Hydroecological Assessment

Breadsell Farm, Hastings

Wates Developments

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Author:	E Rowlands & S Davies
Checker:	S McGeever
Approver:	P Bond
HM Project No:	36145

HM Office:

Shackleton House
Hays Galleria
4 Battlebridge Lane
London
SE1 2HP

T: +44 (0)20 7940 8888
hilsonmoran.com
@HilsonMoran
hilson_moran
Hilson Moran

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Executive Summary

Hilson Moran was instructed by Wates Developments Ltd (the 'Client') to undertake a Hydroecological Assessment of Land located at Breadsell Farm, Breadsell Lane, Saint Leonards-on-Sea (the 'Site'). The assessment was undertaken in relation to the proposed allocation and subsequent development of the site for a residential end-use.

The site covers an area of approximately 25.34 hectares (ha) and comprises greenfield land dissected by the Hastings Borough/Rother District Boundary. The site includes the northern part of the Marline Valley Woods Site of Special Scientific Interest (SSSI) within its boundary.

The site currently comprises three agricultural fields, with woodland in the east and south-east. This woodland is designated as Ancient Woodland and forms part of the SSSI. The Marline Valley Stream flows in a southerly direction through the SSSI. Varied bryophyte (mosses, liverworts and hornworts) assemblages are present within the SSSI associated with the stream.

The site has historically been identified for its potential to provide new dwellings to support the housing needs of both boroughs. However, this has not yet progressed due to objections from Natural England (NE), particularly in relation to a lack of baseline water monitoring and suitable Surface Water Drainage Strategy. Hastings Borough Council are currently updating their Local Plan to cover 2019 to 2039, and this includes planning for new development to meet local housing shortages and enhance the environment. As a result, there is a renewed focus on the site.

There are several studies and reports pertaining to the site which have been reviewed as part of this report, including a Bryophyte Survey commissioned by the Client in 2025, Hydrological and Hydrogeological Assessment, Surface Water Strategy and consultation responses from NE.

NE argue that it is not possible to state the full extent/impact of the hydrological and hydrogeological changes resulting from the development without having a better understanding of the current regime, and have stated that, following a previous recommendation by Rigare Ltd in 2009, they require at least 3 years of monitoring to characterise the site hydrology. This site characterisation can then inform a sustainable drainage strategy which does not alter the current regime.

Hilson Moran has undertaken a review of available information relating to developments and proposed developments nearby to the site and also adjacent to the SSSI, and the associated responses from NE. It is apparent that one year's worth of monitoring has been considered sufficient to establish pre-construction baseline conditions for previously approved planning applications on sites where runoff/baseflow also feeds into the SSSI. This approach would also align with other projects and schemes (examples provided within this report) where there are potential impacts on SSSIs sensitive to changes in the hydrological/hydrogeological regimes, and where NE has agreed, through consultation, to one-year's pre-development monitoring in order to provide suitable baseline data and understand the interactions between the proposed scheme and the nearby water-sensitive SSSIs.

An initial year-long comprehensive monitoring programme to provide physical and qualitative data on surface water, groundwater and soil conditions has therefore been proposed as part of this report.

An outline sustainable drainage strategy has been proposed which aims to limit disturbance to the bryophyte assemblage in the SSSI. A total of 3380m^3 of attenuation within Sustainable Drainage System (SuDS) features has been proposed within the site. This will be achieved by installing detention basins and attenuation ponds, whilst swales and filter strips will be used to convey runoff throughout the site. Runoff will be attenuated within these SuDS features and discharged to the Marline Valley Stream at seven different locations across the site. By limiting proposed runoff rates to existing greenfield rates, this mimics the existing scenario and limits disturbance to the local hydrogeological regime and associated bryophyte assemblage in and around the stream, as a result of the development.

The volume of storage provided exceeds the requirement to attenuate the additional flows from a 1 in 100-year rainfall event (including 45% climate change) to greenfield rates and thus, will not increase flood risk elsewhere.

The CIRIA Simple Index Approach has been applied to each of the proposed SuDS treatment trains on the site. It has been demonstrated that the SuDS mitigation index is greater than the pollution hazard index for each contaminant type in each catchment. The SuDS treatment trains will therefore provide adequate pollutant removal on site before runoff is discharged to the Marline Valley Stream, thereby minimising any detrimental impacts on the sensitive bryophyte assemblage.

It is recommended that preliminary infiltration testing (carried out as per BRE365), and logging of trial pit soils and geology should be conducted to provide representative soil infiltration rates and shallow strata characteristics. This will inform the sustainable drainage strategy, to ensure that the current environmental and hydrologic conditions, which are beneficial to the bryophyte assemblage, are preserved.

A comprehensive review of available bryophyte survey data for the site, together with a detailed bryophyte survey (performed from 22nd and 25th of April, 2025) was commissioned and carried out by Sharon Pilkington BSc (Hons), MSc, CEnv, MCIEEM, a professional bryologist, botanist and ecologist with 25 years' experience. The study was conducted to provide up-to-date data on the composition, health and extent of the bryophyte assemblage and to help understand any likely impacts the proposed development may have on it. Consequently, the field survey was extended to include the full SSSI. The resulting report is presented in Appendix C of this report and concluded that:

- Farmland within the site is of negligible importance for bryophytes;
- The SSSI woodland of Coneyburrow Wood and Birchen Copse supports populations of two of the three species of the bryophyte assemblage feature as well as other nationally and locally notable species;to construction,.
- Marline Valley Woods SSSI continues to be of high importance for its ghyll stream bryophytes, and supports a considerable number of species for a site of this kind in south-eastern England
- Previous bryophyte assessments of the SSSI indicate how vulnerable the communities of the ghyll streams are to hydrological impacts caused by adjacent land-use, but also demonstrate that the site has recovered from such impacts in the past. However, the uncertainty about impacts driven by climate change now and in the future must be acknowledged.
- Siltation is currently considered to be the most serious threat to the SSSI's stream-associated bryophyte communities, with other potential impacts from development concluded to be of far less consequence.
- Previous and current assessments have concluded that the eastern arm of the stream is likely to be a primary source of high levels of silt resulting from bank erosion, and carried down into the SSSI and deposited as silt bars and mud detrimentally impacting on bryophyte habitats. Water-driven erosion of banks is a natural physical process that is almost certainly being inflated by climate change (i.e. by increasing their frequency and intensity). Piped outfalls of run-off from an adjacent residential area are also likely making the problem worse. It is therefore very important that the proposed development at Breadsell Farm does not worsen the existing problem.
- Recommendations include with the report include:
    - Access of people into Coneyburrow and Birchen Wood from the new development should be carefully planned and managed to prevent a proliferation of entry points and paths within this part of the SSSI. In particular, stream crossing points would benefit from construction of footbridges to discourage bank erosion
    - Appropriate drainage, treatment and water management should be included into the development design in order to carefully control the quality and volumes of water entering the ghyll stream catchment.
    - Silt control should be of particular focus within the drainage design of the proposed development;
    - Run-off from roads, other hard surfaced ground, roofs *etc.* should be captured within the development and treated on-site with appropriate

features to remove silt and pollutants at source and to allow gradual infiltration to groundwater and evaporation.

  - The drainage strategy for the proposed development should comply fully with the recommendations for an outline sustainable drainage strategy presented within this Hydroecological Assessment, which aims to mimic the existing scenario and limit disturbance to the local hydrogeological regime and associated bryophyte assemblage in and around the stream.

This approach will ensure that the site will provide desperately needed housing for the borough, whilst at the same time minimising impacts on the neighbouring SSSI and sustainably maintaining the sensitive bryophyte assemblage associated with it.

1. Introduction

1.1. Overview

Hilson Moran has been commissioned by Wates Developments (the 'Client') to undertake a Hydroecological Assessment of land located at Breadsell Farm, Breadsell Lane, St Leonards-On-Sea (the 'Site').

The site comprises greenfield land dissected by the Hastings Borough/Rother District Boundary, with the northern part lying in Rother District and the rest lying in Hastings Borough. The site includes the northern part of the Marline Valley Woods SSSI within the site boundary.

The assessment was undertaken in connection with the proposed development of the site for a residential end-use (with the Client currently exploring the allocation of the site for a housing development through the local plan review process). The red line boundary for the site is shown as **Figure 1-1** below.

Figure 1-1. Site Red Line Boundary (Source: Google Earth).

1.2. Objectives

The purpose of this report is to assess the potential impacts of the proposed residential development on the nearby watercourses, biodiversity and SSSI, and develop an appropriately sensitive outline drainage strategy for the site, which will ensure the preservation and sustainable management of the associated bryophyte (mosses, liverworts and hornworts) assemblage over the lifetime of the scheme. Recommendations for future work are also presented.

1.3. Project Background

In May 2008, Hastings Borough Council (HBC) prepared a Core Strategy Preferred Approaches document ('Shaping Hastings') for consultation as part of the Hastings Local Development Framework (LDF). The document identified a major greenfield site at Breadsell Lane (Preferred Approach 1: Location of New Housing). At the time, it was reported that the site (which was larger than that currently being considered) had an estimated potential to provide up to 1000 new dwellings, including approximately 200 in Rother District and 800 in Hastings Borough.

Natural England (NE) objected to the identification of this area for new housing due to the potential impact on the Marline Valley Woods SSSI, particularly on bryophyte assemblages associated with the Marline Valley Stream (letter dated 3rd July 2008, refer to **Section 5.1**).

In response to NE's objection, HBC undertook several design and impact studies for the site, including a Bryophyte Survey (Simon Davey Ecological Consultants, 2009) and a Hydrological & Hydrogeological Assessment (Rigare Ltd, 2009), which are reviewed in **Section 5**. In March 2010, the outcome of this work was reported to HBC's Cabinet. In particular, the Bryophyte Survey identified potential water quality issues and other environmental pressures potentially impacting the bryophytes. HBC's Cabinet considered how to proceed with the option of identifying greenfield housing potential at the site, given NE's objection.

Work undertaken as part of the Strategic Housing Land Availability Assessment (SHLAA) strengthened the Council's evidence base, and as a result, HBC's Cabinet decided to approve the strategic housing option for the pre-submission version of the LDF Core Strategy, which involved "*a broad distribution of housing across the Borough with some windfall allowance up to 2026*". This decision dropped the site from the Hastings Core Strategy, and Rother District Council (RDC) decided against the development of their frontage land onto the A2100 alone.

The above decisions were made on the basis that NE would not be prepared to withdraw their objection without the results of a further 1 to 3 years of water quality monitoring (NE letter dated 28th January 2010, refer to **Section 5.5**). This stance was primarily based on the conclusions of the 2009 Hydrological & Hydrogeological Assessment (refer to **Section 5.3**).

In February 2012, the principal landowner at Breadsell Farm submitted a Surface Water Strategy (Monson Engineering Ltd, 2012) to NE, HBC and RDC, addressing the concerns previously raised by NE. The report made several recommendations on how runoff from the development could be managed to prevent pollution of the Marline Valley Stream (refer to **Section 5.5**). However, NE re-asserted that further work was required in terms of baseline water monitoring and in designing a suitable Surface Water Drainage Strategy, which would safeguard the SSSI and associated bryophyte assemblage (refer to **Section 5.7**).

More recently, HBC is updating their Local Plan following changes to National Planning Policy Framework (NPPF 2019 and 2024). The new Local Plan will cover a 20-year period from 2019 to 2039. The update process includes planning for new development to meet local needs and enhance the environment for this period.

Hastings has an acute housing shortage and both councils are required to identify suitable sites for housing to meet the local need. As a result, there is a renewed focus on the Breadsell Farm site by both councils. Housing at the site should be delivered in a suitable way that is sympathetic to the neighbouring bryophyte assemblages and ideally benefits the condition of the Marline Valley SSSI.

1.4. Proposed Development

The proposed development is for residential end-use. The main access to the site will be via an access road off Hastings Road to the north. A concept masterplan of the development is included as **Figure 1-2**.

Figure 1-2. Concept Masterplan for the proposed development (Source: Re-Format LLP, dated June 2023).

1.5. Scope of Works

The scope of this Hydroecological Assessment has included the following:

- Identify the soil types, geology, hydrology and hydrogeology of the site and map existing features, by means of a desk-based study.
- Undertake a site walkover targeting ground conditions and existing drainage networks at the site.
- Evaluate surface water flow patterns, including runoff and drainage.
- Identify sensitive ecological and controlled waters (surface water and groundwater) receptors and evaluate how the Proposed Development might affect such receptors.
- Review key previous documents and reports relating to the site, including the concerns raised by NE regarding surface water runoff.
- Review nearby developments and associated responses from NE.
- Make recommendations regarding an approach to infiltration testing.
- Produce An outline Drainage Strategy for the site, which mimics natural conditions throughout the Proposed Development.
- Consider climate change effects on hydrology and ecology.
- Provide a summary of the main findings and conclusions of the report.
- Provide recommendations for future work and mitigation measures to minimise the impact of the Proposed Development, and address any further regulatory/planning requirements.

1.6. Limitations

This report has been prepared on behalf of and for the exclusive use of the Client, for whom the services were undertaken and is subject to and issued in connection with the provisions of the agreement set out by Hilson Moran. Hilson Moran accepts no liability or responsibility for or in respect of any use of or reliance upon this report by any third party. Furthermore, this report is subject to the following limitations:

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- Hilson Moran has not taken any steps to update this report since it was produced, and it accepts no liability for any part of this report that has or may become inaccurate as a result of circumstances that have occurred or arisen in relation to the project after the date of this report.
- No sampling or analysis of soils, waters or other materials has been carried out as part of this Hydroecological Assessment.

2. Site Walkover

The following information was derived from a site visit undertaken on 22nd October 2024 by three Geo-Environmental Consultants from Hilson Moran. The purpose of the visit was to assess the ground conditions and existing drainage networks on the site. Photographs taken during the site visit are provided in **Appendix A**.

Hilson Moran's visit covered the fields comprising the site, as well as areas of woodland and sections of the Marline Valley Stream, which were accessible (predominantly in the south-east of the site). It was not possible to access some of the woodland, (particularly in the north of the site) due to steep slopes down towards the Marline Valley Stream.

2.1. Site Description

The site covers an area of approximately 25.34 hectares (ha) and is located approximately 3.6 km north of St Leonards and 4.3 km north-west of Hastings town centre. The site is approximately centred on National Grid Reference 578109, 113113.

The site currently comprises three agricultural fields bordered by hedgerows and trees, with woodland in the east and south-east of the site. One field occupies the northern portion of the site and extends up to Hastings Road (A2100), which marks the northern site boundary. The other two fields are located adjacent to each other and occupy the southern portion of the site.

Coneyburrow Wood is located in the east of the site and Birchen Wood is located in the south-east of the site. Four Acre Wood is located adjacent to the south-east of the site and extends slightly on-site. These woods are designated as Ancient Woodland and form part of the Marline Valley Woods SSSI, which extends southwards to encompass Marline Wood and Park Wood (both off-site).

The Marline Valley Stream originates in Coneyburrow Wood and flows in a south-easterly direction through Birchen Wood, where the stream confluences with another branch of the stream (originating from the housing estate) and travels in a south-westerly direction along the southern boundary of the site, through Four Acre Wood. The stream continues to flow in this direction through Marline Woods and Park Woods (off-site to the south).

There is an area of woodland in the centre-west of the site, which separates the northern field from the two southern fields. Three ponds were observed within this woodland during the site visit, which are associated with a small watercourse flowing in a south easterly direction, which confluences with the Marline Valley Stream.

Current access to the site is via a gate off Breadsell Lane, which runs along part of the western site boundary and stems off Hastings Road (A2100) to the north-west of the site.

A map showing the watercourses and designated Ancient Woodland and the Marline Valley SSSI at the site is shown in **Figure 2-1.**

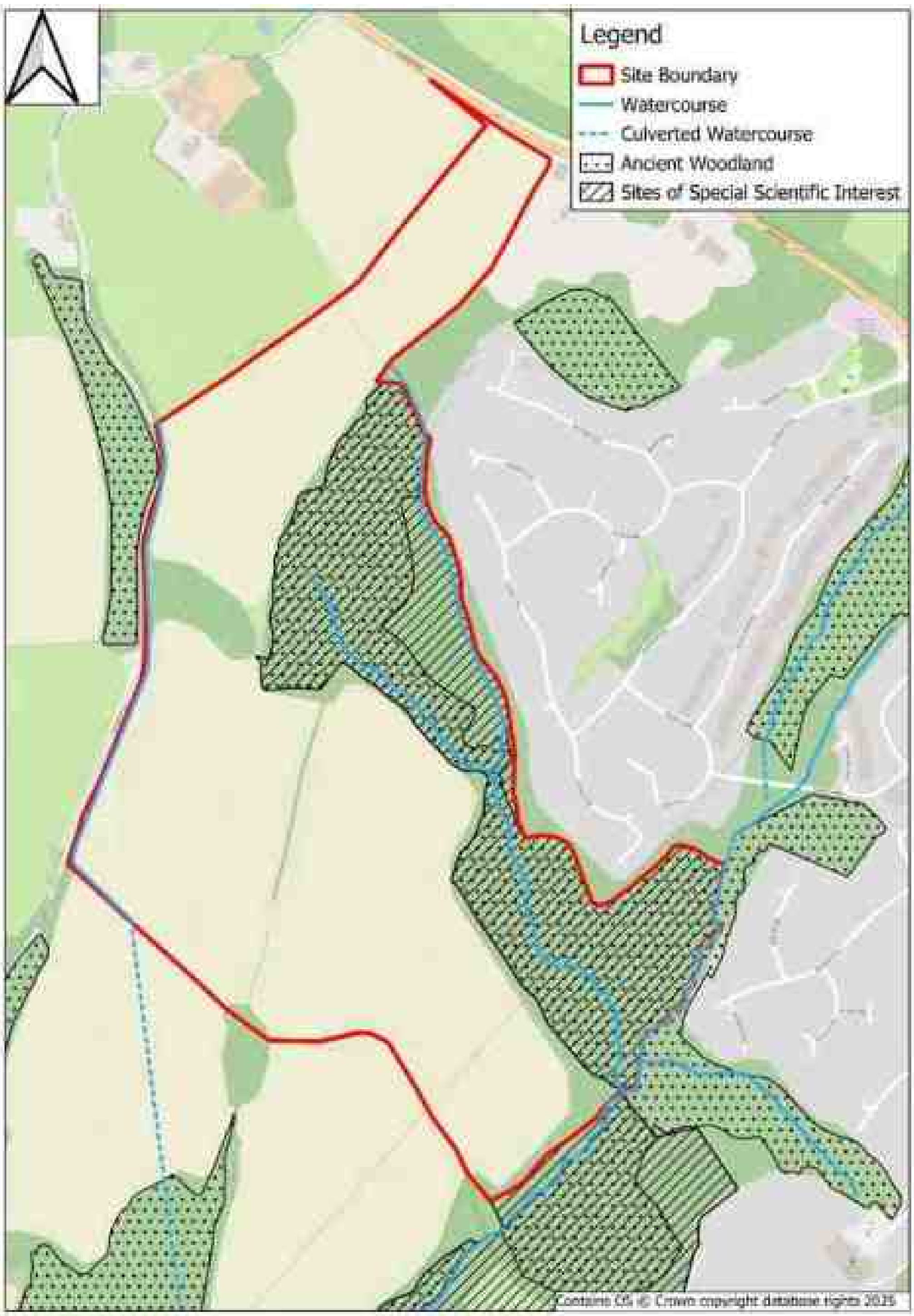


Figure 2-1. Watercourses, Ancient Woodland and SSSI in the site vicinity.

The following observations were made during the site visit:

- Crop residue and evidence of ploughing was observed in all three fields, indicating recent crop growing. Cattle troughs were present in the south-western and northern two fields, indicating previous use for livestock keeping.
- There is a well-defined network of drainage ditches around the perimeter of each field, which flow towards the Marline Valley Stream in the eastern part of the site.
- The site slopes towards the south and east, with steeper gradients in the southern portion of the site. Within the woodland, there are steep slopes down towards the Marline Valley Stream, which were inaccessible during the site walkover due to health and safety concerns.
- Three ponds were observed within the woodland separating the northern and southern fields (two in the west and one in the east).
- Soils were observed to be clayey, with occasional siltstone present.
- Surface water ponding was observed in some areas of the site, including the northern field and the far south-eastern portion of the site.
- A sheen was observed on the surface of water in some of the fields. This is possibly a hydrocarbon sheen originating from spillages from agricultural machinery, or could also be organic. A sheen was also observed on the surface of the Marline Valley Stream in some locations.
- Cloudy water and scum on the surface of the streams was observed in several locations.
- An electricity pylon was observed in the south of the south-eastern field, with associated overhead electricity power lines crossing the field and running in a north-east to south-west direction.
- A marker indicating the presence of a high-pressure gas pipeline was observed in the south of the site.

2.2. Site Topography

In terms of topography, the highest point on the site is on the northern boundary at an elevation of approximately 131 m above Ordnance Datum (AOD). The site slopes down towards the south and east, with the elevation at the southern-most point being approximately 64 m AOD. Observations from the site visit and topographical information show that the northern field slopes downwards at a gentler gradient than the two fields located in the south, which slope downwards more steeply. There is also a valley within the ancient woodland which slopes down towards the Marline Valley Stream. The lowest elevation on the site is located where the Marline Valley Stream meets the south-eastern boundary, at approximately 61 m AOD.

The topography of the area is shown on **Figure 2-2** below.

Figure 2-2 Topography of the site (Source: OpenStreetMap).

2.3. Surrounding Site Uses

The site is located on the outskirts of St Leonards-On-Sea, in a semi-rural area of mixed land use (predominantly agricultural and residential). The surrounding land uses were identified from desk-based sources and verified during the site visit, and can be summarised as follows:

- **North:** To the north, the site is bound by Hastings Road (A2100), with the Beauport Park Golf & Country Club and woodland beyond.
- **North-west:** The site is bound by agricultural fields to the north-west, with Breadsell Farm located approximately 125 m north-west and Bexhill Steelworks located 190 m north-west. An ornamental pond is located approximately 290 m north-west of the site.
- **East:** To the east, the site is bound by woodland and a housing estate (built before *c*. 2004). Beyond the housing estate, there is woodland containing streams which flow in a south-westerly direction and confluence with the Marline Valley Stream at the south-eastern site boundary.
- **South:** The site is bound by agricultural fields and woodland (Four Acre Wood) to the south, with residential properties located 130 m south-east and Park Farm located 380 m south-west.
- **West:** The site is bound by Breadsell Lane to the west, with agricultural fields and woodland beyond.

3. Site Information

3.1. Site History

Hilson Moran has undertaken a review of historical mapping and aerial imagery of the site and surrounding area from online sources (where available), including Old Maps Online[i] (Ordnance Survey maps of various scales), Google Earth Pro[ii] and Britian from Above[iii]. The findings are summarised in the following sections.

3.1.1. The Site

From the earliest available historical map of 1873, the site has comprised fields likely in agricultural use, with Coneyburrow Wood located in the east of the site and trees and hedgerows present along the field boundaries. A stream was shown to flow through Coneyburrow Woods in a south-easterly direction, where it confluences with another branch of the stream (originating from a field to the east of the site) and travelled in a south-westerly direction along the south-eastern boundary of the site (still present). By 1897 mapping, woodland located in the south-east of the site was labelled as Birchen Wood. No significant changes were noted in Ordnance Survey maps dated 1908, 1928, 1938 and 1950.

By the earliest available aerial imagery of 2004, the site still comprised agricultural fields, with Coneyburrow and Birchen Woods in the east of the site and trees and hedgerows along the field boundaries. No significant changes are evident up until 2024 imagery, apart from yearly crop growing and cultivation of the fields.

3.1.2. The Surrounding Area

The earliest available historical map dated 1873 shows the site was located in a predominantly rural area. The site was bound by a roadway (current A2100) to the north, agricultural fields and woodland to the east, agricultural fields and woodland to the south and a track (labelled Breadsell Lane from 1908) to the west. Beauport Park was located beyond the roadway to the north, with Park Wood and Crowhurst Park beyond the track to the west, and Marlin Wood to the south-west of the site (labelled as Marline Wood from at least 1897 mapping).

Several farms were located in the vicinity of the site, including Breadsell Farm ~140 m west and Park Farm ~440 m south-west (both still present). A pump house was located ~270 m west (present until at least 1950 mapping) and a brick and tile works was located ~560 m south-west (no longer in use by 1897).

Mapping dated 1908 shows several ponds were located in the vicinity of the site, including three ponds from ~15 m north in Beauport Park and a large pond ~140 m west to the north-east of Breadsell Farm (present until at least 1950).

By 1927, a large pond was present adjacent to the west of the site, and an additional smaller pond was present at Breadsell Farm. Gravel pits were labelled from ~520 m north-west of the site (present until at least 1950). Sewage beds were located ~50 m east of the site in Four Acre Wood, possibly associated with a High Beech property to the south-east (present until at least 1950).

By aerial imagery dated 2004, the roadway to the north of the site was labelled as the A2100 and a large housing estate had been constructed to the east of the site. A golf driving range was present ~20 m north of the site at the location of Beauport Park, with Bexhill Steelworks ~125 m north-west and Castleham Industrial Estate ~450 m south-east.

No significant changes in the surrounds are evident up until 2024 aerial imagery.

3.2. Environmental Records

3.2.1. Landfill Records

According to the Groundsure.io viewer[iv], there are no historical or authorised landfills within a 250 m radius of the site. The closet landfill record is 630 m east of the site and relates to a historical landfill at Beauport Park, operated by F Avann Ltd (first input 31st July 1982, last input 31st December 1989).

3.2.2. Radon Gas Risk

According to the Radon Map[v], the site does not lie in a “Radon Affected Area” as defined by Public Health England. The site is recorded as being located in an area where between less than 1% of residential properties are projected to contain radon above the residential action threshold.

Under Health and Safety legislation, employers have a duty to manage workplace risks including the potential for radon exposure. Health and Safety Executive guidance recommends radon monitoring for workplaces located in radon Affected Areas. If the workplace radon threshold is exceeded, the Ionising Radiations Regulations 1999 require employers to take action to reduce risks.

According to BRE Report BR211 (2015) Radon: Protective Measures for New Buildings, radon protection measures are not required under building regulations for new buildings at this location.

3.2.3. Preliminary Underground Services Search

The LinesearchbeforeUdig database, which lists pipelines distributing crude oil and refined hydrocarbon products owned and/or operated by a number of UK pipeline operators indicates that there are no records of underground oil or refined hydrocarbon product pipelines on the site or within 250 m.

The LSBUD database indicates that there are records of assets held by National Grid Electricity Transmission (electricity), SGN (gas), UK Power Networks (electricity) and Fulcrum Pipelines Ltd (gas) either on the site or within a 250 m radius (asset plans have not been obtained at this stage). *Hilson Moran observed a marker indicating the presence of a high-pressure gas pipeline in the south of the site during the site walkover.*

3.3. Unexploded Ordnance

A Pre-Desk Study Assessment (PDSA) was procured from Zetica UXO to identify potential sources of unexploded ordnance (UXO) at the site or in the surrounding area (if present) and determine whether further detailed research is required to assess the UXO risk. A copy of the PDSA is included in **Appendix B**.

During World War I (WWI), several potential bombing targets were identified within approximately 5 km of the site. However, no records were found to indicate that the site was bombed.

During World War II (WWII), several potential bombing targets were noted within approximately 5 km of the site. Records indicate that several high explosive bombs fell in close proximity to the site.

In 1944, Marshalling Area 'H' was established on land encroaching onto the north-western part of the site. Troops, vehicles, and supplies were concentrated within the marshalling area prior to the Normandy landings. After WWII, Marshalling Area H was disbanded, and the land was returned to civilian use.

During WWII, anti-invasion defences such as auxiliary unit operational bases and pipe mines, were established in the vicinity. After WWII, these were removed.

Overall, the PDSA recommended that a detailed desk study be undertaken to assess, and potentially zone, the UXO hazard level on the site.

3.4. Regulatory Information

3.4.1. Local Authority Planning Department

Hilson Moran has obtained a planning history of the site from the Planning Department of the Local Authorities (HBC and RDC). A summary of relevant applications submitted in relation to the site is provided below:

- **HS/OA/81/00552** - Comprehensive residential development. Change of use from agriculture to residential. Part of Breadsell Farm, Park Farm and Marline Wood, St Leonards-on-Sea. Withdrawn by applicant 7th December 1983. No further details available.
- **HS/OA/84/00085** - Residential development of 25.24 acres of land. Land at Breadsell Farm and Park Farm West of Marline Wood adjacent to

Breadsell Lane. Permission refused 31st August 1984 due to 1) there being sufficient housing land available elsewhere which has already been provided with the necessary infrastructure, and 2) it was considered premature to permit development prior to a review of the Hastings plan in 1986.

4. Hydroecological Assessment

Desk-based research of the local geology, hydrogeology and hydrology was carried out in order to establish the baseline conditions and assess the potential impacts of development on the nearby watercourses, biodiversity and SSSI.

Information was obtained from several sources, including:

- Geological maps published by the British Geological Survey (BGS);
- Publicly available BGS borehole logs for the site or near vicinity;
- Regulatory Authority websites including the Environment Agency (EA); and,
- Multi-Agency Geographic Information (MAGIC) Map Application managed by Natural England and delivered by Landmark Solutions.

4.1. Geology

4.1.1. Bedrock and Superficial Deposits

According to BGS 1:50,000 mapping of the area (Sheet 320/321), the site is directly underlain by bedrock comprising the Ashdown Formation (sandstone, siltstone and mudstone) in the east and south (lower-lying part of the site), and the Wadhurst Clay Formation (mudstone) in the higher western and northern margins of the site (overlying the Ashdown Formation), as shown in

Figure 4-1 below. No superficial geological deposits are recorded at the site.

Figure 4-1. Bedrock Geology underlying the site (Source: BGS Geology Viewer).

A valuable feature of the Marline Vally Woods SSSI (located on-site and adjacent to the site) is the steep sided stream valley ('ghyll'), which has been created by vigorous downcutting of the stream through the soft sandstones which underlie the Wadhurst Clay Formation.

4.1.2. British Geological Survey Borehole Records

The nearest publicly available BGS borehole log record is located approximately 430 m south-east of the site (borehole ref. TQ71SE228). This gives the following geological sequence:

- Medium to thickly bedded light grey mottled orange fine thinly laminated slightly weathered sandstone and light grey light brown mottled orange thinly laminated slightly weathered silty claystone to a depth of 4.85 m below ground level (bgl);
- Light grey and orange to orangish brown speckled black fine thinly to thickly laminated slightly weathered siltstone to 7.3 m bgl;
- Orangish grey thinly laminated extremely closely fissured slightly weathered silty claystone to 8.45 m bgl;
- Light grey and orangish brown speckled black fine indistinctly laminated silty sandstone to 11.3 m bgl;
- Brown to orange brown and light grey indistinctly laminated sandy siltstone to 12.3 m bgl;
- Orangish brown speckled black fine thinly to thickly laminated micaceous silty sandstone with thick light grey mottled orangish brown moderately weak clayey siltstone beds to 17.85 m bgl;
- Brown to greyish brown thinly laminated silty claystone with fine carbonaceous matter and occasional thick orangish brown fine sandstone beds to 19.68 m bgl; and
- Greyish green claystone to 20 m bgl.

4.1.3. Soils

With reference to the National Soil Resources Institute (NSRI) Soilscape[vi], the north-western part of the site consists of slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils. This includes the northern field and the north-western corner of the south-western field. The remainder of the site consists of slightly acid loamy and clayey soils with impeded drainage. This is shown in **Figure 4-2** below.

Figure 4-2. Soil types at the site (Source: NSRI Soilscape).

4.1.4. Mined, Worked and Infilled Land

According to the Coal Authority, the site is not located in a Coal Mining Affected Area. The Coal Authority Interactive Map does not show the site to be in a mine entry zone of influence or Development High Risk Areas.

As discussed in **Section 3.2.1**, the site and immediate surrounding area is not part of a permitted or historical landfill site.

4.2. Hydrogeology

4.2.1. Geological Aquifer Designations

The Ashdown Formation is classified as a Secondary A bedrock aquifer, while the Wadhurst Clay Formation is classified as an Unproductive Stratum and confines the underlying Ashdown Formation where present in the west of the site.

The EA currently classifies groundwater at the site (the Hastings Beds Cuckmere and Pevensey Levels Water Body) as being of ‘Good’ chemical quality and of ‘Good’ quantitative status under the Water Framework Directive (WFD) classification scheme, dated 2019.

There is currently no available groundwater level information for the site. As part of the Hydrological & Hydrogeological Assessment by Rigare Ltd in 2009, a hand-auger survey (29 locations) was carried out across the site to depths between 0.10 m and 2.10 m bgl. In the Wadhurst Clay, perched water was encountered at two locations (A4 and A20). No groundwater was reported in the Ashdown Formation at the shallow depths targeted by the investigation.

4.2.2. Source Protection Zones

The site is not located within an area covered by a Source Protection Zone (SPZ). A Zone III Total Catchment is located approximately 2.2 km west of the site.

4.3. Hydrology

According to the EA Flood Map for Planning, the nearest identified watercourse is the Marline Valley Stream, which is not classified as a “Main River”, and thus can be assumed to be an “Ordinary Watercourse”. The stream runs through the eastern part of the site within Coneyburrow and Birchen Woods (ancient woodland), flowing in a south-easterly direction. It then confluences with another branch of the stream and travels in a south westerly direction along the southern boundary of the site.

The Marline Valley Stream enters the Coombe Haven (the nearest Main River) approximately 1.9 km south-west of the site. The EA currently classifies the Coombe Haven as being of ‘Poor’ ecological quality and ‘Fail’ chemical quality under the WFD classification scheme (dated 2022 and 2019, respectively).

There are three ponds on the site, which are located within the woodland separating the northern and southern fields (and are associated with a small tributary of the Marline Valley Stream, which flows southeasterly through the woodland).

4.4. Flood Risk

4.4.1.1. Fluvial and Tidal Flooding

According to the EA’s Flood Map for Planning[vii], the majority of the site is located in Flood Zone 1. There are areas of the site adjacent to the Marline Valley Stream located in Flood Zones 2 and 3 (within Coneyburrow Wood, Birchen Wood and Four Acre Wood).

Flood Zone 1 (low probability). This zone comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1% in any year).

Flood Zone 2 (medium probability). This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding (1% – 0.1% in any year) or between a 1 in 200 and 1 in 1000 annual probability of sea flooding (0.5% – 0.1% in any year).

Flood Zone 3 (high probability). This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1% in any year) or a 1 in 200 or greater annual probability of flooding from the sea (>0.5% in any year).

It should be noted that EA flood zones in England do not take into account the presence of flood defences. The EA's Flood Map for Planning is shown below in **Figure 4-3**.

Figure 4-3. EA Flood Map for Planning.

4.4.1.2. Surface Water Flooding

According to the EA Long-term Flood Risk Map, which presents the theoretical potential for flooding from pluvial sources (*i.e.*, flooding caused by rainwater exceeding capacity of drainage systems), the site is predominantly located in an area of very low flood risk. There is a surface water flow path of low risk flowing in a southerly direction across the northern field towards the ancient woodland and Marline Valley Stream. The areas immediately adjacent to the Marline Valley Stream and ponds are at high risk, however these are contained within the woodland and do not encroach onto the fields. These surface water flood flow routes will need to be preserved within any masterplan for the site, ideally within green infrastructure corridors.

Very Low flooding probability - This zone comprises land assessed as having a less than 1 in 1,000 annual probability of pluvial flooding (<0.1% in any year).

Low flooding probability - This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of pluvial flooding (1% – 0.1% in any year).

Medium flooding probability - This zone comprises land assessed as having between a 1 in 100 and 1 in 30 probability of pluvial flooding (3.3% - 1% in any year).

High flooding probability - This zone comprises land assessed as having a 1 in 30 or greater annual probability of pluvial flooding (>3.3% in any year).

The EA Long-term Flood Risk Map is shown below in **Figure 4-4.**

Figure 4-4. EA Long-term Flood Risk Map.

4.5. Ecology

4.5.1. Environmental Designations

4.5.1.1. Marline Valley Woods SSSI

The site includes the northern part of the Marline Valley Woods SSSI, namely Coneyburrow Wood and Birchen Wood, within the site boundary. The SSSI boundary also encompasses Four Acre Wood located adjacent to the south-east of the site (extents partially on-site), and Marline and Park Woods to the south of the site (off-site). Marline Wood Local Nature Reserve (LNR) is located adjacent to the south-west of the site. The LNR forms part of the larger Marline Valley SSSI, and is owned by HBC and managed by the Sussex Wildlife Trust.

The whole site therefore lies within a SSSI Impact Risk Zone. It includes a steep sided stream valley fed by several tributary streams along the length of the SSSI. The reasons for SSSI notification under Section 28 of the Wildlife and Countryside Act 1981[viii] can be summarised as follows:

- A valuable feature is the steep sided stream valley (ghyll) which contains plants that have an 'Atlantic' distribution due to a moist, warm microclimate.
- The ancient woodlands are dominated by pedunculate oak-hornbeam, a nationally uncommon woodland type. Pedunculate oak, hornbeam, hazel and sweet chestnut are all common, with scattered stands of beech, birch, ash and field maple. Alder occurs discontinuously along the stream valley and in small flushes which drain into the stream, with occasional coppices.
- In terms of the shrub layer, holly is locally common, and shrubs associated with ancient woodland (butcher's broom and midland hawthorn) are present.
- In terms of the ground flora, honeysuckle, enchanter's-nightshade, dog's mercury, bluebells and wood avens are often abundant. The stream valley and lateral flushes support pendulous sedge, yellow archangel and opposite-leaved golden saxifrage.
- The stream valley has previously been recorded to support up to 61 species of bryophytes (refer to **Section 4.5.1.3** below for further details), although the current diversity and range of bryophytes will be confirmed by a recently commissioned bryophyte survey, the results of which were pending at the time of writing this report.
- The agriculturally unimproved pasture supports a species-rich neutral grassland flora, dominated by lesser knapweed, red fescue and common bent. Other species adding to the interest include adder's-tongue fern, dyer's greenweed, quaking grass and common spotted-orchid.

4.5.1.2. Environmentally Designated Sites

In addition to the Marline Valley Woods SSSI, there are several other environmentally designated sites within a 2 km radius. These include;

- High Weald Area of Outstanding National Beauty (AONB) located adjacent to the north and west of the site, the boundary of which runs along the A1200 to the north of the site and Breadsell Lane to the west.
- Church Wood and Robsack Wood LNR is located 920 m south-east, with Ponds Wood LNR 2 km south-east.
- Maplehurst Wood SSSI is located 1.87 km north-east of the site.

There are no Ramsar sites, Special Areas of Conservation (SACs) or Special Protection Areas (SPAs) within 2 km of the site. The site is not located within a green belt and there are no green belts recorded within 2 km of the site.

Coneyburrow Wood, Birchen Wood and Four Acre Wood (on-site) are designated as Ancient Woodland. There are many other areas of Ancient Woodland within

2 km of the site, including woodland 10 m west, Marline Wood 30 m south, woodland 40 m east, woodland 70 m south, Alder Wood 80 m south and Brickyard Shaw 490 m south-west.

4.5.1.3. Bryophytes

The SSSI stream valley has previously been reported to support up to 61 species of bryophytes (liverworts, hornworts and mosses), including 3 uncommon ‘Atlantic’ species: *Fissidens rivularis, Tetrodontium brownianum* and *Metzgeria furcata*. The Atlantic bryophyte vegetation within the SSSI requires humid conditions to persist.

Hilson Moran have liaised with a bryophyte expert (Sharon Pilkington of Vegetation Survey and Assessment) who previously completed a comprehensive baseline survey and condition survey of the bryophyte assemblage for Natural England in 2012. Hilson Moran commissioned her to undertake a further survey, which was completed in Spring 2025. The main conclusions and recommendations of the 2025 survey are outlined below, and the full survey report is included as **Appendix C.**

The main conclusions of the survey are:

- Farmland in the vicinity of the site is of negligible importance for bryophytes. However, the SSSI woodland of Coneyburrow Wood and Birchen Wood supports populations of two of the three species of the bryophyte assemblage feature, as well as other nationally and locally notable species. This makes it vulnerable to impacts linked to construction of the proposed site.
- The Marline Valley Woods SSSI is of high importance for the ghyll stream bryophytes, and supports a considerable number of species for a site of this kind in south-eastern England:
    - *Fissiden rivularis* is widespread throughout the ghyll streams except in areas where sediment deposition is high.
    - *Tetrodontium brownianum* on stream bank sandstone was rediscovered.
    - The *Metzgeria conjugata* population, which has always been very small and restricted to one place, appears to have dwindled further since it was last seen in 2020. This liverwort is now at high risk of being lost from the SSSI.
- Most other notable species are thriving except for the semi-aquatic moss *Sciuro-hypnum plumosum* which has declined considerably since 2012. This species is likely to have suffered from the effects of siltation and possibly from flow-related movement of small stones in stream channels.

New species are being recorded in the ghyll streams, the most notable being *Sematophyllum substrumulosum* on deciduous deadwood.

- Previous bryophyte assessments of the SSSI indicate how vulnerable the communities of the ghyll streams are to hydrological impacts caused by adjacent land-use, but also demonstrate that the site has recovered from such impacts in the past. However, the uncertainty about impacts driven by climate change now and in the future must be acknowledged.
- The twin arms of the ghyll stream that rise in springs near the upper edge of Coneyburrow Wood support important habitat features including a waterfall and rocky cascades. Previous and current assessments have concluded that the eastern arm of the stream is likely to be a primary source of the high levels of silt carried down into the SSSI and deposited as silt bars and mud. Water-driven erosion and the slumping and collapse of ghyll stream banks are natural physical processes that are very likely being increased by climate change. Climate change is likely causing more prolonged and intensive episodes of rainfall that drain into the ghyll streams and saturate the clay soil of the bank, making slumping and collapse more probable. Piped outfalls of run-off from the adjacent residential area into the same part of the eastern stream will exacerbate this problem.
- Siltation is currently considered to be the most serious threat to the SSSI's stream-associated bryophyte communities, with other potential impacts from development (Table 2) to be of far less consequence. It is therefore very important that the proposed development at Breadsell Farm does not worsen the existing problem.

The main recommendations of the survey are as follows:

- To minimise impacts of erosion and siltation in the SSSI from the proposed development, it is important to incorporate appropriate drainage, treatment and water management into the development design and to carefully control the quality and volume of water entering the ghyll stream catchment.
- To prevent silt-laden run-off entering the SSSI streams during the construction phase(s), it is recommended that appropriate and effective measures are taken to contain and manage drainage from the development.
- Run-off from roads, hard surfacing and roofs should be captured within the development and treated on-site with appropriate features to remove silt and pollutants at source and to allow gradual infiltration to groundwater and evaporation.
- Access of people into Coneyburrow Wood and Birchen Wood from the new development should be carefully planned and managed to prevent a

proliferation of entry points and paths within this part of the SSSI. In particular, stream crossing points would benefit from construction of footbridges to discourage bank erosion.

- The drainage strategy for the proposed development should comply fully with the recommendations for an outline sustainable drainage strategy presented within this Hydroecological Assessment (refer to Section7), which aims to mimic the existing scenario and limit disturbance to the local hydrogeological regime and associated bryophyte assemblage in and around the stream.

4.6. Groundwater and Surface Water Vulnerability

The site is considered to be situated in an area of moderate sensitivity with respect to groundwater resources due to the underlying Secondary A Aquifer in relation to the Ashdown Formation, which underlies most of the site (eastern and southern portions). The Wadhurst Clay Formation (western and northern margins of the site) is classified as unproductive strata. The EA classifies groundwater at the site (Hastings Beds Cuckmere and Pevensey Levels Water Body) as being of ‘Good’ chemical quality and of ‘Good’ quantitative status under the WFD.

At present, the vulnerability of the groundwater receptor in the vicinity of the site is considered to be high as the whole site comprises fields, with no superficial deposits or hardstanding to afford protection against the vertical migration of contaminants into groundwater. Where present in the far north and west, the Wadhurst Clay Formation (unproductive strata) should offer some protection of the underlying aquifer. The proposed development would introduce buildings / hardstanding cover and likely reduce this vulnerability.

The sensitivity of the hydrological receptor can be considered as high, as the nearest identified watercourse is the Marline Valley Stream which runs through the eastern part of the site. The stream enters the Coombe Haven (the nearest Main River) approximately 1.9 km south-west of the site, which has a ‘Poor’ ecological quality and ‘Fail’ chemical quality under the WFD.

5. Previous Reports & Documents

The following key reports and documents pertaining to the site have been obtained from the HBC website[ix] and/or provided to Hilson Moran for review:

- Letter - Hastings Borough Council LDF Core Strategy, Preferred Approaches, Natural England, 3rd July 2008;
- Bryophyte Survey of the Breadsell Lane Area of Upper Marline Wood, Simon Davey Ecological Consultancy, September 2009;
- Review of Hydrological Information for the Proposed Development at Breadsell Lane, Premier Water Solutions Ltd, September 2009;
- A Scoping Level Hydrological and Hydrogeological Assessment of a Proposed Housing Development Site, Breadsell Lane, Rigare Ltd, December 2009;
- Letter - Breadsell Lane allocation – Hydrological report, Natural England, 28th January 2010;
- Surface Water Strategy for Proposed Site Allocation, Breadsell Lane, Hastings, East Sussex (Ref. 5274), Monson Engineering Ltd, February 2012; and
- Letter - Breadsell Lane Surface Water Strategy by Monson Engineering (Ref. 46830), Natural England, 10th April 2012.

5.1. 2008 NE Letter on the LDF Core Strategy

This letter was written by NE in response to HBC's request for comments on their LDF Core Strategy document. With regard to the allocation of the Breadsell Lane site (*which covered a much larger area than the current site*), the following concerns were raised:

- This site is adjacent to Marline Valley SSSI and on the boundary of The High Weald AONB. Full consideration should be given when assessing site suitability to the impacts on these designated sites, taking into consideration other potentially damaging proposals in the area.
- The document clearly states that planning permission should not normally be granted on land within/outside of a SSSI if it is likely to have an adverse effect.
- NE was highly concerned about the nature and location of this option and would be minded to **object** to any future application to develop this area.
- Any application for housing in this area has the potential to adversely affect the SSSI in the following ways:

- Hydrological Impact – impacts of the quality and quantity of water feeding into the ghyll streams within the SSSI, which support bryophyte assemblages;
- Increased visitor disturbance; and
- Fragmentation of the SSSI – severing biodiversity links to the wider environment, isolating genetic reserves of flora and fauna.

5.2. 2009 Bryophyte Survey

This report summarises the findings of a Bryophyte Survey undertaken by Simon Davey Ecological Consultancy on behalf of Applied Ecology Ltd for the purposes of assessing the bryophytes present in the stream systems that flow into Marline Wood from the Breadsell Lane areas of Coneyburrow and Birchen Woods. *Hilson Moran notes that the appendix which includes a map showing the survey area divided into seven sections which are referred to throughout the report is missing and has made a request to HBC to provide it (response still pending).*

The survey concluded that the study area is not a healthy habitat for bryophytes, as many common species that would be expected in such areas are absent or only present in very small quantities. The report identified several anthropogenic and natural factors likely influencing the abundance, distribution and quality of the bryophyte assemblages within the SSSI, which are summarised below.

Reference is made to a housing estate in the 'north of the survey area'; *Hilson Moran understand this to be the estate located immediately east of the site.*

The report states that the stream system suffers from 'a very low water quality' and identifies several potential reasons for this, as follows:

- There are five outflows from the housing estate into the stream system, only one of which had flow. Visual and olfactory evidence of contamination was noted, including cloudy water and scum on the surface of the streams and on a settling tank directly downstream of one of the outflows, which also had an 'offensive' odour. The report attributed this to car washing in the housing estate. *The plan showing the outfall locations is missing from the report (see above).*
- The stream system drains water off farmland. In view of the 'low water quality' and low bryophyte health in two sections of the study area (one of which does not receive outfall from the estate), it was considered probable that farming run-off (including from a nearby chicken farm) is a contributing to the decline.
- There have been several reported sewage spillages from the housing estate, impacting surface water quality.

- The ghyll streams that abut onto the SSSI from the housing estate reportedly suffer from rubbish dumping, particularly with garden waste dumped over rear garden fences identified as a major issue.

Other environmental pressures identified as impacting the bryophytes included:

i. Iron bacteria (and associated orange discolouration) is frequent in the Marline Valley Wood LNR downstream from the survey area. This impacts the bryophytes, as despite being natural, the insoluble iron compounds form a slime over the stream beds/rock, preventing establishment.

ii. Light levels within the SSSI were low, largely due to fallen coppice. Fallen trunks and branches, overgrown with bramble, were observed to clutter most of the streams, with further shading by holly growth.

iii. Public pressure, including trampling and erosion, largely from people living in the housing estate and by mountain bikers.

The report concluded: "*If the important bryophyte communities in this SSSI are to have any chance of survival, water treatment into the stream system must be improved throughout. This would result from a biological treatment using reed development in ponds to all water entering the system from the housing estate, and an assessment of water quality, and possible action over farming activities. Public access should be controlled and organised away from sensitive bryophyte areas. Leaf accumulation though quite natural will also present photosynthesis in areas of dense woodland*."

Recommendations included investigation into water quality issues associated with the housing estate outfalls, careful designing of future development on land off Breadsell Lane with appropriate SSSI stand-off buffers, development of a SSSI Access Strategy and preparation of a Surface Water & Pollution Control Strategy.

Hilson Moran note that several limitations were identified with the 2009 survey, including the time of year it was undertaken (late season), the lack of light due to the presence of a dense leaf canopy, and restricted access to parts of the system due to vegetation and health and safety concerns.

Furthermore, reference is made to 'poor water quality' throughout the report, which is attributed to urban runoff, sewage discharges and fly-tipping associated with the housing estate to the north-east, elevated nutrient concentrations from agricultural runoff and orange staining of the water due to natural iron bacteria within the water column. It should be noted that these conclusions are based on visual and olfactory observations taken by the surveyor, and no sampling and analysis of surface water was undertaken as part of the survey.

5.3. 2009 Review of Hydrological Information

This report was prepared by Premier Water Solutions (PWS) Ltd in response to HBC's request for additional information regarding the use of Sustainable Urban Drainage Systems (SuDS). A Preliminary Hydrology Report by HydroLogic Ltd was also reviewed within the report.

Upon reviewing the Preliminary Hydrology Report, PWS noted that the emphasis was to assess the natural hydrological processes at the site, principally the water balance as it affects the SSSI. Rainfall monitoring, surface water and groundwater level monitoring and indication of the evapotranspiration rates was considered to be required to inform SuDS development. PWS agreed with the main principles of the drainage scheme proposed by HydroLogic, *i.e*. the ground is not suitable for standard infiltration techniques such as soakaways.

PWS noted that the ghyll streams are important in maintaining the SSSI habitat and the drainage system must mimic the existing processes affecting the streams. PWS proposed to retain the surface water runoff in a series of underground tanks, with rainfall temporarily stored in the tanks, with an attenuated discharge rate of approximately 1 l/s. The attenuation systems would then be collected via a series of networks (above ground swales or traditional underground pipework) before discharging into communal tanks/ponds for further attenuation. PWS proposed that attenuating surface water at the top of the development would reduce the rate of flow, which would otherwise be fast flowing in pipework and swales due to the steepness of the catchment and could cause erosion and scouring.

PWS proposed the following systems for use in the development, but emphasised that the final design will depend on the results from site investigations and hydrological monitoring, and a detailed masterplan:

- Rainwater recycling tanks to collect rainwater from the roofs of private and commercial properties and stored in tanks for non-potable uses;
- Individual attenuation tanks to store surface water runoff and released at a rate of approximately 1 l/s into a subsurface collection system;
- Larger underground attenuation tanks to store surface water from commercial and community areas;
- Permeable paving for pedestrian, private road and driveway surfaces, which would allow the surface water to infiltrate directly into the ground or be collected via pipework and discharge into ponds/tanks for further attenuation (to be determined by percolation tests);
- Possible use of green roofs to attenuate rainfall runoff and enhance the natural surrounding habitat;

- Conduit system to collect and further attenuate the attenuated surface water from commercial and residential areas;
- A separate drainage system to collect surface water from estate roads in line with East Sussex County Council's requirements, such as large underground tanks or above ground ponds attenuated to the Greenfield runoff rate;
- A separate surface water treatment system may be used in 'pollution hotspots' *e.g*. oil interceptors at highway locations;
- Multi-stage treatment train to improve water quality (including sediment control), comprising permeable paving, initial attenuation tank, swales, and above ground ponds before discharging into the ghyll stream; and
- Use of ponds indicated on the edge of the development as a final 'polishing' and settlement of the water before discharging into the stream.

PWS recommended that a Surface Water Management Plan is prepared for the construction phase of the development, where suspended solids are likely to be a greater risk than post construction.

5.4. 2009 Hydrological & Hydrogeological Assessment

This report summarises a scoping level Hydrological and Hydrogeological Assessment prepared by Rigare Ltd on behalf of HBC to assess the potential impacts of developing land between Breadsell Lane and the Marline Valley Woods SSSI. *Hilson Moran note that this report relates to the site and additional portions of land (also comprising agricultural fields) to the north-west and south-west.*

The scope comprised mapping of ponds and drains (including flow directions and rates into the valley), assessment of the effective rainfall, estimation of stream and ditch flows, identification of the clay/sandstone geological boundary and a hand-auger survey to test theoretical boundaries and depth of clay.

Rigare reported that the shallow geology broadly conforms with BGS mapping of the area (refer to **Section 4.1**) with minor exceptions. The auger survey confirmed the highly variable nature of the geology. Sandstone was reported to be close to the surface beneath much of the site and was typically overlain by a variable sequence of silt and sand, but minimal clay. Where the Wadhurst Clay is mapped, the geology was noted to be dominated by clay, but was again highly variable, with inclusions of silt, sand and gravel. It was considered possible that this represents the transition between the Ashdown Sandstone and Wadhurst Clay.

Rigare defined surface water catchments on and in the vicinity of the site using field observation and Ordnance Survey maps (refer to Figure 3-2 of their report, reproduced as **Figure 5-1** below). The Weald watershed bounds the northern edge of the Marline Valley, and two prominent ridges of high ground bound its western and eastern edges. According to Rigare, the site is almost wholly contained within four smaller-scale surface water sub-catchments feeding the Marline Valley stream/SSSI. Rigare estimated the percentage of surface water runoff to groundwater baseflow for the four catchments based on hydrological statistics from the nearby area. *Hilson Moran notes that most of the area covered by the current site is within Catchment 1, with the southern part extending into Catchments 2 and 3.*

Figure 5-1. Water Features mapped by Rigare (Source: Rigare).

The Hydrological Conceptual Model of the site was outlined as follows:

- The average slope gradient across the site is approximately 10%, which combined with the poorly permeable topsoil, results in a higher proportion of the effective rainfall running off over the surface (60-75%) than infiltrating to groundwater (25-40%).
- The Marline Valley Stream running through the SSSI has a quick/flashy response to rainfall.

- During periods of low rainfall, the catchment discharge to the Marline Valley Stream will be low.
- There are several ephemeral springs feeding water into the catchment.
- There is most likely a continuous groundwater baseflow to all but the upper parts of the Marline Valley Stream.
- The topographic ridge on which the site is located stores a small volume of groundwater above the elevation of the streams to either side and is thought to at least partially source the ephemeral springs.
- The spatial and temporal variation of groundwater levels and flow is complex, and is largely controlled by the surface/subsurface lithology and permeability which controls surface infiltration, and groundwater storage and flow.

A preliminary assessment of the potential hydrological and hydrogeological impacts of the Proposed Development highlighted four key factors:

1) Risk of altering the distribution and quantity of surface water runoff through acceleration and redirection from hardstanding and drainage networks. *Hilson Moran note that this could be mitigated through an appropriately designed SuDS system which includes SuDS features being dispersed throughout the site, storing and releasing runoff at existing greenfield rates at multiple points along the watercourse.*
2) Risk of the addition of contaminants to surface water runoff will impact surface water quality. *Hilson Moran note that this could be mitigated through implementation of a Construction Phase Plan (CPP) during the construction phase, along with an appropriately designed drainage system to remove potential contaminants during the operational phase. Furthermore, the change of site use from agricultural to residential would remove this existing on-site contamination source (fertilisers and pesticides), which seems to be overlooked by Rigare.*
3) Risk of changing the distribution of groundwater recharge, flow and discharge due to low permeability surfaces. *Hilson Moran note that this could be mitigated through the inclusion of infiltration SuDS where possible, which would aid groundwater recharge. BRE365 infiltration testing will determine current infiltration rates, which should be mimicked by any proposed infiltration SuDS to ensure that any change to groundwater recharge, flow and discharge is minimal.*
4) Risk of the addition of contaminants to groundwater will impact groundwater quality. *Hilson Moran note that the same mitigation measures for surface waters apply to groundwater.*

The report concluded that: "*A basic understanding of the hydrological functioning of the site could be developed from the results of one full year of monitoring, but* *at least three years monitoring will be required in order to develop a sufficiently refined understanding to enable detailed design of the hydrological aspects of a development*".

The report provided a strategy for the first year of monitoring, which comprised:

i. Three-monthly visits to the site under varying groundwater, rainfall and surface water runoff conditions, to observe and map more effectively the groundwater discharge and drainage features across the site, and to carry out monitoring as detailed below.

ii. Installation of at least four deep (up to 50 m) groundwater boreholes.

iii. High-frequency monitoring of groundwater levels to refine the conceptual understanding of the groundwater system (e.g. confirm the absolute elevation and annual fluctuations of the water table and compare these with the elevations and flow conditions of the mapped springs, and compare groundwater level response with rainfall events, in order to develop an understanding of surface infiltration processes).

iv. Monitoring of surface water and groundwater quality in boreholes and springs within and close to the site, and in stream channels.

v. Observation and monitoring of surface water runoff processes, including flow gauging of stream channels at appropriate locations.

vi. Monitoring of parameters which define the hydro-environmental supporting conditions of conservation interest features, within or close to those features, e.g. install shallow wells to monitor soil water levels within stands of alder and lower plants in lateral flushes, and to carry out observations of groundwater seepage from key areas for bryophytes.

Hilson Moran note that if a 'basic' understanding of the hydrological functioning of the site could be developed from one year of 3-monthly monitoring visits, then a year-long comprehensive programme including monthly monitoring could provide a more in-depth understanding and potentially support the allocation of the site. A proposed water monitoring programme is provided in ***Section 8.2.22*** *of this report.*

5.5. 2010 NE Letter – Rigare Hydrological Report

This letter was written by NE in response to the Hydrological and Hydroecological Assessment produced by Rigare for the Breadsell Lane allocation (refer to **Section 5.4** above). NE made the following comments:

- The hydrological report concludes that the hydrology of the site is complex and "*a basic understanding of the hydrological functioning of the site could be developed from the results of one full year of monitoring*". NE had previously commented that a site-specific understanding of the local hydrological and hydrogeological conditions would be required to assess the environmental capacity of the site and inform whether the proposals would impact the SSSI.

- As the report is unable to provide this information, NE did not consider that there was sufficient information, at this stage, to determine the impacts of the proposed allocation on the SSSI and that further studies, as recommended in the report would be required to address this. NE therefore maintained its **strong objection** to the inclusion of this site as a strategic allocation.

5.6. 2012 Surface Water Strategy

This report presents a Surface Water Strategy prepared Monson Engineering Ltd ('Monson') in connection with the proposed site allocation at Breadsell Lane. The purpose of the report was to consider the impact that development may have on the adjacent SSSI, which is a potential constraint to the site allocation. Monson reduced the site area (*understood to be more in line with the current red line boundary, however a clear boundary is not included in the report*), designed a new masterplan and developed a surface water strategy. *Hilson Moran notes that the strategy responded to some of the potential hydrological impacts raised by Rigare.*

The report identified sustainable drainage issues as a key concern of NE and therefore concentrated on such issues. Monson reported that the base flow in the Marline Valley Stream is generated primarily from groundwater, and that it is this element which needs to be safeguarded. The proposed strategy detailed how runoff from the development can be managed to prevent pollution of the stream. The design utilises SuDS with the aim of replicating the greenfield situation.

The SuDS proposed by Monson are summarised below:

- Parking and driveways will infiltrate to groundwater.
- Roof water will infiltrate to groundwater.
- Spine roads will be constructed with swales to allow water to infiltrate to groundwater.
- Any excess surface water runoff will go to additional storage and infiltrate to ground.
- Any water exceeding the capacity of the infiltration system will be transferred to attenuation ponds, which will have a controlled outlet to the SSSI.
- The attenuation ponds could be used to feed water into the SSSI at low flows.

- Pollution prevention measures will also be introduced, such as specialised membranes, trapped gullies, interceptors and reed beds.

The Surface Water Strategy also proposes two mitigation measures to further safeguard the flows through the SSSI:

1) Construction of an augmentation borehole to abstract groundwater from the Ashdown Beds and supply water to the top end of the watercourse at low flows (subject to agreement with the EA and NE); and
2) Possible installation of reed beds at the edge of the existing eastern housing development (at the end of the surface water drain outfalls) to reduce pollutants reaching the watercourse.

5.7. 2012 Natural England Letter – Monson Strategy

This letter was written by NE in response to the Surface Water Strategy by Monson (refer to **Section 5.6** above). The letter summarises NE's understanding of the site and their concerns over the potential impact of the development on the hydrological regime of the site and the SSSI, including brief summaries of both the Rigare and Monson reports.

NE's concerns can be summarised as follows:

- **Site Area**: It is vital for the understanding of the site and the protection of the SSSI that the hydrology is considered for the site as a whole and is not split across the administrative boroughs (HBC and RDC).
- **Water Quality**: The proposed SuDS begin to solve the potential hydrological impacts relating to water quality if properly designed, implemented and maintained. However, NE was concerned about the outflow of water from the attenuation ponds to the SSSI. During a storm event, water will not have time to infiltrate to the ground, and may not have passed through any of the SuDS membranes. Therefore, polluted water could become resident within the ponds, and although natural attenuation should occur over time, polluted water could be discharged directly to the SSSI shortly after a storm event.
- **Hydrology Change**: Whilst the proposed SuDS should protect groundwater and surface water from pollution, they will significantly alter the distribution and quantity of surface water runoff. Currently, approximately 70% of water feeding the stream is from surface water runoff. The SuDS will collect surface water and allow it to infiltrate to groundwater, altering the hydrology.
    - The EA considered the northern part of the SSSI (Coneyburrow Wood and Birchen Wood), which lies entirely within Catchment 1, to be most at risk due to the high percentage area proposed for development and subsequently the changes to the hydrology. This northern part is fed by 2 tributaries marked as Issues, which are considered likely to be surface water and not groundwater.

   - The natural gradient of the site and proposed location of the SuDS ponds suggests that surface runoff from the higher northern part of the site will potentially drain south and east, potentially bypassing the northern part of the SSSI before infiltrating to groundwater. The Issues sourcing the northern tributaries rise at ~110m AOD and 120m AOD, however the proposed ponds are located further south and much lower at 70 m AOD. Significant pumping would be required to return this water to the current stream sources.

- **Low Flows**: The proposed SuDS include the option to pump water from the attenuation ponds into the SSSI at low flows. NE considered this an interesting idea, but would like to see supporting calculations on the volume of water likely to be available following an extended dry period. It is also vital that this water has been resident within the attenuation ponds for long enough to remove contamination.
- **Mitigation Measures**: The construction of a borehole to supply water to the SSSI at low flows would need licensing. NE considered that the borehole might be licensed with a condition which could stop abstraction during dry periods and would require further information on the technique. In addition, the installation of reed beds at the edge of the housing estate was considered an excellent idea and would help safeguard the SSSI from diffuse urban pollution.

NE noted that the Monson report states that it is unreasonable for NE to object to the proposal based on a lack of hydrological and hydrogeological information. The strategy then tried to set out how the use of SuDS will not change the current natural water environment. NE argued that it is not possible to state the full extent and impact of the hydrological changes without having a better understanding of the current hydrological regime, but it can be stated that there will be significant changes that will have the potential to impact the SSSI. NE again referenced the Rigare report and the requirement for monitoring work to characterise the site's complex hydrology to a sufficient degree.

NE also highlighted the potential damage to the SSSI from recreational pressure, and would have concerns regarding potential impact from trampling and pollution on the ghyll streams.

NE concluded that although the proposed SuDS have the potential to protect the SSSI from pollution, the strategy has not understood the complex hydrology of the site and has therefore failed to protect and mirror the natural environment. NE stated that proper site characterisation is required to inform a strategy which does not alter the current hydrological and hydrogeological regime, and reiterated that for them to remove their objection, at least 3 years of monitoring would be required to develop a detailed hydrological understanding and provide a baseline against which future change can be assessed.

Due to the very close proximity of the Proposed Development to the SSSI, as well as existing pollution from the eastern development, NE considered it vital that the site hydrology is both understood and not significantly changed, which can only be done through further monitoring work.

NE would also require an assessment of the potential impacts from recreational pressure and how these could be avoided or mitigated.

6. Nearby Developments

Hilson Moran has undertaken a review of the HBC planning portal to identify available information relating to developments and proposed developments nearby to the site and also adjacent to the SSSI, and the associated responses from NE and English Nature (merged with the Countryside Agency & Rural Development Service to form NE in 2006). The findings of this review are summarised in the following sections.

6.1. High Beech Residential Estate

The housing estate located adjacent to the east of the site (and therefore also adjacent to the SSSI) is accessed via Washington Avenue, which stems off Battle Road (B2159) to the east.

It appears that the estate was developed by Tristar Development under Outline Planning Permission Ref. HS/FA/85/00060 for 255 homes (granted 30th May 1985) and several plot-specific applications.

Upon review of the Decision Notice for the outline application, the only condition relating to the protection of the SSSI was Condition 4, which required drainage to include the provision of all measures necessary to prevent pollution of adjoining watercourses. No English Nature correspondence is available.

6.2. Stonebeach Rise Residential Estate

The housing estate located adjacent to the east / north-east of the site (and therefore adjacent to and upstream of the SSSI) is accessed via Stonebeach Rise from a roundabout at the eastern end of the A2100.

It appears that most of the estate was developed by Prowtings Homes under Outline Planning Permission Ref. HS/OA/91/0787 for up to 400 homes (granted 22nd February 1994), with later areas built by Bloor Homes and River Oaks Homes under various applications dating up to 2000 (relating to land south of Wynchnour and Hoads Wood North). Supporting infrastructure including a balancing pond, roads, footpaths, sewers, pumping station and rising main for foul sewerage were constructed under separate planning permissions.

Some of the Decision Notices for the applications can be viewed on the planning portal and reference is made to conditions applied under the outline permission, however no documents relating to this permission are available. No additional documents (such as English Nature correspondence) are available to view.

6.3. Hoads Wood North Residential Estate

This smaller residential estate is located between the above two estates, adjacent to the site and also the head of the Marline Valley Stream, and is accessed via Cooden Ledge which stems off Stonebeach Rise to the west.

It appears that the estate was developed by Westbury Homes under Full Planning Permission Ref. HS/FA/03/00622 for 93 homes (granted 24th December 2003). In terms of protecting the SSSI, Condition 2 required the design and installation of SuDS sufficient to control all surface water run-off and prevent any pollution entering adjoining watercourses both during construction and operation, and Condition 15 required a Wildlife protection Plan.

The site was allocated for residential purposes for many years and was the subject of a previous permission and also subject of a 'call-in' public inquiry in June 2001.

English Nature was originally concerned that the development would result in damage of the SSSI, and ancient woodland would also be lost. However, the area that was considered ancient woodland was protected from development and other areas did not fit the ancient woodland definition. Sustainable drainage systems were included within the development and English Nature understood that water quality monitoring would occur during and after development. Support for the LNR and extension to the LNR (including a financial and land contribution) was also indicated. English Nature, therefore, had no further objections to the residential development despite being adjacent to the SSSI.

6.4. Queensway South

The Queensway South site (also referred to as 'Marline Fields' and 'Enviro 21 Park') is located 400 m south of the site, adjacent to the east of Marline Valley Woods. From a review of available information, it is understood that the site is situated upslope of the SSSI and the site drainage, in the form of sub-surface flow, provides water for the springs and small incised streams/ghylls of the SSSI.

The site was first approved for a 16,062m^2 office development in June 2005 (Ref. HS/FA/04/00679), followed by a revised proposal comprising seven office units and an energy centre in November 2007 (ref. HS/FA/07/00966), with the addition of a facility for business, education and community use ('Innovation Exchange') and restaurant to the existing permission in October 2008 (Ref. HS/FA/08/00501).

In support of the original application (Ref. HS/FA/04/00679), a Surface Water Management Plan (SWMP)[x] was submitted and required water quality monitoring pre-construction (monthly), during development (monthly) and during operation (monthly for the first year then frequency reduced). English Nature approved the proposal for a year-long data set prior to construction, and even stated that this could be reduced to a minimum of three months (letter dated 1st March 2005). An Annual Water Quality Report[xi] was prepared in 2006 to determine the site's baseline hydrochemical conditions. It was considered that the results from one year of water quality monitoring provided a good pre-construction dataset to be used for comparative purposes once development commenced.

According to a Hydrogeological Risk Assessment[xii] submitted in support of application Ref. HS/FA/08/00501, a change in land-use would have the potential to affect the quantity and quality of the water draining to Marline Woods. The report noted that NE required the quality and quantity of water draining the site during construction and operational phases to not be significantly different than that under existing baseline conditions.

Following submission of application Ref. HS/FA/08/00501 (including an EIA), NE produced a response letter (dated 20th August 2008) which stated that although some key information was missed, much work had been done to secure a Section 106 Agreement and adequate enforceable conditions accompanied the consented scheme (ref. HS/FA/07/00966). Many of these conditions, particularly those relating to hydrology, protected species and wildlife, are also applicable to the current scheme (Ref. HS/FA/08/00501). NE did not object to the application on the basis that the same strict conditions and Section 106 Agreement were attached and the concerns listed in the letter by NE were fully addressed.

These concerns included the requirement for a full year of hydrological monitoring data prior to the construction works (as undertaken for the original permission back in 2005) to establish a reliable baseline from which to extrapolate accurate trigger and control levels, which will indicate any change in future water quality/quantity during construction and operation.

The conditions applied required a Wildlife Protection Plan, scheme for surveying and monitoring all protected species (including bryophytes), Habitat Management Plan, ground investigation, remediation and verification, SSSI buffer zone, 5 m watercourse buffer, approval for imported material, CEMP (including measures to protect groundwater and the SSI). Monitoring was not outlined in a condition.

Since then, it is apparent that only part of the approved development was constructed, and various other applications have been proposed, including:

- HS/FA/08/00849 - Proposed 2-megawatt wind turbine and associated ground infrastructure and temporary construction works. Granted with conditions 6th July 2009.
- HS/FA/21/00846 - Proposed development of an allocated site to consist of: Building to provide office space, storage and loading areas. Concrete yard for large vehicles and plant storage. Staff and visitor car parking. Submitted 6th September 2021, Status: Registered.

- HS/FA/24/00632 - Coffee shop with drive thru facility with associated parking and landscaping. Validated 9th September 2024.

In relation to the latest application for a coffee shop in an empty plot, NE noted that the likely impacts arising from the proposal are straightforward to assess with confidence by following the advice notes provided, and where necessary, providing further information.

6.5. Queensway North

A proposed development site known as 'Queensway North' is located from approximately 220 m south-east of the site on the opposite side of Four Acre Wood, and is therefore also adjacent to the Marline Valley Woods SSSI. From the topography of the site, it is considered likely that surface water runoff from the site falls towards the low ground and the Marline Stream to the north-west.

Table 6-1. Queensway North Development Planning History

Application Ref.	Status	NE Response
HS/FA/12/0067 - Construction of a new junction including a short length of access road to facilitate the future development of North Queensway.	Granted 8th October 2012, subject to conditions.	No objection in relation to the SSSI as the nature and scale of the proposal was not considered likely to have an adverse effect.
HS/FA/12/00802 - Construction of an estate road and associated infrastructure and works (including drainage & utilities) to facilitate future development of a business park (divided into three plots).	Granted 8th March 2013, subject to conditions. Development completed.	No objection in relation to the SSSI as the nature and scale of the proposal was not considered likely to have an adverse effect. Subject to a Section 106 Agreement, including a Site Management Plan setting out construction and operational requirements to control potential impacts on SSSI.
HS/FA/15/00817 - Construction of new factory premises comprising manufacturing space, showroom, offices, welfare facilities and ancillary service yard and car park areas.	Granted 9th February 2017, subject to conditions. Lapsed/Expired.	NE expressed several concerns that needed to be addressed by the applicant. Overall, no objection subject to conditions.
HS/FA/16/00330 - The erection of a car showroom and workshop, display parking, customer car parking, internal access road and landscaping.	Granted 3rd August 2017, subject to conditions.	NE expressed several concerns that needed to be addressed by the applicant.

Application Ref.	Status	NE Response
	Lapsed.	Overall, no objection subject to conditions.
HS/FA/18/00761 - Proposed new car showroom and workshop, as well as associated uses including plant, pedestrian and vehicular circulation, car parking, cycle parking, hard and soft landscaping, and utilities - Plot 1.	Granted 22nd January 2019, subject to conditions. Lapsed.	NE expressed several concerns that needed to be addressed by the applicant. Overall, no objection subject to conditions.
HS/FA/21/00327 - Business park development to deliver business units consisting of 4010m² of light industrial/ manufacturing units (use classes E/B2), 490m² of bespoke space for a local employer, and the renewal of planning permissions HS/FA/16/00330 & HS/FA/18/00761 for car showrooms (1215 sqm), as well as associated uses including plant, pedestrian and vehicular circulation, car parking, cycle parking, hard and soft landscaping and utilities.	Non determination 18th September 2024.	NE made several objections and original requests for further information, which the applicant responded to in February 2022. NE responded in April 2022, and the client then provided a response to the objections in July 2022.

7. Outline Drainage Strategy

7.1. Background

The NPPF states that the Government's policy is to reduce flood risk. Therefore, the development of the site should be seen as an opportunity for environmental enhancement and a net reduction in flood risk. As such, a development should aim to reduce runoff below the existing runoff rates and volumes. If this is deemed impractical due to various constraints, the proposed development should at least maintain runoff rates and volumes at existing conditions. In order to limit disturbance to the bryophyte assemblage within the Marline Valley SSSI, it is proposed that existing runoff rates, volumes and where possible, discharge points to the Marline Valley Stream are maintained at the site.

East Sussex SuDS guidance[xiii] states that the area of impermeable surfaces within East Sussex has increased as a result of development. This leads to an increase in the amount of water and pollutants entering rivers and drainage systems, increasing the risk of flooding to local communities. SuDS can be used to manage the environmental risks caused by surface water runoff from new and existing development, and can also be designed to enhance the local environment.

The application site is currently a greenfield site. The development will result in an increase in impermeable surfaces due to the construction of floorspace, highways and other hard landscaping. Based on the current concept masterplan (**Figure 1-2**), this increase will be from 0% to approximately 22%.

Consequently, without the inclusion of mitigation measures the proposed development will increase the surface water runoff rates and volumes compared to current conditions.

To provide betterment and to futureproof the scheme against climate change, the proposals will include the attenuation of surface water runoff rates and volumes from the site, to maintain discharge rates at the existing (greenfield) rates throughout the lifetime of the scheme, taking into account the impact of climate change.

This will be achieved by incorporating SuDS into the design and is detailed in the later sections of this chapter.

SuDS can be a combination of both physical structures and techniques used to control surface water runoff as close to its origin as possible before surface water discharges to a watercourse or ground. There is a wide variety of sustainable drainage options available that can be applied in different ways to help manage both surface and ground waters in a sustainable manner. Specific solutions need to be developed for each site, the choice of which will depend on factors such as the nature of the site, the type of pollutants potentially present, the hydrology of the area, and the presence of Groundwater Source Protection Zones (SPZs).

The implementation of SuDS as an alternative to conventional drainage systems can achieve significant direct and indirect long-term environmental benefits. Depending on the choice of the system these can include:

- Reduction in overall flood risk on-site and downstream from the proposed redevelopment by reducing surface water runoff to watercourses, either permanently or after peak flow periods in the system;
- Providing an opportunity for infiltration of surface water into soil, where feasible, to replenish groundwater, and help maintain baseflows in rivers;
- Promoting a healthier waterway flow regime to receiving watercourses and reducing the impact of bank erosion and habitat damage caused by the increase in flow rate of additional surface water runoff;
- Reducing the quantity of pollutants reaching waterways and infiltrating the ground; and
- Habitat creation and enhancement of the amenity of an area. This applies predominantly to open drainage options, especially where wet ponds or wetlands are implemented.

7.2. General Design Concept

For new developments, there is a general expectation that a drainage system should be adequate, particularly with regard to drains created by developments subject to Building Regulations. Adequate performance will usually be achieved if the drainage system:

- Conveys the flow via a suitable network or treatment systems to a suitable outfall (a soakaway, a watercourse, surface water, or combined sewer);
- Minimises the risk of blockage or leakage with good access for clearing blockages and any necessary maintenance;
- Has sufficient capacity to carry or retain the expected flow at any point in the system and so does not increase the vulnerability of the development to flooding; and
- Provides drainage from roofs or paved areas to an adequately and suitably designed drainage system.

It should be noted that:

I. The priority for discharge of rainwater is first to an adequate soakaway or infiltration system, if that is not reasonably practicable then to a watercourse, the last option is to a sewer; and

II. Discharges into the ground (where permitted) should be distributed sufficiently so that the foundations of buildings or structures are not damaged.

7.3. SuDS Hierarchy

When designing the SuDS Strategy, reference has been made to the SuDS Hierarchy outlined in the Hastings Strategic Flood Risk Assessment[xiv] (SFRA).

The proposed bespoke SuDS solution has been arrived at through a process of elimination in the following way:

- **"*Store rainwater for later use*"** – It is proposed that blue roofs are incorporated into the design where feasible. This will be investigated at the detailed design stage.
- **"*Use infiltration techniques, such as porous surfaces in non-clay areas*"** – The hydrological assessment of the site shows that the development is not within a SPZ, with the closest SPZ3 (Total Catchment) located approximately 2.2km west of the site. The NRSI soil map has indicated however that the soils within the site are slowly permeable and only seasonally wet. It is recommended that infiltration testing is required to determine if discharge to the ground is feasible. Refer to **Section 8.2.1** for further information on the recommended infiltration testing.
- **"*Attenuate rainwater in ponds or open water features for gradual release*"** – It is proposed that runoff is attenuated within swales, ponds and detention basins before being discharged from the site.
- **"*Discharge rainwater direct to a watercourse*"** – It is proposed that runoff is discharged to the Marline Valley Stream on site at multiple discharge points. Proposed runoff rates will be reduced to existing greenfield rates, as per the existing scenario. This method of discharge will mimic the existing multiple natural discharge points into the stream from the various springs and ditches that dissect the site. This will limit disturbance to the bryophyte assemblage in and around the stream as a result of the development.
- **"*Discharge to a surface water sewer/drain*"** – Flows will be discharged to the Marline Valley Stream (and via infiltration if deemed feasible), which is higher on the SuDS hierarchy and therefore a more sustainable drainage solution.

- "***Discharge rainwater to the combined sewer***" Flows will be discharged to the Marline Valley Stream (and via infiltration if deemed feasible), which is higher on the SuDS hierarchy and therefore a more sustainable drainage solution.

7.4. Preliminary Runoff Calculations

7.4.1. Methodology

The greenfield peak runoff rates for a range of return periods have been estimated using the IH124 methodology, included within HR Wallingford's Greenfield Runoff Rate Estimation Tool. For sites <50 ha, the method uses a pro-rata methodology based on IH Report 124 with growth curves from the Flood Studies Report and CIRIA Book 14. The method requires input of the standard average annual rainfall (SAAR) for the site in question (which ranges between 781-798 mm).

GIS watershed analysis shows that the site has seven distinct surface water sub-catchments that drain to separate tributaries of the Marline Valley Stream. Catchments 1 and 2 drain in a south east direction towards Coneyburrow Wood, and Catchments 3, 4 and 5 drain in a south east direction towards Birchen Wood. Both of these woods are located within the eastern part of the site. Catchment 6 drains in a south east direction towards Four Acre Wood, positioned south east of the site, and Catchment 7 drains in a southerly direction towards Alder Wood, located south of the site.

The seven catchments drain to separate tributaries of the Marline Valley Stream, which confluence approximately 450 m south of the site. Runoff rates and volumes have been calculated for each of the seven catchments on site. The seven catchments are shown in **Appendix D.**

The SuDS Manual sets out two approaches for managing flows and volumes from a development site. One of the approaches requires that the flow rates discharged from the site are controlled at a rate equivalent to the runoff from a greenfield site for a 1 in 1 year return period (whenever a 1 in 1 year rainfall event occurs), up to the equivalent runoff from a greenfield site for a 1 in 100 year return period (whenever a 1 in 100 year rainfall event occurs). Greenfield runoff rates are generally 3-4 times greater for the 1 in 100 year rainfall event when compared to the 1 in 1 year rainfall event. To capitalise on the use of the 1 in 100 year greenfield runoff allowance, long term storage (LTS) must be provided; whereby a specified volume of water is held on site for a longer period in comparison to the attenuated storage volume.

The calculations for the development's surface storage requirements were produced using HR Wallingford's surface water storage tool.

7.4.2. Greenfield runoff rates

The greenfield runoff rates have been calculated using the HR Wallingford's Greenfield Runoff Rate Estimation Tool, which are shown below in **Table 7-1.** Full calculations are included in **Appendix E.**

Table 7-1. Greenfield runoff rates.

Catchment	Peak 1 in 1 year Greenfield runoff rate (l/s)	Peak 1 in 30 year Greenfield runoff rate (l/s)	Peak 1 in 100 year Greenfield runoff rate (l/s)
1	12.68	34.3	47.57
2	9.04	24.46	33.93
3	9.09	24.59	34.11
4	9.42	25.5	35.37
5	12.61	34.13	47.34
6	9.06	24.52	34.01
7	14.13	38.24	53.04
Total	**76**	**206**	**285**

7.5. Climate Change

Within the design of drainage networks for new developments, the incorporation of an appropriate allowance for future climate change impacts on peak rainfall intensities is recommended to ensure that all future developments give rise to a net reduction in runoff rates and volumes throughout their operational lifetime.

Updated UK Government climate change allowances are available for the "*Cuckmere and Pevensey Levels Management Catchment peak rainfall allowance*" online (refer to https://environment.data.gov.uk/hydrology/climate-change-allowances/rainfall).

Both central and upper end allowances for peak rainfall intensity are provided. Associated guidance advises that "*for flood risk assessments and strategic flood risk assessments, assessments should be provided for both the central and upper-end allowances to understand the range of impact*". Assuming a 100 year lifetime for the proposed development, the guidance suggests that the total potential change anticipated for 2061 to 2125 is 45% for the upper end allowance in the 1 in 100 year event.

7.6. Mitigation Consideration

The existing site currently comprises three agricultural fields with the Marline Valley SSSI (including the Marline Valley Stream) in the eastern part of the site.

The intention is to attenuate surface water flows from the site and discharge at greenfield rates to the Marline Valley Stream. Flows will be discharged from each drainage catchment and will enter the Marline Valley Stream at seven separate locations.

It has been calculated that:

1. The peak greenfield runoff rate for the entire site in the 1 in-1-year rainfall event is **76 l/s** and for the 1 in 100-year rainfall event is **285 l/s**.

2. In order to achieve greenfield runoff rates for each catchment, the 1 in 1-year and 1 in 100-year discharge rates will be regulated at greenfield runoff rates for each catchment as shown in **Table 7-1**.

3. The additional development runoff volume for the 1 in 100-year rainfall event requires **1782 m³** of attenuation storage and **727 m³** of long-term storage to achieve greenfield runoff rates. The total storage requirement is **2508 m³.** These values include a 45% allowance for climate change. The required attenuation storage per catchment is shown in **Table 7-2** and **Appendix F.**

Table 7-2. Required attenuation storage volumes.

Catchment	Attenuation Storage (m³)	Long term storage (m³)	Total storage (m³)
1	181	63	244
2	390	175	565
3	169	49	218
4	365	164	529
5	197	74	271
6	70	20	90
7	410	182	591
Total	**1782**	**727**	**2508**

7.7. SuDS Design Concept

The SuDS strategy will be based on guidance from the SuDS Manual, the DEFRA 2015 Non-Statutory Technical Standards for Sustainable Drainage Systems along with local guidance provided from East Sussex's SuDS Guidance and the Hastings SFRA.

The DEFRA 2015 Non-statutory Technical Standards require the reduction of runoff rates from the proposed development during the 1 in-1 year and the 1 in-

100-year events to respective greenfield rates, accounting for the effects of climate change on rainfall-runoff over the lifetime of the proposed development. Ideally:

"For greenfield developments, the peak runoff rate from the development to any highway drain, sewer, or surface water body for the 1 in 1-year rainfall event and the 1 in 100-year rainfall event should never exceed the peak greenfield runoff rate for the same event."

and

"Where reasonably practicable, for greenfield development, the runoff volume from the development to any highway drain, sewer or surface water body in the 1 in 100-years, 6- hour rainfall event should never exceed the greenfield runoff volume for the same event."

Local guidance is based on the following requirements:

Runoff rates

East Sussex SuDS Guidance: Runoff rates and volumes should not exceed the existing rates prior to development.

Hastings SFRA: Runoff rates from new development should be restricted to greenfield runoff rates wherever possible

SuDS Hierarchy

East Sussex SuDS Guidance: Developments should aim to discharge surface runoff as high up the SuDS Hierarchy as possible, as outlined in the Planning Practice Guidance and Non-statutory Technical Standards. The SuDS Hierarchy is outlined in **Section 6.3.**

Hastings SFRA: Sustainable drainage should be delivered in accordance with the SuDS Hierarchy outlined in **Section 6.3.**

7.8. Proposed Drainage Strategy

The main storage mechanism for the additional surface water runoff at the site will be via detention basins and attenuation ponds. Filter strips and swales will also be provided on the site, but will be used for conveyance of runoff only. The potential for infiltration will be confirmed by BRE365 infiltration testing in due course, however, for the purposes of this report a worst-case scenario has been adopted which assumes that all runoff during the 1 in 100 year event will need to be attenuated.

It is intended that the surface water on the site will be positively drained from the site via gravity. From the drainage strategy sketch (**Appendix G**), this will mainly be by swales, filter strips and conduit pipes. Flows will be discharged to the Marline Valley Brook via outfall pipes at ten locations across the site as shown in **Appendix G.**

The flows from the outfall pipes will be controlled by a "complex flow control" device such as a Hydrobrake (vortex flow control) to ensure that the rate of discharge from the site will be regulated at greenfield rates during the 1 in 1-year and 1 in 100-year rainfall events.

The gradients of the slopes of the swales, detention basins and attenuation ponds should be gentle and not exceed 1:3 to allow safe access and egress, and bankside maintenance. The swales, filter strips, detention basins and attenuation ponds present an opportunity to enhance biodiversity, such as creating wetlands.

The total attenuation volume provided across the site in detention basins and attenuation ponds is **3380 m^3**, which is enough storage to attenuate the additional flows from a 1 in 100-year rainfall event (including 45% climate change allowance). The basins and ponds will have an average depth of 400 mm, except in Catchment 6 where they will have an average depth of 200 mm. A breakdown of the attenuation volume provided per catchment is shown in **Table 7-3** below.

Table 7-3. Proposed attenuation volumes.

Catchment	Attenuation Storage provided (m^3)
1	266
2	720
3	288
4	703
5	525
6	244
7	634
Total	**3380**

7.9. Water Quality

Guidance in the SuDS Manual, East Sussex Suds Guidance and Water.People.Places.[xv] recommends the use of SuDS treatment trains in order to remove pollutants from site runoff before discharge to receiving waters. A treatment train is a number of SuDS components in a series through a development site which facilitates the capture, conveyance and storage of runoff while delivering interception and pollution risk management. A SuDS treatment train is a robust pollutant strategy. Using multiple SuDS components in series targets a range of particulate-bound and dissolved pollutants, improving water quality. At least one SuDS treatment train has been provided in each of the catchments on the site.

The Simple Index Approach, as outlined in the SuDS Manual, has been applied to each of the proposed SuDS treatment trains on the site. The Simple Index Approach follows a three-step process:

1. Allocate suitable pollution hazard indices for the proposed land use
2. Select SuDS with a total pollution mitigation index that equals or exceeds the pollution hazard index
3. Where discharge is to protected surface waters or groundwater, consider the need for a more precautionary approach

Step 1 – Define pollution hazard indices

The pollution hazard indices presented in **Table 7-4** are relevant for the land use categories on the proposed site (residential use).

Table 7-4. Pollution hazard indices at the proposed site (Source: SuDS Manual).

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 and non-residential car parking with infrequent change	Low	0.5	0.4	0.4
Total pollution hazard index	-	**0.7**	**0.6**	**0.45**

Step 2 – Determine SuDS pollution mitigation indices

The proposed SuDS components should have a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type) in order to provide adequate treatment. This is determined by the following formula:

Total SuDS mitigation index >= pollution hazard index
(for each contaminant type) (for each contaminant type)

In England and Wales, where the principle destination for runoff is to a surface water but small amounts of infiltration may occur from unlined components, then the groundwater indices should be used for the discharge to groundwater and the surface water indices should be used for the main surface water discharge. For the purposes of this assessment, until infiltration testing has been conducted, it has been assumed that there will be no targeted infiltration on the site and therefore only the surface water indices have been assessed.

Where the mitigation index of an individual component is insufficient, then two or more components in series will be required, where:

$$\textbf{Total SuDS mitigation index} = \textbf{mitigation index}_1 + 0.5\ (\textbf{mitigation index}_2)$$

A factor of 0.5 is used to account for the reduced performance of secondary or tertiary components associated with already reduced inflow concentrations. The SuDS mitigation indices relevant for the site are shown in **Table 7-5**.

Table 7-5 SuDS mitigation indices at the proposed site – surface water (Source: SuDS Manual)

SuDS Component	Mitigation indices		
	TSS	Metals	Hydrocarbons
Swales	0.5	0.6	0.6
Filter strips	0.4	0.4	0.5
Detention basins	0.5	0.5	0.6
Attenuation ponds	0.7	0.7	0.5

Step 3 - Consider the need for a more precautionary approach where discharges are to protected waters

Protected surface waters or groundwater is defined by the SuDS Manual as those which are protected for the supply of drinking water. This is not the case for the proposed site, however the SuDS Manual recommends that for developments in close proximity to an area with an environmental designation, such as a SSSI, consultation should be made with relevant conservation bodies such as Natural England.

Table 7-6 shows the SuDS treatment trains provided in each of the catchments on the site, along with the total SuDS mitigation index per catchment, calculated using the formula outlined above. It has been demonstrated that the SuDS mitigation index (**Table 7-6**) is greater than the pollution hazard index (**Table 7-4**) for each contaminant type in each catchment. The SuDS treatment trains will therefore provide adequate pollutant removal on site before runoff is discharged to the Marline Valley Stream.

Table 7-6. Proposed SuDS treatment trains and total SuDS Mitigation indices for surface water.

Catchment	SuDS treatment train	Mitigation indices		
		TSS	Metals	Hydrocarbons
1	Swale > Swale	0.75	0.9	0.9
	Basin > Swale	0.75	0.8	0.9
2	Basin > Swale	0.75	0.8	0.9
3	Pond > Filter Strip > Basin	1.15	1.15	1
4	Basin > Swale > Swale > Basin > Swale	1.5	1.65	1.8
5	Filter Strip > Swale > Swale > Basin > Swale	1.4	1.55	1.7
	Basin > Filter Strip	0.7	0.7	0.85
6	Filter Strip > Swale > Pond	1	1.05	1.05
7	Basin > Basin > Swale > Pond	1.35	1.4	1.45

7.10. Maintenance of SuDS

Maintenance will be required to ensure that the SuDS features within the site remain functional throughout the lifetime of the proposed development. It is anticipated that the maintenance will be secured by planning conditions for the duration of the proposed development. This will be subsequently coordinated and paid for by the applicant and comprise:

- Periodic checking of inspection chambers and pipework for blockages or physical damage, and remediation as required;
- Periodic jetting or rodding of pipework as required to clear blockages;
- Periodic desilting of the flow control (e.g. Hydrobrake) sump. The sump should be emptied/checked at least as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, then every 5 years;
- Swales and detention basin: Monthly to half yearly mowing (spring and autumn) dependant on vegetation length preference, together with half yearly inspection of inlets, underdrain pipes and outlets for blockages or physical damage and management of other vegetation;
- On-site wetland vegetation and silt disposal; and
- Also ensure that safe access and egress is maintained throughout the lifetime.

8. Conclusions and Recommendations

8.1. Conclusions

The site covers an area of approximately 25.34 ha and is located approximately 3.6 km north of St Leonards and 4.3 km north-west of Hastings town centre. The site currently comprises three agricultural fields bordered by hedgerows and trees, with woodland in the east and south-east of the site. This woodland is designated as Ancient Woodland and forms part of the Marline Valley Woods SSSI, which extends southwards to encompass Marline Wood and Park Wood (both off-site). The Marline Valley Stream flows in a southerly direction through the Marline Valley SSSI and there is varied bryophyte assemblages present within the SSSI associated with the stream.

There are several previous reports and documents pertaining to the site which have been reviewed as part of this assessment, including a Bryophyte Survey commissioned by Hilson Moran in 2025, Hydrological and Hydrogeological Assessment, Surface Water Strategy and consultation responses from NE. NE have previously objected to the allocation of the site for development, due to the potential impact upon the bryophyte assemblages within the SSSI as a result of changes in the site's hydrological and hydrogeological regime. NE have also raised concerns with the previously proposed Surface Water Strategy for the site which need to be addressed. The proposed drainage strategy within this report therefore aims to limit the disturbance to the bryophyte assemblage by mimicking existing conditions and flows into the Marline Valley Stream.

NE have also argued that it is not possible to state the full extent/impact of the hydrological and hydrogeological changes resulting from the development without having a better understanding of the current regime, and require at least 3 years of water monitoring. This 3-year monitoring requirement is based on a report produced for the site in 2009. Hilson Moran has undertaken a review of available information relating to developments and proposed developments nearby to the site and also adjacent to the SSSI, and the associated responses from NE. It is apparent that one year's worth of monitoring has been considered sufficient to establish pre-construction baseline conditions for previously approved planning applications on sites where runoff/baseflow also feeds into the SSSI. Hilson Moran has produced a comprehensive surface water and groundwater monitoring plan, which is outlined in **Section 8.2.2.**

The outline sustainable drainage strategy proposed in this report aims to limit disturbance to the bryophyte assemblage in the SSSI. The total proposed impermeable area is yet to be confirmed; however, the concept masterplan shows there will be a potential increase in impermeable surfaces on the site from 0% to 22% as a result of the development. In order to return runoff rates to greenfield rates post-development, **3380 m³** of attenuation within Sustainable Drainage System (SuDS) features will be provided within the site. This will be achieved by installing detention basins and attenuation ponds within the site. Swales and filter strips will also be used to convey runoff throughout the site. Runoff will be attenuated within these SuDS features and discharged to the Marline Valley Stream at seven different locations across the site (one outfall for each drainage catchment). By limiting proposed runoff rates to existing greenfield rates, this mimics the existing scenario and limits disturbance to the bryophyte assemblage in and around the stream as a result of the development.

The volume of storage provided exceeds the requirement to attenuate the additional flows from a 1 in 100-year rainfall event (including 45% climate change) to greenfield rates and will not increase flood risk elsewhere.

The Simple Index Approach as outlined in the SuDS Manual has been applied to each of the proposed SuDS treatment trains on the site. It has been demonstrated that the SuDS mitigation index is greater than the pollution hazard index for each contaminant type in each catchment. The SuDS treatment trains will therefore provide adequate pollutant removal on site before runoff is discharged to the Marline Valley Stream.

8.2. Recommendations

Several recommendations are made on the basis of the findings of this Hydrogeological Assessment, which are outlined in the following sections.

8.2.1. Infiltration Testing

Preliminary infiltration testing (carried out as per BRE 365) and logging of trial pit soils should be commissioned at the site to determine shallow soil characteristics and representative soil infiltration rates. The findings will inform the production of an appropriate SuDS Strategy for the site, which will aim to mimic existing greenfield runoff rates and volumes. This will maintain the levels and flows within the Marline Valley Stream, which is important for preserving the current environmental conditions which are beneficial to the bryophyte assemblage.

Hilson Moran have liaised with the Lead Local Flood Authority (LLFA) for the site (East Sussex County Council) to confirm their planning requirements. For developments proposing to discharge to ground, they will require the results from infiltration testing to accompany the SuDS Strategy submitted with a future Outline Planning Application.

A total of seven (7 No.) infiltration testing locations are proposed. The locations have been chosen to reflect potential SuDS locations and to assess changes in geology/soils across the site and are shown in **Figure 8-1.**

Figure 8-1. Proposed infiltration testing locations.

If infiltration is found to be feasible and there is a risk of elevated groundwater levels, the LLFA require groundwater level monitoring (fortnightly readings from November to the end of March) to demonstrate that there will be at least 1 m unsaturated zone between the base of the infiltration features and the highest groundwater level recorded. The boreholes installed for this purpose could also be retained for future groundwater monitoring associated with contaminated land planning requirements.

At the time of writing this report, a proposal had been provided to the Client for the infiltration testing. If infiltration is found to be feasible, a scope for the above groundwater level monitoring in line with LLFA requirements will be provided.

8.2.2. Water Monitoring Programme

Given the urgency of both HBC and RDC in allocating suitable housing sites, and previous conclusions by Rigare Ltd that a basic understanding of the hydrological functioning of the site could be developed from the results of one full year of monitoring, it is proposed to conduct an initial, year-long comprehensive monitoring programme to provide physical and qualitative data on surface water, groundwater and soil conditions, and potentially enable allocation of the site.

It is anticipated that subsequent monitoring would then continue beyond this initial 1-year programme, focussing on any identified data gaps, and conducted in parallel with Local Plan production/examination and/or the submission and determination of an appropriate planning application for the scheme.

This approach would align with other projects and schemes where there are potential impacts on SSSIs sensitive to changes in the hydrological/hydrogeological regimes, and where NE has agreed, through consultation, to one-year's pre-development monitoring in order to provide suitable baseline data and understand the interactions between the proposed scheme and the nearby water-sensitive SSSIs. Examples of other recent schemes, where similar timeframes of pre-application monitoring has been agreed with NE include:

i. The monitoring of groundwater and related surface water features by Anglian Water in connection with the construction (including dewatering), operation and maintenance of the Cambridge Waste Water Treatment Plant Relocation Project (CWWTPR)[xvi]. The scheme has the potential to detrimentally impact the nearby Stow-cum-Quy-Fen SSSI (designated includes a number of pools formed on Chalk Marl, which support a range of aquatic plants including some uncommon species) and Wilbraham Fens SSSI (large area of fen and neutral grassland with associated scrub and open water communities). The groundwater and surface water monitoring programme was agreed in consultation with Natural England and the Environment Agency, as key stakeholders, in August 2023 and comprised:

    - Pre-construction monitoring of groundwater levels and quality for 12 months prior to construction from boreholes on and closer to the construction site (monthly dips and quarterly water quality sampling);
    - Comprehensive surface water quality monitoring suites, together with levels and flows (quarterly) for 12 months prior to construction, of ditches feeding into the SSSIs and water bodies within the SSSIs;

- Similar groundwater and surface water monitoring throughout the construction phase;
- Post-construction groundwater and surface water monitoring to continue for 12 months following construction completion. This will include reduced surface water and groundwater quality suites to include any determinants of interest as identified in results from the pre-construction monitoring stage. The post construction monitoring suite will be proposed within the Detailed Operational Water Quality Monitoring Plan to be prepared and agreed prior to the start of year 1 of operation.

In its Statement of Common Ground[xvii] prepared as part of an application by Anglian Water for a Development Consent Order under the Planning Act 2008 for the for CWWTPR, NE agreed on all matters, stating: "*The Outline Water Quality Monitoring Plan……is now agreed. Natural England will review the monitoring reports produced during construction and operation, and will work with the Applicant to resolve any queries/concerns if needed. Natural England has also reviewed the Applicant's responses….and is satisfied that these have been adequately addressed*."

ii. The Affinity Water/Severn Trent Water Minworth Strategic Resource Option (SRO) and South Lincolnshire Reservoir (SLR)[xviii] scheme, where groundwater and surface water monitoring was required to appraise the potential impact of SRO abstractions on the water regime and associated impacts on, and interactions with, a number of downstream SSSIs, habitats and species, that are sensitive to humidity and soil moisture levels, with particular focus on the River Blythe SSSI (which comprises diverse aquatic and water-dependent terrestrial habitats, populated by varied plant and invertebrate communities). Following discussions and agreement with key stakeholders, including NE and the EA, a 1-year, pre-application (August 2021 to August 2022) water quality sampling programme was required upstream and downstream from Minworth and Coleshill Wastewater Treatment Works (WwTW) discharges.

To date, NE, together with the EA, have reviewed the environmental sections of the submissions and provided positive feedback, permitting the scheme to progress as planned[xix].

Consequently, the following monitoring scope is proposed:

8.2.2.1. Surface Water Monitoring

Initially, it is proposed that one year of surface water monitoring visits are undertaken to determine surface water quality. These will be conducted on a monthly basis and will include water sampling and measuring watercourse flows. This will allow seasonal fluctuations to be determined and response to weather conditions (such as antecedent rainfall) to be assessed.

A maximum of seven sampling locations are proposed, which are shown in **Figure 8-2**. Some of these locations target potential contamination sources including outfalls from the housing estate to the east and areas where foam and a sheen were observed during the October 2024 site walkover.

Figure 8-2. Proposed surface water quality/flow monitoring locations.

Surface water samples will be analysed for a comprehensive suite of potential contaminants, including those common in urban runoff, together with suspended sediments, nitrates and phosphates, to allow for sediment and nutrient concentrations in the watercourses to be monitored, and potential sources to be determined. In addition, volumetric flow will be measured at each location using appropriate gauge plates/flow monitoring instruments.

The results will provide baseline information including quantitative sediment and pollutant loadings. This will help to infer the water quality pressures impacting the bryophyte assemblage, permit suitable bryophyte enhancement and management measures and practices to be developed and enable an appropriate SuDS Strategy to be developed for the site, which will aim to improve the condition of the SSSI.

8.2.2.2. Groundwater Monitoring

Initially, it is proposed that the groundwater monitoring programme will comprise the drilling of up to 5 boreholes at the site to a maximum depth of 50 m below ground level (bgl), to allow groundwater monitoring and sampling, particularly from the Ashdown Formation Secondary A Aquifer.

It is proposed that one year of groundwater level monitoring visits will be conducted on a monthly basis, at approximately the same times as the surface water flow monitoring. Groundwater sampling and analysis will be undertaken on a quarterly basis. It is intended that the monitoring will aid the determination of:

- Baseline groundwater contaminant levels, including nutrients and urban runoff indicators;
- Spatial and temporal groundwater levels, providing information on water table gradients, seasonal fluctuations, responses to weather conditions (such as antecedent rainfall), sub-surface flow to the SSSI, and interactions with the surface water network (including local spring flows);
- The suitability of infiltration SuDS for year-round effectiveness (these can be compromised by high groundwater levels); and,
- The potential of using local groundwater to supplement flows in the Marline Valley Stream in times of drought (particularly when accounting for future climate change), as suggested in the 2012 Monson Surface Water Strategy.

The proposed locations of the boreholes have been positioned to allow for them to be retained throughout the construction phase of the development and will therefore allow for post-development monitoring and sampling, together with the potential to use at least one of the boreholes for stream flow augmentation during drought conditions, if deemed feasible and worthwhile.

9. Summary and Conclusions

The Breadsell Farm site covers an area of approximately 25.34 hectares (ha) and comprises greenfield land dissected by the Hastings Borough/Rother District Boundary. The site includes the northern part of the Marline Valley Woods SSSI within its boundary.

The site currently comprises three agricultural fields, with woodland in the east and south-east. This woodland is designated as Ancient Woodland and forms part of the SSSI. The Marline Valley Stream flows in a southerly direction through the SSSI. Varied bryophyte (mosses, liverworts and hornworts) assemblages are present within the SSSI associated with the stream.

The site has historically been identified for its potential to provide new dwellings to support the housing needs of both boroughs. However, this has not yet progressed due to objections from NE, particularly in relation to a lack of baseline water monitoring and suitable Surface Water Drainage Strategy. Hastings Borough Council are currently updating their Local Plan to cover 2019 to 2039, and this includes planning for new development to meet local housing shortages and enhance the environment. As a result, there is a renewed focus on the site.

There are several studies and reports pertaining to the site which have been reviewed as part of this report, including a Bryophyte Survey commissioned by the Client in 2025, Hydrological and Hydrogeological Assessment, Surface Water Strategy and consultation responses from NE.

NE argue that it is not possible to state the full extent/impact of the hydrological and hydrogeological changes resulting from the development without having a better understanding of the current regime, and have stated that, following a previous recommendation by Rigare Ltd in 2009, they require at least 3 years of monitoring to characterise the site hydrology. This site characterisation can then inform a sustainable drainage strategy which does not alter the current regime.

Hilson Moran has undertaken a review of available information relating to developments and proposed developments nearby to the site and also adjacent to the SSSI, and the associated responses from NE. It is apparent that one year's worth of monitoring has been considered sufficient to establish pre-construction baseline conditions for previously approved planning applications on sites where runoff/baseflow also feeds into the SSSI. This approach would also align with other projects and schemes (examples provided within this report) where there are potential impacts on SSSIs sensitive to changes in the hydrological/hydrogeological regimes, and where NE has agreed, through consultation, to one-year's pre-development monitoring in order to provide suitable baseline data and understand the interactions between the proposed scheme and the nearby water-sensitive SSSIs.

An initial year-long comprehensive monitoring programme to provide physical and qualitative data on surface water, groundwater and soil conditions has therefore been proposed as part of this report.

An outline sustainable drainage strategy has been proposed which aims to limit disturbance to the bryophyte assemblage in the SSSI. A total of 3380m^3 of attenuation within Sustainable Drainage System (SuDS) features has been proposed within the site. This will be achieved by installing detention basins and attenuation ponds, whilst swales and filter strips will be used to convey runoff throughout the site. Runoff will be attenuated within these SuDS features and discharged to the Marline Valley Stream at seven different locations across the site. By limiting proposed runoff rates to existing greenfield rates, this mimics the existing scenario and limits disturbance to the local hydrogeological regime and associated bryophyte assemblage in and around the stream, as a result of the development.

The volume of storage provided exceeds the requirement to attenuate the additional flows from a 1 in 100-year rainfall event (including 45% climate change) to greenfield rates and thus, will not increase flood risk elsewhere.

The CIRIA Simple Index Approach has been applied to each of the proposed SuDS treatment trains on the site. It has been demonstrated that the SuDS mitigation index is greater than the pollution hazard index for each contaminant type in each catchment. The SuDS treatment trains will therefore provide adequate pollutant removal on site before runoff is discharged to the Marline Valley Stream, thereby minimising any detrimental impacts on the sensitive bryophyte assemblage.

It is recommended that preliminary infiltration testing (carried out as per BRE365), and logging of trial pit soils and geology should be conducted to provide representative soil infiltration rates and shallow strata characteristics. This will inform the sustainable drainage strategy, to ensure that the current environmental and hydrologic conditions, which are beneficial to the bryophyte assemblage, are preserved.

A comprehensive review of available bryophyte survey data for the site, together with a detailed bryophyte survey has been commissioned and carried out to provide up-to-date data on the composition, health and extent of the bryophyte assemblage and to help understand any likely impacts the proposed development may have on it. A number of recommendations are made in the report, which include:

- Access of people into Coneyburrow and Birchen Wood from the new development should be carefully planned and managed to prevent a proliferation of entry points and paths within this part of the SSSI. In particular, stream crossing points would benefit from construction of footbridges to discourage bank erosion
- Appropriate drainage, treatment and water management should be included into the development design in order to carefully control the quality and volumes of water entering the ghyll stream catchment.
- Silt control should be of particular focus within the drainage design of the proposed development;
- Run-off from roads, other hard surfaced ground, roofs *etc.* should be captured within the development and treated on-site with appropriate features to remove silt and pollutants at source and to allow gradual infiltration to groundwater and evaporation.
- The drainage strategy for the proposed development should comply fully with the recommendations for an outline sustainable drainage strategy presented within this Hydroecological Assessment, which aims to mimic the existing scenario and limit disturbance to the local hydrogeological regime and associated bryophyte assemblage in and around the stream.

This approach will ensure that the site will provide desperately needed housing for the borough, whilst at the same time minimising impacts on the neighbouring SSSI and sustainably maintaining the sensitive bryophyte assemblage associated with it.

Appendix A - Site Walkover Photographs

Site Photos	Description
	View across the field located in the south western part of the site, looking towards the south.
	Pond observed within woodland between the northern and southern fields.

	View across the field in the south eastern part of the site, looking towards the south east.
	View across the field in the south eastern part of the site, looking towards the west.

	Marline Valley Brook located within the Marline Valley Woods SSSI in the east of the site.
	Scum observed on the water surface of the Marline Valley Brook.

	Marline Valley Woods SSSI, located in the eastern part of the site.
	View across the field in the northern part of the site, looking towards the north.

Appendix B – Pre-Desk Study Assessment

PA022028 — BREADSELL FARM

DOCUMENT DETAILS

Site name:	Breadsell Farm		
Reference:	PA022028	**Client:**	Hilson Moran
Date:	14th January 2025	**Contact:**	Sophie Davies

RECOMMENDATION

A detailed desk study is recommended to assess, and potentially zone, the Unexploded Ordnance (UXO) hazard level on the Site.

SUMMARY OF FINDINGS

Military Activity	In 1944, Marshalling Area 'H' was established on land encroaching ono the northwestern part of the Site. Troops, vehicles, and supplies were concentrated within the marshalling area prior to the Normandy landings. After WWII, Marshalling Area H was disbanded and the land returned to civilian use. During WWII, anti-invasion defences, including pipe mines and auxiliary unit operational bases, were established in the vicinity of the Site. After WWII, these were removed.
WWI Bombing	Potential targets within approximately 5km of the Site: ▪ Hastings Harbour. ▪ Transport infrastructure and public utilities. ▪ Engineering works. ▪ Military establishments and training areas. No readily available records have been found indicating that the Site was bombed.
WWII Bombing	The Site was located in Hastings County Borough (CB) and Battle Rural District (RD). Hastings CB officially recorded 591No. High Explosive (HE) bombs, with a density of 80.8 bombs per 405 hectares (ha). Battle RD officially recorded 1,428No. HE bombs, with a density of 12.2 bombs per 405ha. Potential targets within approximately 5km of the Site: ▪ Hastings Harbour. ▪ Transport infrastructure and public utilities. ▪ Engineering works. ▪ Military establishments and training areas. ▪ Anti-Aircraft (AA) and anti-invasion defences. Readily available records indicate that several HE bombs fell in close proximity to the Site.
Bombing Decoys	None identified within 5km of the Site.

FURTHER INFORMATION

These findings are based on a cursory review of readily available records; caution is advised if you plan to action work based on this PDSA.

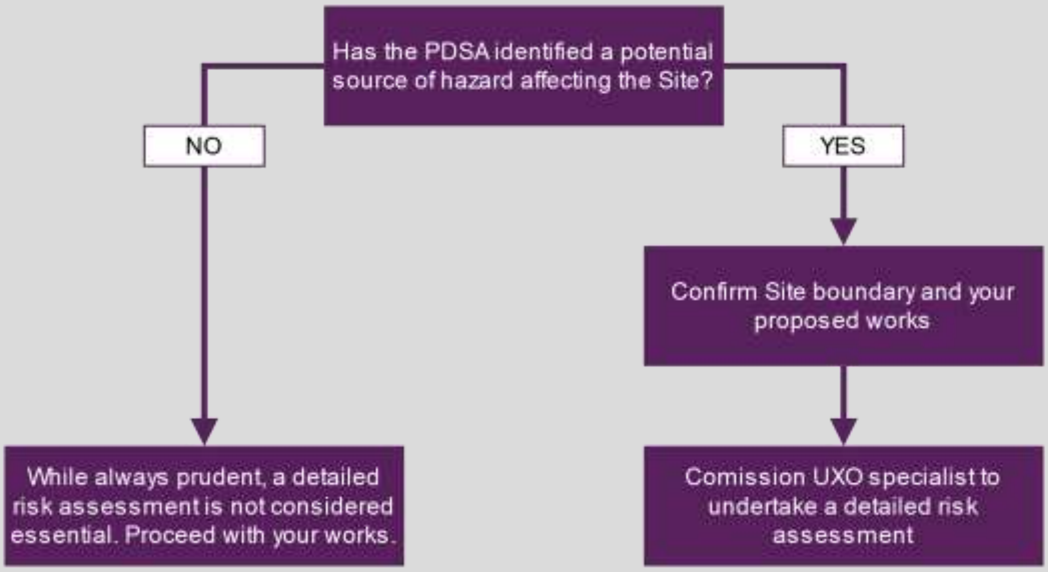
Where a potentially significant UXO hazard source has been identified on the Site, no further research has been undertaken. A detailed UXO desk study and risk assessment may identify other potential UXO hazard sources on the Site.

Visit www.zeticauxo.com to learn more about Zetica's detailed UXO desk studies and other UXO services. Click here for more information about the most common UXO hazard sources in the UK.

If you have any further queries, please don't hesitate to contact us at uxo@zetica.com or 01993 886 682.

NEXT STEPS

Follow the steps below to determine the appropriate course of action:



Potential UXO hazard identified? If the PDSA has identified a potential source of UXO hazard affecting your site, then a detailed UXO risk assessment is recommended.

No obvious source of UXO hazard? If the PDSA has not identified any obvious source of potential UXO, works can proceed.

It is good practice to raise awareness of the background UXO risk in the UK as part of a standard site induction. This will ensure that appropriate action is taken in the unlikely event that UXO is discovered.

Don't skip a stage: If you skip the detailed risk assessment stage, you could end up undertaking unnecessary work (e.g. trying to detect a UXO hazard that has already been removed).

Similarly, a detailed risk assessment might find that the UXO hazard is worse than expected and has a greater potential to cause harm, requiring a different mitigation approach than would otherwise be undertaken.

Appendix C – Bryophyte Survey Report

VEGETATION SURVEY & ASSESSMENT

BREADSELL FARM AND MARLINE VALLEY WOODS SSSI, HASTINGS

BRYOPHYTE ASSESSMENT

For Hilson Moran

DRAFT 2

May 2025

CONTENTS

Sharon Pilkington BSc (Hons) MSc CEnv MCIEEM
Botanist – Bryologist – Vegetation Ecologist

Vegetation Survey & Assessment Ltd
66 Newtown
Westbury
Wiltshire
BA13 3EF
Tel: 01373 827074
Mob: 07801 627449
sharon.pilkington@vegetationsurvey.co.uk
www.vegetationsurvey.co.uk

SUMMARY

This report documents a comprehensive survey of mosses and liverworts (bryophytes) in relation to a planning application at Breadsell Farm, near Hastings. As well as farmland, the Application Area includes Coneyburrow Wood and Birchen Wood, which together form Unit 4 of Marline Valley Woods Site of Special Scientific Interest. This SSSI supports a notified bryophyte assemblage feature and populations of a number of other bryophytes of high national or regional importance, the majority of which are restricted to the SSSI's ghyll stream habitats. To help understand any likely impacts of developing the open land at Breadsell Farm on Unit 4 and other parts of the SSSI further downstream, the assessment was extended to include the full SSSI and a review of other relevant bryophyte assessments.

Farmland in the Application Area was found to be of negligible importance for bryophytes. In the SSSI, notable species of ghyll streams were found to be in mainly good heath and, in the case of *Fissidens rivularis*, a bryophyte assemblage species, to be widespread. Water levels at the time of survey were very low, allowing access into most parts of the streams (except in Park Wood) which enabled the discovery of several new locations for *Tetrodontium brownianum*, another assemblage species as well as a new moss for the SSSI, the Nationally Scarce deadwood specialist *Sematophyllum substrumulosum*.

Generally, the bryophyte interest and condition of the SSSI was considered to be good and broadly similar to most of the previous assessments. However, there was evidence of recent substantial stream bank erosion and collapse in Coneyburrow Wood, which had caused considerable sedimentation downstream. Siltation is the most probably cause of an observed significant decline in frequency of at least one regionally rare semi-aquatic moss recently.

Although unsupported by any hydrological evidence, the main drivers of the stream erosion are thought to be related to climate change and different patterns of precipitation causing prolonged (clay) soil waterlogging and collapse of stream banks. The erosive forces of larger and more frequent pulses of water in the upper streams may also be exacerbated by the irregular discharge of run-off from nearby residential areas into the channels. Previous assessments highlighted other significant sedimentation episodes linked to run-off from nearby developments under construction.

Good management of water and silt run-off during the construction phase(s) of any developments in the Breadsall Farm Application Area is imperative to minimising impacts on the SSSI ghyll streams and their dependent bryophytes. Careful development design that incorporates appropriate surface water run-off handling, storage and treatment once operational is strongly recommended for the same reason.

1. INTRODUCTION

1.1 Breadsell Farm Application Area

1.1.1 Breadsell Farm lies just beyond the north-western urban edge of Hastings. A number of intensively managed fields to the south and east of the farm complex have been identified as a potential location for a new residential development. Most of the fields lie adjacent to Coneyburrow Wood and Birchen Wood, which together form the upper part (Unit 4) of Marline Valley Woods Site of Special Scientific Interest (SSSI). For the purposes of impact assessment, these woodlands have been included in the Application Area boundary, which is shown in Figure 1.

1.2 Marline Valley Woods SSSI

1.2.1 Marline Valley Woods SSSI is a 55 ha complex of ancient woodland and neutral grassland lying in a steep-sided valley in the Sussex High Weald. The downcutting of a fast-flowing stream through soft Lower Tunbridge Wells Sandstone underlying Wadhurst Clay has created narrow, steep sided ghylls within the woodland. The woodland and streams are very sheltered and have a humid and temperate microclimate which favours oceanic bryophytes more characteristic of the north and west of the country.

1.2.2 The woodland lies between residential areas and commercial developments on the urban fringe, and open farmland to the west. Its central ghyll stream rises from two main springs in Coneyburrow Wood, before uniting into one stream and flowing down through Birchen Wood, Four Acre Wood, Marline Wood, and along the edge of Park Wood, a distance of around 2.5 km. Numerous flushes and intermittently active springs feeding shallow channels rise in the woods at the boundary between the clay and sandstone and two other small tributary streams join the main channel at the lower end of Birchen Wood.

1.2.3 Throughout the SSSI, the woodland canopy is dominated by mature Pedunculate Oak *Quercus robur* with Hornbeam *Carpinus betulus*, Sweet Chestnut *Castanea sativa* and Hazel *Corylus avellana*. Holly *Ilex aquifolium*, Honeysuckle *Lonicera periclymenum* and Ash *Fraxinus excelsior* are locally prominent. Alder *Alnus glutinosa* is widespread near the stream and in flushed ground and much of the woodland has been historically managed as coppice-with-standards. Bluebell *Hyacinthoides non-scripta* is abundant across extensive tracts of woodland floor, giving way to strong populations of Ramsons *Allium ursinum* with Pendulous Sedge *Carex pendula*, Opposite-leaved Golden-saxifrage *Chrysosplenium oppositifolium* and Yellow Archangel *Lamiastrum galeobdolon* subsp. *montanum* on the heavy clay of the valley floor.

1.2.4 The SSSI has a bryophyte assemblage feature of '*Atlantic bryophyte species associated with gill woodland (Western oceanic woodland – Special habitat 1):* Fissidens rivularis, Tetrodontium brownianum, Metzgeria furcata *and* Metzgeria conjugata.' *Metzgeria furcata* is a very common and widespread liverwort and accordingly, Pilkington (2013) recommended that it be removed from the SSSI's bryophyte assemblage. Table 1 lists the current conservation status of the other assemblage species.

Table 1. SSSI Bryophyte Assemblage

Species	Conservation Status
Fissidens rivularis	Nationally Scarce[1]
Metzgeria conjugata	Very rare in south-eastern England
Tetrodontium brownianum	Rare in southern England

[1] Pescott (2016)

1.2.5 Historically, there have been a number of bryophyte surveys in the Marline Valley, although it has received less attention from bryologists than some other sites in the Hastings area, possibly because of the challenges of access into ghyll streams in the more remote parts of the wood. Parts of the site have been visited and recorded ad hoc by some well-known amateur bryologists, including Rod Stern and Francis Rose in the 1980's, and Tom Ottley and Howard Wallis in 2011-12. Simon Davey also surveyed the lower parts of the SSSI (Marline Wood and downstream) for the Sussex Wildlife Trust on several occasions between 1996 and 2005 and for Natural England (as English Nature), on unknown dates. Where more systematic professional-level surveys have taken place, they have primarily focussed on assessing potential impacts of hydrological changes to the SSSI in relation to construction and operation of developments nearby.

1.3 Objectives

1.3.1 Vegetation Survey & Assessment Ltd was commissioned by Hilson Moran to undertake a bryophyte survey of land within the Breadsell Farm Application Area, extending into all other parts of Marline Valley Woods SSSI. The objectives of this work included:

- Undertaking a bryophyte survey of the Breadsell Farm Application Area, including Coneyburrow Wood, Birchen Wood and any other potentially good habitat in the farmland;
- Completing a bryophyte survey of the remainder of Marline Valley Woods SSSI to include the ghyll streams and associated hydrological features and sandrock exposures on the stream banks;
- Reviewing the findings of previous bryophyte survey work and commenting on subsequent changes and bryophyte population dynamics;
- Assessing (where possible) and providing commentary on the importance of environmental or anthropogenic impacts on the SSSI's most important bryophytes;
- Recommending ways in which likely development-led impacts on important bryophytes can be eliminated and/minimised.


Figure 1. Location of Breadsell Farm Application Area
Application Area
Marline Valley Woods SSSI
Breadsell Farm
Collects
Sks
131m
Coneyburrow Wood
Birchen Wood
Four Acre Wood
Wood
107m
MARE BAY CLOSE
COXHEATH CL
HIGHWATER VW
SHINGLE CT
STONEBEACH RISE
BEACHY HEAD VIEW
HARBOUR WAY
CARLE CT
DELAWARE D
JEFFERSON WY
0 50 100 150 200 250 m
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2. METHODS

2.1 Personnel

2.1.1 All elements of the assessment were undertaken by Sharon Pilkington BSc (Hons), MSc, CEnv, MCIEEM, a professional bryologist, botanist and ecologist with 25 years' experience. The fieldwork was carried out between the 22nd and 25th of April, 2025 when weather conditions were dry and water levels in the ghyll streams were low. No significant constraints were encountered that might compromise the outcomes.

2.2 Field Surveys

2.2.1 Targeting of habitats and features with potential to support the SSSI bryophyte assemblage species and any others of recognised national conservation importance (Box 1) was undertaken during an unstructured walk over the survey area. All such populations, and other species of regional conservation importance were recorded using a GPS/GLONASS hand-held navigational receiver[2] with a typical spatial accuracy of 5-10 metres.

2.2.2 Habitats and features that were targeted during the fieldwork included:

- Ghyll stream habitats: channels, rocks, banks, waterfalls, cascades, tree roots and woody debris;
- Flushes and spring-fed side-channels;
- Stream bridge and culvert masonry;
- Sandrock exposures;
- Pond margins, banks and woody debris;
- Decaying fallen tree trunks and branches and stumps on the woodland floor; and
- Branches and trunks of trees and shrubs (for epiphytes).

2.2.3 Most species were identified *in hand* with the help of an illuminated x20 hand-lens. Where it was necessary to confirm the identification of very small and/or morphologically difficult species, a small collection was subsequently examined microscopically.

Box 1. Bryophytes of National Conservation Importance meet at one or more of these Criteria:

- Nationally Rare: species recorded from ≤15 hectads (10 km OS grid squares) in Britain (Pescott 2016);
- Nationally Scarce: species recorded from 16-100 hectads in Britain (Pescott 2016);
- British Red List: species categorised as Critically Endangered, Endangered, Vulnerable, Near-threatened or Data Deficient (Callaghan 2022);
- Section 41: species of principal importance for the purpose of conserving biodiversity (in England) under the Natural Environment and Rural Communities Act 2006;
- W&CA 1981: species listed on Schedule 8 of the Wildlife and Countryside Act 1981 (as amended);
- Annex II: species listed on Annex II of the EC Habitats Directive.

Quantum GIS software (QGIS Development Team, 2025) was used for the digitisation, presentation and analysis of results. Names of mosses, liverworts and hornworts used in this report follow Blockeel *et al.* (2021); names of higher plants follows the taxonomy of Stace (2019).

[2] Garmin model GPSMAP 64S

3. RESULTS

3.1 Summary

3.1.1 Within the survey area, nearly all of the bryophyte interest (including the majority of the most notable species) was confined to ghyll stream habitat, both within the Breadsell Farm Application Area (Coneyburrow Wood and Birchen Wood) and elsewhere in the SSSI. A small (non-SSSI) copse in the Application Area of the same woodland type as nearby Coneyburrow Wood, did not have any ghyll streams and was of lower bryophyte importance. The intensively cultivated farmland supported few bryophytes at all, apart from a community of common epiphytic mosses and liverworts on bark in the denser boundary hedgerows.

3.1.2 Figures 2.1 – 2.3 show the distribution of notable bryophytes, including the SSSI bryophyte assemblage feature (Section 3.2), other nationally important species (Box 1) and regionally rare species (Section 3.3) In total, 89 bryophyte taxa (species, sub-species and varieties) were confirmed, including 69 mosses and 20 liverworts (Appendix 1). The majority of these were common and widespread species typical of the habitats present. Populations of 3 Nationally Scarce mosses were also confirmed, including one not previously known from the SSSI. 6 other species known to be rare in southern/south-eastern England were also found.

3.1.3 The work also confirmed the continued presence of nearly all species recorded in previous bryophyte surveys. Several other common species e.g. *Epipterygium tozeri* and *Oxyrrhynchium schleicheri* were found new to the SSSI.

3.2 SSSI Bryophyte Assemblage Feature

3.2.1 Figure 2 shows the strong association of the SSSI bryophyte assemblage species with ghyll stream habitats. *F. rivularis* was found to be widespread, from the upper end of Coneyburrow Wood to the culvert below the railway line where the stream leaves Park Wood. This moss was found on stones, bedrock steps, cascades and waterfalls and flushed bedrock on banks, always in situations where it was regularly splashed, intermittently inundated or gently irrigated. Many plants were fertile and most colonies appeared to be healthy. *F. rivularis* was also seen in the section of streambed in Marline Wood where iron had been deposited naturally from groundwater seepages and appears to be tolerant of this. It was however absent from parts of the channel where there were substantial silt deposits, and where flows were ponded or otherwise sluggish.

3.2.2 *Metzgeria conjugata* is a rock-dwelling thallose liverwort and is not normally regarded as a species of watercourses. However, it is common only in the more humid parts of northern and western Britain, so its single locality in Marline Wood, on a sandrock exposure just below a prominent waterfall would provide appropriately humid and temperate conditions. This population has been known since 1962. Several individuals were found by Pilkington (2020), but only one moribund-looking plant was detected in the current work, suggesting that it has declined since then.

3.2.3 *Tetrodontium brownianum* was last seen in the SSSI (Marline Wood) in 2011 and its deeply shaded sandrock habitat on a stream bank was thought to have been destroyed by a bank collapse. In the current work it was found in 3 discrete places on sheltered sandrock on the ghyll stream banks, with the largest population in a gully just above a waterfall in Coneyburrow Wood (Plate 1). Other colonies were confirmed in Marline Wood. It had not been searched for specifically since 2012 (Pilkington, 2013) but could have been overlooked if water levels at the time of that work were too high to permit access to these sections of ghyll stream. The population appeared to be healthy and thriving.

Plate 1. Waterfall in Coneyburrow Wood (OS gridref TQ7810813228). *Tetrodontium brownianum* occupies one side of the rocky gully immediately above the waterfall and *Fissidens rivularis* is abundant on its damp face.

3.3 Other Notable Species

3.3.1 All but one of the other notable bryophyte species were also restricted to ghyll stream habitats. Two of these – *Dichodontium pellucidum* and *Sciuro-hypnum plumosum* - are semi-aquatic species of stones, bedrock and exposed tree roots in the channel where they would be either splashed, irrigated or intermittently inundated at times of higher water levels. They are both common mosses of northern and western watercourses, but are very rare in south-eastern England. Occurrences of *D. pellucidum* were not recorded as it was locally frequent in the SSSI. Like *F. rivularis*, it was absent from places where the stream channel was heavily silted. *S-h. plumosum* was only found in two places, in Marline Wood. A strong population occupied a few square metres of irrigated sandrock below the main waterfall, where it has long been known. A small colony also grew on an exposed tree root on the stream bank downstream. In 2012 this moss was observed to be occasional on stones in the ghyll stream from Coneyburrow Wood down into Marline Wood, suggesting that its population has undergone a substantial decline in since then.

3.3.2 The classic habitat of *Fissidens celticus* is shady clay-rich earth banks by streams. The Wealden populations represent the main outlier in southeast England, where it is otherwise very rare. An extremely small moss, it is easy to overlook and is likely to be much more widespread in the SSSI than Figure 2 suggests. It was only found on steeply sloping clay banks of the ghyll stream.

3.3.3 *Heterocladium flaccidum* is another southeast England rarity. Only one population was found, on slightly base-enriched sandrock exposures below the Marline Wood waterfall, where it appeared to be healthy and was growing in quantity. This moss has been seen in this locality previously, and shares the damp sandrock below the waterfall with *Trichostomum brachydontium* and several other bryophytes only known in the SSSI from here.

3.3.4 *Sematophyllum substrumulosum* is a new addition to the SSSI's bryophyte flora and fertile patches of this Nationally Scarce moss were found in three places in Birchen Wood. All of these were on well-decayed, fallen trees lying prone across the stream gully. Although there is a huge resource of similar fallen dead wood and stumps throughout all of the surveyed woodland, *S. substrumulosum* was restricted to deeply incised parts of the ghyll stream, a highly sheltered situation that must be to its liking. This moss is a deadwood specialist and is usually found on well-decorticated tree bark in mixed or coniferous woodland. It has undergone a massive range expansion in southern Britain in the past few decades and is now known from a number of woodlands in East Sussex.

3.3.5 The only notable species found away from the ghyll streams was the Nationally Scarce moss, *Herzogiella seligeri*. A single fertile population grew where it was first discovered in 2020, on a decaying fallen tree close to the upper edge of Marline Wood. This moss is also a deadwood specialist, favouring fallen decaying Sweet Chestnut and Pedunculate Oak. However, it was found nowhere else, despite plenty of potentially good deadwood habitat being available.

3.4 Habitat Condition

3.4.1 At the time of fieldwork, the water in the stream channels was predominantly clear and shallow, following a dry spell. There was no sign of any gross contamination e.g. hydrocarbon slicks or effluent discolouration/odours nor evidence of gross eutrophication as indicated by accumulations of green algae or cyanobacteria. Iron-rich groundwater seeping into the stream in Marline Wood and below had stained its bedrock orange in places, but this appears to be a naturally occurring feature of the SSSI's hydrogeology.

3.4.2 Ghyll stream bed habitats were varied and included numerous physical features indicative of natural stream development and functioning. They included waterfalls, cascades and bedrock steps, pools, channel braiding, riffles, loose stones, larger rocks/boulders, prone windthrown trees, and root plates. The streams flowed through closed-canopy deciduous woodland and the entire SSSI channel was in dappled or deep shade. Fallen decaying wood abounded on the woodland floor and where woody debris had been washed into the channel it occasionally formed blockages and small pools.

3.4.3 Other than a few places heavily frequented by people and pet dogs, e.g. footbridges and the waterfall in Marline Wood, ghyll stream banks and channels were mostly undisturbed, with steep, slippery terrain, fallen trees lying in and across the streams and Bramble *Rubus fruticosus* agg. probably serving as deterrents to human and canine access. The banks were well vegetated, by large quantities of bryophytes, ferns and higher plants. Most sandrock outcrops were closely associated with the stream channels and were damp enough to support strong bryophyte communities. Others higher on the valley slopes were drier and supported no species of importance.

3.4.4 Parts of the woodland floor in Birchen Wood, Four Acre Wood and Marline Wood had been disturbed by people, with significant path development and construction of 'camps' and other built features. These had not obviously affected the ghyll stream bryophyte communities, however.

3.4.5 Bank erosion has long been known from the ghyll streams, but it appears to have increased substantially, causing major deposition of silt in the form of bars and mud in lower sections of stream. The erosion was most pronounced in the very deeply incised eastern stream of Coneyburrow Wood, where it flows close to the back gardens of a series of houses on Harbour Way. In this area there had been a series of recent large bank slumps and slippages (Plate 2). Water outfall pipes that potentially discharge urban run-off were seen in the same area. The western stream in Coneyburrow Wood does not appear to carry as much water and had not been subject to the same levels of erosion.

3.4.6 Many silt bars and submerged patches of muddy sediment were evident downstream, with notably large examples near the footbridge at the upper end of Marline Wood (Plate 3). In Park Wood, where the stream levels out and flows more sluggishly, sections of the stream bed were covered in a thick layer of silt (Plate 4), obscuring features of importance to *F. rivularis* and other semi-aquatic mosses.

3.4.7 Some of the side channels originating from seasonally flowing springs high on the valley sides formed deeply incised 'mini-ghylls'. At the time of survey, some of these were actively flowing with clear water whilst others were dry. No species of importance were found in these and it is likely that flow is strongly dependent upon groundwater levels which in turn fluctuate in response to infiltration from rainfall and possibly anthropogenic factors.

Plate 2. A substantial recent stream bank collapse in Coneyburrow Wood.

Plate 3. Banks severely eroded by dogs/people near the footbridge in Marline Wood. Prominent silt bars are also present above (arrowed) and below the bridge

Plate 4. In Park Wood, thick sediment obscures the stream bed.

4. REVIEW OF PREVIOUS ASSESSMENTS

4.1.1 One of the first assessments of the implications of nearby development on the SSSI's bryophytes was attempted by Davey (2009), who surveyed the ghyll stream systems that flow into Marline Wood from Coneyburrow and Birchen Woods. He concluded that the stream system suffered from *'very low water quality' caused by iron-forming bacteria, causing orange discolouration of channel bedrock in Marline Wood, although he also acknowledged that 'the internet did not provide any evidence for a link between iron bacteria and pollution*.' He also identified '*at least five outflows from the housing estate into the stream system*' and suggested that they might also be the cause of increased siltation and poor water quality in the ghyll streams. Finally, Davey concluded that the '*system also drains water off farmland*' and this may be causing [unspecified] problems.'

4.1.2 Between 2006 and 2010, the bryophyte communities of the SSSI's ghyll streams were monitored annually by Simon Davey and Neil Sanderson following development of the Queensway South (QWS) business park (Sanderson & Davey, 2010). The monitoring, which involved sampling of fixed-point quadrats in the stream channels and banks and on sandrock exposures, was designed to assess the effectiveness of measures put in place to preserve as far as possible the existing pattern and quality of run-off and infiltration from the development site and to avoid any impact on the special interest features of the SSSI. They described how the SSSI had suffered from diffuse farm pollution and siltation in the ghyll stream (in 2005) caused by construction of the Land South of Wychnour and/or Hoads Wood housing development(s). However, they concluded that the bryophyte communities (of the QWS catchment) recovered relatively quickly and by 2009 the stream bed had locally high bryophyte cover.

4.1.3 After their fifth and final QWS monitoring survey in 2010, Sanderson and Davey concluded that no effects on the bryophyte communities of the SSSI that could be attributed to the development were identified.

4.1.4 In 2012, Sharon Pilkington completed a comprehensive baseline survey and condition assessment of the SSSI bryophyte assemblage feature for Natural England (Pilkington, 2013) and found it to be in favourable condition.

4.1.5 In 2017, the first of 5 intended annual monitoring surveys was undertaken to fulfil planning conditions for the proposed North Queensway (NQW) development (Pilkington, 2017). As the potential impact area of the development included much of the same hydrological catchment as the QWS development, the scope of the monitoring was based on a modified version of Sanderson and Davey's approach in order to allow some general comparisons and conclusions to be made. Year 1 of the NQW survey was repeated and updated in 2020 (Pilkington, 2020) as the development had been delayed, but no further monitoring was undertaken thereafter.

4.1.6 In 2017, there was no suggestion of '*any decline in the diversity, extent and species composition of any of the bryophyte communities of the SSSI*.' In 2020, on attempting to compare the updated results with the earlier QWS monitoring work, Pilkington (2020) concluded that '*habitats within the NQW drainage catchment support diverse bryophyte communities and populations of a number of bryophytes of national or local conservation importance, none of which appear to have undergone any substantial change since earlier cycles of monitoring linked to the QWS development*.' However, she did highlight that there had been more stream bank collapses in Coneyburrow Wood and elsewhere since 2017 and although *'it was not immediately clear what they had been caused by although it's possible to speculate that a wetter than normal autumn and winter on 2019-20 might be a significant contributory factor.'* She also commented that (at that time) silt bars were '*not considered to be excessive in either size or number and did not appear to be significantly larger or smaller than in October 2017*'.

5. POTENTIAL IMPACTS OF DEVELOPMENT

5.1.1 Marline Valley Woods SSSI continues to support rich bryophyte communities which include Atlantic bryophyte species associated with ghyll streams as well as mosses and liverworts that are of regional or national conservation importance. Such communities are potentially vulnerable to development-related changes to local natural drainage patterns (Table 2).

Table 2. Potential Impacts of Adjacent Residential / Commercial Development

Cause	Effect(s)	Potential Impact on Bryophyte Communities
Increased run-off from impervious surfaces or drainage schemes in adjacent housing or commercial land	➢ Increased slumping, scouring and erosion of stream banks. ➢ Displacement of channel rocks and woody debris. ➢ Accumulation of large/frequent sediment bars in main channel.	➢ Reduced diversity and abundance of semi-aquatic bryophytes e.g. *Fissidens rivularis, Sciuro-hypnum plumosum* in ghyll stream channels. ➢ Loss of / decline of bryophyte populations on stream banks.
Reduced surface infiltration	➢ Drying of springs and side channels. ➢ Drying of sandrock exposures.	➢ Reduced bryophyte diversity and cover in side-channels. ➢ Replacement of aquatic bryophytes by woodland species in side-channels. ➢ Loss of species indicative of flushed sandrock g e.g. *Sciuro-hypnum plumosum* and *Hookeria lucens*.
Water-borne pollutants	➢ Increased alkalinity of groundwater. ➢ Contamination of water with metal ions and/or hydrocarbon run-off.	➢ Replacement of calcifuge species e.g. *Mnium hornum* and *Pellia epiphylla* by calcicoles such as *Pellia endiviifolia* or *Cratoneuron filicinum*. ➢ Hydrocarbon pollution may leave residues but effects on bryophytes are unclear.
Disturbance from people and dogs	➢ Localised bank trampling and erosion. ➢ Displacement of channel rocks and woody debris.	➢ Reduced diversity and abundance of semi-aquatic bryophytes e.g. *Fissidens rivularis, Sciuro-hypnum plumosum* in ghyll stream channels. ➢ Loss of / decline of bryophyte populations on stream banks.

6. CONCLUSIONS

6.1.1 Farmland in the Breadsall Farm Application Area is of negligible importance for bryophytes. However, the SSSI woodland of Coneyburrow Wood and Birchen Copse supports populations of two of the three species of the bryophyte assemblage feature as well as other nationally and locally notable species, making it vulnerable to impacts linked to construction.

6.1.2 Marline Valley Woods SSSI continues to be of high importance for its ghyll stream bryophytes, and supports a considerable number of species for a site of this kind in south-eastern England. It also retains populations of its bryophyte assemblage species, with *F. rivularis* widespread through the SSSI ghyll streams except for places where sediment deposition is high. The rediscovery of *T. brownianum* on stream bank sandstone is also very encouraging. Conversely, the population of *Metzgeria conjugata*, always very small and restricted to one place, appears to have dwindled still further since it was last seen in 2020, for reasons unknown. This liverwort is now at high risk of being lost from the SSSI.

6.1.3 Most other notable species are thriving except for the semi-aquatic moss *Sciuro-hypnum plumosum* which has declined considerably since 2012. This species is likely to have suffered from the effects of siltation and possibly from flow-related movement of the small stones it prefers in the stream channels. It is also positive that new species are still being recorded in the SSSI ghyll streams, the most notable one being *Sematophyllum substrumulosum,* apparently on deciduous deadwood rather than its usual coniferous hosts.

6.1.4 Previous bryophyte assessments of the SSSI indicate how vulnerable the communities of the ghyll streams are to hydrological impacts caused by adjacent land-use, but also demonstrate that the site has recovered from such impacts in the past. However, the uncertainty about impacts driven by climate change now and in the future must be acknowledged.

6.1.5 The twin arms of the ghyll stream that rise in springs near the upper edge of Coneyburrow Wood support important habitat features including a waterfall and rocky cascades. Previous and current assessments have concluded that the eastern arm of the stream is likely to be a primary source of the high levels of silt carried down into the SSSI and deposited as silt bars and mud. Water-driven erosion and the slumping and collapse of ghyll stream banks are natural physical processes that are almost certainly being inflated by climate change. This is likely to be causing more prolonged and intensive episodes of rainfall that drain into the ghyll streams and saturate the clay soil of the bank, making slumping and collapse more likely. Piped outfalls of run-off from an adjacent residential area into the same part of the eastern stream can only make the problem worse.

6.1.6 Siltation is currently considered to be the most serious threat to the SSSI's stream-associated bryophyte communities, with other potential impacts from development (Table 2) to be of far less consequence. It is therefore very important that the proposed development at Breadsell Farm does not worsen the existing problem.

7. RECOMMENDATIONS

7.1.1 To minimise additional impacts of erosion and siltation in the SSSI from any proposed development on the Breadsell Farm Application Area, it is very important to incorporate appropriate drainage, treatment and water management into the development design and to carefully control the quality and volumes of water entering the ghyll stream catchment.

7.1.2 To prevent silt-laden run-off entering the SSSI streams during the construction phase(s), it is recommended that appropriate and effective measures are taken to contain and manage drainage from the development.

7.1.3 Run-off from roads, other hard surfaced ground, roofs etc. should be captured within the development and treated on-site with appropriate features to remove silt and pollutants at source and to allow gradual infiltration to groundwater and evaporation. It is recommended that the drainage strategy should comply fully with the recommendations of the Hilson Moran hydroecological report (Rowlands & Davies, 2025).

7.1.4 Access of people into Coneyburrow and Birchen Wood from the new development should be carefully planned and managed to prevent a proliferation of entry points and paths within this part of the SSSI. In particular, stream crossing points would benefit from construction of footbridges to discourage bank erosion.

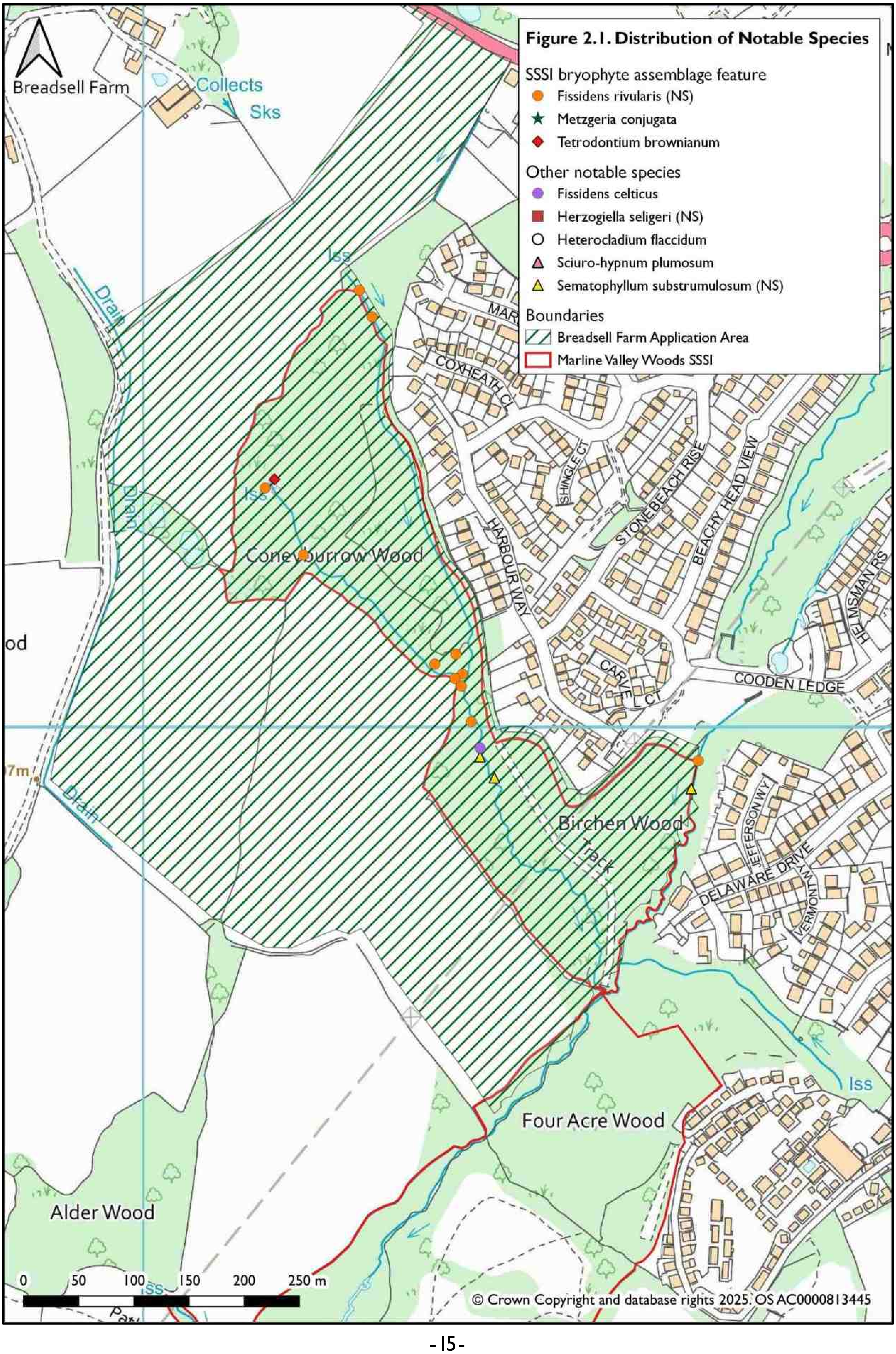
Figure 2.1. Distribution of Notable Species
SSSI bryophyte assemblage feature
Fissidens rivularis (NS)
Metzgeria conjugata
Tetrodontium brownianum
Other notable species
Fissidens celticus
Herzogiella seligeri (NS)
Heterocladium flaccidum
Sciuro-hypnum plumosum
Sematophyllum substrumulosum (NS)
Boundaries
Breadsell Farm Application Area
Marline Valley Woods SSSI
Breadsell Farm
Collects
Sks
Drain
Iss
Coneyburrow Wood
Birchen Wood
Four Acre Wood
Alder Wood
Track
COXHEATH CL
HARBOUR WAY
SHINGLE CT
STONEBEACH RISE
BEACHY HEAD VIEW
HELMSMAN RS
COODEN LEDGE
CARVEL CT
JEFFERSON WY
DELAWARE DRIVE
VERMONT WY
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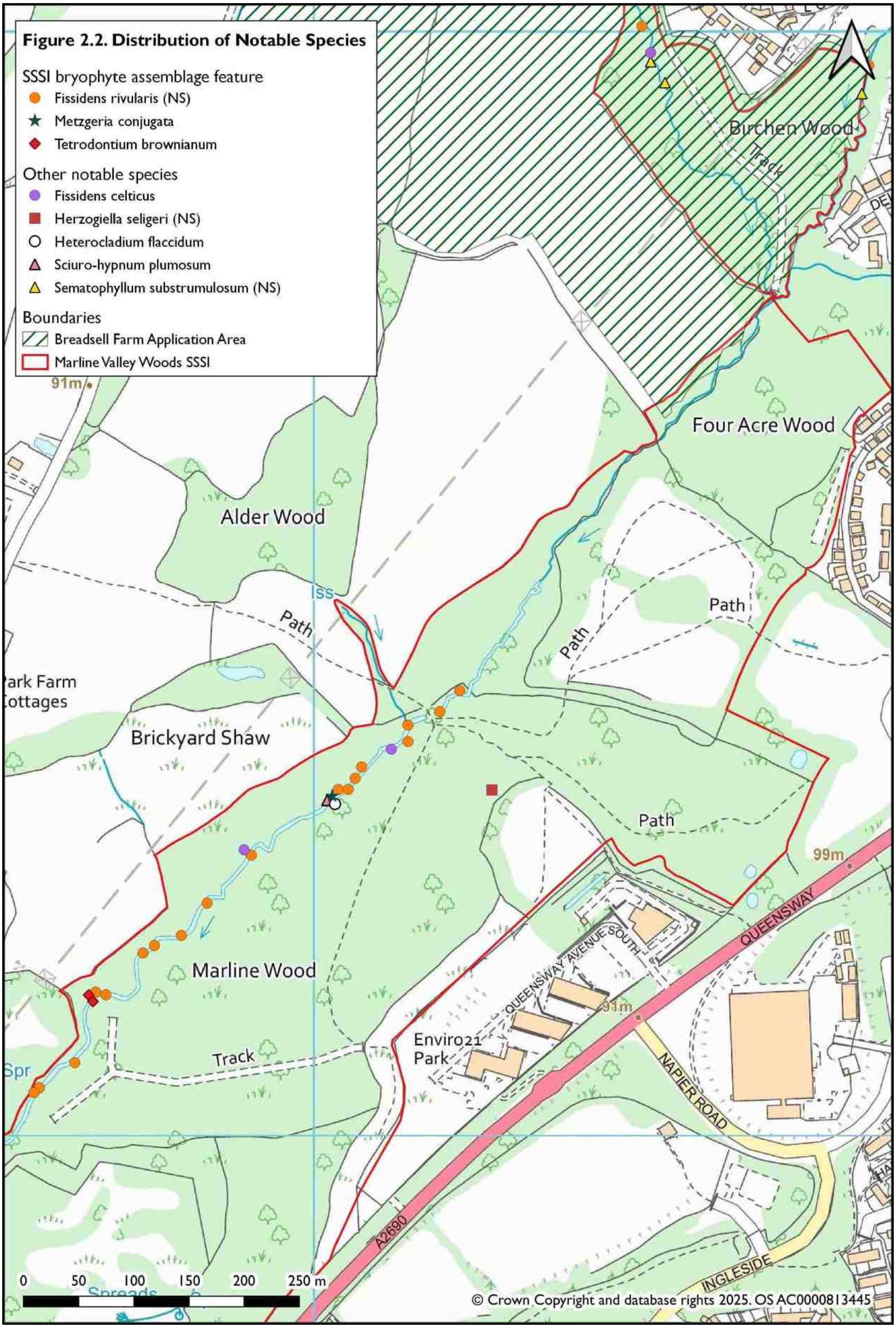

Figure 2.2. Distribution of Notable Species
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Boundaries
Breadsell Farm Application Area
Marline Valley Woods SSSI
Birchen Wood
Track
Four Acre Wood
Alder Wood
Path
Park Farm Cottages
Brickyard Shaw
Marline Wood
Enviro21 Park
QUEENSWAY AVENUE SOUTH
QUEENSWAY
NAPIER ROAD
INGLESIDE
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99m
0 50 100 150 200 250 m
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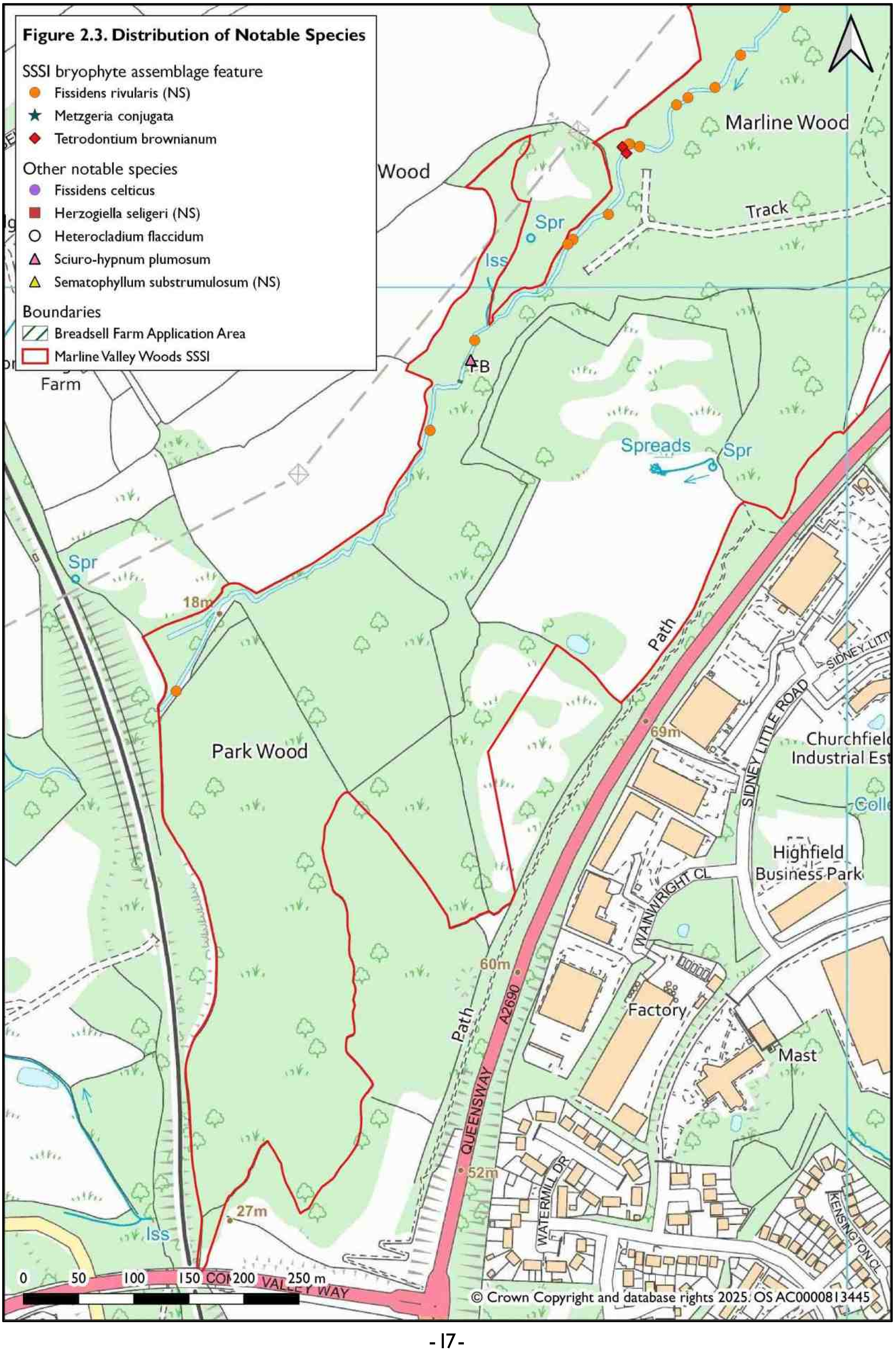
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Sciuro-hypnum plumosum
Sematophyllum substrumulosum (NS)
Boundaries
Breadsell Farm Application Area
Marline Valley Woods SSSI
Marline Wood
Wood
Farm
Track
Spr
Iss
FB
Spreads
18m
Path
69m
Park Wood
Churchfield
Industrial Est
SIDNEY LITTLE ROAD
Highfield
Business Park
WAINWRIGHT CL
60m
Factory
Mast
A2690
QUEENSWAY
52m
27m
WATERMILL DR
KENSINGTON CL
VALLEY WAY
0 50 100 150 200 250 m
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APPENDIX I: SPECIES INVENTORY (APPLICATION AREA AND SSSI)

Species name	Common name	Conservation Status	Abundance (DAFOR[3])
Mosses			
Amblystegium serpens	Creeping Feathermoss		O
Atrichum undulatum	Common Smoothcap		F
Brachythecium rivulare	River Feathermoss		LF
Brachythecium rutabulum	Rough-stalked Feathermoss		F
Bryum dichotomum	Bicoloured Bryum		R
Cratoneuron filicinum	Fern-leaved Hookmoss		R
Cryphaea heteromalla	Lateral Cryphaea		O
Ctenidium molluscum	Chalk Comb-moss		R
Dichodontium pellucidum	Transparent Forkmoss	Rare in SE England except in Wealden districts	O
Dicranella heteromalla	Silky Forklet-moss		F
Dicranella staphylina	Field Forklet-moss		R
Didymodon sinuosus	Wavy Beardmoss		R
Epipterygium tozeri	Tozer's Threadmoss	New species in SSSI?	LF
Eucladium verticillatum	Whorled Tufa-moss		R
Eurhynchium striatum	Common Striated Feathermoss		LF
Fissidens bryoides var. bryoides	Lesser Pocketmoss		F
Fissidens celticus	Welsh Pocketmoss	Rare in SE England except in Wealden districts	O
Fissidens dubius	Rock Pocketmoss		R
Fissidens exilis	Slender Pocketmoss		R
Fissidens pusillus	Petty Pocketmoss		LF
Fissidens rivularis	River Pocketmoss	Nationally Scarce	LF
Fissidens taxifolius	Common Pocketmoss		A
Grimmia pulvinata	Grey-cushioned Grimmia		R
Herzogiella seligeri	Silesian Feathermoss	Nationally Scarce	R
Heterocladium flaccidum	Slender Tamarisk-moss	Rare in SE England except in Wealden districts	R
Homalia trichomanoides	Blunt Feathermoss		O
Homalothecium sericeum	Silky Wall Feathermoss		O
Hookeria lucens	Shining Hookeria		O
Hypnum andoi	Mamillate Plaitmoss		F
Hypnum cupressiforme var. cupressiforme	Cypress-leaved Plaitmoss		O
Hypnum cupressiforme var. resupinatum	Supine Plaitmoss		F
Hypnum jutlandicum	Heath Plaitmoss		R
Isothecium alopecuroides	Larger Mouse-tail Moss		O

[3] Dominant/Abundant/Frequent/Occasional/Rare (within survey area). L is a prefix for local or patchily distributed taxa

Species name	Common name	Conservation Status	Abundance (DAFOR[3])
Isothecium myosuroides	Slender Mouse-tail Moss		R
Kindbergia praelonga	Common Feathermoss		F
Leptodictyum riparium	Kneiff's Feathermoss		O
Lewinskya affinis	Wood Bristlemoss		O
Lewinskya striata	Smooth Bristlemoss		R
Microeurhynchium pumilum	Dwarf Feathermoss		O
Mnium hornum	Swan's-neck Thyme-moss		A
Neckera complanata	Flat Neckera		O
Orthodontium lineare	Cape Threadmoss		O
Orthotrichum diaphanum	White-tipped Bristlemoss		R
Orthotrichum pulchellum	Elegant Bristlemoss		R
Orthotrichum tenellum	Slender Bristlemoss		R
Oxyrrhynchium hians	Swartz's Feathermoss		F
Oxyrrhynchium schleicheri	Twist-tip Feathermoss	New species to SSSI?	R
Plagiomnium undulatum	Hart's-tongue Thyme-moss		O
Plagiothecium denticulatum	Dented Silkmoss		R
Plagiothecium succulentum	Juicy Silkmoss		O
Plenogemma phyllantha	Frizzled Pincushion		O
Polytrichum formosum	Bank Haircap		R
Pseudotaxiphyllum elegans	Elegant Silkmoss		O
Pulvigera lyellii	Lyell's Bristlemoss		R
Rhizomnium punctatum	Dotted Thyme-moss		F
Rhynchostegium confertum	Clustered Feathermoss		F
Rhynchostegium riparioides	Long-beaked Water Feathermoss		F
Sciuro-hypnum plumosum	Rusty Feathermoss	Rare in SE England except in Wealden districts. Appears to be declining	R
Sematophyllum substrumulosum	Bark Signal-moss	Nationally Scarce/new species to SSSI	R
Syntrichia papillosa	Marble Screwmoss		R
Tetraphis pellucida	Pellucid Four-tooth Moss		O
Tetrodontium brownianum	Brown's Four-tooth Moss	Rare in SE England except in Wealden districts	R
Thamnobryum alopecurum	Fox-tail Feathermoss		LF
Thuidium tamariscinum	Common Tamarisk-moss		F
Tortula muralis	Wall Screwmoss		R
Trichostomum brachydontium	Variable Crisp-moss		R

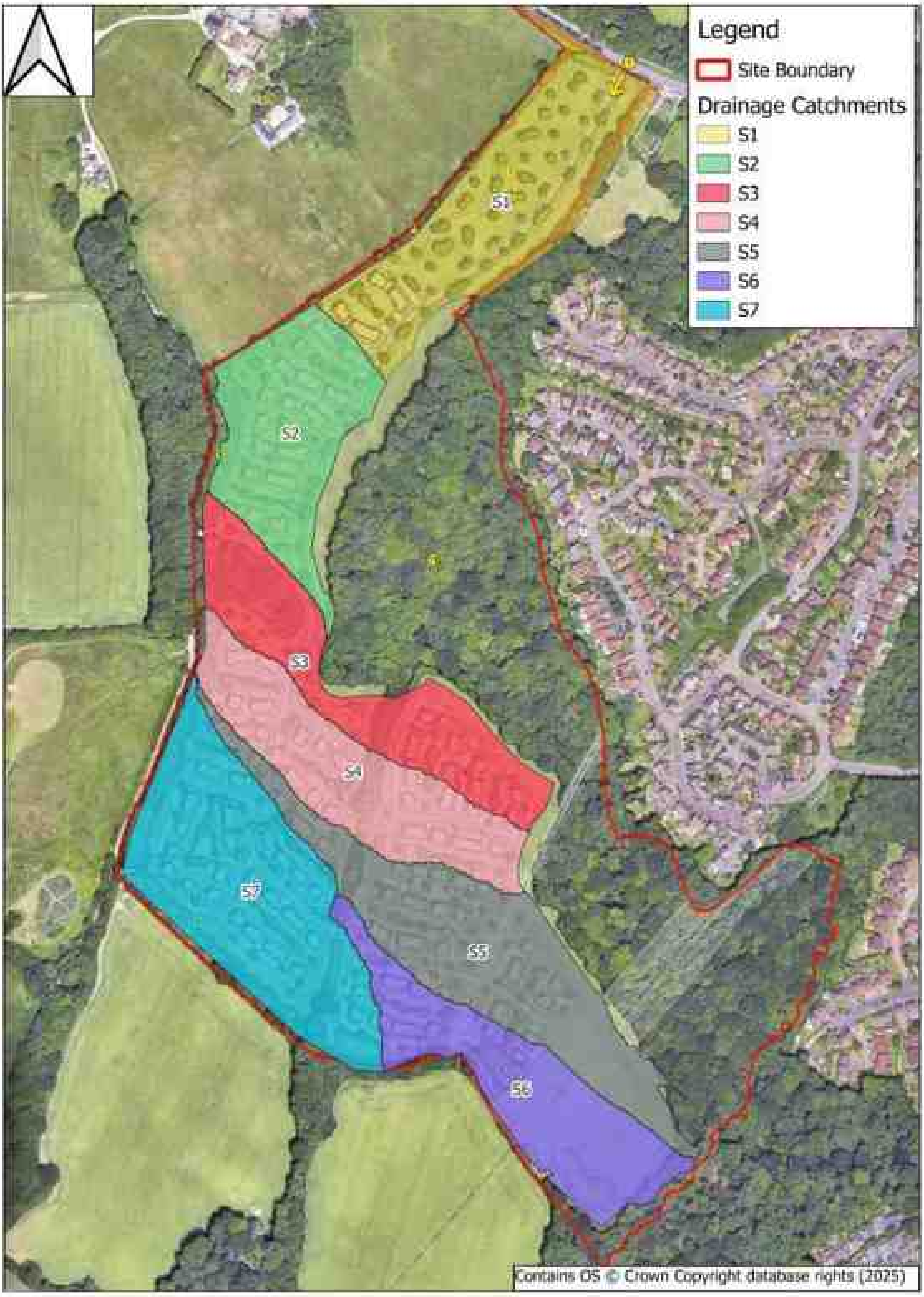
Species name	Common name	Conservation Status	Abundance (DAFOR[3])
Ulota bruchii	Bruch's Pincushion		R
Zygodon conoideus	Lesser Yokemoss		O
Zygodon viridissimus	Green Yokemoss		O
Liverworts			
Calypogeia arguta	Notched Pouchwort		F
Calypogeia fissa	Common Pouchwort		O
Cephalozia bicuspidata	Two-horned Pincerwort		O
Cephalozia curvifolia	Wood-rust		R
Chiloscyphus pallescens	St Winifrid's Other Moss		R
Chiloscyphus polyanthos	St Winifrid's Moss		F
Conocephalum conicum	Great Scented Liverwort		O
Diplophyllum albicans	White Earwort		R
Frullania dilatata	Dilated Scalewort		O
Lophocolea bidentata	Bifid Crestwort		F
Lophocolea heterophylla	Variable-leaved Crestwort		R
Metzgeria conjugata	Rock Veilwort	Only extant site in SE England. Only one patch found – is declining	R
Metzgeria consanguinea	Whiskered Veilwort		R
Metzgeria furcata	Forked Veilwort		F
Microlejeunea ulicina	Fairy Beads		R
Myriocoleopsis minutissima	Minute Pouncewort		O
Pellia epiphylla	Overleaf Pellia		LA
Plagiochila asplenioides	Greater Featherwort		R
Radula complanata	Even Scalewort		R
Scapania undulata	Water Earwort		O

APPENDIX II: NOTABLE SPECIES POPULATIONS

Species name	Gridref	Remarks
Fissidens celticus	TQ7792612268	Stream bank.
	TQ7807012349	On stream bank.
	TQ7830512980	On soil of stream bank
Fissidens rivularis	TQ7804312333	Small amount on a few stones.
	TQ7801812320	Enormous population on lower face of sandrock waterfall and stones below.
	TQ7826413056	At least 1m² patch on 1 m high rock step in stream, some capsules present.
	TQ7778312065	Small quantity in streamside seepage.
	TQ7808512356	Numerous plants on multiple stones in 10 m long section of stream
	TQ7802512317	On bedrock above waterfall in stream.
	TQ7767911945	Small amount on flushed bedrock.
	TQ7803612326	On stones in 5 m section of streambed.
	TQ7787512190	On iron-flushed bedrock at side of stream channel.
	TQ7828913047	On rocks and low stream cascade.
	TQ7780212129	Large quantity on flushed bedrock at edge of stream.
	TQ7780512133	On iron-stained bedrock step in stream channel.
	TQ7820013401	Small plants. 0.5 x 0.5 m patch on downflow side of rock in stream.
	TQ7829713004	Large amount with capsules on vertical flushed stream bank, over several metres of stream.
	TQ7828813036	Plentiful on stream bedrock.
	TQ7810513222	Large amount on prominent 4 m high sandrock waterfall.
	TQ7851412975	Small patch on stone in stream.
	TQ7762111869	Rocks on bank of stream.
	TQ7821513381	Plentiful on rocks in stream cascade.
	TQ7814513155	On rock in stream cascade.
	TQ7774612037	Small amount on stone in streambed.
	TQ7813212402	In heavily dog-disturbed part of stream, on bedrock approx. 30 m upstream of bridge
	TQ7793012267	On rocks in streambed.
	TQ7828213043	At stream confluence on broken concrete structure and stones in stream bed.
	TQ7828313065	Around 20 cm² on stone in stream bed.
	TQ7811412383	In heavily dog-disturbed part of stream, on bedrock step approx. 10 m upstream of bridge
	TQ7790612207	Large amount on numerous bedrock steps in streambed where there is much iron seepage.
	TQ7737811635	On the masonry of the stream culvert below railway embankment and on stones going 20 m upstream in channel.
	TQ7808512371	-
	TQ7785712165	In iron-rich seep in stream bedrock.
	TQ7784612161	Plentiful along 10 m of iron-rich seep in stream bedrock.
	TQ7774612038	In 5 m length of iron-stained channel seepage.
Herzogiella seligeri	TQ7816112312	Apparently still on same decaying tree where first seen. Good sized patch, with capsules.

Species name	Gridref	Remarks
Heterocladium flaccidum	TQ7800612307	On sandrock exposures below prominent waterfall.
Metzgeria conjugata	TQ7802512304	On vertical sandrock exposure just below waterfall and facing it. Only one moribund plant seen.
Sciuro-hypnum plumosum	TQ7765811933	Exposed tree root on stream bank just above footbridge.
	TQ7800612307	On sandrock exposures below prominent waterfall.
Sematophyllum substrumulosum	TQ7830512972	A few patches with capsules on a couple of well rotted trees lying across deep stream gully.
	TQ7850712944	Large patch with capsules on dead fallen tree in ghyll.
	TQ7831812953	On a well rotted tree lying across deep stream gully.
Tetrodontium brownianum	TQ7810813228	Large patch on shaded sandrock stream gully just above a 4 m high waterfall.
	TQ7779812128	Large quantity on deeply shaded vertical rocks 1 m above stream bed on bank.
	TQ7779712136	Small patch on vertical rock face above seepage on stream bank.

Appendix D - Drainage Catchments



Appendix E – Greenfield Runoff Rates

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 1
Site location:	Hastings

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:	50.89378° N
Longitude:	0.53315° E
Reference:	3288175482
Date:	Jan 29 2025 13:17

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 2.65

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	798	798
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	14.91	14.91
1 in 1 year (l/s):	12.68	12.68
1 in 30 years (l/s):	34.3	34.3
1 in 100 year (l/s):	47.57	47.57
1 in 200 years (l/s):	55.78	55.78

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 2
Site location:	Hastings

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:	50.89197° N
Longitude:	0.53032° E
Reference:	3834699295
Date:	Jan 29 2025 13:18

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.89

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	798	798
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	10.64	10.64
1 in 1 year (l/s):	9.04	9.04
1 in 30 years (l/s):	24.46	24.46
1 in 100 year (l/s):	33.93	33.93
1 in 200 years (l/s):	39.78	39.78

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by: Emma Rowlands

Site name: Breadsell Farm Catchment 3

Site location: Hastings

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: 50.88978° N

Longitude: 0.53194° E

Reference: 31466488

Date: Jan 29 2025 13:47

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.90

Methodology

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

SPR estimation method: Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	798	798
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	10.69	10.69
1 in 1 year (l/s):	9.09	9.09
1 in 30 years (l/s):	24.59	24.59
1 in 100 year (l/s):	34.11	34.11
1 in 200 years (l/s):	39.99	39.99

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 4
Site location:	Hastings

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:	50.88927° N
Longitude:	0.53072° E
Reference:	3916157834
Date:	Jan 29 2025 13:49

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.97

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	798	798
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	11.09	11.09
1 in 1 year (l/s):	9.42	9.42
1 in 30 years (l/s):	25.5	25.5
1 in 100 year (l/s):	35.37	35.37
1 in 200 years (l/s):	41.46	41.46

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 5
Site location:	Hastings

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:	50.88765° N
Longitude:	0.53327° E
Reference:	1942368688
Date:	Jan 29 2025 13:52

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 2.7

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	782	782
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	14.84	14.84
1 in 1 year (l/s):	12.61	12.61
1 in 30 years (l/s):	34.13	34.13
1 in 100 year (l/s):	47.34	47.34
1 in 200 years (l/s):	55.5	55.5

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 6
Site location:	Hastings

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:	50.88673° N
Longitude:	0.53322° E
Reference:	2950415958
Date:	Jan 29 2025 13:52

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 1.94

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	782	782
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	10.66	10.66
1 in 1 year (l/s):	9.06	9.06
1 in 30 years (l/s):	24.52	24.52
1 in 100 year (l/s):	34.01	34.01
1 in 200 years (l/s):	39.88	39.88

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 7
Site location:	Hastings

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:	50.88858° N
Longitude:	0.52894° E
Reference:	641047965
Date:	Jan 29 2025 13:53

Runoff estimation approach

IH124

Site characteristics

Total site area (ha): 3.03

Methodology

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

Soil characteristics

	Default	Edited
SOIL type:	4	4
HOST class:	N/A	N/A
SPR/SPRHOST:	0.47	0.47

Hydrological characteristics

	Default	Edited
SAAR (mm):	781	781
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

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):	16.63	16.63
1 in 1 year (l/s):	14.13	14.13
1 in 30 years (l/s):	38.24	38.24
1 in 100 year (l/s):	53.04	53.04
1 in 200 years (l/s):	62.19	62.19

Appendix F – Storage Volume Calculations

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 1
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.89365° N
Longitude:	0.53307° E
Reference:	929702430
Date:	Feb 11 2025 12:08

Site characteristics

Total site area (ha):	2.65
Significant public open space (ha):	2.28
Area positively drained (ha):	0.3700000000000001
Impermeable area (ha):	0.37
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.37
Net impermable area for storage volume design (ha):	0.37
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	798	798
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	14.91	14.91
Q_{BAR} for net site area (l/s):	2.08	2.08

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	4.8	4.8
1 in 100 year (l/s):	6.6	6.6

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	241	181
Long term storage 1/100 years (m^3):	58	63
Total storage 1/100 years (m^3):	299	244

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 2
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.89216° N
Longitude:	0.53045° E
Reference:	3652269912
Date:	Feb 12 2025 14:44

Site characteristics

Total site area (ha):	1.89
Significant public open space (ha):	1.11
Area positively drained (ha):	0.7799999999999998
Impermeable area (ha):	0.7799999999999998
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.78
Net impermable area for storage volume design (ha):	0.78
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	798	798
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45	Growth curve factor 100 years:	3.19	3.19
Urban creep allowance factor:	1.1	Q_{BAR} for total site area (l/s):	10.64	10.64
Volume control approach	Use long term storage	Q_{BAR} for net site area (l/s):	4.39	4.39
Interception rainfall depth (mm):	5			
Minimum flow rate (l/s):	2			

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	3.7	3.7
1 in 30 years (l/s):	10.1	10.1
1 in 100 year (l/s):	14	14

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	530	390
Long term storage 1/100 years (m^3):	162	175
Total storage 1/100 years (m^3):	692	565

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 3
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.89040° N
Longitude:	0.52959° E
Reference:	531206267
Date:	Feb 12 2025 14:49

Site characteristics

Total site area (ha):	1.9
Significant public open space (ha):	1.56
Area positively drained (ha):	0.33999999999999986
Impermeable area (ha):	0.33999999999999986
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.34
Net impermable area for storage volume design (ha):	0.34
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	798	798
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45		
Urban creep allowance factor:	1.1		
Volume control approach	Use long term storage		
Interception rainfall depth (mm):	5		
Minimum flow rate (l/s):	2		

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	10.69	10.69
Q_{BAR} for net site area (l/s):	1.91	1.91

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	4.4	4.4
1 in 100 year (l/s):	6.1	6.1

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m³):	222	169
Long term storage 1/100 years (m³):	46	49
Total storage 1/100 years (m³):	267	218

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 4
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.88957° N
Longitude:	0.53026° E
Reference:	1379566754
Date:	Feb 12 2025 14:53

Site characteristics

Total site area (ha):	1.97
Significant public open space (ha):	1.24
Area positively drained (ha):	0.73
Impermeable area (ha):	0.73
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.73
Net impermable area for storage volume design (ha):	0.73
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	798	798
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	11.09	11.09
Q_{BAR} for net site area (l/s):	4.11	4.11

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	3.5	3.5
1 in 30 years (l/s):	9.4	9.4
1 in 100 year (l/s):	13.1	13.1

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	496	365
Long term storage 1/100 years (m^3):	152	164
Total storage 1/100 years (m^3):	648	529

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 5
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.88791° N
Longitude:	0.53257° E
Reference:	3389977348
Date:	Feb 12 2025 15:00

Site characteristics

Total site area (ha):	2.7
Significant public open space (ha):	2.3
Area positively drained (ha):	0.40000000000000036
Impermeable area (ha):	0.40000000000000036
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.4
Net impermable area for storage volume design (ha):	0.4
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	782	782
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45	
Urban creep allowance factor:	1.1	
Volume control approach	Use long term storage	
Interception rainfall depth (mm):	5	
Minimum flow rate (l/s):	2	

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	14.84	14.84
Q_{BAR} for net site area (l/s):	2.2	2.2

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	5.1	5.1
1 in 100 year (l/s):	7	7

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	264	197
Long term storage 1/100 years (m^3):	68	74
Total storage 1/100 years (m^3):	332	271

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 6
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.88741° N
Longitude:	0.53253° E
Reference:	1743540824
Date:	Feb 12 2025 15:04

Site characteristics

Total site area (ha):	1.94
Significant public open space (ha):	1.76
Area positively drained (ha):	0.17999999999999994
Impermeable area (ha):	0.17999999999999994
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.18
Net impermable area for storage volume design (ha):	0.18
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	782	782
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	10.66	10.66
Q_{BAR} for net site area (l/s):	0.99	0.99

Site discharge rates

	Default	Edited
1 in 1 year (l/s):	2	2
1 in 30 years (l/s):	2.3	2.3
1 in 100 year (l/s):	3.2	3.2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m³):	92	70
Long term storage 1/100 years (m³):	19	20
Total storage 1/100 years (m³):	111	90

Surface water storage requirements for sites

www.uksuds.com | Storage estimation tool

Calculated by:	Emma Rowlands
Site name:	Breadsell Farm Catchment 7
Site location:	Hastings

This is an estimation of the storage volume requirements that are needed 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). It is not to be used for detailed design of drainage systems. It is recommended that hydraulic modelling software is used to calculate volume requirements and design details before finalising the design of the drainage scheme.

Site Details

Latitude:	50.88864° N
Longitude:	0.52891° E
Reference:	1168340706
Date:	Feb 12 2025 15:07

Site characteristics

Total site area (ha):	3.03
Significant public open space (ha):	2.22
Area positively drained (ha):	0.8099999999999996
Impermeable area (ha):	0.8099999999999996
Percentage of drained area that is impermeable (%):	100
Impervious area drained via infiltration (ha):	0
Return period for infiltration system design (year):	10
Impervious area drained to rainwater harvesting (ha):	0
Return period for rainwater harvesting system (year):	10
Compliance factor for rainwater harvesting system (%):	66
Net site area for storage volume design (ha):	0.81
Net impermable area for storage volume design (ha):	0.81
Pervious area contribution to runoff (%):	30

* where rainwater harvesting or infiltration has been used for managing surface water runoff such that the effective impermeable area is less than 50% of the 'area positively drained', the 'net site area' and the estimates of Q_{BAR} and other flow rates will have been reduced accordingly.

Methodology

esti	IH124
Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics

	Default	Edited
SOIL type:	4	4
SPR:	0.47	0.47

Hydrological characteristics

	Default	Edited
Rainfall 100 yrs 6 hrs:	--	67.93
Rainfall 100 yrs 12 hrs:	--	76.86
FEH / FSR conversion factor:	1.18	1
SAAR (mm):	781	781
M5-60 Rainfall Depth (mm):	20	20
'r' Ratio M5-60/M5-2 day:	0.4	0.4
Hydological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 10 year:	1.62	1.62
Growth curve factor 30 year:	2.3	2.3

Design criteria

Climate change allowance factor:	1.45
Urban creep allowance factor:	1.1
Volume control approach	Use long term storage
Interception rainfall depth (mm):	5
Minimum flow rate (l/s):	2

Growth curve factor 100 years:	3.19	3.19
Q_{BAR} for total site area (l/s):	16.63	16.63
Q_{BAR} for net site area (l/s):	4.45	4.45

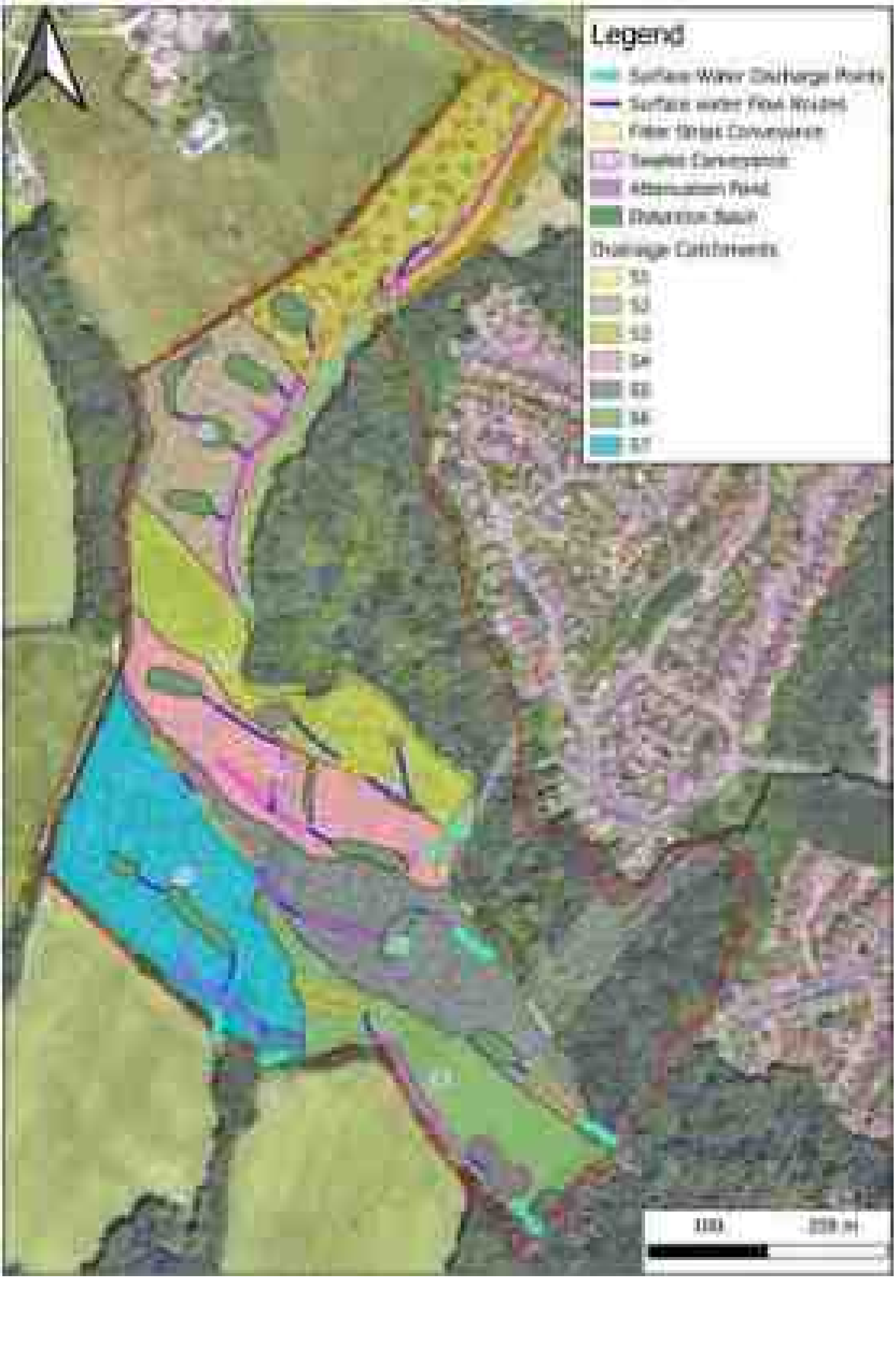
Site discharge rates

	Default	Edited
1 in 1 year (l/s):	3.8	3.8
1 in 30 years (l/s):	10.2	10.2
1 in 100 year (l/s):	14.2	14.2

Estimated storage volumes

	Default	Edited
Attenuation storage 1/100 years (m^3):	556	410
Long term storage 1/100 years (m^3):	168	182
Total storage 1/100 years (m^3):	724	591

Appendix G – Proposed Drainage Strategy



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[xvii] Refer to Cambridge Waste Water Treatment Plant Relocation Project, Anglian Water Services Limited: Statement of Common Ground: Natural England, Application Document Reference: 7.14.8, PINS Project Reference: WW010003 available at Microsoft Word - 7.14.8 Natural England SoCG April 2024 (TRACKED)
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Hilson Moran
part of the Tyréns Group

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