint.

TRIAL PIT COLLAPSED DURING TEST. TEST TERMINATED.

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**N/A**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

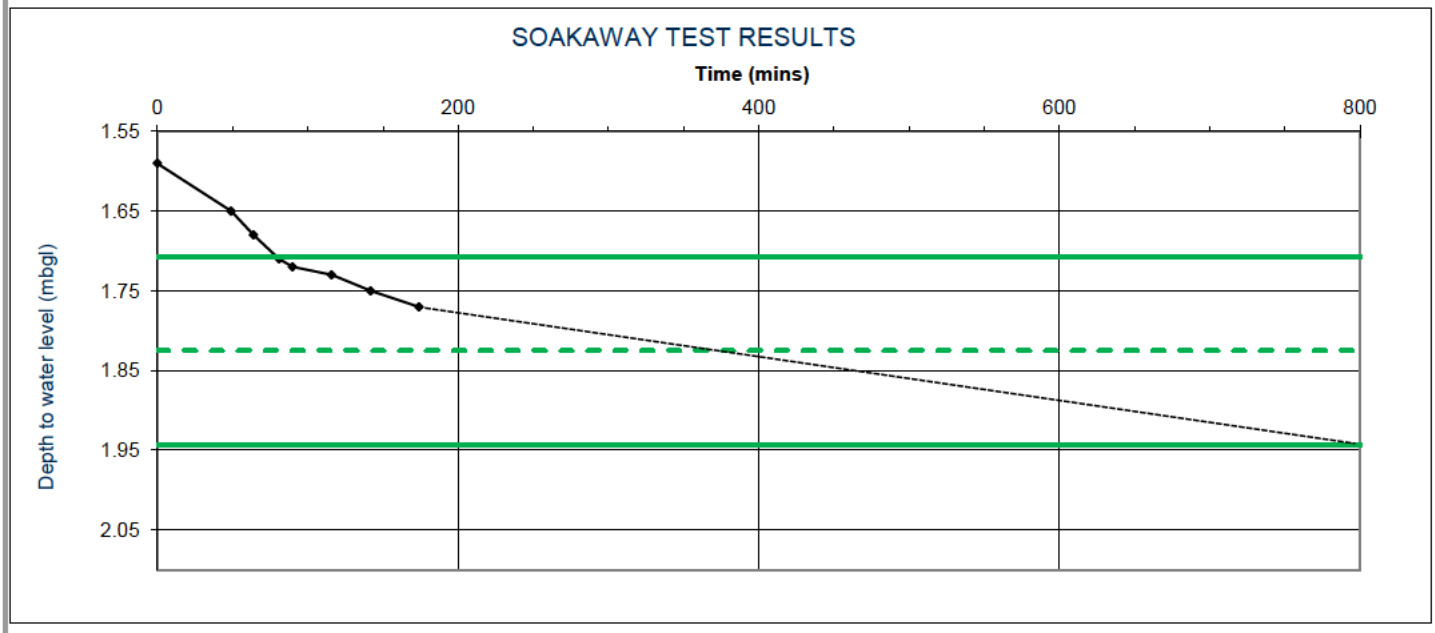
PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0003

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	2.40	2.06

Test Date 04/10/2023

Soakaway No. SA02 - Cycle 1, Attempt 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



0.24	m	= Depth drop between 75% and 25% of maximum depth to final depth
720	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	0.3102	m^3
ap50 =	2.7065	m^2
tp75-25 =	720.0	min

General Geological Profile :

0.00 - 0.35	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.35 - 1.10	Structureless CHALK composed of white stained brown on faces slightly sandy sliightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint.
1.10 - 2.10	Greenish grey slightly gravelly slightly cobbly SAND. Cobbles and gravel are fine to coarse well rounded flint cobbles.
2.10 - 2.80	Structureless CHALK composed of white stained brown on faces slightly sandy sliightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint.

SOIL INFILTRATION RATE EXTRAPOLATED ASSUMING LINEAR RATE OF DISSIPATION.

			Permeability Guideline (m/s)		
			Good	Poor	Practically Impervious
Soil Infiltration Rate (f) =	**2.65E-06**	m/s	10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

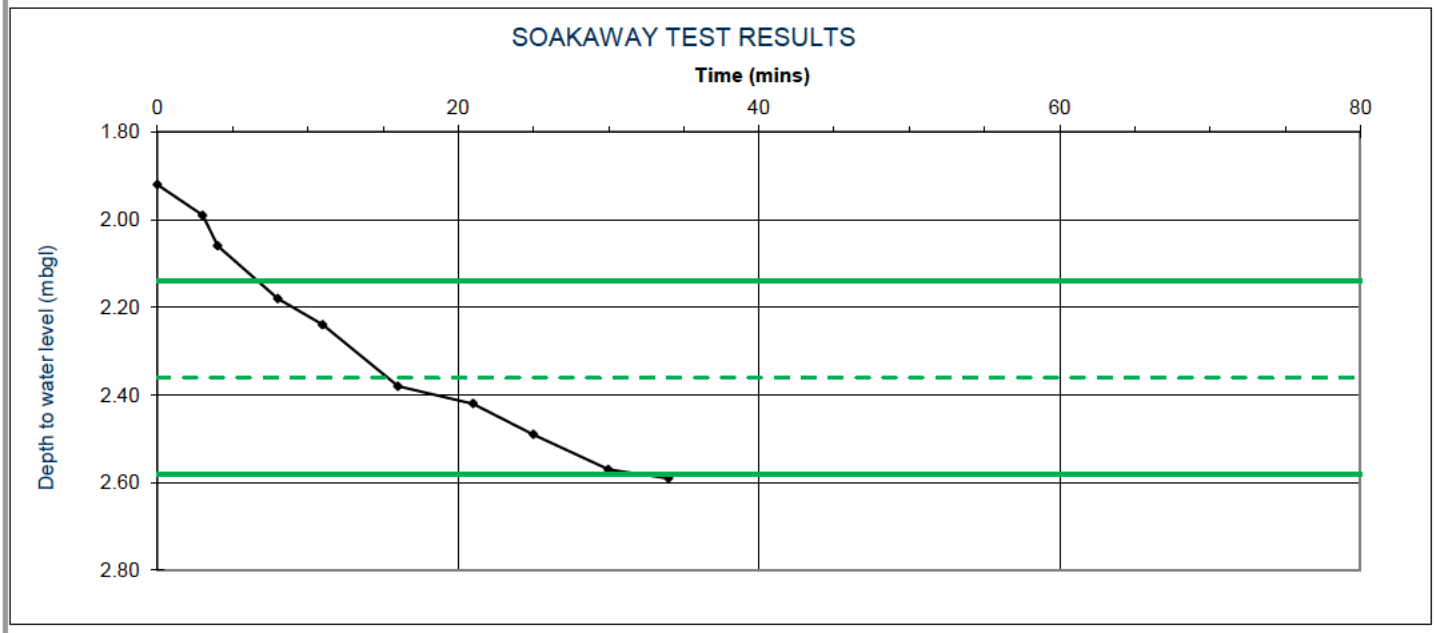
PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0004

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	3.10	2.80

Test Date 05/10/2023

Soakaway No. SA03 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



0.44	m	= Depth drop between 75% and 25% of maximum depth to final depth
25	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	0.7502	m³
ap50 =	4.917	m²
tp75-25 =	25.0	min

General Geological Profile :

0.00 - 0.36	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.36 - 2.80	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint. Band of flint cobbles noted between 1.50m and 1.60m.

			Permeability Guideline (m/s)		
			Good	Poor	Practically Impervious
Soil Infiltration Rate (f) =	**1.02E-04**	m/s	10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

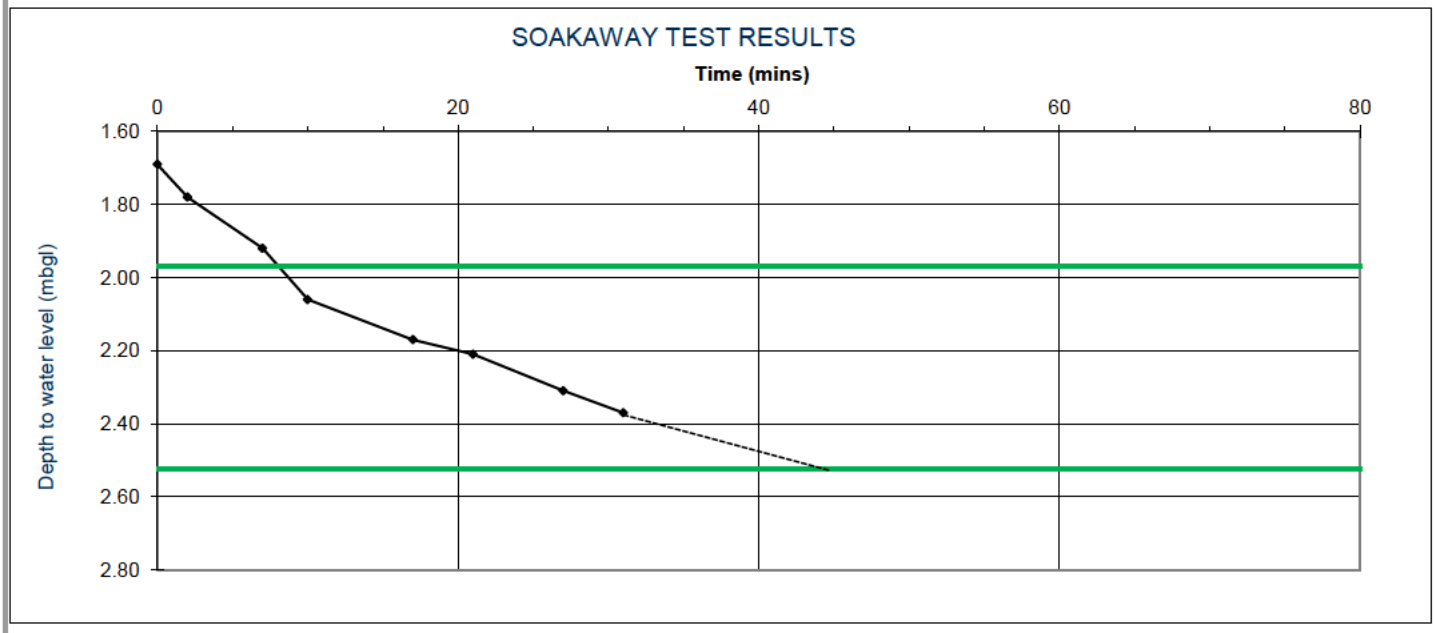
PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0005

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	3.10	2.80

Test Date 05/10/2023

Soakaway No. SA03 - Cycle 2

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



0.56	m	= Depth drop between 75% and 25% of maximum depth to final depth
30	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	0.946275	m^3
ap50 =	5.7565	m^2
tp75-25 =	30.0	min

General Geological Profile :

0.00 - 0.36	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.36 - 2.80	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint. Band of flint cobbles noted between 1.50m and 1.60m.

SOIL INFILTRATION RATE EXTRAPOLATED ASSUMING LINEAR RATE OF DISSIPATION.

			Permeability Guideline (m/s)		
			Good	Poor	Practically Impervious
Soil Infiltration Rate (f) =	**9.13E-05**	m/s	10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

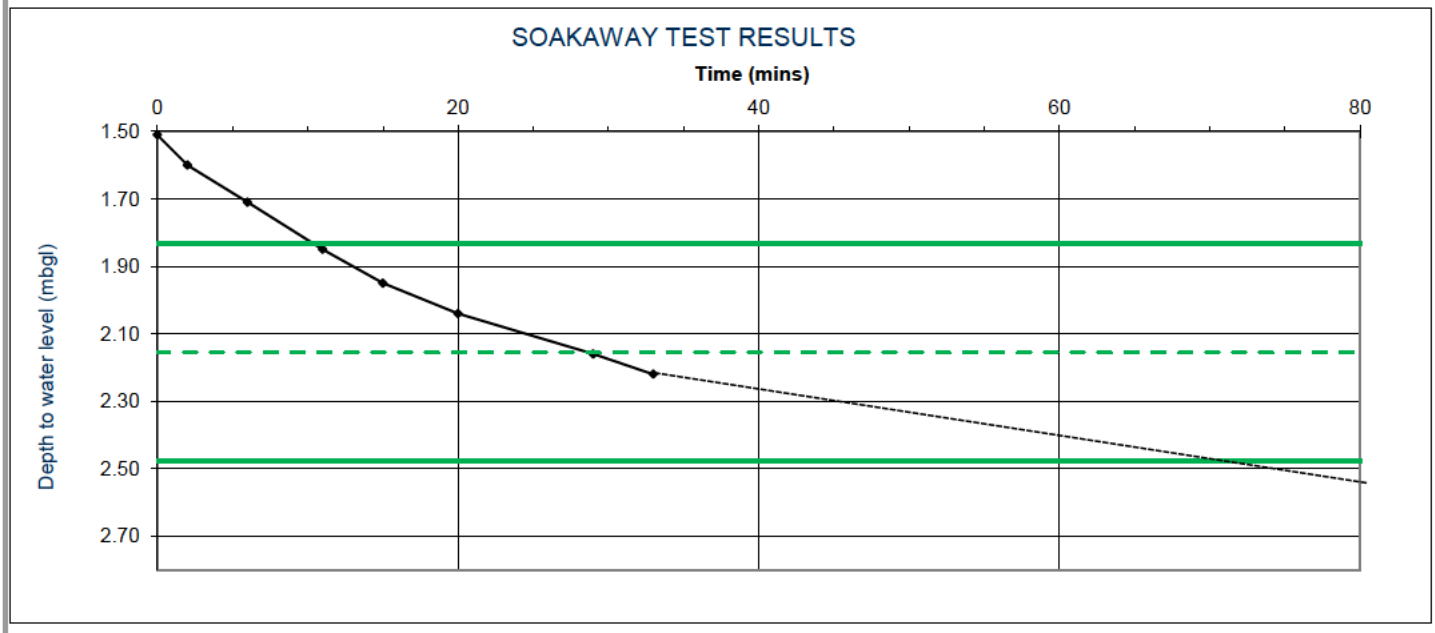
PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0006

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	3.10	2.80

Test Date 05/10/2023

Soakaway No. SA03 - Cycle 3

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



0.65	m	= Depth drop between 75% and 25% of maximum depth to final depth
60	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	1.099725	m³
ap50 =	6.4135	m²
tp75-25 =	60.0	min

General Geological Profile :

0.00 - 0.36	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint and limestone.
0.36 - 2.80	Structureless CHALK composed of white stained brown on faces slightly sandy slightly cobbly (chalk) GRAVEL. Gravel and cobbles are very weak low density chalk and flint. Band of flint cobbles noted between 1.50m and 1.60m.

SOIL INFILTRATION RATE EXTRAPOLATED ASSUMING LINEAR RATE OF DISSIPATION.

			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**4.76E-05**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

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SOAKAWAY TESTING SCHEDULE

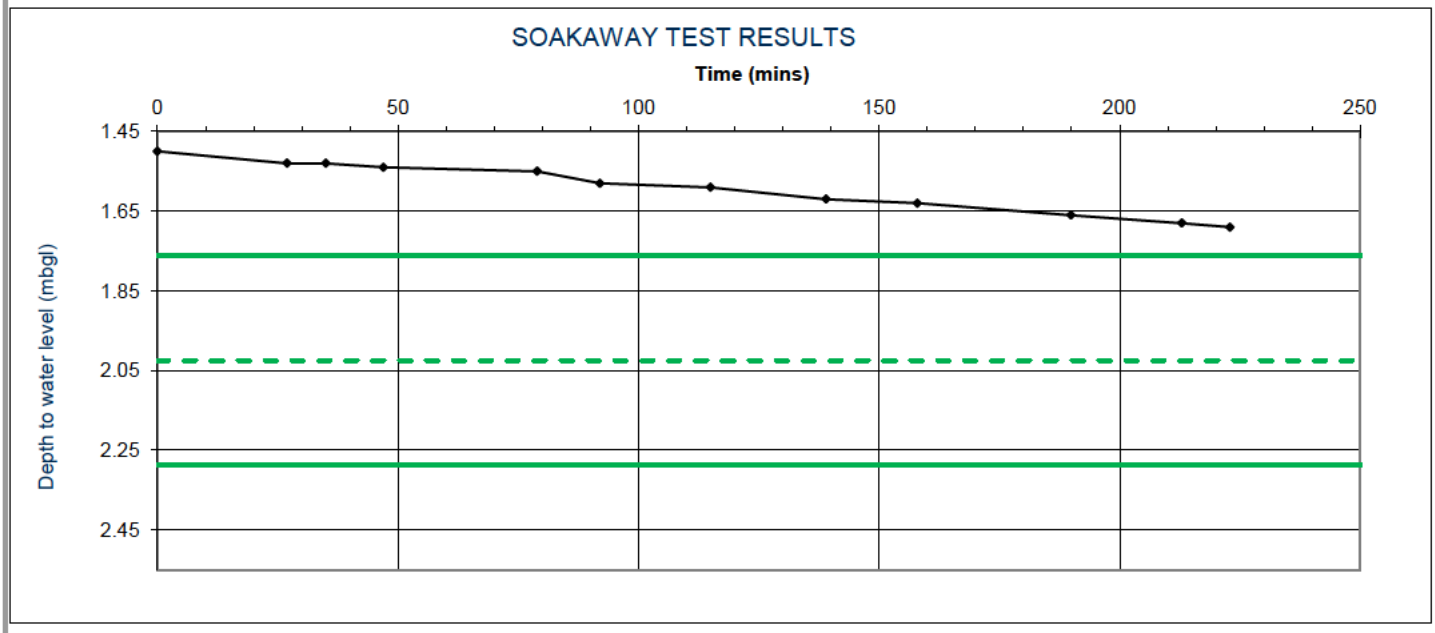
PROJECT NO :	22-0222
PROJECT:	Land east of Thaxted Road
DOC REF:	220222-RGL-ZZ-XX-SH-G-500-0007

Trial Pit Dimensions (m)	Width	Length	Depth to Base
	0.55	2.40	2.55

Test Date 05/10/2023

Soakaway No. SA04 - Cycle 1

Calculation of Infiltration Rate in Accordance with BRE Digest 365.



	m	= Depth drop between 75% and 25% of maximum depth to final depth
	mins	= Extrapolated time for outflow between 75% and 25% of maximum to final depth

Calculation of Soil Infiltration Rate (f):

where

$$f = \frac{VP75\text{-}25}{ap50 \times tp75\text{-}25}$$

using

VP75-25 = Volume outflowing between 75% and 25% of effective depth.
ap50 = Mean surface area through which the outflow occurs.
tp75-25 = Time for the outflow between 75% and 25% of the effective depth.

VP75-25 =	0.693	m³
ap50 =	4.4175	m²
tp75-25 =	99.0	min

General Geological Profile :

0.00-0.30	TOPSOIL: soft locally firm greyish brown slightly sandy gravelly organic silty CLAY. Gravel of fine sub angular to subrounded chalk, flint, limestone and brick.
0.30 - 0.90	Soft off-white becoming light brown slightly gravelly slightly cobbly sandy CLAY. Cobbles and gravel of fine to coarse angular flint.
0.95 - 2.55	Stiff dark yellowish brown sandy CLAY with occasional fine to coarse gravel of angular flint. Band of flint cobbles noted between 2.40m and 2.50m.

Infiltration rate was insufficient to be calculated in accordance with BRE 365.

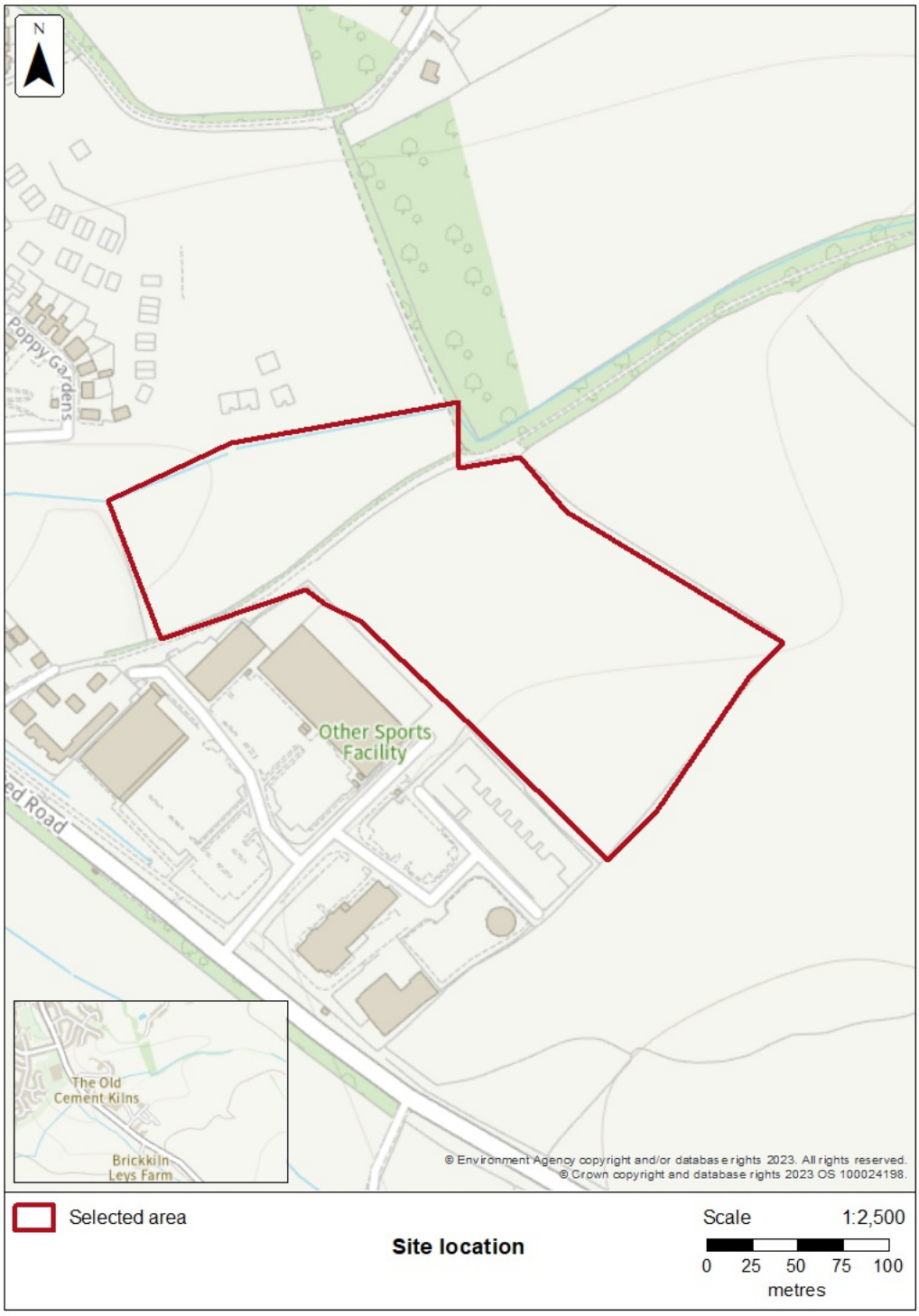
			Permeability Guideline (m/s)		
Soil Infiltration Rate (f) =	**N/A**	m/s	Good	Poor	Practically Impervious
			10^{-3} - 10^{-5}	10^{-6} - 10^{-7}	10^{-8} - 10^{-10}

APPENDIX E – ENVIRONMENT AGENCY'S PRODUCT 4 INFORMATION

Flood risk assessment data

Location of site: 555194 / 237420 (shown as easting and northing coordinates)
Document created on: 23 June 2023
This information was previously known as a product 4.
Customer reference number: BFW5EN55NDKX

Map showing the location that flood risk assessment data has been requested for.



How to use this information

You can use this information as part of a flood risk assessment for a planning application. To do this, you should include it in the appendix of your flood risk assessment.

> **We recommend that you work with a flood risk consultant to get your flood risk assessment.**

Included in this document

In this document you'll find:

- how to find information about surface water and other sources of flooding
- information on the models used
- definitions for the terminology used throughout
- flood map for planning (rivers and the sea)
- modelled data
- climate change modelled data
- information about strategic flood risk assessments
- information about this data
- information about flood risk activity permits
- help and advice

Not included in this document

This document does not include a Flood Defence Breach Hazard Map.

If your location has a reduced flood risk from rivers and sea because of defences, you need to request a Flood Defence Breach Hazard Map and information about the level of flood protection offered at your location from the East Anglia Environment Agency team at enquiries_eastanglia@environment-agency.gov.uk. This information will only be available if modelling has been carried out for breach scenarios.

Include a site location map in your request.

Information that's unavailable

This document **does not** contain:

- historic flooding
- flood defences and attributes

We do not have historic flooding data for this location.

Please note that:

- flooding may have occurred that we do not have records for
- flooding can come from a range of different sources
- we can only supply flood risk data relating to floodng from rivers or the sea

You can contact your Lead Local Flood Authority or Internal Drainage Board to see if they

have other relevant local flood information. Please note that some areas do not have an Internal Drainage Board.

We aren't able to display flood defence locations and attributes as there are no formal flood defences in the area of interest.

Surface water and other sources of flooding

Use the long term flood risk service to find out about the risk of flooding from:

- surface water
- ordinary watercourses
- reservoirs

For information about sewer flooding, contact the relevant water company for the area.

About the models used

Model name: EAn_Cam Phase 2_Slades_Halcrow_2012
Scenario(s): No defences exist fluvial, no defences exist climate change fluvial
Date: 22 February 2012

This model contains the most relevant data for your area of interest.

Terminology used

Annual exceedance probability (AEP)

This refers to the probability of a flood event occurring in any year. The probability is expressed as a percentage. For example, a large flood which is calculated to have a 1% chance of occuring in any one year, is described as 1% AEP.

Metres above ordnance datum (mAOD)

All flood levels are given in metres above ordnance datum which is defined as the mean sea level at Newlyn, Cornwall.

Flood map for planning (rivers and the sea)

Your selected location is in flood zone 1.

Flood zone 3 shows the area at risk of flooding for an undefended flood event with a:

- 0.5% or greater probability of occurring in any year for flooding from the sea
- 1% or greater probability of occurring in any year for fluvial (river) flooding

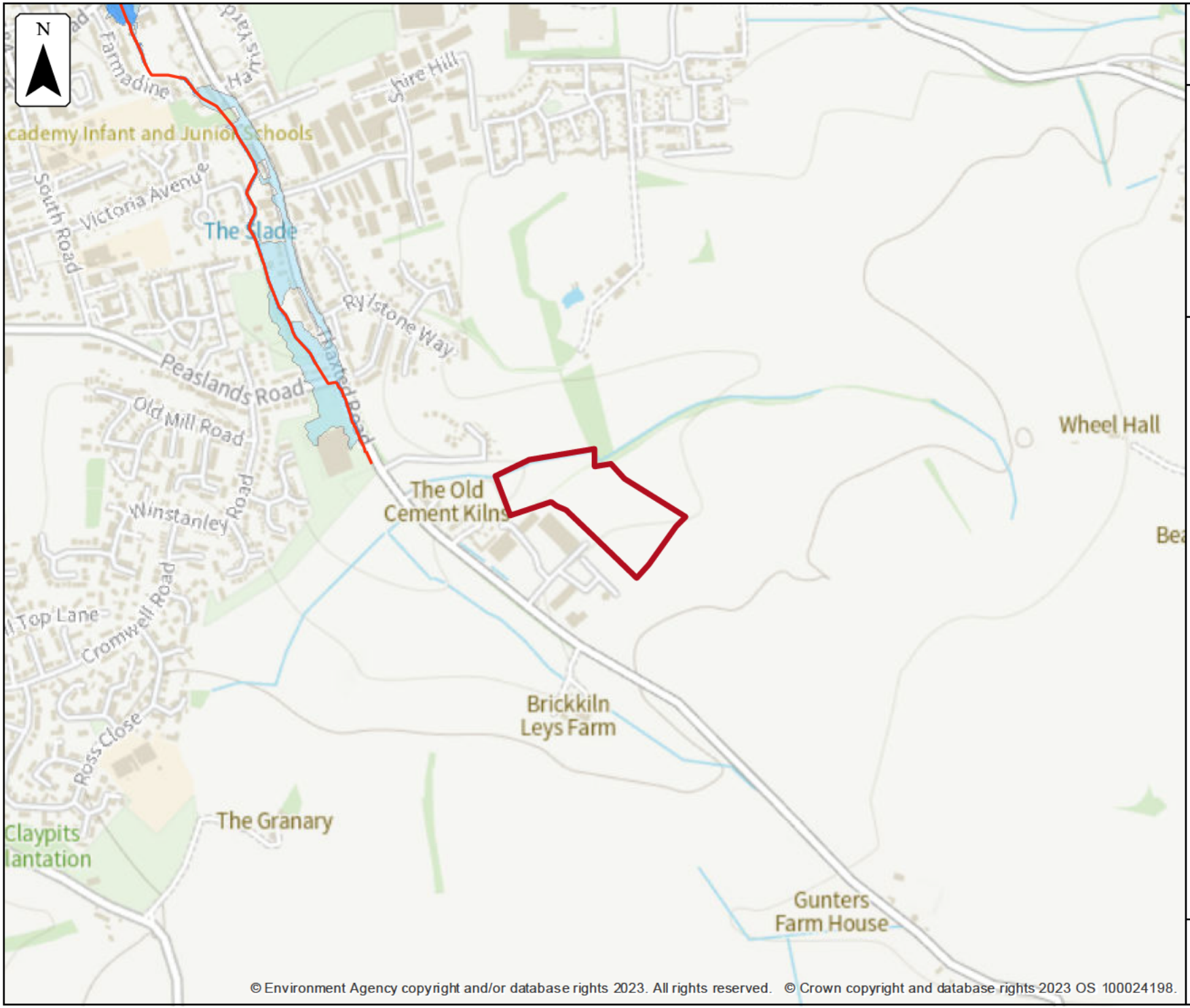
Flood zone 2 shows the area at risk of flooding for an undefended flood event with:

- between a 0.1% and 0.5% probability of occurring in any year for flooding from the sea
- between a 0.1% and 1% probability of occurring in any year for fluvial (river) flooding

It's important to remember that the flood zones on this map:

- refer to the land at risk of flooding and do not refer to individual properties
- refer to the probability of river and sea flooding, ignoring the presence of defences
- do not take into account potential impacts of climate change

This data is updated on a quarterly basis as better data becomes available.



Environment Agency

Flood map for planning

Location (easting/northing)
555194/237420

Scale
1:10,000

Created
23 Jun 2023

- Selected area
- Main river
- Flood zone 3
- Flood zone 2

0 100 200 300 400 500
metres

Modelled data

This section provides details of different scenarios we have modelled and includes the following (where available):

- outline maps showing the area at risk from flooding in different modelled scenarios
- modelled node point map(s) showing the points used to get the data to model the scenarios and table(s) providing details of the flood risk for different return periods
- map(s) showing the approximate water levels for the return period with the largest flood extent for a scenario and table(s) of sample points providing details of the flood risk for different return periods

Climate change

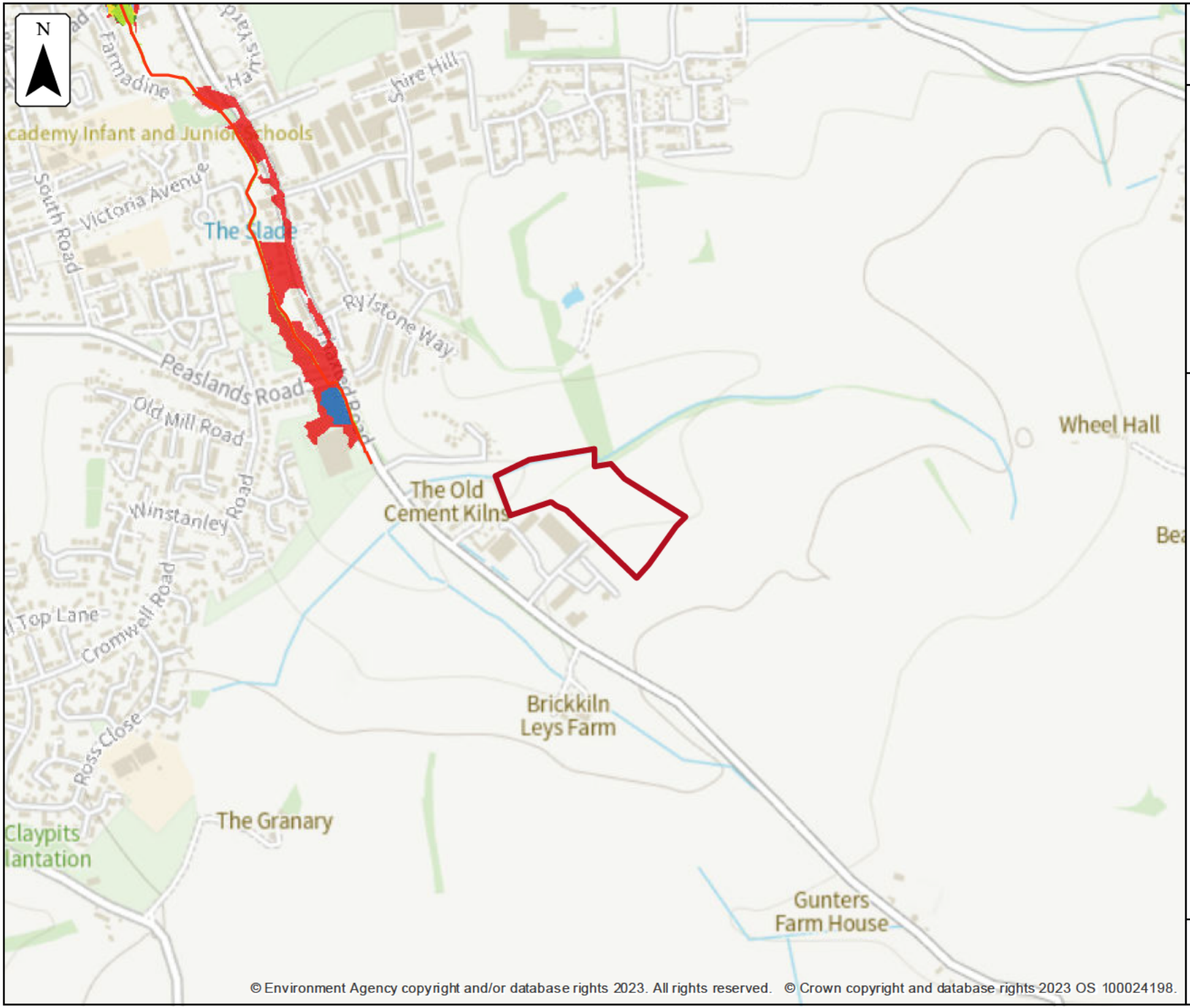
The climate change data included in the models may not include the latest flood risk assessment climate change allowances. Where the new allowances are not available you will need to consider this data and factor in the new allowances to demonstrate the development will be safe from flooding.

The Environment Agency will incorporate the new allowances into future modelling studies. For now, it's your responsibility to demonstrate that new developments will be safe in flood risk terms for their lifetime.

Modelled scenarios

The following scenarios are included:

- No defences exist modelled fluvial: risk of flooding from rivers where there are no flood defences
- No defences exist climate change modelled fluvial: risk of flooding from rivers where there are no flood defences, including estimated impact of climate change



Environment Agency

No defences exist modelled fluvial extent

Location (easting/northing)
555194/237420

Scale
1:10,000

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

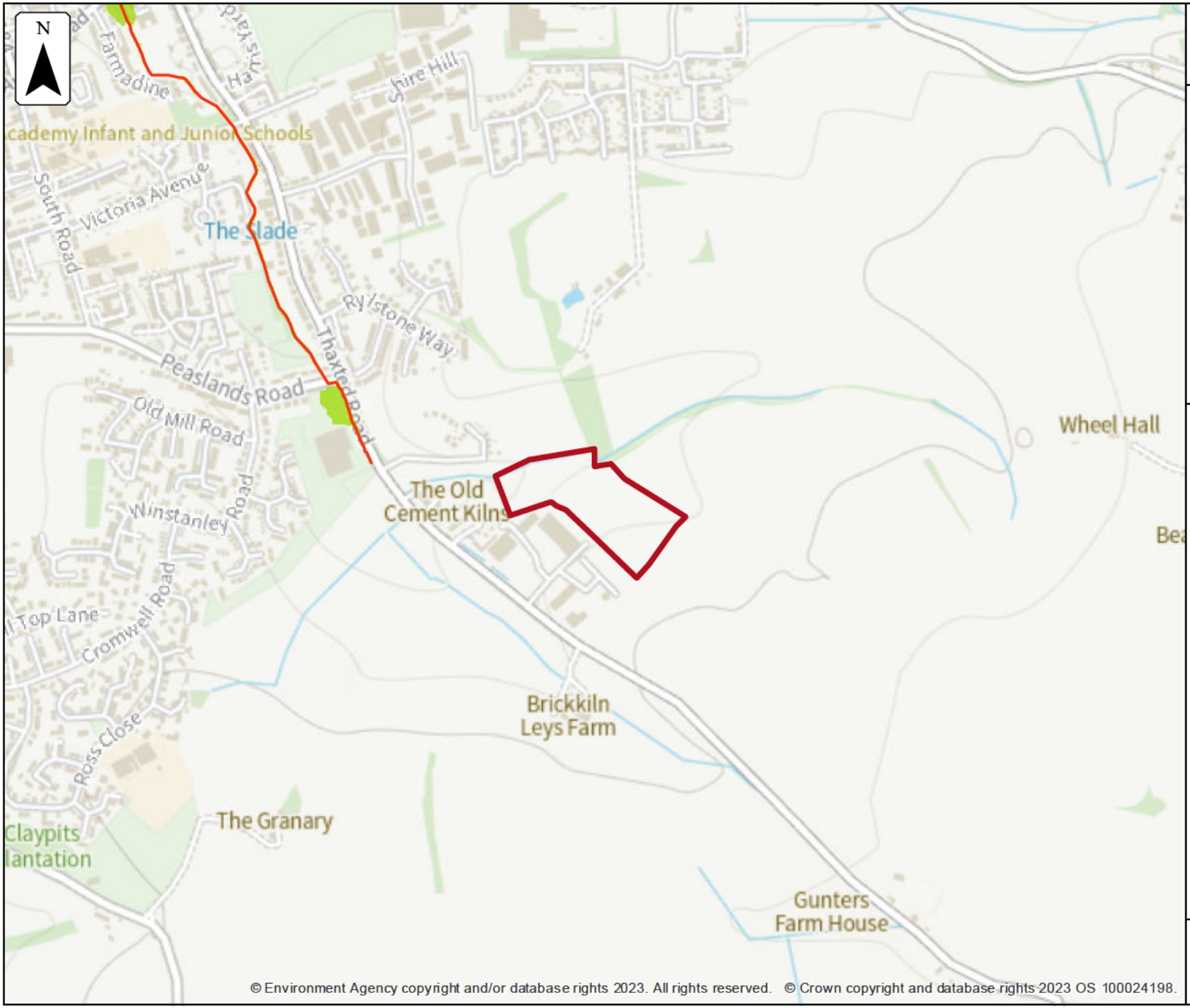
- Selected area
- Main river

Modelled flood extent

- 5% AEP
- 2% AEP
- 1.33% AEP
- 1% AEP
- 0.5% AEP
- 0.1% AEP

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

No defences exist climate change modelled fluvial extent

Location (easting/northing)
555194/237420

Scale
1:10,000

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

Selected area

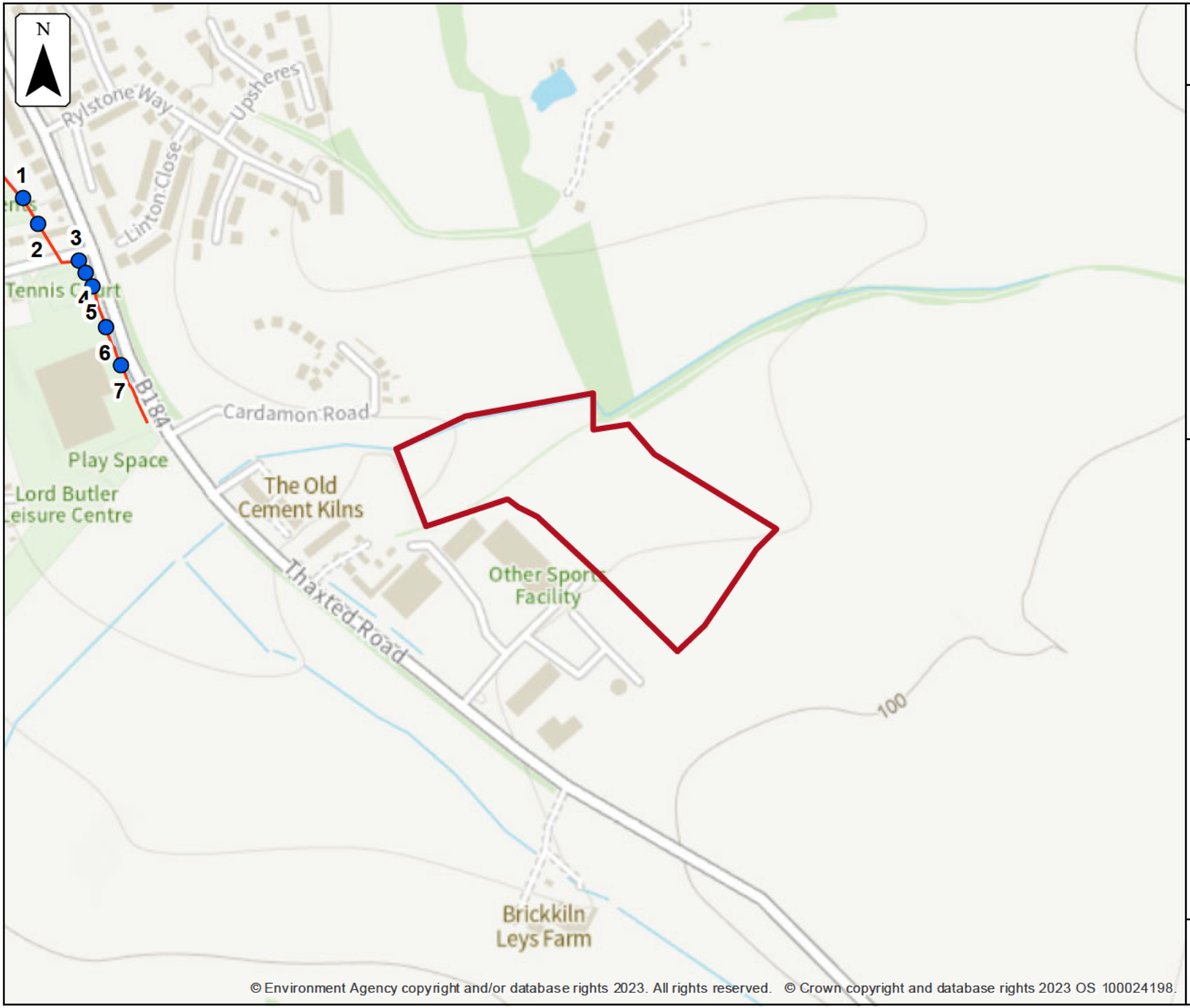
Main river

Modelled flood extent

1.0% AEP (+20%)

Flood extents may not be visible where they overlap other return periods

0 100 200 300 400 500
metres



Environment Agency

No defences exist modelled fluvial node locations

Location (easting/northing)
555194/237420

Scale
1:5,000

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

Selected area
Modelled location
Main river

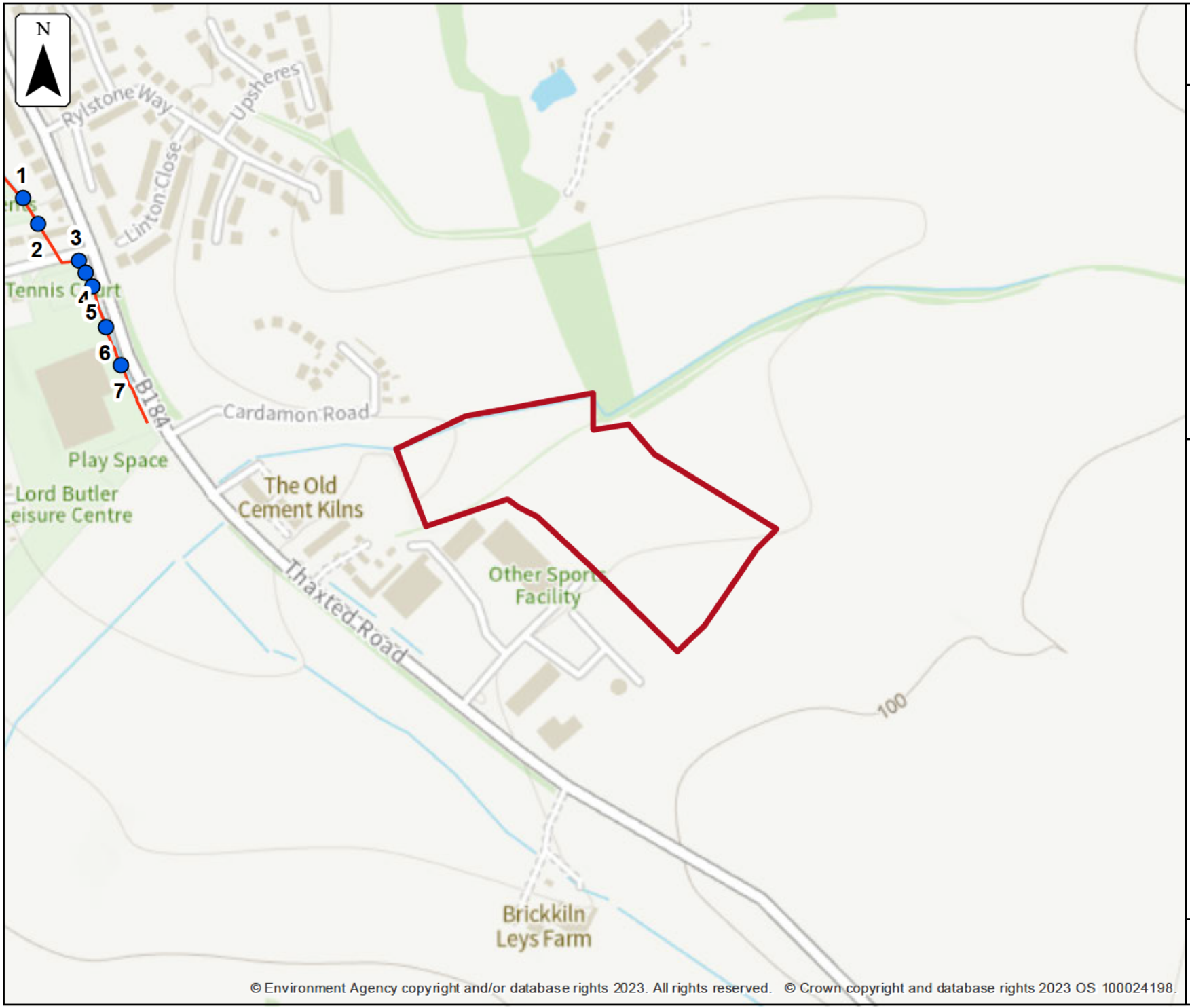
0 50 100 150 200 250
metres

Modelled node locations data

No defences exist

Label	Modelled location ID	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
				Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow	Level	Flow
1	1268638	554638	237716	67.74	1.35	67.79	1.66	67.82	1.83	67.84	1.96	67.88	2.27	67.98	3.13
2	1268749	554653	237692	68.44	1.35	68.51	1.66	68.54	1.83	68.56	1.96	68.60	2.27	68.71	3.13
3	1268610	554692	237656	68.81	1.35	68.88	1.66	68.91	1.83	68.93	1.96	68.98	2.27	69.11	3.13
4	1268680	554699	237643	69.19	1.15	69.26	1.42	69.29	1.56	69.32	1.67	69.39	1.91	69.57	2.50
5	1268803	554706	237631	70.71	1.15	70.85	1.42	70.92	1.56	70.98	1.67	71.09	1.91	71.34	2.50
6	1268785	554720	237591	70.90	1.15	71.03	1.42	71.10	1.56	71.15	1.67	71.26	1.91	71.47	2.20
7	1268557	554734	237554	71.20	1.16	71.29	1.42	71.34	1.56	71.38	1.67	71.45	1.99	71.56	2.92

Data in this table comes from the EAn Cam Phase 2 Slades Halcrow 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

No defences exist climate change modelled fluvial node locations

Location (easting/northing)
555194/237420

Scale
1:5,000

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

- Selected area
- Modelled location
- Main river

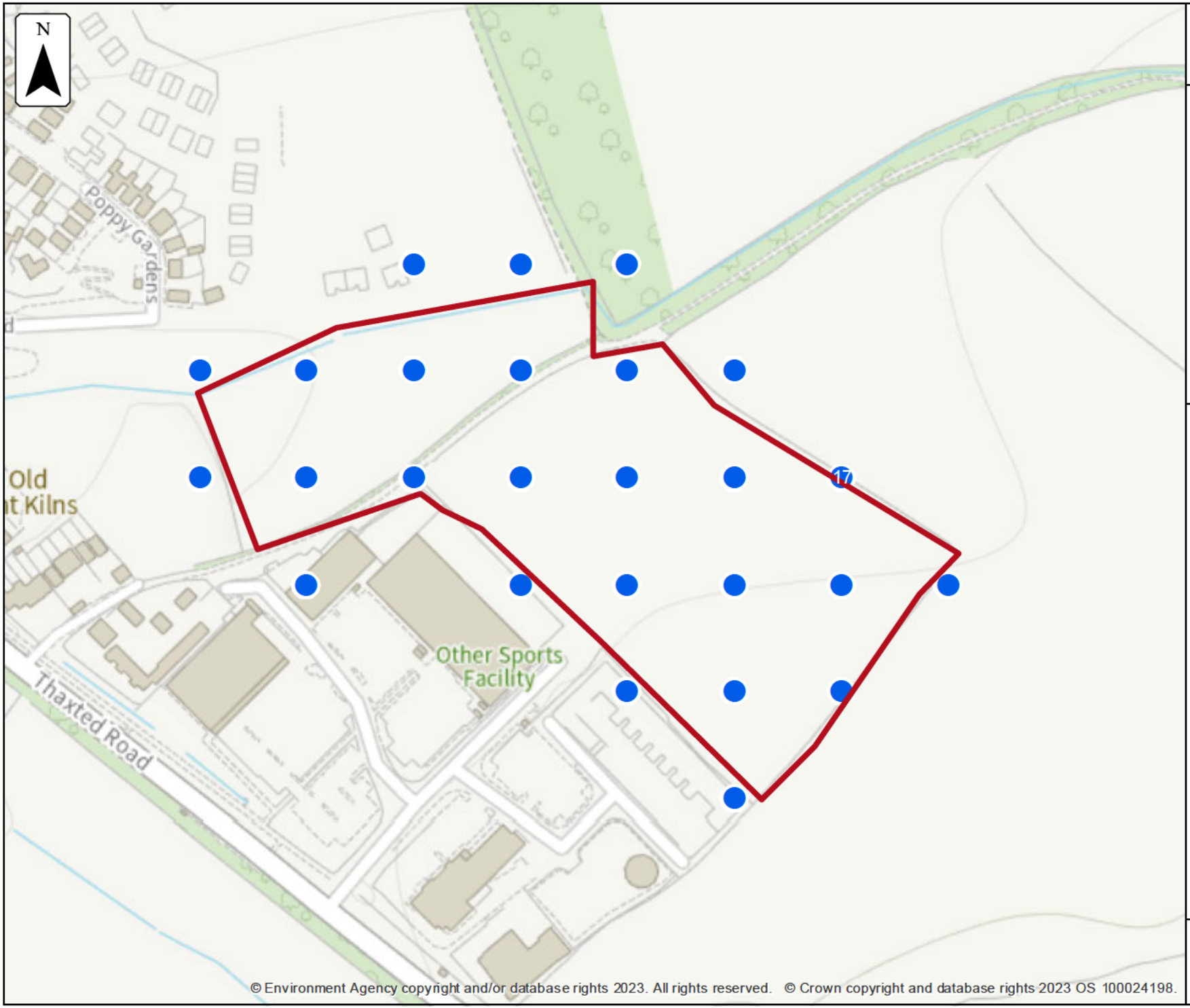
0 50 100 150 200 250
metres

Modelled node locations data

No defences exist climate change

Label	Modelled location ID	Easting	Northing	1.0% AEP (+20%)	
				Level	Flow
1	1268638	554638	237716	67.88	2.27
2	1268749	554653	237692	68.60	2.27
3	1268610	554692	237656	68.98	2.27
4	1268680	554699	237643	69.38	1.92
5	1268803	554706	237631	71.09	1.92
6	1268785	554720	237591	71.26	1.92
7	1268557	554734	237554	71.45	2.01

Data in this table comes from the EAn Cam Phase 2 Slades Halcrow 2012 model.
Level values are shown in mAOD, and flow values are shown in cubic metres per second.
Any blank cells show where a particular scenario has not been modelled for this location.



Environment Agency

No defences exist modelled fluvial extent and height

Location (easting/northing)
555194/237420

Scale
1:2,500

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

Selected area

Main river

Modelled 2D grid

Water level in mAOD

- 0 - 43.0
- 43.0 - 46.625
- 46.625 - 50.25
- 50.25 - 53.875
- 53.875 - 57.5
- 57.5 - 61.125
- 61.125 - 64.75
- 64.75 - 68.375
- 68.375 - 72.0

This map shows the 0.1% AEP height data

0 25 50 75 100
metres

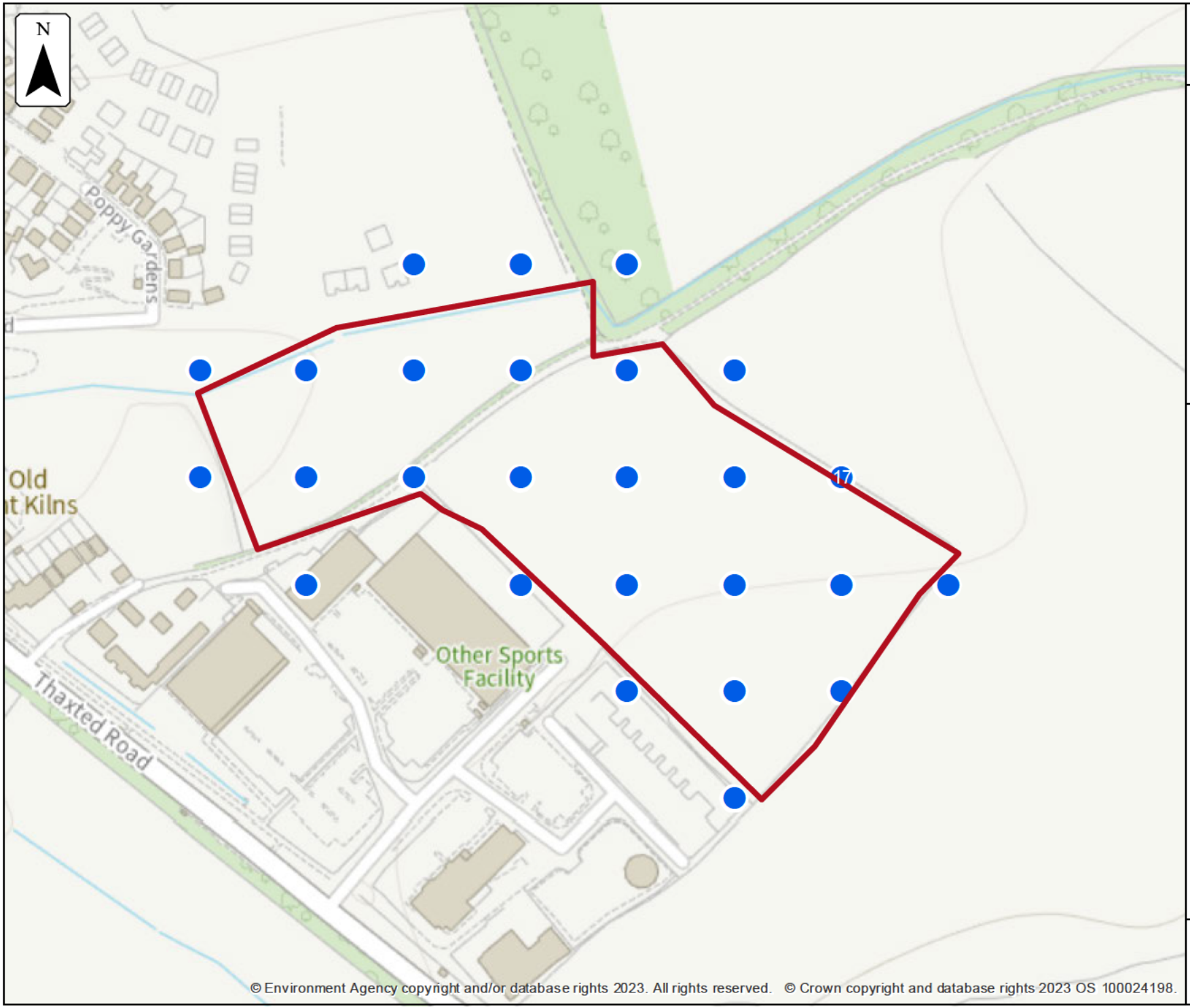
Sample point data

No defences exist

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
1	555263	237277	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
2	555211	237329	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
3	555263	237329	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
4	555315	237329	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
5	555055	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
6	555159	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
7	555211	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
8	555263	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
9	555315	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
10	555367	237381	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
11	555003	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
12	555055	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
13	555107	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
14	555159	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
15	555211	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
16	555263	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Label	Easting	Northing	5% AEP		2% AEP		1.33% AEP		1% AEP		0.5% AEP		0.1% AEP	
			Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height	Depth	Height
17	555315	237433	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
18	555003	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
19	555055	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
20	555107	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
21	555159	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
22	555211	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
23	555263	237485	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
24	555107	237537	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
25	555159	237537	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData
26	555211	237537	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData	NoData

Data in this table comes from the EAn Cam Phase 2 Slades Halcrow 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.



Environment Agency

No defences exist climate change modelled fluvial extent and height

Location (easting/northing)
555194/237420

Scale
1:2,500

Created
23 Jun 2023

Model name
EAn Cam Phase 2 Slades Halcrow 2012

Selected area

Main river

Modelled 2D grid

Water level in mAOD

- 0 - 43.0
- 43.0 - 46.625
- 46.625 - 50.25
- 50.25 - 53.875
- 53.875 - 57.5
- 57.5 - 61.125
- 61.125 - 64.75
- 64.75 - 68.375
- 68.375 - 72.0

This map shows the 1.0% AEP +20% height data

0 25 50 75 100
metres

Sample point data

No defences exist climate change

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
1	555263	237277	NoData	NoData
2	555211	237329	NoData	NoData
3	555263	237329	NoData	NoData
4	555315	237329	NoData	NoData
5	555055	237381	NoData	NoData
6	555159	237381	NoData	NoData
7	555211	237381	NoData	NoData
8	555263	237381	NoData	NoData
9	555315	237381	NoData	NoData
10	555367	237381	NoData	NoData
11	555003	237433	NoData	NoData
12	555055	237433	NoData	NoData
13	555107	237433	NoData	NoData
14	555159	237433	NoData	NoData
15	555211	237433	NoData	NoData
16	555263	237433	NoData	NoData

Label	Easting	Northing	1% AEP (+20%)	
			Depth	Height
17	555315	237433	NoData	NoData
18	555003	237485	NoData	NoData
19	555055	237485	NoData	NoData
20	555107	237485	NoData	NoData
21	555159	237485	NoData	NoData
22	555211	237485	NoData	NoData
23	555263	237485	NoData	NoData
24	555107	237537	NoData	NoData
25	555159	237537	NoData	NoData
26	555211	237537	NoData	NoData

Data in this table comes from the EAn Cam Phase 2 Slades Halcrow 2012 model.
Height values are shown in mAOD, and depth values are shown in metres.
Any blank cells show where a particular scenario has not been modelled for this location.
Cells which contain text 'NoData' for a scenario show that return period has been modelled but there is no flood risk for that return period for that location.

Strategic flood risk assessments

We recommend that you check the relevant local authority's strategic flood risk assessment (SFRA) as part of your work to prepare a site specific flood risk assessment.

This should give you information about:

- the potential impacts of climate change in this catchment
- areas defined as functional floodplain
- flooding from other sources, such as surface water, ground water and reservoirs

About this data

This data has been generated by strategic scale flood models and is not intended for use at the individual property scale. If you're intending to use this data as part of a flood risk assessment, please include an appropriate modelling tolerance as part of your assessment. The Environment Agency regularly updates its modelling. We recommend that you check the data provided is the most recent, before submitting your flood risk assessment.

Flood risk activity permits

Under the Environmental Permitting (England and Wales) Regulations 2016 some developments may require an environmental permit for flood risk activities from the Environment Agency. This includes any permanent or temporary works that are in, over, under, or nearby a designated main river or flood defence structure.

Find out more about flood risk activity permits

Help and advice

Contact the East Anglia Environment Agency team at enquiries_eastanglia@environment-agency.gov.uk for:

- more information about getting a product 5, 6, 7 or 8
- general help and advice about the site you're requesting data for

APPENDIX F – SURFACE WATER DRAINAGE CALCULATIONS

Greenfield runoff rate estimation for sites

[redacted] | Greenfield runoff tool

Calculated by: [redacted]

Site name: Land North of Thaxted Road

Site location: Saffron Walden

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: 52.01367° N

Longitude: 0.25997° E

Reference: 2193322840

Date: Nov 15 2023 21:21

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 2.95

Methodology

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

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics

	Default	Edited
SAAR (mm):	593	593
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

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):	0.41	0.41
1 in 1 year (l/s):	0.36	0.36
1 in 30 years (l/s):	1	1
1 in 100 year (l/s):	1.45	1.45
1 in 200 years (l/s):	1.72	1.72

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

Half Drain Time : 322 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	88.411	0.411	0.1	2.4	O K
30 min Summer	88.523	0.523	0.1	3.1	O K
60 min Summer	88.622	0.622	0.1	3.7	O K
120 min Summer	88.694	0.694	0.1	4.1	O K
180 min Summer	88.713	0.713	0.1	4.2	O K
240 min Summer	88.711	0.711	0.1	4.2	O K
360 min Summer	88.693	0.693	0.1	4.1	O K
480 min Summer	88.675	0.675	0.1	4.0	O K
600 min Summer	88.655	0.655	0.1	3.9	O K
720 min Summer	88.635	0.635	0.1	3.7	O K
960 min Summer	88.597	0.597	0.1	3.5	O K
1440 min Summer	88.528	0.528	0.1	3.1	O K
2160 min Summer	88.443	0.443	0.1	2.6	O K
2880 min Summer	88.372	0.372	0.1	2.2	O K
4320 min Summer	88.263	0.263	0.1	1.5	O K
5760 min Summer	88.184	0.184	0.1	1.1	O K
7200 min Summer	88.126	0.126	0.1	0.7	O K
8640 min Summer	88.085	0.085	0.1	0.5	O K
10080 min Summer	88.060	0.060	0.1	0.4	O K
15 min Winter	88.412	0.412	0.1	2.4	O K
30 min Winter	88.523	0.523	0.1	3.1	O K
60 min Winter	88.623	0.623	0.1	3.7	O K
120 min Winter	88.697	0.697	0.1	4.1	O K
180 min Winter	88.718	0.718	0.1	4.2	O K
240 min Winter	88.718	0.718	0.1	4.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
15 min Summer	142.716	0.0	19
30 min Summer	92.222	0.0	33
60 min Summer	56.713	0.0	62
120 min Summer	33.722	0.0	122
180 min Summer	24.576	0.0	180
240 min Summer	19.534	0.0	236
360 min Summer	14.061	0.0	290
480 min Summer	11.142	0.0	354
600 min Summer	9.297	0.0	422
720 min Summer	8.015	0.0	490
960 min Summer	6.338	0.0	626
1440 min Summer	4.546	0.0	906
2160 min Summer	3.257	0.0	1300
2880 min Summer	2.568	0.0	1696
4320 min Summer	1.836	0.0	2424
5760 min Summer	1.445	0.0	3168
7200 min Summer	1.200	0.0	3824
8640 min Summer	1.031	0.0	4504
10080 min Summer	0.906	0.0	5152
15 min Winter	142.716	0.0	18
30 min Winter	92.222	0.0	33
60 min Winter	56.713	0.0	62
120 min Winter	33.722	0.0	120
180 min Winter	24.576	0.0	176
240 min Winter	19.534	0.0	230

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

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
360 min Winter	88.695	0.695	0.1	4.1	O K
480 min Winter	88.674	0.674	0.1	4.0	O K
600 min Winter	88.650	0.650	0.1	3.8	O K
720 min Winter	88.625	0.625	0.1	3.7	O K
960 min Winter	88.575	0.575	0.1	3.4	O K
1440 min Winter	88.483	0.483	0.1	2.8	O K
2160 min Winter	88.371	0.371	0.1	2.2	O K
2880 min Winter	88.282	0.282	0.1	1.7	O K
4320 min Winter	88.153	0.153	0.1	0.9	O K
5760 min Winter	88.073	0.073	0.1	0.4	O K
7200 min Winter	88.046	0.046	0.1	0.3	O K
8640 min Winter	88.040	0.040	0.1	0.2	O K
10080 min Winter	88.035	0.035	0.0	0.2	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)
360 min Winter	14.061	0.0	298
480 min Winter	11.142	0.0	370
600 min Winter	9.297	0.0	446
720 min Winter	8.015	0.0	524
960 min Winter	6.338	0.0	674
1440 min Winter	4.546	0.0	966
2160 min Winter	3.257	0.0	1380
2880 min Winter	2.568	0.0	1760
4320 min Winter	1.836	0.0	2504
5760 min Winter	1.445	0.0	3120
7200 min Winter	1.200	0.0	3680
8640 min Winter	1.031	0.0	4408
10080 min Winter	0.906	0.0	5128

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	1.000
Region	England and Wales	Cv (Winter)	1.000
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.439	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+40

Time Area Diagram

Total Area (ha) 0.007

Time (mins) From:	To:	Area (ha)
0	4	0.007

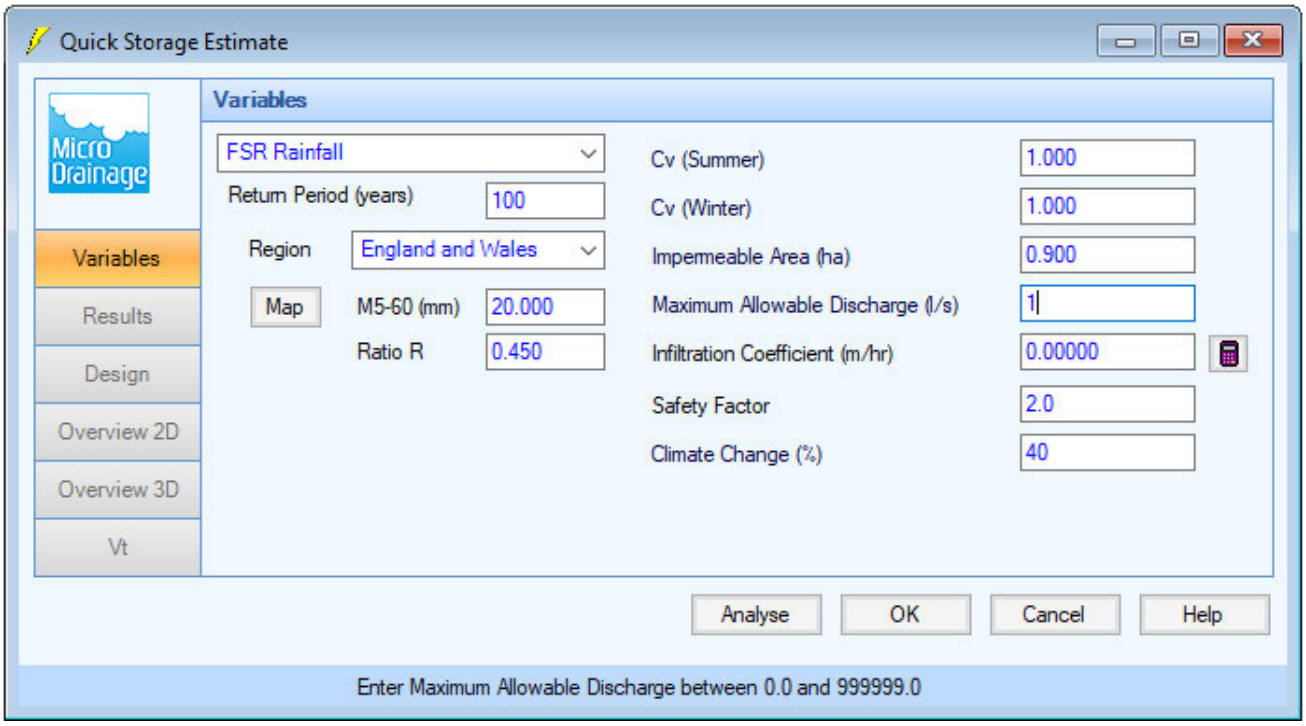
Model Details

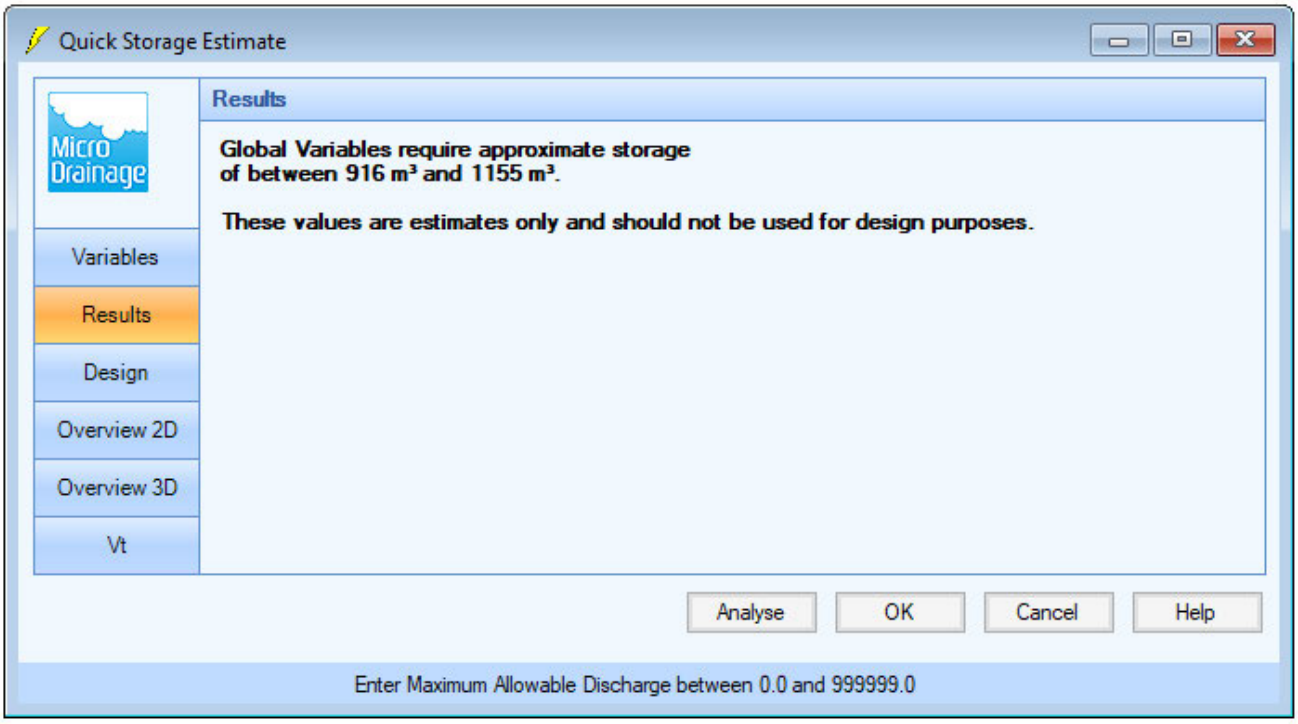
Storage is Online Cover Level (m) 90.000

Cellular Storage Structure

Invert Level (m) 88.000 Safety Factor 5.0
Infiltration Coefficient Base (m/hr) 0.17000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.17000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	6.2	6.2	0.800	6.2	14.2	0.801	0.0	14.2





APPENDIX G - MAINTENANCE SCHEDULE

A maintenance company will be appointed to ensure that regular inspection of the drainage systems are carried out, the inspections are logged and any remedial work necessary at the time of inspection is completed to ensure continued satisfactory operation of the designed system.

PLANNED PREVENTATIVE MAINTENANCE

As a minimum the appointed maintenance company should complete the following scope of works, during the planned bi-annual preventative maintenance inspection, for the following Surface Water features:

- Swales
- Permeable Paving
- Attenuation/Infiltration Tank
- Pond/Detention Basins
- Soakaways

SWALES

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter including leaf litter and debris from swale surface, access chambers and pre-treatment devices	Monthly (or as required)
	Inspect swale surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage	Monthly
	Inspect pre-treatment systems, inlets and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies	Six monthly
	Remove sediment from pre-treatment devices	Six monthly, or as required
Occasional Maintenance	Remove or control tree roots where they are encroaching the sides of the swale, using recommended methods (eg NJUG, 2007 or BS 3998:2010)	As required
	At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium	Five yearly, or as required
	Clear perforated pipework of blockages	As required

Prepared By:	[redacted]	Date:	10.11.23	Verified By:	[redacted]	Date:	14.11.23

PERMEABLE PAVING

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Brushing and vacuuming (standard cosmetic sweep over whole surface	Once a year, after autumn leaf fall, or reduced frequency as required, based on site-specific observations of clogging or manufacturers recommendations – pay particular attention to areas where water runs onto pervious surface from adjacent impermeable areas as this area is most likely to collect the most sediment
Occasional Maintenance	Stabilise and mow contributing and adjacent areas	As required
	Removal of weeds or management using glyphosate applied directly into the weeds by an applicator rather than spraying	As required – once per year on less frequently used pavements
Remedial Actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50mm of the level of the paving	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users, and replace lost jointing material	As required
	Rehabilitation of surface and upper substructure by remedial sweeping	Every 10 to 15 years or as required
Monitoring	Initial inspection	Monthly for 3 months after installation
	Inspect for evidence of poor operation and / or weed growth – if required, take remedial action	Three-monthly, 48h after large storms in first six months
	Inspect silt accumulation rates and establish appropriate brushing frequencies	Annually

Prepared By:	[redacted]	Date:	10.11.23	Verified By:	[redacted]	Date:	14.11.23

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
	Monitor inspection chambers	Annually

ATTENUATION/INFILTRATION TANKS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action	Monthly for 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment, algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
Remedial Action	Repair/rehabilitate inlets, outlet, overflows and vents	As required
Monitoring	Inspect/check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed	Annually
	Survey inside of tank for sediment build-up and remove if necessary	Every 5 years or as required

Prepared By:	[redacted]	Date:	10.11.23	Verified By:	[redacted]	Date:	14.11.23

INFILTRATION/DETENTION BASINS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Remove litter and debris	Monthly
	Cut grass – for spillways and access routes	Monthly (during growing season), or as required
	Cut grass – meadow grass in and around basin	Half yearly (spring – before nesting season, and autumn)
	Manage other vegetation and remove nuisance plants	Monthly (at start, then as required)
	Inspect inlets, outlets and overflows for blockages, and clear if required	Monthly
	Inspect banksides, structures, pipework etc for evidence of physical damage	Monthly
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Monthly (for first year), then annually or as required
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Annually
	Tidy all dead growth before start of growing season	Annually
	Remove sediment from inlets, outlet and forebay	Annually (or as required)
	Manage wetland plants in outlet pool – where provided	Annually (or as required)
Occasional Maintenance	Reseed areas of poor vegetation growth	As required
	Prune and trim any trees and remove cuttings	Every 2 years, or as required
	Remove sediment from inlets, outlets, forebay and main basin when required	Every 5 years, or as required (likely to be minimal requirements where effective upstream source control is provided)
Remedial Action	Repair erosion or other damage by reseeding or returfing	As required
	Realignment of rip-rap	As required
	Repair/rehabilitation of inlets, outlets and overflows	As required
	Relevel uneven surfaces and reinstate design levels	As required

Prepared By:	[redacted]	Date:	10.11.23	Verified By:	[redacted]	Date:	14.11.23

SOAKAWAYS

MAINTENANCE SCHEDULE	REQUIRED ACTION	TYPICAL FREQUENCY
Regular Maintenance	Inspect for sediment and debris in pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	Annually
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional Maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube or chamber and inside of concrete manhole rings	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Prepared By:	[redacted]	Date:	10.11.23	Verified By:	[redacted]	Date:	14.11.23

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The Development: Land North of Thaxted Road, Saffron Walden

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