



Drainage Strategy Report

Land at South Road
Bretherton
Lancashire
PR26 9BH

PN0283-PEL-XX-XX-RP-D-0002

15.12.25

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Produced By:



Emily Wilkes
Environmental Engineer

Checked By:



Rod Green MSc, BSc(Hons), IENG, FCIPHE, MSOPHE
Director

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1. EXECUTIVE SUMMARY

The following proposal outlines the surface water management and foul water drainage systems for a proposed residential development on existing farmland.

The proposed development consists of approximately 26 dwellings. This drainage strategy report outlines the surface water and foul drainage of the proposed development.

The strategy takes into account a number of types of flooding, it has been noted that pluvial flooding is present within the development. However, Pluvial flooding can be mitigated by incorporating a detailed SuDS drainage strategy to ensure sufficient storage is incorporated within the site boundary or external to the site boundary providing flood mitigation measures for the development. With appropriate mitigation measures the site can be considered acceptable.

1.1 Foul Water Drainage

The performance objectives are to collect, convey and discharge all foul effluents from within the confines of the site.

At this stage of the design, it is assumed that foul water will discharge to United Utilities combined sewer located in South Road.

1.2 Surface Water Drainage

The performance objectives are to collect, convey and attenuate all storm and surface water within the confines of the site perimeter.

A maximum storm of 1 % AEP storm event plus 45 % for climate change and a 10% allowance for urban creep has been considered for the Causeway Flow calculations based on a Greenfield Flow rate 7.3 l/s. The attenuated surface water will discharge to an existing ditch located South of the site.

2. THE SITE AND DEVELOPMENT

2.1 Existing Site

The proposed development site, South of South Road, Bretherton PR26 9BH, is located in the eastern extent of the Bretherton village in the borough of Chorley, Lancashire. The site is surrounded by agricultural land to the south and east, residential housing to the west and east and South Road to the north. The site is accessed from South Road to the north of the site.

The proposed development site currently functions as agricultural land and is approximately 1.096ha, falling from southeast to north with a number of localised low spots present throughout the site. A topographical survey of the existing site has been completed, see **Appendix A**.

Figure 1 shows the location of the proposed development site, outlined in red.



Figure 1 Location Plan

2.2 Drainage Infrastructure

Details of the existing drainage system have not been provided at this time.

The nearest watercourse is an unnamed ditch extending from a depression southeast of the site, adjacent to the recreation ground, which extends to the south. The unnamed ditch is part of a system of ditches which extends southwest towards Sarah Lane. From interrogation of ScalGo contour mapping produced using LIDAR data, it appears that surface water can flow from the identified ditch and ditches to the east, from the local area towards Sarah Lane, see figure 2 below. Further survey of these ditches is required.



Figure 2 Existing Drainage Ditch Locations and Routes Interpretation from Scalgo Mapping

2.3 Geology

An intrusive ground investigation report has not been completed for the site. In the absence of the ground investigations, classifications given by the Cranfield National Soil Resources Institute and BGS mapping and borehole logs have been used to get an indication of ground conditions.

According to the classifications given by the Cranfield National Soil Resources Institute, the predominant soil type across the site is slightly acid loamy and clayey soils with impeded drainage, **Appendix B**.

The BGS 1:50,000 Geology map for Garstang contained within **Appendix C** indicates that the site is directly underlain by bedrock of the Singleton Mudstone Member - Mudstone. Sedimentary bedrock formed between 252.2 and 241.5 million years ago during the Triassic period.

The BGS Geology map indicates that the superficial deposits underlying the site consists of Till, Devensian - Diamicton. Sedimentary superficial deposit formed between 116 and 11.8 thousand years ago during the Quaternary period.

A number of boreholes are shown in the area of the development site: SD42SE27, SD42SE28, SD41NE87 and SD41NE12. Borehole logs SD42SE27, SD42SE28 and SD41NE87 do not have logs available or the logs available do not provide log information. Borehole log SD41NE12, found on the BGS website (06.05.2023) dating back to 1968, was carried out to the south west of the proposed site. The log indicates loamy, peaty, clayey soils overlaying compacted sand.

The proposed site area is also denoted as located within an aquifer vulnerability zone on the BGS Geoindex map.

There are no BGS Recorded Mineral Sites within 1,000m of the site.

2.4 Infiltration

Cranfield National Soil Resources Institute and BGS mapping and borehole logs indicate that the ground is underlain by till which predominantly comprise of peat and clay. BRE 365 infiltration testing has not been completed at this stage. Due to the ground conditions shown from the BGS and Cranfield National Soil Resource Institute it is likely that infiltration will be at a very slow rate and would not be feasible on site.

A walkover survey was conducted by Pluviam Environmental on 03.02.23. The weather was dry on the day and had been dry for a few days following some heavy rainfall periods. The ground was wet and soft underfoot. Water was visible along the boundary ditches and within the central ditch (part). A small area of standing water was visible in the centre of the site and it was concluded that the nature of the sub-soil does not permit sufficient infiltration for any new drainage system.

In addition, the site is located within an aquifer vulnerability zone on the BGS Geoindex mapping.

2.5 Proposals

It is proposed that the site will be developed for housing. The development will consist of approximately 26 dwellings. The development will be accessed by the B5247, South Road. The proposed site location is shown in figure 3 below.

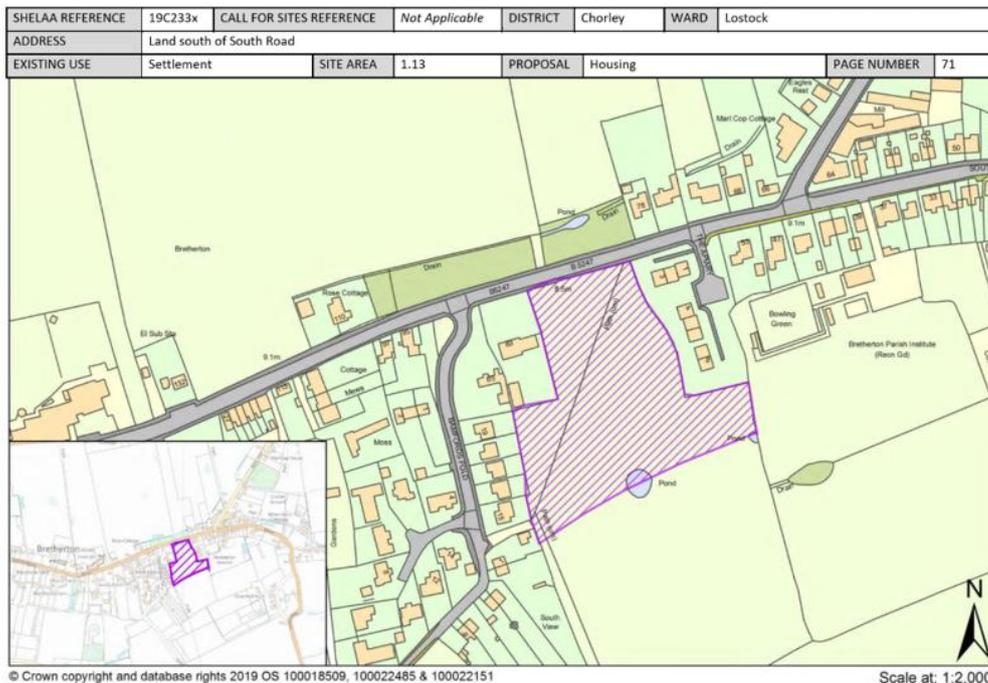


Figure 3 Proposed Site Location Plan

2.6 Design Parameters

National Planning Policy Framework (NPPF) requires that new developments should not increase flood risk both on the Site and in the area surrounding it. Therefore, surface water runoff should not exceed the peak volumes already generated on the Site and betterment should be provided where possible.

Environment Agency Climate Change Guidance provides peak rainfall intensity allowances to be applied during drainage design for each Management Catchment, using the upper end 2070s epoch allowances for surface water in developments with lifetimes beyond 2100.

DEFRA National Standards for Sustainable Drainage Systems provide statutory guidance on the peak flow and volume from a development as well as managing flood risk within the development. Notably relevant standards include:

1. Runoff destinations – Discharge must follow a clearly defined hierarchy, with evidence needed to justify use of lower priority routes. Rainwater reuse and infiltration are prioritised.
2. Interception of everyday rainfall – Requires that the first 5mm of most rainfall events (80% in summer, 50% in winter) is retained on site through source control measures.
3. Extreme rainfall and flood risk – Addresses 1:1 and 1:100 AEP events, urban creep, exceedance routes, and climate change allowances.
4. Water quality protection – Requires robust risk assessment and SuDS trains tailored to land use pollution risks.
5. Amenity benefits – SuDS should be multifunctional and enhance landscape character, health, education, and placemaking.
6. Biodiversity enhancement – Drainage systems must contribute to habitat creation, BNG, and LNRS goals.
7. Design for construction, operation and maintenance – Emphasises whole-life design, access, inspection, and resilience.

Additionally, Pluviam Environmental Ltd has reviewed the information provided and considered an approach based on previous experience of similar sites and current SuDS guidance provided in:

- Sustainable Design and Construction - Supplementary Planning Guidance, April 2014.
- CIRIA report C753 (2016); The SUDS manual
- CIRIA Report C724 (2013) Creating water sensitive places-scoping the potential for water sensitive urban design in the UK.
- BS 8582:2013, Code of practice for surface water management for development sites

3. FOUL WATER DRAINAGE PROPOSALS

3.1 Peak Flows

The peak flow calculations have been based on BS EN 12056 -2:2000, Sanitary pipework, layout and calculation.

The foul water discharge from the new residential properties will be collected in a new below ground drainage pipework system and will extend to connect into United Utilities combined water sewer within South Road via a new foul water pumping station and gravity break manhole.

Using The British Water CoP, Flows and Loads – 4, the following daily flow from the assumed development has been assessed at 20850.00 litres, refer to figure 4 below. The equates to approximately 0.24 litres/s.

Pluviam Environmental Limited						South Road, Bretherton					
Title: Sewerage Treatment System Calculation Sheet											
Prepared by: RG			Date: 28.10.25								
Reference data utilised: British water COP Flow and Loads - 4											
Source of waste	No. of	No of	Population	Balancing	P	Flow rate/Day		BOD Grams/day		NH ₃	
	Dwellings	Bedrooms	P	Co-eff		Per Head	Total	Per head	Total	Per head	Total
5 bed house	4	5	7	1	28	150	4200	60	1680	8	224
4 bed house	10	4	6	1	60	150	9000	60	3600	8	480
3 bed house	7	3	5	1	35	150	5250	60	2100	8	280
2 bed house	4	2	4	1	16	150	2400	60	960	8	128
							20850		8340		1112

Figure 4 British water Flows and Loads-4 Calculation

Using BS EN 12056-2:2000 the predicted peak foul flow rate has been calculated at circa 5.88l/s, refer to figure 5 below.

Pluviam Environmental Ltd								Project: South Road, Bretherton			Client:		
Title: Above Ground Sanitation Calculation Sheet											Sheet 1 of 1		
Prepared by: RG				Date: 28.10.25							Rev:		
Reference data utilised: EN 12056-2:2000 Gravity Drainage Systems Inside Buildings											Dwg Refs:		
Table 2 - Discharge Units (DU) and Table 3 Typical Frequency Factors (K)											K = 0.5		
Table 11 - Hydraulic Capacity (Qmax) swept enteries 50Ø = 0.7l/s, 100Ø = 5.2l/s, 150Ø = 12.4l/s and 200Ø= 21.0l/s													
6.3 Calculation of Flowrate Q _{ww} = K ∑ Du													
Equip Des	WC	WHB	Shw	Bath	Sink	D/Wash	W/Mac			Total Du's	Flow l/s	Stack Ø	Comments
Du Load	1.7	0.3	0.5	1.3	1.3	0.6	2.4						
5 bed house x 4	16	16	8	4	8	1	1			54.6	3.69	100	
4 bed house x 7	21	21	7	7	14	7	7			93.8	4.84	100	
3 bed house x 10	20	20		10	10	10	10			96	4.90	100	
2 bed house x 5	5	5		5	5	5	5			38	3.08	100	
											0.00	0	
Total										282.4	8.40	150	
Allowance for time of entry, pipework friction, gradient, Peak flow = 8.40 * 0.7 = 5.88l/s													

Figure 5 Foul Water peak flow calculation

Peak foul flows to be confirmed at detailed design.

3.2 Proposed Foul Water Design

Foul water internal to the proposed buildings will be collected within an internal drainage system and conveyed to the outer perimeter of the buildings. A proposed foul water pipe network will collect the foul water and route to United Utilities combined sewer in South Road. The United Utilities sewer record is available in **Appendix E**.

4. SURFACE WATER DRAINAGE PROPOSALS

4.1 Discharge Review

National Standards for Sustainable Drainage Systems standard 1 run off destinations states the following discharge hierarchy:

Priority 1: collected for non-potable use

Priority 2: infiltrated to ground

Priority 3: discharge to an above ground surface water body

Priority 4: discharged to a surface water sewer, or another piped surface water drainage system

Priority 5: discharged to a combined sewer

4.1.1 Non-potable Use

Water butts will be provided on a select number of rainwater down pipes at the individual properties. Rainwater diverters on the rainwater downpipes will allow water to collect within the water butts for reuse.

4.1.2 Infiltration

BRE 365 infiltration testing has not been completed to date, however the presence of peat and till, predominantly clay, suggest that the infiltration rate on site will be poor.

A walkover survey was conducted by Pluviam Environmental on 03.02.23. The weather was dry on the day and had been dry for a few days following some heavy rainfall periods. The ground was wet and soft underfoot. Water was visible along the boundary ditches and within the central ditch (part). A small area of standing water was visible in the centre of the site and it was concluded that the nature of the sub-soil does not permit sufficient infiltration for any new drainage system.

Taking into consideration the ground types outlined in section 2.3 of this report, on site observations and the site being located within an aquifer vulnerability zone, infiltration has been discounted as a method of discharge.

4.1.3 Surface Water Body

A number of ditches are located within the proximity of the proposed development site and so discharge to a surface water body is proposed be used as the method of discharge.

An existing ditch has been identified to the south of the proposed development site. Full survey of the ditch has not been made available at this time and a survey of the ditch will be required to determine its suitability as an outfall location.

4.1.4 Surface Water Sewer

The United Utilities sewer record is available in **Appendix E**. There are no surface water sewers within the vicinity of the site. Therefore, surface water will not discharge to a surface water sewer.

4.1.5 Combined Sewer

The United Utilities sewer record is available in **Appendix E**. A combined sewer is located in South Road.

4.2 Greenfield Runoff Rate

National standards for sustainable drainage systems (SuDS) standard 3 requires the peak allowable discharge rate to surface waters or sewers for a 50% AEP event be limited to the equivalent 50% AEP greenfield runoff rate, or 3 l/s/ha, whichever is greater. Q_{BAR} or Q_{MED} for the site can be considered as the 50% AEP greenfield runoff rate.

The greenfield runoff rate has been estimated using HR Wallingford's tool on uksuds.com for the 1.096ha site area of the development. Q_{BAR} for the site has been calculated as 6l/s. The HR Wallingford calculation inputs and results can be found in full in **Appendix D**.

4.3 Climate Change Allowances

Climate change is expected to have an impact on the frequency and intensity of rainfall events, in addition to rates of infiltration and evaporation within a catchment. The Environment Agency published climate change allowances which were most recently revised in May 2022.

For site-scale applications, the Environment Agency provides peak rainfall intensity allowances for each Management Catchment. Figure 6 shows the projected changes in peak rainfall intensity for small or urbanised drainage catchments in the Douglas Management Catchment. The maximum design lifetime of the Proposed Development is assumed to be 75 years. For developments with a lifetime beyond 2100, the upper end allowances should be assessed for 1 % and 3.3 % AEP events for the 2070s epoch (2061-2125). As shown in figure 3, this is a +40 % allowance for 3.3% AEP events and a + 45% allowance for 1 % AEP events.

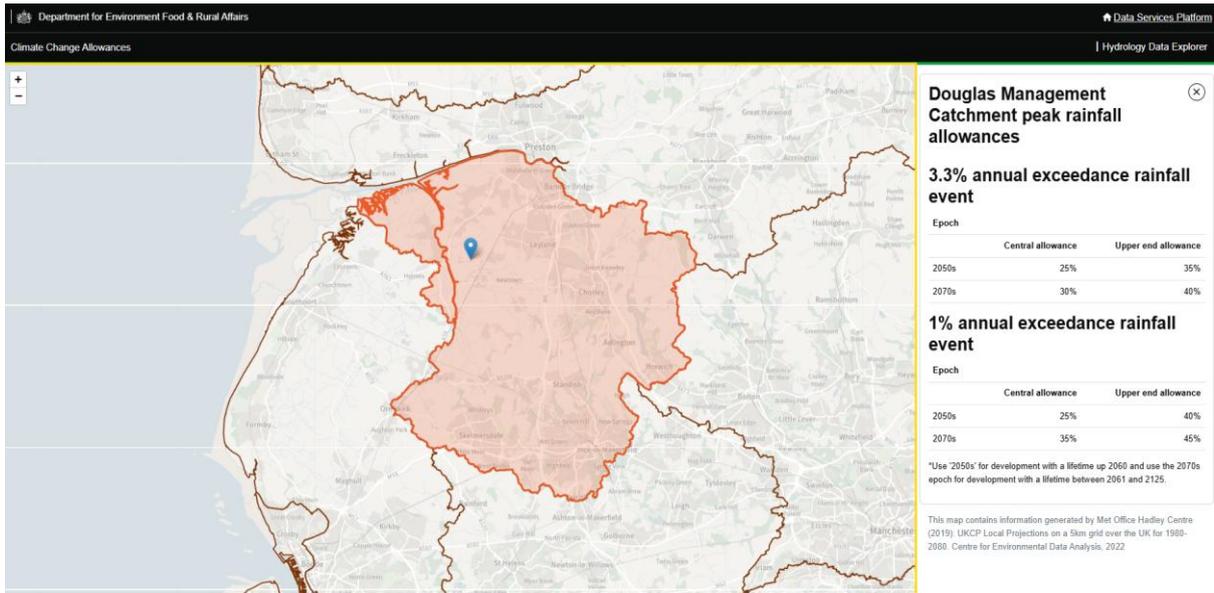


Figure 6 Peak rainfall allowances for the site

4.4 Hydraulic Calculations

A simplified model of the site’s drainage system has been developed in Causeway Flow to provide an estimate of storage required for surface water runoff. The inputs are listed below:

Table 1 Hydraulic inputs

Location	PR26 9BH
FEH Data 2022	
Rainfall	
Proposed impermeable development area	0.910 ha
Proposed permeable development area	0.160 ha
Offsite overland flow areas	TBC
Storms run	1 year (100 %), 2 year (50%) 30 year (3.3 %) and 100 year (1 %)
Climate change factor	+40% for 3.3% AEP and +45 % for 1 % AEP
Urban creep	+10% for 3.3% AEP and +10% for 1% AEP

The total contributing catchment area modelled is 1.07ha, comprising of the proposed impermeable and permeable areas. Areas of adjacent land with overland flow routes into site have not been included within the calculation and need to be considered at detailed design stage.

Overland flow routes and catchment areas have been identified using ScalGo mapping. The ScalGo overland flow analysis package shows flooding on the development site by using LIDAR data. Figure 7 shows the flow paths and depressions presented in the overland flow ScalGo analysis.

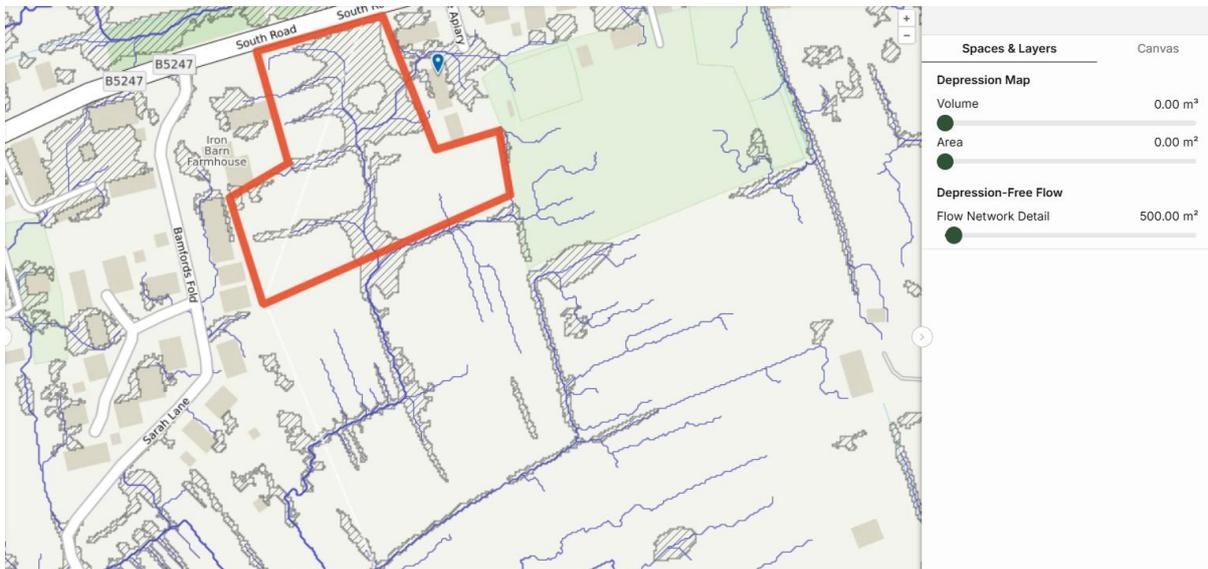


Figure 7– ScalGo Fluvial Flow Paths and Depressions

Figure 8 shows the depression shown at the southern extent of the development proposals that is indicated as an existing pond on the topographical survey highlighted in red along with the associated catchment areas (green areas) and overland flow paths.

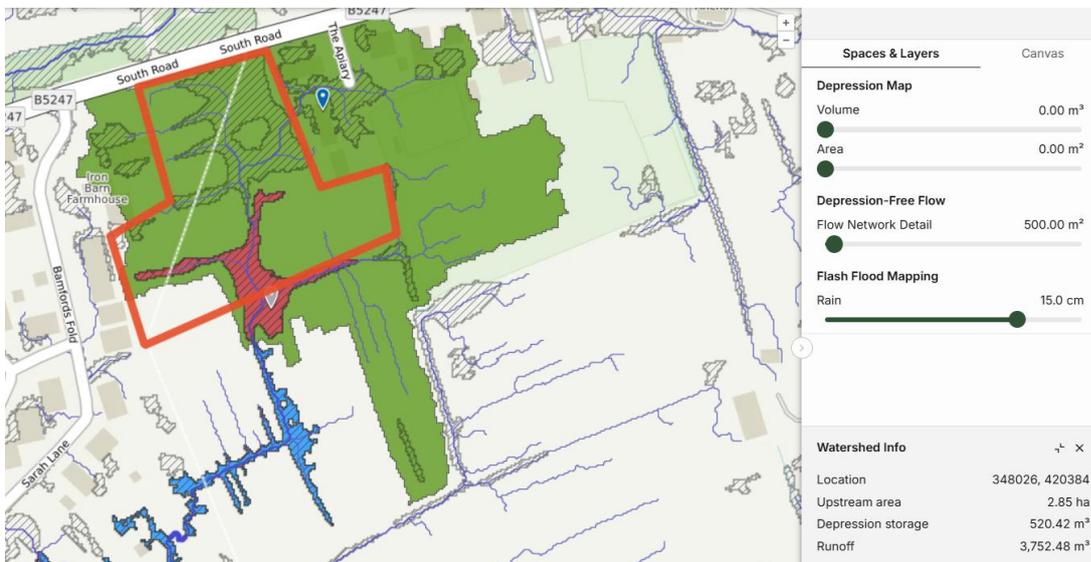


Figure 8 – ScalGo Fluvial Flow Paths and Depressions for the Proposed Site

The drainage strategy considers runoff from the development using FEH22 data for the site to determine the storage requirements to ensure no flooding during the 1 % AEP +45% climate change storm event + 10% urban

creep with discharge restricted to 6.0l/s by a pump system. Approximately a total of 541 - 737m³ worth of storage is required, refer to figures 9 and 10 below.

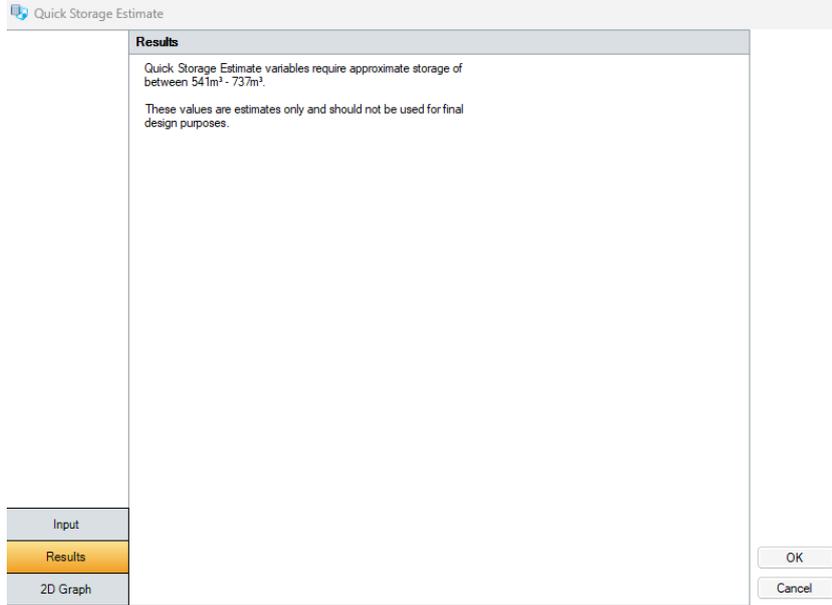


Figure 9 – Calculation results for the Proposed Site

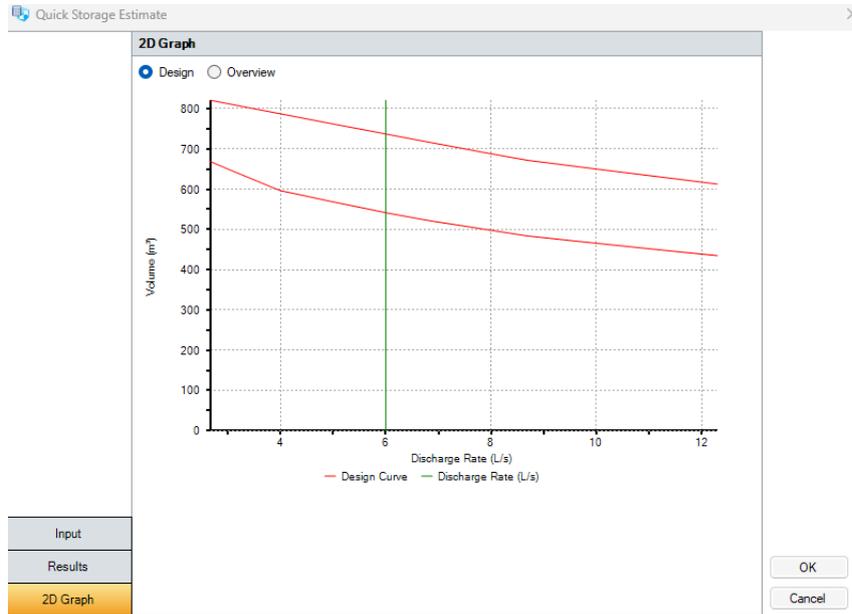


Figure 10 – Calculation graph for the Proposed Site

The InfoDrainage calculations have been produced to simulate on the required onsite storage. The storage that will be provided has been estimated using the site boundary layout and assumptions of drainage features that are feasible in the absence of a finalised architectural layout.

4.5 High Flow and Exceedance Events

As per National standards for sustainable drainage systems (SuDS) standard 3, flooding is permitted on site in events exceeding 3.3 % AEP, so long as it does not flood buildings or critical infrastructure or means of access and escape in a 1 % AEP. For events in excess of 1 % AEP, it states that flows should be managed in exceedance routes that minimise the risks to people and property.

The drainage strategy is to be developed so that during the 1 % AEP + 45 %CC + 10% urban creep storm event, all runoff remains below ground. Levels will be developed on site to ensure exceedance beyond this event will be directed away from buildings and towards drainage features present around the site.

4.6 Proposed Surface Water Drainage Strategy

The proposed surface water drainage system will be designed to collect the roof and hardstanding areas.

A proportion of the roof water will be discharge into rainwater harvesting butts.

A proportion of the surface water runoff from footpaths, the proposed access road and roofs will be collected and pass through raingardens located around the site.

Surface water on the private driveways will be captured by permeable paving. Surface water from shared driveways will be captured by permeable paving and stored within a Permavoid system beneath.

Surface water can also be attenuated in a detention basin(s) prior to discharge to the identified ditch south of the site. If required the detention basin(s) will overlay a suitably sized attenuation tank.

Offline attenuation tank(s) can be incorporated into the detailed design scheme to provide additional onsite attenuation.

The surface water runoff will be discharged in line with the drainage hierarchy, see section 4.1. Due to the limited fall across the site, it is proposed that the surface water will be drained by gravity to discharge via a new surface water pumping station(s) and gravity break manhole(s) to the existing ditch southeast of the site.

A series of filter drains have been proposed along lengths of the site boundary to intercept identified overland flow routes.

Discharge to the ditch will be limited to 6l/s during the proposed 1 in 100 +45% climate change storm event and 10% urban creep.

A combination of catchpits, and specialist geotextiles shall be incorporated into the design to prevent sediment from entering the drainage pipework system.

Based on the above calculations and SuDS components highlighted it would be possible to develop a detailed drainage design strategy to mitigate pluvial design within the site boundary. This will also take into account offsite pluvial flows that traverse the site.

4.7 Pollution Removal

The site consists of run off from residential roofs, footways, individual property driveways, residential car parking spaces and the proposed access road. Due to the pollution hazard levels associated with the on-site features, it has been determined that the simple index approach is a suitable approach to water quality risk management for this development.

The simple index approach is outlined in CIRIA C753 where pollution hazard indices for different land use classifications and SuDS mitigation indices for different SuDS features are provided. In order to demonstrate adequate treatment is achieved, the SuDS features total pollution mitigation index should be equal to or greater than the pollution hazard index. Tables 2 and 3 are extracts from CIRIA C753 showing the pollution hazard indices and SuDS mitigation indices for the relevant land use classifications and SuDS features, respectively.

Residential roofs are classed to have a pollution hazard level of very low, which has pollution indices of 0.2, 0.2, 0.05 for TSS, metals and hydrocarbons. The footpaths and access road have a pollution hazard level of low, with pollution indices of 0.5, 0.4, 0.4 for TSS, metals and hydrocarbons. Runoff from the roof areas and footpaths is proposed to pass through raingardens acting as bioretention systems, which have mitigation indices of 0.8, 0.8, 0.8 for TSS metals and hydrocarbons. Therefore, meeting the hazard indices.

The driveways have pollution hazard level that is classed as low, with a pollution indices of 0.5, 0.4, 0.4 for TSS, metals and hydrocarbons. It is proposed that the surface water run off from these areas will drain to permeable paving, which has mitigation indices of 0.7, 0.6 and 0.7. Therefore, meeting the required hazard indices.

In addition to the above features, all surface water runoff will pass through a detention basin prior to discharging into the identified ditch. Detention basins have a mitigation indices of 0.5, 0.5, 0.6 for TSS, metals and hydrocarbons.

Table 2 Pollution hazard indices for different land use classifications

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, homezones and general access roads)	Low	0.5	0.4	0.4

Table 3 Indicative SuDS mitigation indices for discharges to surface waters

Type of SuDS component	Total suspended solids (TSS)	Metals	Hydrocarbons
Bioretention system (raingardens)	0.8	0.8	0.8
Permeable pavement	0.7	0.6	0.7
Detention Basin	0.5	0.5	0.6

The site contains a number of treatment devices to prevent silts and spillage from entering the field drain.

4.7.1 Flow Controls

A surface water pumping station(s) is proposed to be provided prior to the identified field drain to restrict the discharge of surface water to the Q_{BAR} rate of 6 l/s.

4.7.2 Catchpit Chambers

Catchpit chambers are a traditional drainage device that reduces the velocity of the flow of stormwater flowing through the chamber to allow the settling of detritus and silts in the pit at the bottom of the inspection chamber. Catchpit chambers are to be provided throughout the proposed surface water drainage system.

4.7.3 Permeable Pavements and Sub-base

Permeable sub-base layers have an extensive track record as an effective sustainable drainage component providing filtration and treatment of daily effluent loadings associated with car park run-off. The granular sub-base tanks would be surrounded by a SuDS treatment geotextile or can be surrounded by an impermeable membrane to prevent infiltration into the sub-soils.

4.7.4 Oil Separation and Filtration via specialised Geotextiles

The SuDS geotextile is to be used in car parking sub base areas and wrapped around the subterranean geocellular attenuation tank. It comprises a non-woven, dimpled, needle punched geotextile that has been specifically designed for hydrocarbon pollution treatment in civil engineering applications (such as filtration, drainage and pavement reinforcement). The dimpled geotextile comprises a proprietary blend of polyester fibres that incorporate hydrophilic (water attracting / oil repellent) and hydrophobic (oil attracting / water repellent) properties to achieve oil retention to the upper surface. The geotextile is capable of retaining oil contamination ranging from daily car drip losses up to catastrophic spillages e.g. originating from car oil-sump failures. The entrapped hydrocarbons are biodegraded by naturally occurring micro-organisms providing a self-cleansing and maintenance free mechanism.

4.7.5 Dry Basins

Dry Basins are a widely used traditional SuDS techniques that are well understood and provide very robust and cost-effective features that can be used for attenuation and treatment of run-off to varying degrees depending on their detailed design. Dry basins are designed to capture, temporarily hold, and gradually release (infiltrate) a volume of surface water during peak storm events.

Dry basins provide treatment and also provide amenity and bio-diversity benefits.

4.7.6 Plastic Geocellular Units

1000 x 500 x 400mm deep modular interlocking plastic geocellular unit system designed for use as a subterranean drainage storage component with a high compressive strength (610kN/m²) and a high void ratio (95%) to achieve highly efficient water storage capacity.

Consideration of aesthetics aspects should be balanced with treatment efficacy and bio-diversity aspects, which can be addressed in the specification of appropriate planting etc.

5. MAINTENANCE

5.1 Avoiding Damage to the Drainage System

The main cause of damage to the system is likely to be due to litter, excessive silt accumulation or physical damage to the system.

Litter should be regularly removed from the site and the system will need to be inspected after any prolonged storm event. The drainage inlets to gullies should be routinely inspected for blockages. This is achieved via removable covers to the gullies. To avoid excessive silt build up road and car park surfaces should be swept at least once a year.

During cold weather, if maintenance includes gritting, then grit application should be kept to a minimum. Grit should not be stockpiled in areas that drain to the drainage system.

If modifications to the site are proposed, designers and contractors should be made aware of the presence of the SUDS, so that due regard can be given to the system and damage avoided.

Maintenance of the pumping station should be to the manufacturer's details and must be observed.

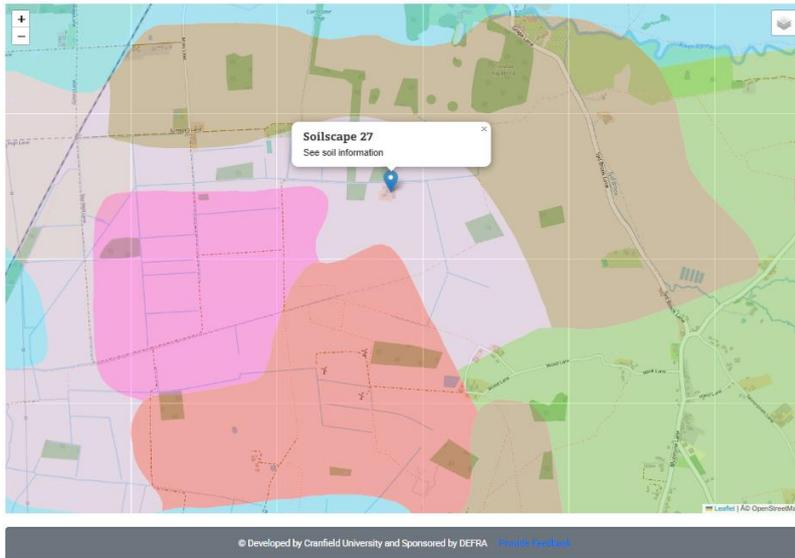
5.2 Maintenance & Management Plan

The management and operation of the SuDS features will be undertaken by the client or their nominated management party.

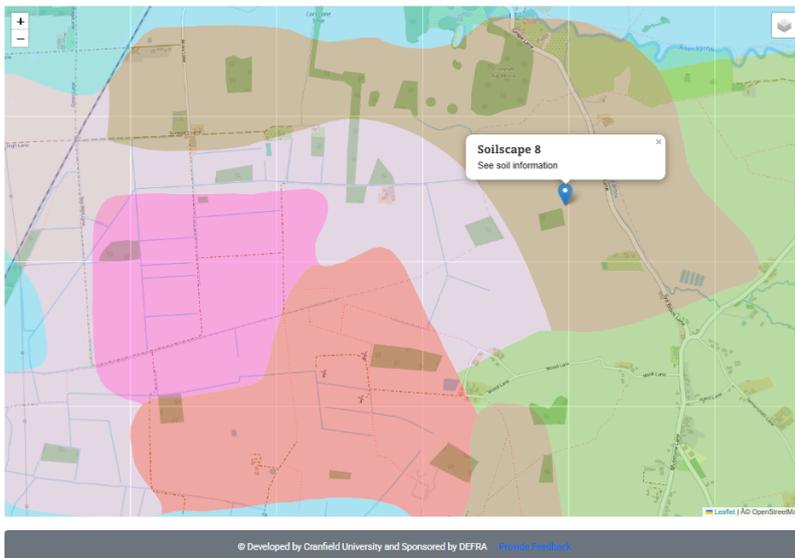
A Sustainable Drainage System Operation and Maintenance Manual will be produced as part of detailed design.

APPENDIX A. TOPOGRAPHICAL SURVEY

APPENDIX B. LLANDIS SOILSCAPES MAPS



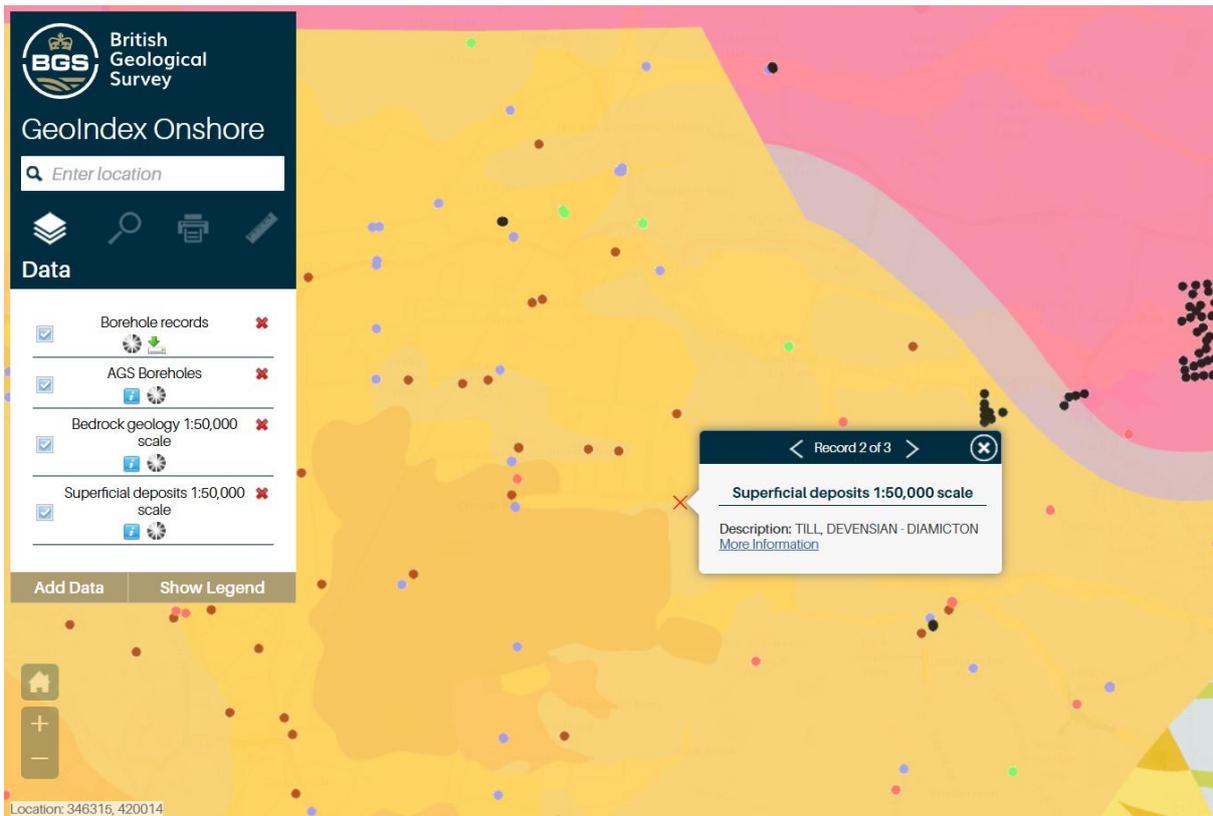
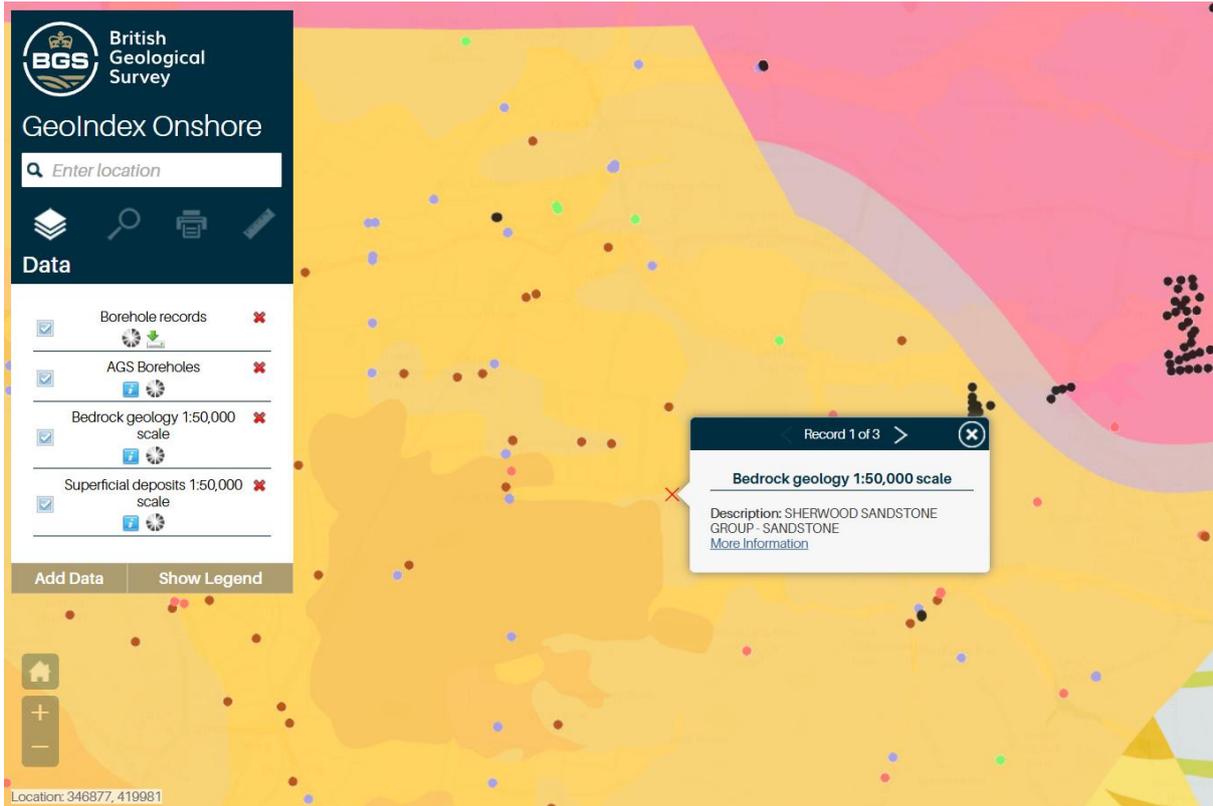
Soil Information	
Soilscape 27:	Fen peat soils
Texture:	Peaty
Coverage:	England: 0.7%, Wales: 0.1%, England & Wales: 0.6%
Drainage:	Naturally wet
Fertility:	Mixed, very low to lime-rich
Landcover:	Arable and horticulture
Habitats:	Wet fen and carr woodlands
Carbon:	Medium/High
Drains to:	Local groundwater
Water protection:	Cultivated soils are drained. Shallow groundwater and marginal ditches to most fields mean that the water resource is vulnerable to pollution from nutrients applied to the land. Drainage of peat containing sulphides will release extremely acid drainage water
General cropping:	Once drained, soils are suitable for arable and horticultural cropping but cultivation leads to gradual loss of the peat through wind erosion and oxidation. Where sulphide is present, extremely acid subsoil prevents rooting and leads to an irrigation requirement.

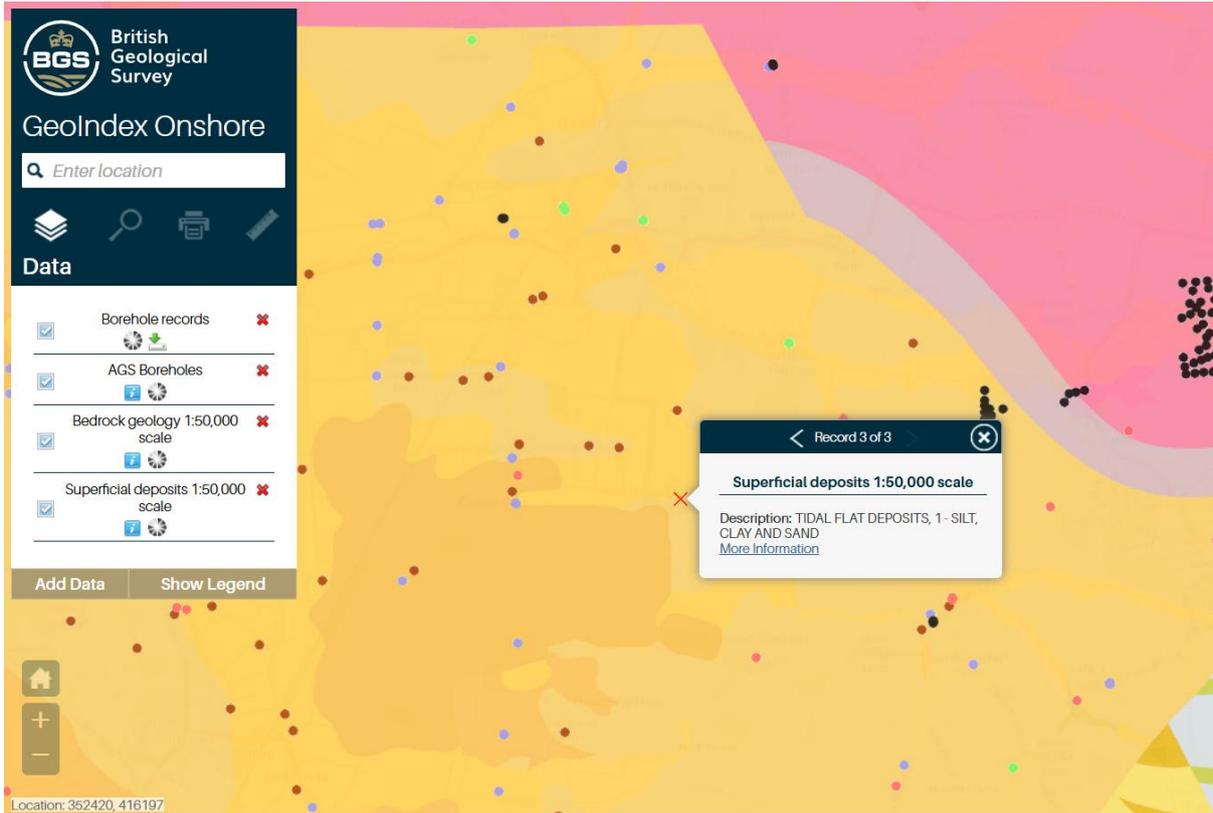


Soil Information	
Soilscape 8:	Slightly acid loamy and clayey soils with impeded drainage
Texture:	Loamy some clayey
Coverage:	England: 10.6%, Wales: 1.9%, England & Wales: 9.4%
Drainage:	Slightly impeded drainage
Fertility:	Moderate to high
Landcover:	Arable and grassland
Habitats:	Wide range of pasture and woodland types
Carbon:	Low
Drains to:	Stream network
Water protection:	Farmed land is drained and therefore vulnerable to pollution run-off and rapid through-flow to streams; surface capping can trigger erosion of fine sediment
General cropping:	Reasonably flexible but more suited to autumn sown crops and grassland; soil conditions may limit safe groundwater and grazing, particularly in spring

Accessed from Llandis Soilscape website 02.09.25

APPENDIX C. BRITISH GEOLOGICAL SOCIETY MAP





Accessed 12.12.25 from the BGS web viewer

APPENDIX D. HR WALLINGFORD GREENFIELD RUNOFF RATE CALCULATIONS

APPENDIX E. UNITED UTILITIES SEWER RECORD