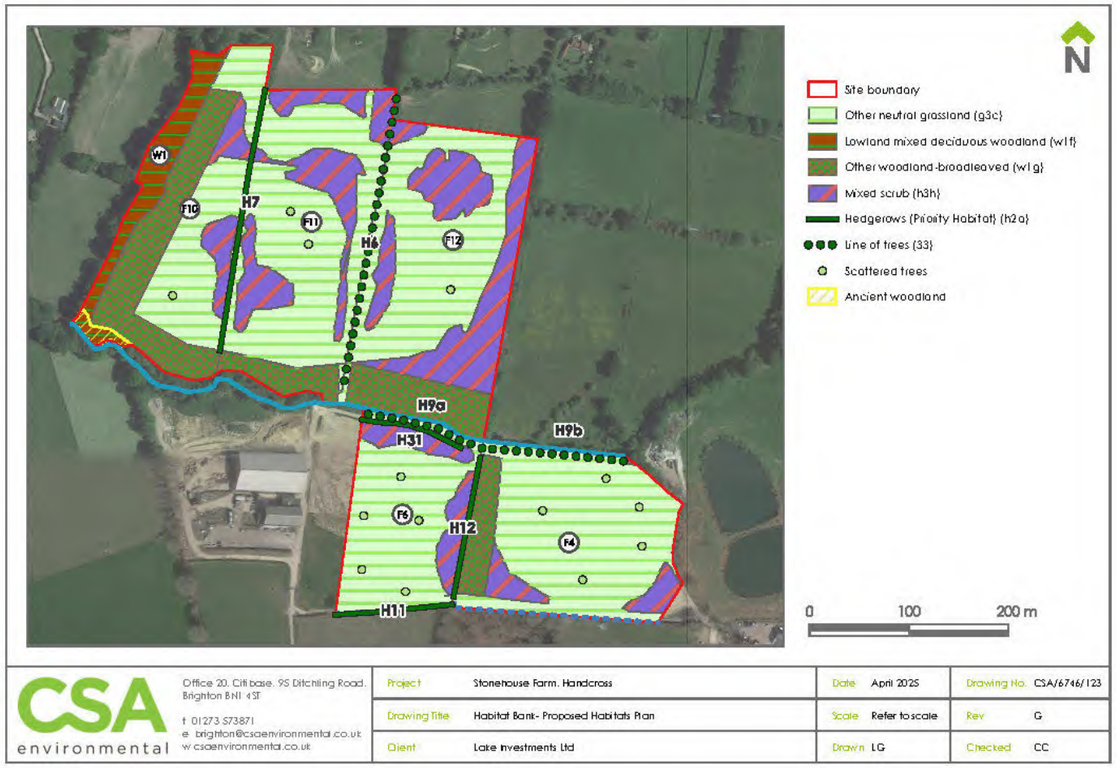
NATURAL ENGLAND

Department for Environment Food & Rural Affairs

Habitat Management and Monitoring Plan

Site Name:	Stonehouse Farm, Handcross, West Sussex
Date:	17/04/2025
Version:	CSA/6476/07



Author: CSA Environmental

Client: Lake Investments Ltd

CSA environmental

Template Version 1.0 November 2023

Contents

Version Control

The version control is used for updates to the content. Record the initial version and further version control details in this table each time the management plan is altered throughout the management and monitoring period.

Version	Issue Status	Prepared by / Date	Approved by / Date
CSA/6745/07	Draft	CSA Environmental	CC 11/04/2025

Document Details

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Authorship Details
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1. Project Background

Summarise the key aspects of your management plan in this section. Table PB-B01 can be extended to suit the specific needs of individual projects.

Site Overview PB-B01	
Project type	Habitat Bank
Development Name and Address	N/A
BNG Project Name and Address	Stonehouse Farm, Handcross, West Sussex
Author Organisation	CSA Environmental
Landowner	Lake Investments Ltd
Land Manager	Hunter Development Holdings Ltd
Responsible person/organisation for creating or enhancing the habitat	Lake Investments Ltd
Period covered by this management plan	To be confirmed
Planning authority	Horsham District Council
Planning reference (if applicable)	N/A
BNG register reference (if applicable)	N/A
Central OS grid reference	TQ 22974 28266
Metric revision/title	CSA/6745/V5
Are any Irreplaceable Habitats present onsite	Yes: ☒ No: ☒

Summary of Management Plan

Habitats to be Retained, Created and Enhanced PB-B02

Thicket, woodland and species-rich native hedgerow will be created. Existing grassland fields will be enhanced. Woodland and hedgerows will be retained alongside proposals.

Timescales for Actions PB-B03

The management plan will cover a 30-year period following the commencement of the Habitat Bank. Habitat-specific timescales for establishment and management are set out herein. The exact commencement date of habitat creation works will be confirmed within the development specific legal agreements as biodiversity units are purchased.

Monitoring Requirements PB-B04

Monitoring visits will be undertaken regularly during initial establishment years (Years 1, 2, 3 and 5), then at a 5–10-year frequency thereafter (Years 10, 15, 25 and 30). Updated habitat and condition assessments will be undertaken to evaluate the success of habitat creation and enhancement measures, alongside fixed-point photography.

Required Consents and Licences PB-B05

Consents will be obtained as appropriate (e.g. tree and scrub planting).

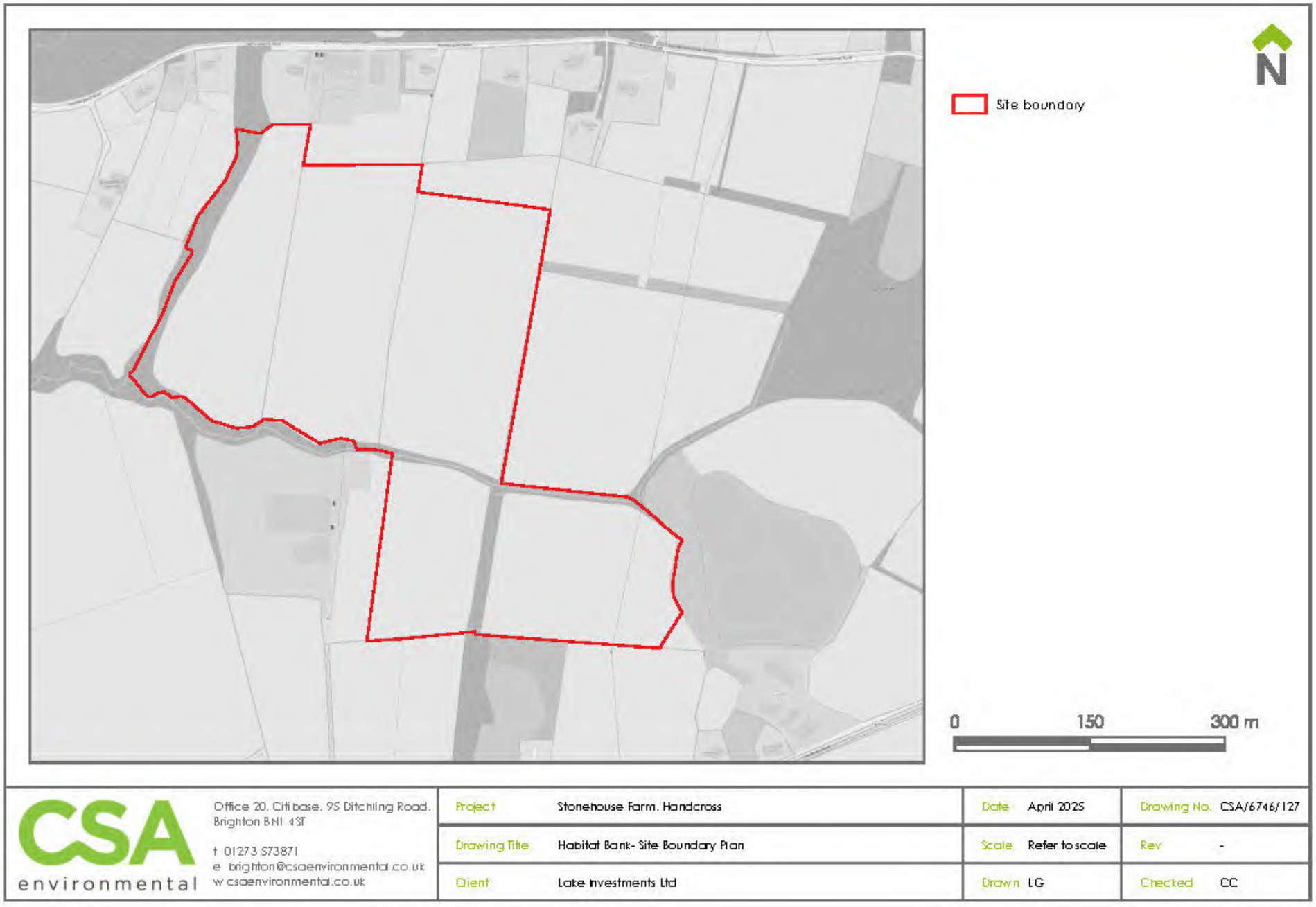
Funding PB-B06

The purchasing of biodiversity units from the site will fund the proposals. Lake Investments Ltd may forward fund initial elements of the proposals.

Legal Agreement PB-B07

To be agreed in due course with responsible body (RSK Biocensus)

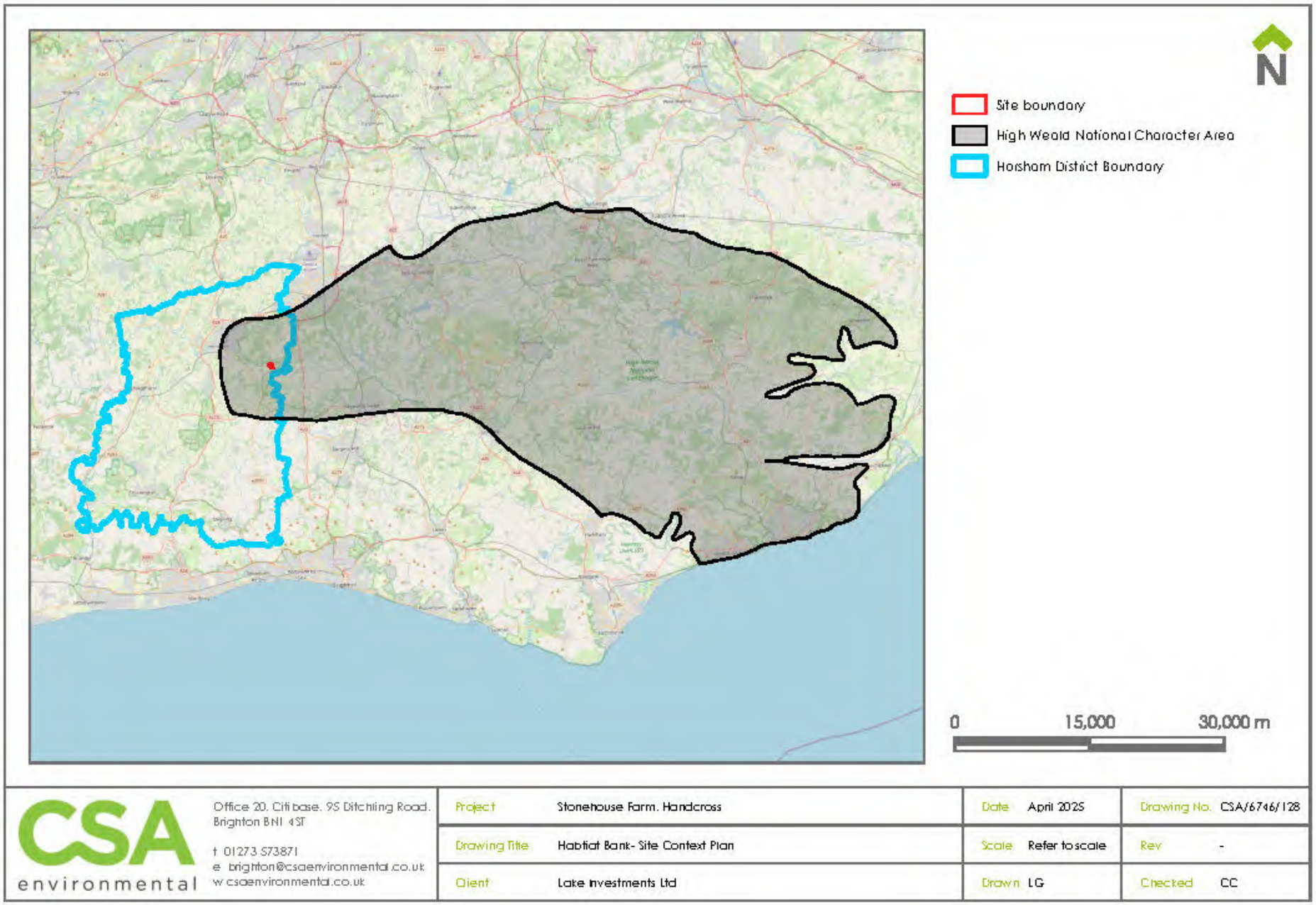
Site Boundary Plan PB-F01



CSA environmental Office 20, Citibase, 95 Ditchling Road, Brighton BN1 4ST t 01273 573871 e brighton@csaenvironmental.co.uk w csaenvironmental.co.uk	Project	Stonehouse Farm, Handcross	Date	April 2025	Drawing No. CSA/6746/127
	Drawing Title	Habitat Bank- Site Boundary Plan	Scale	Refer to scale	Rev -
	Client	Lake Investments Ltd	Drawn	LG	Checked CC

Site Context Plan PB-F02

This plan should show the location of the site, including the LPA, boundary, national character area, and any relevant landscape scale policy or guidance information.



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	Drawing Title	Habitat Bank- Site Context Plan	Scale	Refer to scale	Rev -
	Client	Lake Investments Ltd	Drawn	LG	Checked CC

Phasing strategy

Will the proposed work measures be delivered in phases? PB-B08	**Yes: ☐ No: ☒**
No 'Phasing' as such is anticipated. However, it is envisaged that the delivery of the Habitat Bank proposals will be implemented to meet demand, as/when legal agreements are made with third party developers. The expectation is that implementation will commence in late 2025 / early 2026.	

Roles and Responsibilities

Provide details of the responsible persons and organisation(s) for delivering this management plan.

Ecologist or Other Professional Responsible for HMMP PB-B09				
Name or Initials		Clare Caudwell CEcol CIEEM – Director (Ecology)		
Organisation		CSA Environmental		
Responsibility	Start Date:	TBC	End Date:	TBC
This HMMP has been produced by CSA Environmental on behalf of Lake Investments Ltd. Baseline condition assessments, post-intervention assessments and the Biodiversity Metric have been completed by CSA Environmental. Advice and inputs into the scheme proposals have been provided by CSA from the outset and CSA will be responsible for ongoing monitoring and advice throughout the implementation of the habitat bank proposals.				
Statement of Competency				
This HMMP and associated BNG assessment has been completed by Lydia Galbraith ACIEEM and reviewed by Clare Caudwell CEcol MCIEEM of CSA Environmental. Lydia Galbraith is an Ecologist with extensive experience and knowledge of Biodiversity Net Gain, condition assessments (FISC level 3) and use of the Biodiversity Metric. Lydia is trained and accredited to completed River Condition Assessments (RCA), having completed 'Modular River Survey' training and CIEEM's 'Introduction to the Rivers and Streams Metric for Biodiversity Net Gain' training course. Clare Caudwell is Director of Ecology at CSA Environmental and is experienced in Biodiversity Net Gain assessment and ecological assessment, and has completed the 'Calculating and Using Biodiversity Units with Metric 2.0 CIEEM Training Course' (December 2019), and has completed numerous net gain assessments using iterations of the Metrics v2.0 to the Statutory Metric. Clare is also trained and accredited to completed River Condition Assessments (RCA).				

Landowner or Land Manager PB-B10				
Name or Initials		Lee Goossens		
Organisation		Lake Investments Ltd		
Responsibility	Start Date:	TBC	End Date:	TBC
Lakes Investments Ltd are the landowners and will be responsible for delivery of the habitat bank, including appointing appropriately qualified persons as necessary to undertake relevant roles. Management implementation actions will be undertaken by Hunter Developments Holdings Ltd.				
Statement of Competency				
Hunter Developments Holdings Ltd. will engage with specialist contractors as necessary to facilitate specific works. Such planting, wildflower seeding and a regenerative livestock farmer will manage the livestock and assist with landscape and habitat management.				

Management Organisation(s) Responsible for Implementing the HMMP PB-B11				
Name or Initials		Lee Goossens		
Organisation		Hunter Developments Holdings Ltd		
Responsibility	Start Date:	TBC	End Date:	TBC
Management implementation actions will be undertaken by Hunter Developments Holdings Ltd				
Statement of Competency				
Hunter Developments Holdings Ltd has specialised in the sympathetic redevelopment of country estates and smallholdings for 25 years. In recent years Hunters have progressively focused on renaturing the environment whilst continuing to support and promote local food production. Hunters currently owns or manages more than 1000 acres across four separate land holdings within the Horsham District. Land holdings are mainly conversationally grazed, cropped or laid to woodland and scrub. Hunters works with several tenant farmers and benefits from an established resource of local agricultural and forestry workers.				

LPA or Responsible Body for Reviewing HMMP PB-B12				
Name or Initials		TBC		
Organisation		RSK Biocensus		
Responsibility	Start Date:	TBC	End Date:	TBC

Land Use Summary

Overview of Baseline Site Use PB-B13

The site is currently subject to regular agricultural management, including cattle grazing within all fields F4, F6, F10-F12 (See Baseline Habitats Plan (CSA/6746/124/B) for habitat parcel reference numbers. At present the site is grazed by c.80-100 cattle and 30-40 sheep from April through to late October.

Previously grassland areas are understood to have been subject to more intensive cattle grazing. An old slurry pit is located within the former farmyard to the north of field F11, and it is understood that slurry may have previously been spread over the fields north of the Goldings Stream (F10, F11 and F12) by way of enrichment. This has likely promoted the dominance of vigorous agricultural grasses. South of the stream (F6 and F4) enrichment appears to have been less, although these fields have been subject to some disturbance as a result of land raising activities with inert hardcore being spread and surface dressed, by the previous landowner.

Overall the grassland fields exhibit poor condition associated with past and current agricultural management, being generally species-poor in nature, dominated by fast-growing grasses and ruderal species. All grassland is currently considered to be 'modified'. Fields F4 and F6 (south of the stream), and F11 and F12 (north of the stream; south of the farmyard) are in 'poor' condition due to poor species diversity (failing Criterion A; which is essential for achieving moderate – good condition) and lack of variation in sward height (failing Criterion B). F11 also has localised areas bear ground (failing Criterion E). Field F10 is considered to be in 'moderate' condition as they are slightly more species rich (passing Criterion A; 6-8 vascular plant species per m2), but still showing little variation in sward height (failing Criterion B) and localised bare ground (failing Criterion E).

Lowland deciduous woodland (W1) occurs along the western boundary of F10; and also along the Goldings Stream corridor to the south of F10 and F11 (currently outside of the habitat bank area). This woodland comprises mature semi-natural woodland dominated by beech / oak, with an understory of holly, hawthorn, elder and old hazel coppice. A tributary of Goldings Stream follows north to south through the woodland. The southern end of the woodland adjacent to Goldings Stream is mapped as Ancient Woodland. The woodland is considered to be in moderate condition. The woodland is not under any form of current management.

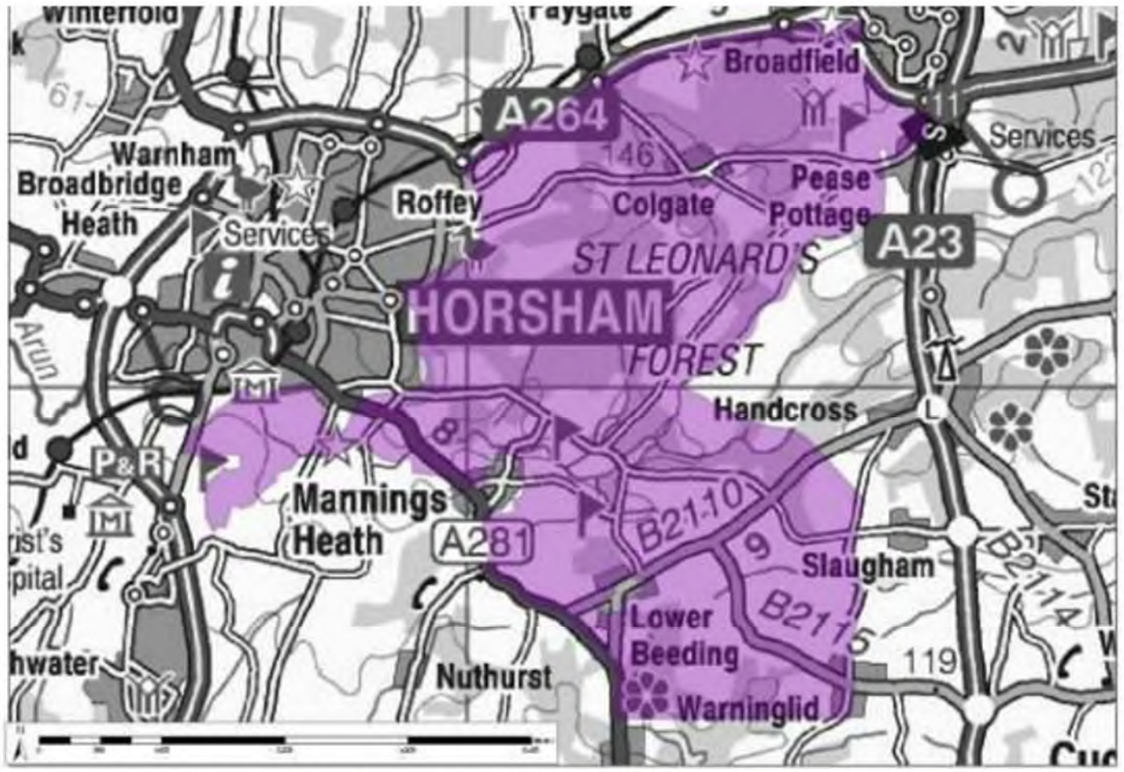
Goldings Stream flows east to west between fields F6 and F10-12; and is bordered by a mature tree belt within F6. The stream was subject to an RCA and considered to be in 'moderate' condition. A series of drainage ditches are associated with hedgerows / tree lines, which convey surface water during periods of rainfall to Goldings Stream. Native hedgerows (H7, H11, H12 and H31) comprise a range of native species and are all considered to be in 'good' condition, with H11 also being associated with a bank / ditch and H7 comprising mature trees. Lines of mature trees (H6, H9a and H9b) are considered to be in 'moderate' condition; with H6 being gappy (failing criterion B) and H9a and H9b having areas of disturbed ground at their base as a result of hardcore previously being dumped in this area (failing Criterion D). Hedgerows / tree lines are current subject to an annual cut by way of management.

Overview of Proposed Site Use PB-B14

The site is proposed to become a strategically located Habitat Bank, to enhance and create biodiverse habitats. Whilst a Nature Recovery Network (NRN) has not formally been adopted within Horsham District, the proposed Habitats Bank is located within the following areas and habitat proposed creation and enhancement is considered to be within an ecologically desirable area:

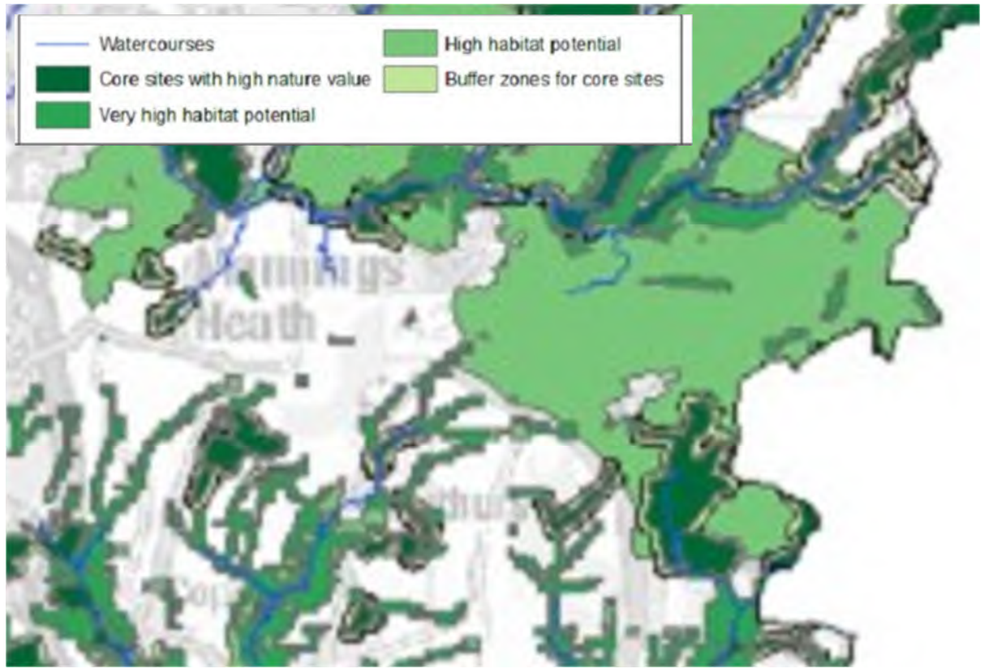
- St Leonards Biodiversity Opportunity Area (BOA)
- 'Buffer Zone for Core Sites' as identified within the Draft Horsham District Nature Recovery Network Report (2021)
- Weald to Waves- The Corridor Map

St Leonards Biodiversity Opportunity Area (BOA) (as identified by the Sussex Biodiversity Partnership). BOAs represent priority areas for the delivery of Biodiversity Action Plan targets. Gill streams within the BOA are the source of the River Arun. Heath and woodland comprise the principal priority interest areas in the north, with watershed of river tributaries, woodland, wood-pasture and parkland with species rich hedgerows in the south of the BOA (within which the proposed Habitat Bank is located).

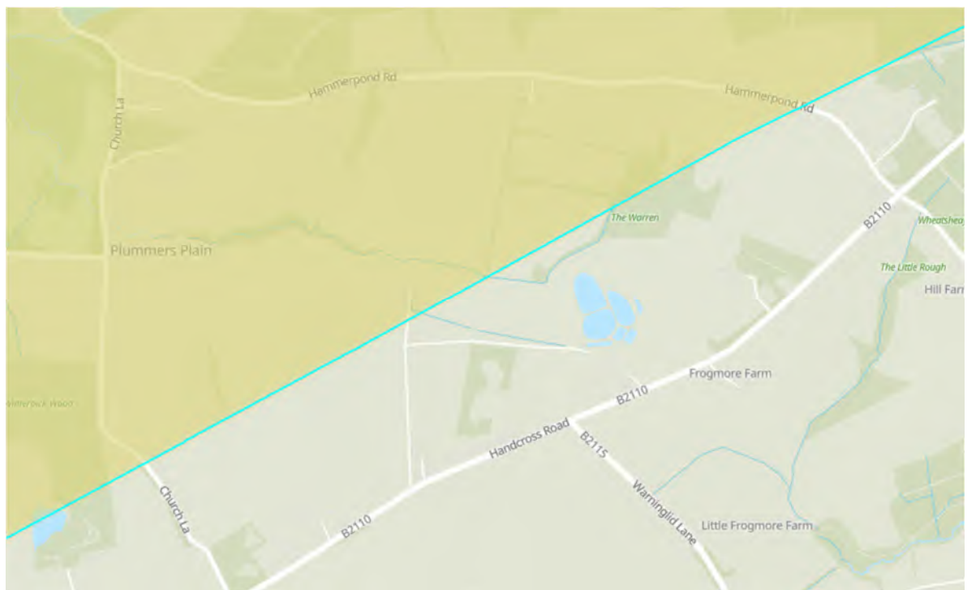


The Biodiversity Opportunity Areas (BOAs) are the regional priority areas of opportunity for restoration and creation of Biodiversity Action Plan (BAP) habitats. They are a spatial representation of BAP targets and are areas of opportunity, not constraint. The BOAs are the property of the South East England Biodiversity Forum www.sebiodiversity.org.uk. Contains Ordnance Survey data Crown copyright and database right 2010

The proposed Habitat Bank is located within a 'Buffer Zone for Core Sites' as identified within the Draft Horsham District Nature Recovery Network Report (2021).



Weald to Waves (WTW) initiative aim to link up BOAs through positive land management / habitat creation initiatives within the WTW corridor routes. The northern part of the proposed Habitat Bank is located within the WTW Corridor 'Radiant Zone'; which is a 2km wide corridor from the 'Core Corridor Route'. The southern part of the proposed habitat bank.



Proposed Habitat Creation & Enhancement

Existing grassland will be enhanced from modified 'poor' condition ('moderate' condition for F10) to 'other neutral grassland' 'moderate' condition, thorough changes in management and overseeding here necessary. Current agricultural management regime will cease, and the grassland field will be enhanced through a regime of cutting and conservation grazing.

Habitat within these land parcels will be diversified through the creation of native scrub and woodland planning, to create habitat mosaics and increase nesting and foraging opportunities for birds / invertebrates / bats etc.

Where possible – existing tree lines and hedgerows will be enhanced. The gappy tree line (H6) between will be enhanced through infill planting of native shrub and standard tree specimens.

The site will be managed over the management plan period to achieve positive conditions, in line with targets set out in the Statutory Biodiversity Metric.

Site Context Photos PB-F03

Please include two overview photographs of the site in its current form here. Include additional photographs in an appendix if needed. Tick if additional photographs are provided in the Appendices
☒ Reference: 6476_Photosheet

Site Baseline, Environmental Information and Associated Impacts Checklist PB-T01

Consider the Baseline and Environmental Information listed below. These are likely to be appropriate factors informing your proposals and project design. They can provide the reviewer with important contextual information for the management prescriptions provided later in this document. Use your professional judgement to determine which factors are relevant to your specific project.

Please use the check box to indicate which are included in your plan. For any not included, provide brief reasons why the factor is not relevant to your project using your professional judgement. Where this information is provided elsewhere, you can reference existing reports and, or, plans that have informed your decisions. For the templates for each heading see pages 3-20 of the Companion Document.

Baseline and Environmental Information	**Prompts for when these may be relevant.** This is not an exhaustive list. Use your professional judgement to determine which are required for your HMMP	Check box if included	Document Reference or Reason if not included
Statutory / Non-statutory Designated Sites	Will your proposals lead to direct or indirect effects on designated sites?	☒	No designations cover the proposed Habitat Bank (See Ecological Impact Assessment (CSA/6747/08/C))
Protected and Notable Species	Does the presence or proximity of specific species on or near your site present any constraints or opportunities to project design or management?	☒	No specific constraints to the delivery of the proposals; but new habitat creation will result in positive outcomes for a range of protected / notable species (e.g. breeding birds, bats, etc). Details of protected / notable species records provided in Ecological Impact Assessment (CSA/6747/08/C)).
Invasive Non-Native Species (INNS)	Are any INNS present onsite that could affect the proposals?		None known to be present
Biological Records Plan - Sites and Species	Does the presence of designated sites or specific species on or near the site present any constraints or opportunities to proposals?	☐	Sites and species are described in their relevant sections above. (Also see Ecological Impact Assessment (CSA/6747/08/C))
Baseline Habitats Survey	Is this current and important HMMP information located in a separate document? If so, provide details on where it is located.	☒	Also see appended Habitat Summary Table, Flora Lists, Habitat Condition Assessment Sheets
Public Access	Has public access, or proposals to allow public access, influenced your management prescriptions? If so, how?	☒	An existing footpath crosses the site north to south, through F11 and along the boundary of F6. Proposals have been designed both to respect this footpath and to maintain attractive walking routes, and a new permissive circular walking route will be created within Field F4 and F6,
Climate	Are local climate conditions and, or, climate change likely to impact the target habitat retention, creation or enhancement?	☐	Climate is not considered a constraint in relation to the habitat types proposed above the normal risks associated with weather and climate change.
Geology and Topography	Any geological or topographical constraints or opportunities?	☒	Relevant information provide herein.
Agricultural Land Status	Does the site support any land favourable for agricultural management? Could this affect the proposals?	☐	The Site primary falls into the “non-agricultural land; other land primarily used in non-agricultural use” category, whilst some of the site falls into grade 4 agricultural land- ‘poor’. The Site is therefore not considered to be ‘the best and most versatile agricultural land’, and the habitat proposals will not significantly affect land most favourable for agricultural management.
Soils and Substrates	Do soils and substrates present any constraints or opportunities?	☒	See appended Baseline Soil Assessment appended to this document, Tim O’Hare Associates (reference: Stonehouse Farm, West Sussex Baseline Soil Assessment TOHA/24/4515/HM)
Contaminated Land	If there is any contaminated land, will this present any constraints?	☐	No known constraints to Habitat Bank proposals. See Preliminary Ground Contamination Risk Assessment Report (Ashdown Site Investigation) in relation to development on side site.
Hydrology and Drainage	Will the site hydrology present any constraints or opportunities?	☐	Not considered necessary. The site has been actively managed for a significant period of time, with no significant issues encountered; see Flood Risk Assessment & Drainage Strategy (Motion, February 2025)
Flood Risk Zones	Is the site within a flood risk zone? Will that present any site management risks?	☒	Flood Risk Zone 1 – low risk; see Flood Risk Assessment & Drainage Strategy (Motion, February 2025)
Landscape Character and Designations	Does the landscape character of the site present any constraints or opportunities?	☒	National Character Area: High Weald – historically comprising species rich meadows, species rich hedgerows and wooded shaws.

Historic Land Use	Does the historic land use present any constraints or opportunities?	☐	Land historically used for farming. 2020/2021 hard core was spread over some of F4 / F6 as part of a landfill / raising exercise. This could provide some potential constraints to habitat establishment; but can be dealt with vis adequate ground preparations.
Historic Environment and Earth Heritage	Are there any historic environment designations? What are the implications for your plan?	☐	No known constraints.
Other – please specify	Any other details - for example underground services or overhead powerlines, which may impact habitat management.	☐	Overhead pylons cross F4; proposals have taken account of this with no woodland planting proposed below.

1. Baseline and Environmental Information

Designated Sites (BI-T01)

A search has been undertaken in regards to other proposals within the wider landholding, identifying any

Internationally designated Statutory sites within 10km, and Nationally designated sites within 3km.

Site Name	Designation	Distance from Project Site	Potential Impact from Project
St Leonards Woodland	SSSI	c. 1km north west of the site	Negligible

Summary of Designated Sites (BI-B01)

St Leonards Woodland SSSI is designated for the following important features:

- Semi-natural broadleaved woodland
- Lowland mixed deciduous woodland
- Wet woodland with streams, spring and acid flush vegetation
- Notable plant species including lemon scented fern *Oreopteris limbisperma* which is scarce in Sussex

Constraints and Opportunities for Project (BI-B02)

Five non-statutory Designations were identified within 2km of the Site, including Hydewill Wood and Hyde Gill Local Wildlife Site (LWS), Orange Gill and Homestead Wood LWS, Mill Pond LWS, St Leonard Forest LWS and Old Deer Park LWS. No impacts to any non-statutory sites are anticipated due to the nature of the proposals. All existing habitats will be retained or enhanced and the proposals will therefore maintain or improve their biodiversity value. A range of ecologically valuable habitats will be created, of benefit to a variety of wildlife. The proposals are not anticipated to effect the special interest features of the St Leonards Woodland SSSI.

Protected and Notable Species (BI-T02)

A search has been undertaken during desktop studies for other proposals within the wider landholding. These studies identified any notable species within 2km of the Site and is summarised below

Species	Dates	Conservation Status	Distance of Closest Record	Potential Impact from Project
Common pipistrelle	1985 - 2020	GB Red List: Least Concern (LC)	c. 50m east	Positive
Soprano pipistrelle	2010 - 2021	GB Red List: Least Concern (LC)	c. 1.9km north-west	Positive
Nathusius' pipistrelle	2020	GB Red List: Near Threatened (NT)	c. 60m west	Positive
Pipistrelle sp.	2000 - 2016	GB Red List: up to Near Threatened (NT)	c. 115m south	Positive
Noctule	2018 - 2020	GB Red List: Least Concern (LC)	c. 60m west	Positive
Brown long-eared bat	1985 - 2020	GB Red List: Least Concern (LC)	c. 60m west	Positive
Long-eared bat sp.	2002 - 2018	GB Red List: up to Endangered (EN)	c. 90m east	Positive
Natterer's bat	1992 - 2018	GB Red List: Least Concern (LC)	c. 500m east	Positive
Daubenton's bat	2020	GC Red List: Least Concern (LC)	c. 60m west	Positive
Serotine	1987 - 2020	GB Red List: Vulnerable (VU)	c. 60m west	Positive
Dormouse	2018-2021	GB Red List: Vulnerable (VU)	c. 1.1km west	Positive
Water vole	1997-1998	GB Red List: Endangered (EN)	c. 1.3km west	Negligible
Barn Owl	1982 - 2022	UK Red List for Birds: Green	Within 2km	Negligible
Slow worm	1988 - 2018	Protected under the Wildlife and Countryside Act 1981; Priority	c. 550m east	Positive

		Species under UK Post-2010 Biodiversity Framework		
Common lizard	1993 - 2002	Protected under the Wildlife and Countryside Act 1981; Priority Species under UK Post-2010 Biodiversity Framework	c. 30m north	Positive
Adder	1981 - 2010	Protected under the Wildlife and Countryside Act 1981; Priority Species under UK Post-2010 Biodiversity Framework	c. 800m north-west	Positive
Grass snake	1985 - 2022	Protected under the Wildlife and Countryside Act 1981; Priority Species under UK Post-2010 Biodiversity Framework	c. 15m east	Positive
Great Crested Newt	1983 - 2021	Protected under the Wildlife and Countryside Act 1981; Priority Species under UK Post-2010 Biodiversity Framework	c. 250m north-east	Negligible

Summary of Protected and Notable Species (BI-B03)

See EcIA (CSA/6746/08) for details on protected and notable species and relevance to area.

Constraints and Opportunities for Project (BI-B04)

The proposals are not anticipated to result in changes to habitats that would be anticipated to negatively impact on protected species, including those identified above. The proposals include for significant new and diverse habitats that will provide optimal habitat conditions for a range of species that will be present within the local area. The proposals are expected to result in overall positive effects on protected and notable species.

Baseline Habitats Survey

Ecologist responsible for baseline surveys (BI-T03)	
Name or Initials	Clare Caudwell (CEcol MCIEEM), Christian Gunn (MCIEEM), Jeff Turton (ACIEEM), Lydia Galbraith (AICEEM), Lucy Moorhouse (ACIEEM)
Organisation	CSA Environmental
Survey Date	20/12/23 (initial walkover); 18/07/24 & 23/07/24 (update UKHabs & HCAs)
Statement of Competency	
An initial UK Habitat Classification ('UKHab') survey was carried out in fine and dry weather conditions on 20 December 2023 by Clare Caudwell CEcol MCIEEM FISC Level 4, Jeff Turton ACIEEM and Lydia Galbraith ACIEEM, both FISC Level 3, and updated on July 2024 by Christian Gunn ACIEEM (Ucert in Species Identification), Lydia Galbraith ACIEEM (FISC Level 3) and Lucy Moorhouse (FISC Level 4). All surveyors are experienced ecologists, competent in habitat classification and flora identification, in addition to detailed condition assessments for Biodiversity Net Gain.	
Survey conditions and limitations	
Final baseline habitat survey work was undertaken in dry and sunny weather conditions at an appropriate time of year. No limitations were identified.	

Habitat Degradation

Are there any signs or evidence that the baseline habitats have been purposefully degraded since 30th January 2020? (BI-B05)

The previous landowner stripped the northern areas of F6 at some point between 2020 and 2023 (below images is from March 2022) and spread builders hardcore. The current landowner doesn't have any further details; however grassland has now established over the areas impacted.

If habitats have been purposefully degraded, provide details of how this has been accounted for (BI-B06)

The metric baseline has been assessed as 'modified grassland' in poor condition for the whole of F4. There does not appear to have been any significant difference in grassland type or condition between the area impact above, and areas of retained grassland to the south. The grassland type and condition was also found to be consistent across all other grassland parcels surveys. As such, there is no reason to believe that pre-degradation the grassland of a higher distinctiveness or condition.

Baseline Habitat Descriptions and Condition

Habitats (BI-T04) See Appendix for full species list

Parcel Refs	Habitat Type and Code	Irreplaceable	Priority	Description and Condition Justification	Condition	Area (ha)
F4 & F6	Modified grassland (g4)	No	No	F4 and F6 is permanent grassland that exhibited a short, grazed grassland sward at the time of survey. The fields exhibited species poor diversity, with the grassland dominated by creeping bent *Agrostis stolonifera*, with Yorkshire fog *Holcus lanatus*, perennial rye grass *Lolium perenne* and meadow grass sp. *Poa sp.* Herbaceous species included creping buttercup *Ranunculs repens*, creeping thistle *Cirsium arvense*, curled dock *Rumex crispus*, broad-leaved dock *Rumex obstusifolius*, scarlet pimpernel *Anagallis arvensis*, white clover *Trifolium repens*, dandelion sp. *Taraxacum sp.* and nettle Urtica dioica. Criteria A – Fail, Criteria B – Fail, Criteria C – Pass, Criteria D – Pass, Criteria E – Pass, Criteria F – Pass and Criteria G – Pass.	Poor	5.79
F10	Modified grassland (g4)	No	No	F10 is permanent grassland, exhibiting short grassland sward at the time of survey. Species composition is very similar to F4 & F6, with a slightly higher sp/m2 in comparison (7sp/m2). Criteria A – Pass, Criteria B – Fail, Criteria C – Pass, Criteria D – Pass, Criteria E – Pass, Criteria F – Pass and Criteria G – Pass.	Moderate	2.904
F11-F12	Modified grassland (g4)	No	No	F11- F12 are permanent grassland, exhibiting short grassland sward at the time of survey. Species composition is very similar to F4 & F6, with the addition of rare instances of meadow foxtail *Alopecurus pratensis* in Field F11. F11: Criteria A – Fail, Criteria B – Fail, Criteria C – Pass, Criteria D – Pass, Criteria E – Fail, Criteria F – Pass and Criteria G – Pass. F12: Criteria A – Fail, Criteria B – Fail, Criteria C – Pass, Criteria D – Pass, Criteria E – Fail, Criteria F – Pass and Criteria G – Pass.	Poor	8.384
W1	Lowland mixed deciduous	No	No	W1 is a broadleaved woodland, consisting silver birch *Betula pendula*, hawthorn *Crataegus monogyna*, oak *Quercus sp*, cherry *Prunus avium*, hazel *Corylus avellana* and holly *Ilex aquifolium*. Scrub layer limited in areas outside of fencing (woodland along western boundary unfenced), consisting of rose sp. *Rosa sp.*, bramble *Rubus fruticosus agg.* and buddleia *Buddleja sp*. Criteria A- 2 B- 1 C- 3 D- 3 E- 3 F- 3 G- 2 H- 3 I- 1 J- 2 K- 1 L- 2 M- 3 (Total 29 out of possible 39)	Moderate	0.611
W1	Lowland mixed deciduous	Yes	Yes	A small parcel in the west of W1 is categorised as ancient woodland on MAGIC.	Moderate	0.064

Hedgerows (BI-T05)

Feature Refs	Habitat Type and Code	Irreplaceable	Priority	Description and Condition Justification	Condition	Length km
H6	Line of trees associated with bank or ditch	No	No	H6 is line of trees with multiple gaps, species including beech *Fagus sylvatica*, hawthorn and elder *Sambucus nigra* with a bramble understory. Criteria A- Pass B- Fail C- Pass D- Pass E- Pass	Moderate	0.31
H7	Native hedgerow with trees	No	Yes	H7 is a native hedgerow with trees, with an understory of elder, bramble and hawthorn, and a number of mature oaks scattered within. Criteria A1- Yes A2- Yes B1- Yes B2- No C1- Yes C2- Yes D1- Yes D2- Yes E1- No E2- Yes	Good	0.321
H9a	Line of trees	No	No	H9a is the portion of tree line that borders the stream than runs along Field F6. It consists of oak, holly, hawthorn, buddleia, elder, silver birch, cherry, goat willow, beech and rowan *Sorbus aucuparia*. Criteria A- Pass B- Pass C- Pass D- Fail E- Pass	Moderate	0.166
H9b	Line of trees	No	No	H9b is the portion of tree line that borders the stream that along Field F4. It consists of oak, holly, hawthorn, buddleia, elder, silver birch, cherry, goat willow, beech and rowan. Criteria A- Pass B- Pass C- Pass D- Fail E- Pass	Moderate	0.168
H11	Native hedgerow with trees associated with bank or ditch	No	Yes	H11 is a native hedgerow with trees that runs along the seasonally wet ditch along the southern boundary of F6. It is dominated by hawthorn, with instances of dog rose *Rosa canina*, oak, silver birch, gorse *Ulex europaeus* and bramble. Criteria A1- Yes A2- Yes B1 No B2- Yes C1- No C2- Yes D1- Yes D2- No E1- Yes E2- Yes	Good	0.163
H12	Native hedgerow with trees	No	Yes	H12 is a native hedgerow with trees that dissects Fields F4 and F6. It consists a number of mature oak trees, with a scattered understory of gorse, bramble and holly. Criteria A1- Yes A2- Yes B1- Yes B2- No C1- Yes C2- No D1- Yes D2- Yes E1- Yes E2- No	Good	0.135
H31	Native hedgerow	No	Yes	Goat willow hedge running alongside path in the north of F6. Criteria A1- Yes A2- No B1- Yes B2- Yes C1- Yes C2- Yes D1- Yes D2- Yes E1- N/A E2- N/A	Good	0.135

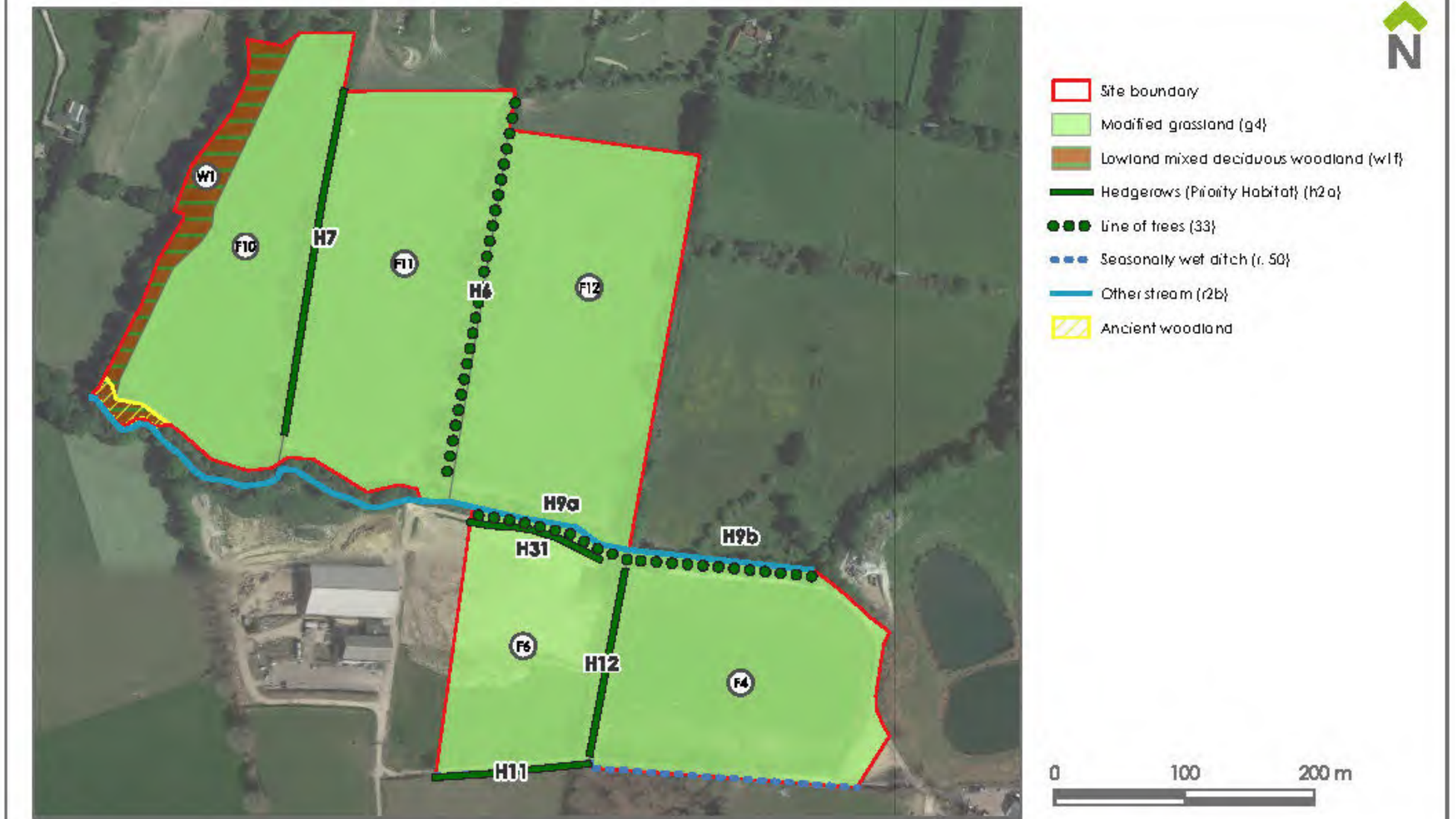
Watercourses (BI-T06)

Feature Refs	Habitat Type and Code	Irreplaceable	Priority	Description and condition justification	Condition	Length km
Stream	Other rivers and stream (r2b)	No	Yes	Stream running through the centre of the Site, along the northern boundary of F4 and F6, and just off-Site along the southern boundary of F10-F12. Condition scores: Sub-reach 1- 1.089 (moderate) Sub-reach 2- 1.198 (moderate) Sub-reach 2- 1.567 (moderate)	Moderate	0.287
Ditches	Ditch (r, 50)	No	No	A seasonally wet ditch runs along the southern boundary of F4 and F6 Criteria A-Dry B- Fail C- Dry D- Fail E- Pass F- Fail G- Fail H- Pass	Poor	0.369

Priority and Irreplaceable Habitats

Summary of Priority and Irreplaceable Habitats (BI-B07)
Hedgerows and the small parcel of ancient woodland are the only Priority habitat present within the Site.
Potential Constraints and Opportunities for Project (BI-B08)
Hedgerows at the site will be retained. The parcel of ancient woodland will not be impacted by the scheme, and an area of buffer planting will be created. No constraints have been identified.

Baseline Habitats Plan (BI-F02)



CSA environmental Office 20, Citibase, 95 Ditchling Road, Brighton BN1 4ST t 01273 573871 e brighton@csaenvironmental.co.uk w csaenvironmental.co.uk	Project	Stonehouse Farm, Handcross	Date	Jan 2025	Drawing No.	CSA/6746/124
	Drawing Title	Habitat Bank- Baseline Habitats Plan	Scale	Refer to scale	Rev	B
	Client	Lake Investments Ltd	Drawn	LG	Checked	CC

Baseline Habitats Photos (BI-F04)

Photograph 1 Field F6.

Photograph 2. Field F10 and Woodland W1.

Photograph 5. Field F6.

Photograph 3. Field F11 and Hedgerow H6.

Photograph 4. Woodland Stream (W1).

Land Tenure and Public Access

Relevant Land Tenure Information (EI-B01)

The land is owned by Lake Investments Ltd and will remain so for the duration of HMMP – Hunter Developments Holdings Ltd will be awarded a management contract for the duration of the HMMP and will be responsible for the creation and management of the habitat as well as the granting of seasonal grazing licenses as required.

Potential Impact to Scheme (EI-B02)

Hunters Developments Holdings Ltd are established land managers with established local resources and a strong focus of renaturing; it is considered the experience and skill set with results in an expedient and progressive impact in delivery.

Public Access Information (EI-B03)

Public Right of Way (PRoW) provided north-south through the side; with diversion as shown on the attached currently being determined by Horsham District Council (see top figure). This will provide continued public access through field F1; and adjacent to the western edge of F6.

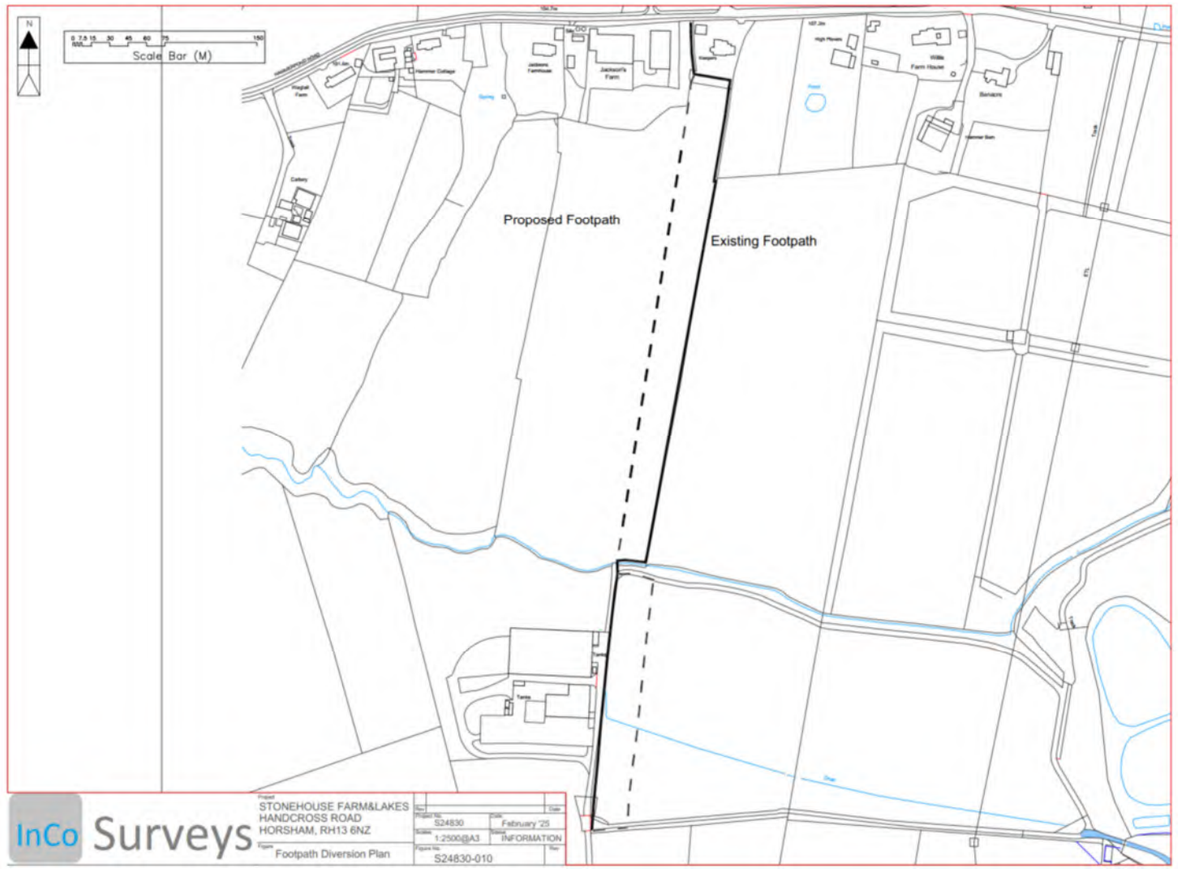
It is also intended the permissive access will be provided through F4 and F6 (see bottom figure; permissive access shown as pink dotted line). This will be linked to the PRoW (shown as yellow dotted line).

It is not envisaged that this will change over the lifetime of the HMMP.

Potential Impact to Scheme (EI-B04)

It is not considered that the proposed public access will impact the HMMP prescription detailed herein. Access will be through field margins and shall not affect habitat management work.

Land Tenure and Public Access Plan (EI-F01)



Soils and Substrates (EI-T02)

Provide the results of the soil analysis. Modify the table below to provide the relevant soils information to inform targeted habitat creation proposals.

Parcel Refs	Soil Texture	pH	Nitrogen (N)	Phosphorous (P)	Potassium (K)
F4	FINE SANDY LOAM / SANDY SILT LOAM (Medium Texture; low stone content)	Slightly acid (top soil) Slightly acid (sub soil)	Mod-Mod High	Mod-High	Low-Mod
F6	SILTY CLAY LOAM (heavy texture low-mod stone content)	Moderately alkaline (top) Moderately alkaline (sub)	Mod-Mod High	Low	Low
F10	SILTY CLAY LOAM (heavy texture low-mod stone content)	Slightly acid (top soil) Slightly acid (sub soil)	Mod-Mod High	Mod-High	Low-Mod
F11	SILTY CLAY LOAM (heavy texture low-mod stone content)	Slightly acid (top soil) Slightly alkaline (sub soil)	Mod-Mod High	Low	Low
F12	SILTY CLAY LOAM (heavy texture low-mod stone content)	Slightly acid (top soil) Slightly alkaline (sub soil)	Mod-Mod High	Low	Low

Summary of Soils Information (EI-B13)

Baseline Soil Assessment (TOHA/24/4515/HM)

A baseline soil assessment was undertaken by Tim O-Hare Associates (August, 2024; appended) to inform habitat creation and enhancement proposals. Based on the site assessment and laboratory analysis, the topsoils across the farm could be described as a slightly acid/non-calcareous to moderately alkaline/calcareous silty clay loam to clay loam (heavy soil texture) with low stone contents and adequate soil structure. The topsoil samples typically contained moderately high levels of organic matter and extractable magnesium. The extractable phosphorus and extractable potassium values varied from low to moderately high. *N.B. Slightly acid = pH 6.3; moderately alkaline = pH 7.8*

Overall fertility status:

- F4 = High, pH suitable for ONG; but fertility needs to be reduced for ONG. Good for tree planting; some compost may be required to aid planting.
- F6 = Low, pH suitable for ONG – but mod alkaline so need to consider species mix suited to more alkaline conditions; tree / scrub planting could be more alkaline tolerant species otherwise soil improvement may be required; some compost may be required to aid planting.
- F10 = High, pH suitable for ONG; but fertility needs to be reduced for ONG. Good for tree planting; some compost may be required to aid planting.
- F11 = Low, pH suitable for ONG; tree planting - some compost may be required to aid planting
- F12 = Low, pH suitable for ONG; tree planting - some compost may be required to aid planting.

Arboricultural Briefing Note (BHA, April 2024):

Establishment of some native tree species is impeded by clay and /or very wet soils. Wealden Clay (deep clay to clayey loam) on lower slopes north of Goldings Stream.

Areas of made-up ground (F4 & F6); potentially making soil compacted, clayey and prone to waterlogging or drought (not good for tree establishment). Compaction may need to be alleviated by cultivation to 1m depth before planting.

Site slopes towards Goldings Stream – southern end of F10, F11 and F12 are wetter; and will require seeding / planting with moisture tolerant species (e.g. wet woodland planting mix; plus grassland seed mix tolerant of moist conditions)

Suitable tree species: Hawthorn, blackthorn and hazel – suitable for a range of soil types; with hornbeam suitable for poor soils including clay. Other species present in the local landscape include oak, birch, holly and guelder rose. On-site woodland (W1) comprises oak, birch, hawthorn, cherry, hazel and holly (however BHA advise silver birch and wild cherry should be avoided in very poor soil / compaction). Where soil compaction is a problem then species such as common alder, crack willow and white / black poplar, goat willow, downy birch and whitebeam can be tolerant to drought and infertility (only suitable if clay not in place); and some can be subject to coppice management.

Potential Impact on Project (EI-B14)

- F4: Due to ‘high’ fertility status creation of ONG grassland is targeted in ‘moderate’ condition; on the assumption that it may be difficult to created a swards with a diversity of more that 10 vascular plant species / m2 (overseeding required). Tree planting will be suitable; but could be constrained by areas of made-up ground and soil preparation and some composting may be required to ensure establishment. Tree species to be selected which can cope with compacted soil prone to waterlogging / drought.
- F6: Due to ‘Low’ fertility creation of ONG is ‘good’ condition is targeted; with overseeding with a grassland mix suited to more alkaline conditions. Tree / scrub planting targeted acid tolerant species and include species tolerate of compacted soil prone to waterlogging / drought (as above).
- F10: Due to ‘High’ fertility status creation of ONG grassland is targeted in ‘moderate’ condition; on the assumption that it may be difficult to create a sward with a diversity of more than 10 vascular plant species / m2 (overseeding required). Conditions are suitable for tree planting; noting that moisture tolerant species should be selected for areas adjacent to the stream corridor which could be subject to waterlogging. Some compost may be required to aid planting)
- F11: Due to ‘Low’ fertility creation of ONG is ‘good’ condition is targeted; with overseeding with a grassland mix suited to more acid conditions. Conditions are suitable for tree planting; noting that moisture tolerant species should be selected for areas adjacent to the stream corridor which could be subject to waterlogging. Some compost may be required to aid planting)
- F12: Due to ‘Low’ fertility creation of ONG is ‘good’ condition is targeted; with overseeding with a grassland mix suited to more acid conditions. Conditions are suitable for tree planting; noting that moisture tolerant species should be selected for areas adjacent to the stream corridor which could be subject to waterlogging. Some compost may be required to aid planting)

Soils and Substrate Plan (EI-F04)

Flood Risk Zones

Summary of Flood Risk Information (EI-B19)

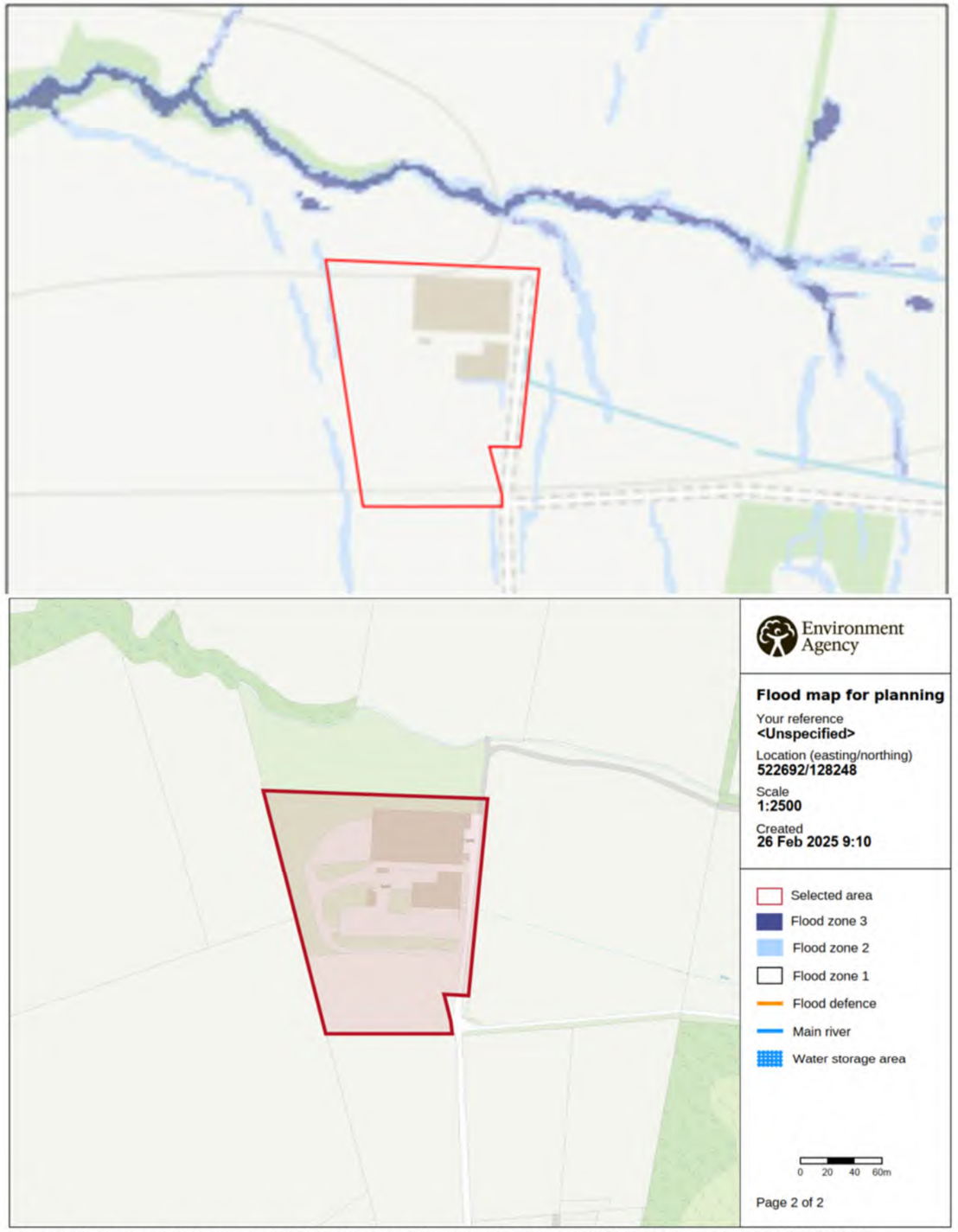
The site lies within flood risk zone 1; low probability of surface water flooding (Land having a less than 1 in 1,000 annual probability of river or sea flooding). Details are provided within the Flood Risk Assessment & Drainage Strategy (Motion, February 2025); and shown on the extracts adjacent.

Potential Impact on Project (EI-B20)

Flooding is not considered to be a risk to the delivery of the proposed habitat creation and enhancement measures. Goldings Stream is a very steep side features and no risk of flooding of the field to the south is anticipated. Any surface water flooding in times of heavy rainfall within field to the north is considered to be very minimal (given the sloping topography of the valley sides) and tree species selected for planting to the north of the stream will be tolerant of minor waterlogging.

Management operations, particularly the aftermath cattle grazing can present a risk to the habitat types being created and enhanced when ground conditions are particularly wet. Grazing in these conditions may lead to excessive poaching if the grazing intensity and duration is too high. Adaptive management practices have been set out in this document to ensure that grazing management is modified in line with ground conditions in any given year.

Surface Water Flood Risk on Lot 8



Geology and Topography

Geological Information (EI-B07)

Geology: Upper Tunbridge Wells Sand bedrock geology; described as interbedded mudstone, siltstone and sandstone. Stream valley is Weald Clay. See figure adjacent taken from the Arboricultural Briefing Note – Tree Planting Advice for Habitat Creation (BHA, April 2024).

Potential Impact to Scheme (EI-B08)

Geology (and soil type) have influenced prescription for habitat creation proposals; acknowledging that where soils are on clay that species mixes tolerant of waterlogging (i.e. within the valley bottom) and / or drought will be selected to ensure success full establishment.

Topography (EI-B09)

Topography: The site sloped downwards from south and north to a central valley, through which Goldings Stream flows along a shallow gradient east to west. No changes to the site topography are proposed under the HMMP.

Potential Impact to Scheme (EI-B10)

Where habitat creation is proposed; habitat type and species mixes selected have taken account of the potential for waterlogging within the valley bottom; particularly at the southern extents of fields F1- to F12 where clayey spoils occur. Waterlogging is likely to be less of an issue in fields F4 and F6 where sandy – silty loam soils are present.

Geology and Topography Plan (EI-F02)

Figure 1: Approximate site boundary showing bedrock types.

Figure 2: Site soil types.

Landscape Character and Designations

Summary of Landscape Character and Designations (EI-B21)

The site is situated within the High Weald National Character Area and is described as follows within the National Character Area profile:

‘The High Weald National Character Area (NCA) encompasses the ridged and faulted sandstone core of the Kent and Sussex Weald. It is an area of ancient countryside and one of the best surviving medieval landscapes in northern Europe. The High Weald Area of Outstanding Natural Beauty (AONB) covers 78 per cent of the NCA. The High Weald consists of a mixture of fields, small woodlands and farmsteads connected by historic routeways, tracks and paths. Wildflower meadows are now rare but prominent medieval patterns of small pasture fields enclosed by thick hedgerows and shaws (narrow woodlands) remain fundamental to the character of the landscape.’

Four environmental opportunities are identified for the NCA:

- SEO 1: Maintain and enhance the existing woodland and pasture components of the landscape, including the historic field pattern bounded by shaws, hedgerows and farm woods, to improve ecological function at a landscape scale for the benefit of biodiversity, soils and water, sense of place and climate regulation, safeguard ancient woodlands and encourage sustainably produced timber to support local markets and contribute to biomass production.
- SEO 2: Maintain and restore the natural function of river catchments at a landscape scale, promoting benefits for water quality and water flow within all Wealden rivers, streams and flood plains by encouraging sustainable land management and best agricultural practices to maintain good soil quality, reduce soil erosion, increase biodiversity and enhance sense of place. Maintain and enhance the geodiversity and especially the exposed sandrock.
- SEO 3: Maintain and enhance the distinctive dispersed settlement pattern, parkland and historic pattern and features of the routeways of the High Weald, encouraging the use of locally characteristic materials and Wealden practices to ensure that any development recognises and retains the distinctiveness, biodiversity, geodiversity and heritage assets present, reaffirm sense of place and enhance the ecological function of routeways to improve the connectivity of habitats and provide wildlife corridors.
- SEO 4: Manage and enhance recreational opportunities, public understanding and enjoyment integrated with the conservation and enhancement of the natural and historic environment, a productive landscape and tranquillity, in accordance with the purpose of the High Weald AONB designation.

The location of the NCA designation is illustrated on the Site Context Plan PB-F02.

Potential Impact on Project (EI-B21)

The project provides the opportunity to promote specific environmental opportunities identified for the National Character Area; through enhancing habitat corridors within river catchments, safeguarding ancient woodlands, promoting wildlife friendly land management practices, tree planting to reduce soil erosion and increase biodiversity. The project also has the potential to enhance recreational opportunities through the creation of new permissive access routes.

3. Planned Management Activities

Provide the site-wide aims and objectives. These should consider the Project Background information section outlined above as well as the outcomes of the Metric.

Management Plan Aims and Objectives PM-B01

This site makes up Phase 1 of the Stonehouse Farm Habitat Bank. The landowner is passion about nature conservation and see the provision of Biodiversity Net Gain units as a great opportunity to create and maintain important and distinctive wildlife habitat on their land.

Until now, most of the fields on the farm have been part of a conventional animal-rearing farming system, grazing cattle. Giving this land over to new habitats will provide benefits for local wildlife, as well as providing attractive outdoor space to local people through a permissive circular walk around the site.

The Stonehouse Farm Habitat bank proposals aim to enhance and create the following habitat types. A brief description of each is provided below:

Other neutral grassland (enhancement)

Existing modified grassland (poor condition) in Field F4, F6, F10-F12 will be enhanced to other neutral grassland in moderate condition. Enhancement will be achieved through an improved management protocol of cutting followed by aftermath grazing. Scarification and overseeding with an appropriate seed mix will be undertaken to improve diversity and introduce key indicator species.

Mixed scrub (creation)

Parcels of dense mixed scrub will be created within low density planted groups of native woody species. Planting will be irregular and grouped to form natural structural diversity and encourage regeneration within open spaces. The scrub will be coppiced every 3-6 years on a rotational basis.

Other broadleaved woodland (creation)

Broadleaved woodland will be created in parcels containing a mixture of native species suitable to both upper canopy and understory heights to achieve a diverse vertical structure. The woodland parcels will be subject to selective thinning in years 5 and 15 to introduce areas.

Scattered trees (creation)

Trees will be planted within Field F4, F6, F10-F12, which will be managed through formative pruning to encourage healthy growth and longevity, promoting formation of natural features and niches that can be utilised by a range of species.

Principles Informed by Design Stage

The project's BNG target(s) should be set and documented early in the design process. Outline how background and baseline information influenced key design principles for the project from an early stage. This can provide useful context for the proposed retention, creation and enhancement measures.

Design Principles Informed by Baseline Information PM-B02

The initial UK Habitat Classification survey identified the habitat types present on-site, and from the outset the key design principals for the project were to maximise biodiversity value sensitively with clear consideration of the existing habitat types and conditions. A key feature of the site is the extensive network of existing hedgerows and tree lines, and early in the design process, habitat creation measures were targeted to buffer and extend these green corridors, providing green infrastructure around and across the site. New woodland and thicket planting has been proposed in strategic locations to achieve this.

Enhancing existing agricultural grassland habitat was a key aim from the outset. Detailed soil analysis has been undertaken across the site to inform the feasibility of the proposed habitat creation and enhancement measures. This analysis found that soil fertility was highest in F6 and F10, and therefore whilst creation of 'other neutral grassland' is still considered to be suitable 'moderate' condition was targeted (rather than good) to reflect potential difficulties in achieving more than 10 vascular plant species per m2. Scrub and woodland creation as also been targeted here, where good fertility should allow for good establishment.

The soil analysis considered all other habitat types proposed, and whether they could be appropriately established and managed in their target locations. Species mixes will be selected which are suited to the clay / loamy soil conditions identified; and tree/ scrub planting prescriptions take account of the potential for waterlogging / drought and presence made-up ground (F4). This early baseline information was crucial in forming and finalising the proposals, providing confidence that the habitat types and conditions proposed were feasible.

<u>Strategic significance</u>

The Horsham District Nature Recovery Network (NRN) (Wider Horsham District Project, 2021) illustrates that the Stonehouse Farm Habitat Bank is situated in an area classified as having "High Habitat Potential" which are areas that have been identified due to their location and potential to provide connectivity between other sites.

The Site falls partially (F10-F12) within the Weald to Waves Corridor Radiant Zone. The Weald to Waves project aims to establish a nature recovery corridor from the High Weald to the Sussex coast. The Radiant Zone represents a 2km buffer either side of the Core Corridor Route, in which landholders are encouraged to pledge land to improve habitat connectivity.

Habitat and Condition Targets PM-T01

This table presents a summary record of what you have agreed to deliver based on the biodiversity metric. These habitat condition targets form the basis of what the management plan is setting out to achieve. Include the relevant 'Area', 'Hedgerow', and 'Watercourse' types to be implemented and managed throughout the period of 30 years or more.

Baseline Habitat Type	Target Habitat Type	Parcel / Feature Refs	Baseline Condition	Targeted Condition	Years to Targeted Condition	Condition Assessment Targets
Modified grassland	Other neutral grassland	F6, F11, F12	Poor	Good	15 (standard)	Good condition will be targeted by achieving a pass in criteria A, B, C, D, E and F.
Modified grassland	Other neutral grassland	F4	Poor	Moderate	10 (standard)	Moderate condition will be targeted by achieving a pass in criteria A, B, C, D and E. Additional criterion F will not be targeted.
Modified grassland	Other neutral grassland	F10	Moderate	Moderate	10 (standard)	Moderate condition will be targeted by achieving a pass in criteria A, B, C, D and E. Additional criterion F will not be targeted.
Modified grassland	Other broadleaved woodland	F4, F11, F12	Poor	Moderate	15 (standard)	Moderate condition will be targeted by achieving a score of 28 (A = 2, B = 3, C = 3, D= 3, E = 3, F = 1, G = 1, H = 3, I = 1, J = 2, K = 1, L = 1 and M = 3).
Modified grassland	Other broadleaved woodland	F10	Moderate	Moderate	15 (standard)	Moderate condition will be targeted by achieving a score of 28 (A = 2, B = 3, C = 3, D= 3, E = 3, F = 1, G = 1, H = 3, I = 1, J = 2, K = 1, L = 1 and M = 3).
Modified grassland	Mixed scrub	F4, F6, F11, F12	Poor	Good	10 (standard)	Good condition will be targeted by achieving a pass in all criteria (A, B, C, D and E).
Modified grassland	Mixed scrub	F10	Moderate	Good	10 (standard)	Good condition will be targeted by achieving a pass in all criteria (A, B, C, D and E).
n/a	Rural trees	F4, F6, F10, F11, F12	n/a	Moderate	27 (standard)	Moderate condition will be targeted by achieving a pass in criteria A, B, D and F. Criteria E and F will not be targeted, as these relate to maturity and natural ecological niches that result in time)

Habitat Retention

Provide a concise description of the habitats that are to be retained in their baseline condition. Habitats being retained may still require ongoing measures to maintain their baseline condition.

Measures to be Implemented to Protect Retained Habitats PM-03

Habitat to be retained at the Site include:

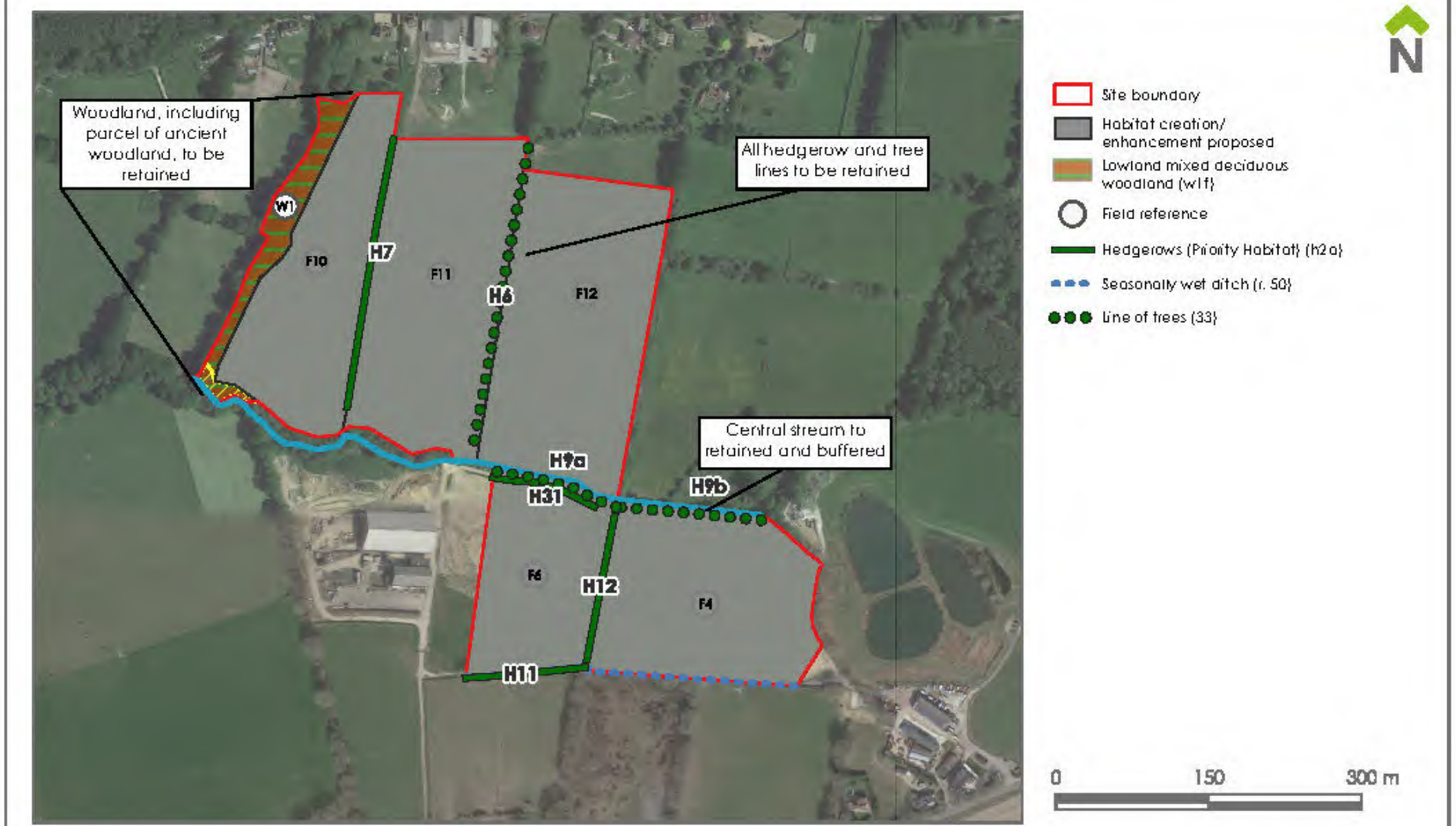
- Woodland W1- existing woodland will be retained and buffered with additional woodland and thicket planting
- Hedgerows- all existing hedgerows on-site will be retained and will be managed at a reduced frequency comprising of rotational cutting and laying as appropriate
- Stream- the existing stream running through the centre of the site will be retained and buffered with woodland and thicket planting

No management measures are anticipated to be required to maintain these habitats in their current states.

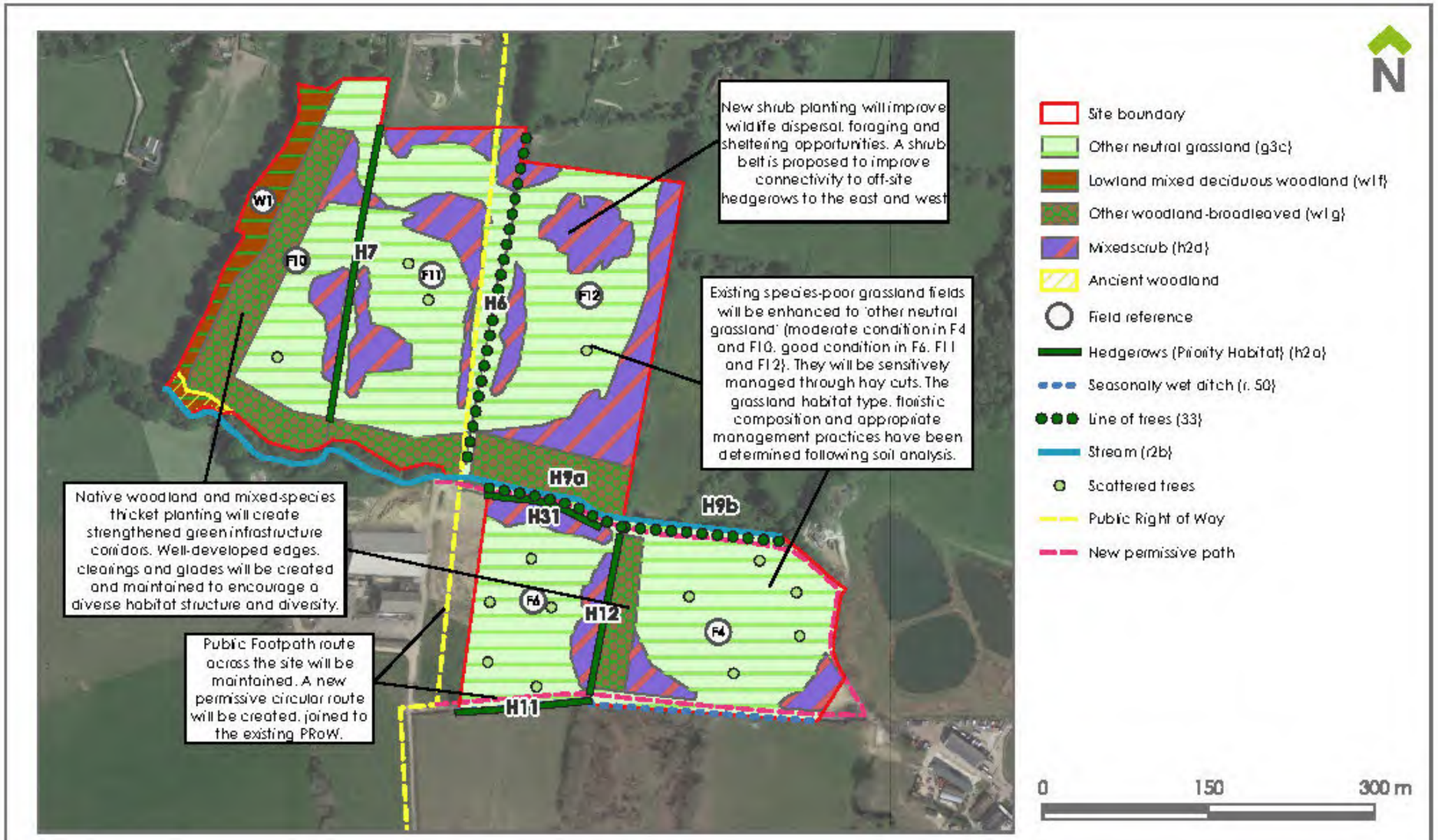
Specification of Protective Measures to be Used PM-04

The site is currently under active agricultural management, and these habitats to be retained are already clearly avoided and retained under current management actions. Given the scale and locations of these habitats, protective measures are not considered necessary alongside habitat creation and enhancement measures elsewhere on-site. A copy of this HMMP document and the Habitat Retention Plan will be utilised and referred to by habitat management operatives at all times.

Habitat Retention Plan PM-F01



CSA environmental Office 20, Citibase, 95 Ditchling Road, Brighton BN1 4ST t 01273 573871 e brighton@csaenvironmental.co.uk w csaenvironmental.co.uk	Project	Stonehouse Farm, Handcross	Date	April 2025	Drawing No. CSA/6746/125
	Drawing Title	Habitat Bank- Retention Plan	Scale	Refer to scale	Rev -
	Client	Lake Investments Ltd	Drawn	LG	Checked CC



CSA environmental Office 20, Citibase, 95 Ditchling Road, Brighton BN1 4ST t 01273 573871 e brighton@csaenvironmental.co.uk w csaenvironmental.co.uk	Project	Stonehouse Farm, Handcross	Date	April 2025	Drawing No. CSA/6746/126
	Drawing Title	Habitat Bank- Habitat Creation, Enhancement and Management Plan	Scale	Refer to scale	Rev A
	Client	Lake Investments Ltd	Drawn	LG	Checked CC

Creation, Enhancement and Management Targets and Prescriptions

Grassland (Medium, High, and Very High Distinctiveness)

Creation, Enhancement and Management Summary (GH-T01)

Target Habitat					
Condition Assessment Criteria		**Targeted**	**Relevant Parcels**	**Enhancement Approach**	**Management Approach**
A	The parcel represents a good example of its habitat type, with a consistently high proportion of characteristic indicator species present relevant to the specific habitat type. **Note – this criterion is essential for achieving Moderate or Good condition for non-acid grassland types only.**	Yes	Enhancement in F4, F6, F10-F12	Initial cut and collect, followed by aftermath grazing will allow sufficient bulk and nutrients to be removed. Scarification and overseeding will then introduce appropriate characteristic indicator species.	Cut, collect and aftermath grazing following initial establishment will avoid dominance by fast growing undesirable species. Indicator species will be able to grow and parcels will represent good examples of other neutral grassland.
B	Sward height is varied (at least 20% of the sward is less than 7 cm and at least 20 per cent is more than 7 cm) creating microclimates which provide opportunities for insects, birds and small mammals to live and breed.	Yes		Sowing of an appropriate seed mix containing a range of grasses and broadleaved herbs to allow a diverse sward height structure to develop.	Following initial cut and remove for establishment/ enhancement, the cut will be followed by aftermath grazing thereafter to maintain the varied sward height.
C	Cover of bare ground between 1% and 5%, including localised areas, for example, rabbit warrens.	Yes		Only some fields are failing this criteria at present.	Grazing will result in some poaching of the sward which will encourage bare ground; and open sward to allow seed to set.
D	Cover of bracken *Pteridium aquilinum* less than 20% and cover of scrub (including bramble) less than 5%.	Yes		None of the field are failing this criteria at present.	Annual cut and aftermath grazing will removed / limit bracken and scrub growth and cover.
E	Combined cover of species indicative of suboptimal condition and physical damage (such as excessive poaching, damage from machinery use or storage, damaging levels of access, or any other damaging activities) accounts for less than 5% of total area. If any invasive non-native species (as listed on Schedule 9 of WCA) are present, this criterion is automatically failed.	Yes		Initial cut and remove in years 1 and 2 will remove bulk and nutrients, minimising growth of species indicative of suboptimal condition. Invasive non-native species are currently absent and enhancement methods are not anticipated to introduce these species.	Ongoing cut and grazing management will minimise growth of species indicative of suboptimal condition. Public access will not be provided away from the existing public footpaths/ identified permissive routes, limiting associated damage. Monitoring visits will confirm the presence/absence of invasive non-native species, with measures implemented to reduce/remove these if required.

F	There are 10 or more vascular plant species per m^2 present, including forbs that are characteristic of the habitat type. **Note – this criterion is essential for achieving Good condition for non-acid grassland types only.**	Yes (F6,F11, F12) No (F4, F10)		Scarification and overseeding with a mix containing greater than 10 vascular plant species per m^2, characteristic of other neutral grassland.	Cut and aftermath grazing will avoid the dominance of fast-growing species, allowing a diverse range of characteristic indicator species to grow.

Grassland (Medium, High, and Very High Distinctiveness)

Creation, Enhancement and Management Detailed Methods (GH-T02)

Provide detailed prescriptions for the creation and management of the habitat.

Action	Relevant Parcels	Timing	Prescriptions
Year 1: Initial management	All enhanced parcels- F4, F6, F10-F12	April to October	Cuts of grassland once every two months as required to maintain sward at 100mm between April and October. Arisings removed following each cut (to reduce nutrient content)
Year 2: Cut and Remove management		April to May July and September September - December	Continue cuts as for Year 1 to maintain 100mm sward between April and May. Arisings removed following each cut. Followed by two cuts, one in late July and one in September, both to 100mm with arisings removed. Aftermath grazing September – December (or until condition become too wet to do so). Grazing may be undertaken on a rotational basis; to limit potential damage / poaching and encourage a diverse sward structure across the landholding.
Year 3: Cut, scarification and overseeding		April to May May - November	Continue cuts as for Year 1 to maintain 100mm sward between April and May. Arisings removed following each cut. Cut in late July/early August to no lower than 100mm. Arisings removed after 1-7 days. Scarification of topsoil by chain harrowing to break up soil surface. Broadcast overseeding (spring or autumn) with an appropriate seed mix of local provenance (e.g. Emorsgate EM4 Meadow Mixture for Clay Soils – F10, F11 & F12) and/or Emorsgate EM5 Meadow Mixture for Loamy Soils – F4 & F5), rolled to ensure good contact. A further light cut to 100mm may be required prior to winter.
Year 4 onwards: cut and collect		Option 1: July – December (latest) Option 2: July and September	**OPTION 1 – cut with aftermath grazing (preferred)** Annual cut in late July/early August to no lower than 100mm. Arisings removed after 1-7 days. Grazing after cut (minimum 6 week grazing period, maximum until December or until conditions become too wet). Optimal between September and October. Hardy heritage cattle breeds preferred. Livestock density of 1 to 2.25 livestock units per hectare. **OPTION 2 – two cuts each year (typically only if ground conditions not suitable for grazing)**

			Annual cut in late July/early August to no lower than 100mm. Arisings removed after 1-7 days. Second cut in September to simulate aftermath grazing. Arisings raked and removed after 1-7 days. <u>For both options:</u> No cut/grazing during spring or summer (until July earliest). Ongoing grassland management will be closely monitored each year and management can be varied depending on the weather, ground conditions and how habitats are establishing, using a combination of cutting and grazing methodologies.

Grassland (Medium, High, and Very High Distinctiveness) Species Lists (GH-T03)

Common Name	Scientific Name	Abundance / %
Yarrow	*Achillea millefolium*	0.80%
Agrimony	*Agrimonia eupatoria*	0.60%
Betony	*Betonica officinalis*	1.00%
Common Knapweed	*Centaurea nigra*	2.80%
Lady's Bedstraw	*Galium verum*	0.60%
Meadow Crane's-bill	*Geranium pratense*	0.40%
Meadow Vetchling	*Lathyrus pratensis*	1.00%
Rough Hawkbit	*Leontodon hispidus*	0.30%
Oxeye Daisy	*Leucanthemum vulgare*	1.80%
Bird's-foot Trefoil	*Lotus corniculatus*	0.30%
Musk Mallow	*Malva moschata*	1.40%
Black Medick	*Medicago lupulina*	0.70%
Ribwort Plantain	*Plantago lanceolata*	2.80%
Cowslip	*Primula veris*	0.80%
Selfheal	*Prunella vulgaris*	1.10%
Meadow Buttercup	*Ranunculus acris*	1.10%
Yellow Rattle	*Rhinanthus minor*	1.00%
Great Burnet	*Sanguisorba officinalis*	0.20%
Pepper-saxifrage	*Silaum silaus*	0.10%
Ragged Robin	*Silene flos-cuculi*	0.40%
– Tufted Vetch	*Vicia cracca*	0.80%
Common bent	*Agrostis capillaris*	8.00%
Sweet Vernal-grass (w)	*Anthoxanthum odoratum*	2.40%
Quaking Grass (w)	*Briza media*	4.00%
Crested Dogstail	*Cynosurus cristatus*	40.00%
Red Fescue	*Festuca rubra*	20.00%
Meadow Foxtail (w)	*Alopecurus pratensis*	2.80%
Meadow Fescue	*Schedonorus pratensis*	2.80%

What Does Success Look Like? (GH-F01)

Scrub

Creation, Enhancement and Management Summary (SC-T01)

Provide details of the approach to delivering each of the targeted condition criteria and habitat. Conditions from Statutory Biodiversity Metric habitat condition assessment sheets – Sheet 19. Scrub.

Target Habitat:			Mixed scrub		
Condition Assessment Criteria		**Targeted**	**Relevant Parcels**	**Creation approach**	**Management Approach**
A	The parcel represents a good example of its habitat type – the appearance and composition of the vegetation closely matches its UKHab description (where in its natural range). - At least 80% of scrub is native, - There are at least three native woody species, - No single species comprising more than 75% of the cover (except hazel *Corylus avellana,* common juniper *Juniperus communis,* sea buckthorn *Hippophae rhamnoides* or box *Buxus sempervirens,* which can be up to 100% cover).	Yes	F4, F6, F10-F12	A mixture of >3 native woody species will be planted, in a ratio where no one single species will comprise more than 75% cover.	Management will include monitoring of the species composition and cover to ensure specifications within Criteria A are maintained.
B	Seedlings, saplings, young shrubs and mature (or ancient or veteran) shrubs are all present.	Yes		N/A	Management through rotational thinning of mixed scrub parcels will allow a diverse age range of scrub species to develop.
C	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA) and species indicative of suboptimal condition make up less than 5% of ground cover.	Yes		Invasive non-native species are currently absent and creation methods are not anticipated to introduce these species.	Monitoring visits will confirm the presence/absence of invasive nonnative species, with measures implemented to reduce/remove these if required.
D	The scrub has a well-developed edge with scattered scrub and tall grassland and or forbs present between the scrub and adjacent habitat.	Yes		Scrub parcels will be created along field edges where they will grade into adjacent meadows, with no restriction on the growth of a well-developed edge.	N/A
E	There are clearings, glades or rides present within the scrub, providing sheltered edges.	Yes		N/A	Management through rotational thinning of mixed scrub parcels will create clearings and glades to allow natural regeneration and localised sheltered edges.

Scrub

Creation, Enhancement and Management Detailed Methods (SC-T02)

Provide detailed prescriptions for the creation and management of the habitat.

Action	Relevant parcels	Timing	Prescriptions
Year 0: Preparation and planting	F4, F6, F10-F12	November to March	**Soil preparation** – new planting into well-prepared ground following good horticultural practice including cultivation and scarification where appropriate. **Planting** - in dormant season (November to March) using a range of native species, mixed randomly. Planting density of <1000/ha**.** Planting should be irregular and wide-spaced in places to encourage natural infill and develop clearings and structural diversity. Planting at edges should be scalloped. **Protection** - use of appropriate tree protection guards or fencing.
Year 1		Quarterly November to March October to November	Quarterly inspection of tree guards and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Annual formative pruning of young trees to encourage good growth and shape.
Year 2		Anytime November to March October to November	Annual inspection of tree guards and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Annual formative pruning of young trees to encourage good growth and shape.
Year 3 onwards		Anytime November to March September to February	Annual inspection of tree guards and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Coppice 20% of each scrub parcel every three to six years on rotation (depending on growth and conditions). Timing to avoid nesting bird season. Machinery use if ground conditions allow or using hand tools. Remove tree guards as appropriate (Years 10-15).

Scrub Species Lists (SC-T03)

Provide a detailed species list for the habitat to be created.

Common Name	Scientific Name	Abundance / %
Downy birch	*Betula pubescens*	10%
Guelder rose	*Viburnum opulus*	10%
Common hawthorn	*Crataegus mongyna*	10%
Goat willow	*Salix caprea*	10%
Holly	*Ilex aquifolium*	10%
Crab apple	*Malus sylvestris*	10%
Blackthorn	*Prunus spinosa*	10%
Wild privet	*Lingustrum vulgare*	10%
Hazel	*Corylus avellana*	10%
Willow	*Salix spp.*	10%

What Does Success Look Like? (SC-F01)

Woodland

Creation, Enhancement and Management Summary (WO-T01)

Provide details of the approach to delivering each of the targeted condition criteria and habitat. Conditions from Statutory Biodiversity Metric habitat condition assessment sheets – Sheet 24. Woodland

For each condition row, delete the condition targets that aren't being targeted as necessary.

Target Habitat:			Other woodland; broadleaved			
Condition Assessment Criteria			**Target Score**	**Relevant Parcels**	**Creation Approach**	**Management Approach**
A	Age distribution of trees	Three age classes present	2	Parcels within F4, F10-F12	N/A	Over the 30-year management period, young and intermediate age classes would be anticipated. With selective thinning promoting regeneration of young trees
		Two age classes present				
		One age class present				
B	Wild, domestic and feral herbivore damage	No significant browsing damage evident in woodland	3		Woodland parcels will be surrounded by stock-proof fencing to avoid significant browsing damage.	Fencing and tree guards to be checked regularly and remedial actions implemented if issues identified.
		Evidence of significant browsing pressure is present in 40% or less of whole woodland				
		Evidence of significant browsing pressure is present in 40% or more of whole woodland				
C	Invasive plant species	No invasive species present in woodland	3		No invasive species are currently present at the site and the planting mix does not include them. Creation measures are not anticipated to result in the growth of invasive species.	Monitoring visits will regularly check for the presence of invasive species. If identified, invasive species will be removed.
		Rhododendron *Rhododendrion ponticum* or cherry laurel *Prunus laurocerasus* not present, other invasive species <10% cover				
		Rhododendron or laurel present, or other invasive species) 10% cover				
D	Number of native trees species	Five or more native tree or shrub species found across woodland parcel	3		The woodland planting mix contains more than five native tree and shrub species.	Monitoring visits will regularly check on the species composition within the woodland, with targeted clearance of dominating species and/or additional species planting provided if necessary.
		Three to four native tree or shrub species found across woodland parcel				
		Two or less native tree or shrub species present across woodland parcel				
E	Cover of native tree	>80% of canopy trees and >80% of understorey shrubs are native	3			

	and shrub species	50 – 80% of canopy trees and 50-80% of understorey shrubs are native			All woodland species to be planted are native. Cover of >80% is anticipated.	Monitoring visits will regularly check on the species composition within the woodland, with targeted clearance of non-native species undertaken if necessary.
		<50% of canopy trees and <50% understorey shrubs are native				
F	Open space within woodland	10-20% of woodland has areas of temporary open space. Unless woodland <10ha in which case 0-20% temporary open space is permitted.	1		N/A	Management includes selective thinning in years 5 and 15 which will create localised temporary areas of open space, however these will not be present in years 1-4 or when regeneration infills open spaces. A score of 1 is targeted for this criterion as a result, but an improved score may be identified in certain monitoring years.
		21-40% of woodland has areas of temporary open space				
		<10% or >40% of woodland has areas of temporary open space. But if woodland <10ha has <10% temporary open space, please see Good category.				
G	Woodland regeneration	All three classes present in woodland; trees 4-7cm Diameter at Breast Height (DBH), saplings and seedlings or advanced coppice regrowth	1		N/A	Management includes selective thinning in years 5 and 15 which will create localised temporary areas of open space which will promote woodland regeneration. Following thinning works in these years a score greater than 1 is likely to be achieved. Prior to thinning works, >1 may not be achieved.
		One or two classes only present in woodland				
		No classes or coppice regrowth present in woodland				
H	Tree health	Tree mortality less than 10%, no pests or diseases and no crown dieback	3		Tree and shrub species have been selected to avoid species prone to diseases and crown dieback (e.g. ash trees). Significant tree mortality is not anticipated.	Management will include regular visits to check tree health. Formative pruning of young trees will be undertaken to promote healthy growth and longevity. Failed plants will be replaced when identified.
		11% to 25% mortality and/or crown dieback or low risk pest or disease present				
		Greater than 25% tree mortality and or any high risk pest or disease present				
I	Vegetation and ground flora	Recognisable NVC plant community at ground layer present, strongly characterised by ancient woodland flora specialists.	1		N/A	A recognisable NVC plant community is not anticipated over the 30-year management period.
		Recognisable NVC plant community at ground layer present				
		No recognisable NVC plant community at ground layer present.				
J	Woodland vertical structure	Three or more storeys across all survey plots or a complex woodland.	2		Planted species include taller tree species and lower understory shrub species. Two storeys are anticipated to develop.	Management by selective thinning will allow for regeneration and continued development of upper and lower storeys within the woodland parcels.
		Two storeys across all survey plots				
		One of less storey across all survey plots				

K	Veteran trees	Two of more veteran per hectare	1		N/A	Veteran trees are not anticipated over the 30-year management period.
		One veteran tree per hectare				
		No veteran trees present in woodland				
L	Amount of deadwood	50% of all survey plots within the woodland parcel have deadwood, such as standing deadwood, large dead branches and or stems and stumps, or an abundance of small cavities.	1		N/A	Significant deadwood is not anticipated over the 30-year management period.
		Between 25% and 50% of all survey plots within the woodland parcel have deadwood, such as standing deadwood, large dead branches and or steams, stubs and stumps, or an abundance of small cavities.				
		Less than 25% of all survey plots within the woodland parcel have deadwood, such as standing deadwood, large dead branches and or steams, stubs and stumps, or an abundance of small cavities.				
M	Woodland disturbance	No nutrient enrichment or damaged ground evident	3		N/A	Woodland parcels will be fenced off to avoid damage, such as from livestock poaching, machinery and litter. Nutrient enrichment is not anticipated as the plots will be surrounded by semi-natural habitats.
		Less than 1 hectare in total of nutrient enrichment across woodland area and or less than 20% of woodland area has damaged ground				
		More than 1 hectare of nutrient enrichment and or more than 20% of woodland area has damaged ground				

Woodland

Creation, Enhancement and Management Detailed Methods (WO-T02)

Action	Relevant Parcels	Timing	Prescriptions
Year 0: Preparation and planting	All newly created woodland	November to March	**Soil preparation** – new planting into well-prepared ground following good horticultural practice including cultivation and scarification where appropriate. **Planting** - in dormant season (November to March) using a range of native species, mixed randomly. Planting density of <1000/ha. Planting should be in regular rows with scalloped edges. **Protection** - use of appropriate tree protection guards or fencing. **Ground flora** – sown with an appropriate shade-tolerant woodland mix as trees establish (Emorsgate EG9 Grass Mixture for Hedgerows and Woodland).
		Autumn or spring (ground flora)	
Year 1		Quarterly November to March October to November April to October	Quarterly inspection of tree guards/fencing and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Annual formative pruning of young trees to encourage good growth and shape. Monthly cuts of grassland as required to maintain sward at 100mm during first growing season between April and October. Arisings collected and removed following each cut.
Year 2 - 4		Anytime November to March October to November	Annual inspection of tree guards and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Annual formative pruning of young trees to encourage good growth and shape. **Year 2 ground flora:** continue monthly cuts as required to maintain 100mm sward between April and May. Arisings collected and removed following each cut. Followed by two cuts, one in late July and one in September, both to 100mm with arisings removed.
Year 5		Anytime November to March September to February	Annual inspection of tree guards and replacement if necessary. Replacement of failed planting as required, annual inspection and replanting in November to March. Selective thinning of 30% of woodland parcels in Year 5. Timing to avoid nesting bird season. Machinery use if ground conditions allow or using hand tools.
Year 6 - 14		Anytime November to March	Annual inspection of tree guards and replacement if necessary (until removed). Replacement of failed planting as required, annual inspection and replanting in November to March. Remove tree guards as appropriate (Years 10-15).
Year 15		September to February	Selective thinning of 30% of woodland parcels in Year 15. Timing to avoid nesting bird season. Machinery use if ground conditions allow or using hand tools.

Woodland Species Lists (WO-T03)

Final species mix/abundance will be agreed with a specialist contractor prior to planting. Species are provided below.

Common Name	Scientific Name
Hornbeam	*Carpinus betulus*
English oak	*Quercus robur*
Common alder	*Alnus glutinosa*
White willow	*Salix alba*
Black poplar	*Poplus nigra*
Whitebeam	*Sorbus aria*
Goat willow	*Salix caprea*
Field maple	*Acer campestre*
Common hawthorn	*Crataegus mongyna*
Blackthorn	*Prunus vulgarus*
Hazel	*Corylus avellana*

Hedgerow

Creation, Enhancement and Management Summary (HD-T01)

Target Hedgerow Type:			Species-rich native hedgerow		
Condition Assessment Criteria		**Targeted?**	**Relevant Features**	**Creation Approach**	**Management Approach**
A1	Height >1.5m average along length.	Yes	All newly created hedgerows.	N/A	Management will be undertaken to encourage bushy growth and maintain average height at minimum of 1.5m.
A2	Width >1.5m average along length.	Yes		N/A	Management will be undertaken to encourage bushy growth and maintain average width at minimum of 1.5m.
B1	Gap – hedge base Gap between ground and base of canopy <0.5m for >90% of length.	Yes		Stock-proof fencing will be installed to protect the hedgerow basis from grazing.	N/A
B2	Gap – hedgerow canopy continuity Gaps make up <10% of total length; and no canopy gaps >5m.	Yes		Hedgerows will be planted in double staggered rows to ensure sufficient coverage to establish intact hedgerows.	Management prescriptions include replacement of any failed planting and supplementary infill planting as required to fill any gaps that do develop.
C1	Undisturbed ground and perennial vegetation >1m width of undisturbed ground with perennial herbaceous vegetation for >90% of length: • measured from outer edge of hedgerow, and • is present on one side of the hedge (at least)	Yes		All hedgerows are situated where they will have at least one side of the hedge facing semi-natural habitat to be created or enhanced. No development or recreational pressure is anticipated that would disturb these edges.	N/A
C2	Nutrient-enriched perennial vegetation Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground.	Yes		N/A	All habitats within the site will be actively monitored and managed. The cutting and grazing regime of grassland habitats adjacent to newly created hedgerows will avoid nutrient-enriched perennial vegetation from dominating.
D1	Invasive and neophyte species >90% of the hedgerow and undisturbed ground is free of invasive non-native plant species (including those listed on Schedule 9 of WCA) and recently introduced species.	Yes		Invasive non-native species are currently absent and creation methods are not anticipated to introduce these species.	Monitoring visits will confirm the presence/absence of invasive non-native species, with measures implemented to reduce/remove these if required.

D2	Current damage >90% of the hedgerow or undisturbed ground is free of damage caused by human activities.	Yes		N/A	The only human activities at the site will be the ongoing management of the retained, enhanced and created habitats for biodiversity value. No damaging activities are anticipated.

Hedgerow

Creation, Enhancement and Management Methods (HD-T02)

Provide detailed prescriptions for the creation and management of the habitat.

Action	Relevant Features	Timing	Prescriptions
Year 0: Planting	Enhancement of H6	November to March inclusive	Planted in double staggered rows (40cm apart) into well-prepared ground, with a minimum of five native tree species used at a frequency of 4-6 plants per metre. The plants should be protected with suitable guards during establishment. A 75mm mulch layer is to be maintained at the hedgerow bases or suitable herbicide spray application to avoid growth of undesirable species.
Year 1: Pruning		Regularly in year 1	In Year 1, prune lateral growth only to encourage bushy growth. Top up mulch layer as required or continue with herbicide spray applications as necessary. Re-firm and replace any loose or failed plants as required.
Year 2 onwards		September to February	Cut hedgerows annually on rotation, no more than 1 year in 3 between 1st September and 28th February. Leaving at least two-thirds of hedges untrimmed each year. A minimum height and width of 1.5m is required to meet condition criteria, but ideally greater sizes of 2-3m will be targeted. Infill planting of new specimens where required if gaps begin to form.
Year 5 - 10		As required	Tree guards removed as appropriate.
Year 10 – 15		As required	Lay to promote thickness, if required.

Hedgerow Species Lists (HD-T03)

Provide a detailed species list for the habitat to be created

Common Name	Scientific Name	Abundance / %
Hawthorn	*Crataegus monogyna*	65%
Blackthorn	*Prunus spinosa*	10%
Field maple	*Acer campestre*	5%
Hazel	*Corylus avellana*	5%
Dogwood	*Cornus sanguinea*	5%
Guelder rose	*Viburnum opulus*	5%
Spindle	*Euonymus europaeus*	5%

What Does Success Look Like? (HD-F01)

Individual Trees

Creation, Enhancement and Management Summary (UT-T01)

Provide details of the approach to delivering each of the targeted condition criteria and habitat. Conditions from Statutory Biodiversity Metric habitat condition assessment sheets – Sheet 9. Individual Trees

Target Habitat:					
Condition Assessment Criteria		**Targeted**	**Relevant Features**	**Creation Approach**	**Management Approach**
A	The tree is a native species (or more than 70% within the block are native species).	Yes	All newly planted trees	Tree planting will include native species of local provenance	
B	The tree canopy is predominantly continuous, with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide (individual trees automatically pass this criterion).	Yes		Trees will be planted individually and spaced across the site, therefore automatically passing this criteria	
C	The tree is mature (or more than 50% within the block are mature).	No		N/A	N/A
D	There is little or no evidence of an adverse impact on tree health by human activities (such as vandalism, herbicide or detrimental agricultural activity). And there is no current regular pruning regime, so the trees retain >75% of expected canopy for their age range and height.	Yes			Trees bases will be buffered and protected from grassland management activities. Formative pruning of young trees will be undertaken to removed any dead branches and reduce selected side branches, ensuring development of a single strong leader and good overall form.
E	Natural ecological niches for vertebrates and invertebrates are present, such as presence of deadwood, cavities, ivy or loose bark.	No		N/A	N/A
F	More than 20% of the tree canopy area is oversailing vegetation beneath.	Yes		Trees will be planted within enhanced grassland habitat, and will oversail appropriately managed other neutral grassland	

Individual Trees

Creation, Enhancement and Management Detailed Methods (UT-T02)

Provide detailed prescriptions for the creation and management of the habitat.

Action	Relevant Features	Timing	Prescriptions
Year 0: Tree planting and establishment		Planting November to late March	Plant bare-rooted trees (heavy rootstock trees proposed) between November and late March, avoiding hard frosts and waterlogged conditions. Green compost to be added to planting beds. Trees protected with appropriate tree guards.
Year 1-5:		Winter As required	Annual formative and restorative pruning as necessary to ensure longevity Keep planting beds clear of vegetation and maintain a mulch layer of 75mm for the first 3 years Guards inspected twice yearly
Year 6 onwards		Winter As required	Annual formative and restorative pruning as necessary to ensure longevity Guards inspected twice yearly and removed when appropriate

Individual Trees Species Lists (UT-T03)

Provide a detailed species list for the habitat to be created

Common Name	Scientific Name	Abundance / %
Alder	*Alnus glutinosa*	13.33
Aspen	*Populus tremula*	6.67
Black poplar	*Populus nigra*	6.67
Blackthorn	*Prunus spinosa*	6.67
Field maple	*Acer campestre*	6.67
Goat willow	*Salix caprea*	13.33
Hawthorn	*Crataegus monogyna*	13.33
Hazel	*Corylus avellana*	13.33
Hornbeam	*Capinus betulus*	13.33
Whitebeam	*Sorbus aria*	6.67

What Does Success Look Like? (UT-F01)

Habitat Creation and Management – Risk Register and Remedial Measures PM-T02

Provide a site-wide risk register associated with creating, enhancing and, or, managing each habitat type. Consider your approach to delivering the BNG targets in case the management prescriptions do not deliver as expected.

Risk Identification Date	Habitat Type	Risk Factor	Trigger for Action	Remedial Measure
April 2025	Grassland	Sward height and bare ground cover not meeting condition criteria specifications due to inappropriate grazing level/frequency and/or failed seeding areas.	Condition criteria not met upon monitoring visit.	Adjust grazing intensity, timing and frequency to achieve desired result. Reseeding as required in excessive bare patches.
	Grassland	Cover of undesirable and ruderal species too high.	>5% cover of undesirable species	Spot treatment of ruderals and adjustment of cutting/grazing frequency as necessary.
	Grassland	Cover of scrub and bracken too high.	>5% and >20% respectively.	Scrub and bracken removal and adjust cutting/grazing frequency as necessary.
	Grassland	Grassland indicator species low in abundance or absent. Poor species diversity.	Quadrat monitoring results find that Criteria A has failed (criteria F not targeted).	Consideration for adjusting cutting/grazing frequency and duration. Potential to undertake addition rounds of overseeding if required.
	Hedgerow, mixed scrub, woodland and scattered trees	Newly planted trees failing to establish	10% of targeted number of newly planted trees found to be dead during years 1-10.	Undertake additional round of planting as necessary, replacing failed specimens on a like-for-like basis.
	Hedgerows	Gaps in hedgerows develop.	Gaps identified that make up >10m of total hedgerow length or individually measure >5m.	Infill planting in gaps.
	Woodland	Minimum of two age classes and two storeys do not develop.	Monitoring visits find <2 classes/storeys within woodland parcels.	Increase in frequency and extent of thinning to promote regeneration. Planting of additional species in existing open spaces to promote specific age classes/storeys developing.
	All	Invasive species present.	Monitoring visit identified an invasive species.	Species-specific eradication measures to be implemented depending on habitat type and severity.
	All	Extended period of hot and dry weather in spring/summer months during initial establishment years.	Excessive failure of plants and multiple condition criteria not being met.	Implement watering regime as required in such circumstances. Replace failed planted.

4. Monitoring Schedule

Monitoring Strategy

Provide details of the monitoring strategy to encourage successful implementation of the management plan (MS-B01)
Monitoring visits will be undertaken in Years 1, 2, 3, 5, 10, 15, 25 and 30. The monitoring visit frequency will ensure that early adaption can be undertaken in management. Each visit will consist of the following measures: • UK Habitat Classification survey to map the extent and nature of habitats, in addition to condition assessments in accordance with Statutory Metric guidance (all habitats). Evaluation of habitat types against set condition criteria targets • Fixed point photography (locations set out in Table MS-T01 below). A Monitoring Report will be written after each visit to include findings and recommendations for any changes in management or remedial actions as necessary.

Monitoring Methods and Intervals MS-T01

Habitat Type	Monitoring Methods	Monitoring Interval and Timing
Grassland	Standard condition assessment. In addition, a simple, repeatable grassland monitoring regime is proposed which would include a general assessment of grassland habitats, as well as sampling of fixed quadrat locations across the site. Five quadrats will be sampled in each grassland field area, in a broadly 'w-shaped' layout. Each quadrat will record species with a 2m x 2m area, abundance on the DAFOR scale and the average number of species per m^2. The quadrat locations selected in Year 1 will be recorded using "what3words" and approximate locations re-surveyed on each monitoring visit. A botanical species list of each field area will also be collected to check the species assemblage against target species lists.	Undertaken on each monitoring visit. Surveys to be completed between May and August
Other habitats	Standard condition assessments will be undertaken, recording values for all criteria as required.	
Fixed point photography	A total of 20 locations have been selected for fixed point photography to be undertaken during each monitoring visit. The exact location, aspect and height of photographs will be recorded on each occasion to allow between-year comparisons of habitat establishment, structure and diversity to be made. See Fixed-point Photography Plan (MS-F01) below for photograph locations and directions.	

Monitoring Reports

Following completion of habitat creation and initial enhancement works, prepare for your monitoring report for the Local Planning Authority or Responsible Body. You should monitor each habitat type comprising the BNG project. Provide sufficient detail for the reviewing authority to assess the progress. The 'Monitoring Report Template' can help you do this. The requirements and regularity with which the monitoring reports are required are at the discretion of the LPA or Responsible Body. Prepare the monitoring requirements below.

Monitoring Report Schedule MS-T02

Provide details of the person or organisation that will be responsible for submitting the monitoring reports. Also state the responsible organisation for receiving and reviewing the reports.

Organisation Responsible for Submitting the Monitoring Reports	Organisation Receiving and Responsible for Reviewing Reports
CSA Environmental	TBC

Provide details of when the monitoring surveys and reports will be undertaken and submitted. You can extend the table and adjust according to your required schedule.

Project Year	Month Report to be Submitted	Month Management Plan to be reviewed	Comments
1	November - December	December	Initial habitat establishment.
3	November - December	December	
5	November - December	December	Confirmation of appropriate establishment and commencement of management procedures (e.g. woodland/scrub thinning).
10	November - December	December	Long-term habitat condition progress with evaluation against target criteria.
15	November - December	December	
25	November - December	December	
30	November - December	December	

Adaptive Management

Summary of Adaptive Management Approaches (MS-B02)

During initial site works and habitat establishment, detailed 'toolbox talks' will be held with the landowners and land managers/contractors to explain the measures within this Monitoring Plan and encourage an adaptive management approach. Regular communication will be held between CSA Environmental and The Hunter Group where positive and negative issues can be explored and rectified as required. Day to day issues can be captured by all involved and issues resolved collectively.

Regular, robust monitoring visits will be undertaken in line with the schedule and methods set out above. These visits will be more frequent in initial years when the potential for issues and external unknown variables will be higher. Monitoring reports will regularly feedback findings to the responsible body.

Photograph 1. Field F10 with Hedgerow H7.

Photograph 2. Field F12 and Hedgerow H6.

Photograph 3. Field F10 and Woodland W1.

Photograph 4. Field F4.

Photograph 5. Field F6 with views of F11 and F12 in north.

Photograph 6. Stream running along H9a and H9b.

Table 1. Habitat Polygons

Site Name	Stonehouse Farm					
Survey Date and Surveyor(s)	18/07/2024 CG/LG					
Scientific Name	**Common Name**	**Habitat Parcel Number/Habitat Type**				
		F4 Modified grassland	F6 Modified grassland	F10 Modified grassland	F11 Modified grassland	F12 Modified grassland
Herb Species						
Anagallis arvensis	Scarlet pimpernel	R		R		
Cirsium arvense	Creeping thistle	R		R	O	O
Cirsium vulgare	Spear thistle		R			
Plantago major	Greater plantain			R	R	R
Prunella vulgaris	Selfheal			O		R
Ranunculus repens	Creeping buttercup	O	O	O		F
Rumex acetosa	Common sorrel		R	R		
Rumex crispus	Curled dock	R		R	F	
Rumex obtusifolius	Broad-leaved dock	R		R	R	F
Taraxacum agg.	Dandelion	R			R	R
Trifolium pratense	Red clover		R			
Trifolium repens	White clover	R	F	F	R	A
Urtica dioica	Common nettle	R			R	
Grasses						
Agrostis stolonifera	Creeping bent	A	A	R	F	R
Alopecurus pratensis	Meadow foxtail		F		R	R
Dactylis glomerata	Cock's-foot	R		R		R
Holcus lanatus	Yorkshire-fog	R	O	R		R
Lolium perenne	Perennial rye-grass	A	A	D	D	D
Phleum pratense	Timothy	R				
Poa annua	Annual meadow-grass			R	R	O
Poa infirma	Early meadow-grass				R	
Poa sp.	Meadow-grass	R				
Poa trivialis	Rough meadow-grass			O		O

Table 2. Linear Habitats

Site Name	Stonehouse Farm							
Survey Date and Surveyor(s)	18/07/2024 CG/LG							
Scientific Name	**Common Name**	**Habitat Parcel Number/Habitat Type**						
		H6	H7	H9a	H9b	H11	H12	H31
Broadleaved								
Betula pendula	Silver birch			X	X	X		
Buddleja davidii	Butterfly-bush			X	X			
Crataegus monogyna	Hawthorn	X	X	X	X	X		
Fagus sylvatica	Beech	X		X	X			
Ilex aquifolium	Holly			X	X		X	
Prunus avium	Cherry			X	X			
Quercus sp.	Oak		X	X	X	X	X	
Rosa canina sp.	Dog-rose					X		
Rubus fruticosus agg.	Bramble	X	X			X	X	
Salix caprea	Goat willow			X	X			X
Sambucus nigra	Elder	X	X	X	X			
Sorbus aucuparia	Rowan			X	X			
Ulex europaeus	Gorse					X	X	

Habitat Condition Sheet: **GRASSLAND – LOW DISTINCTIVENESS**

sment Criteria			Pass? (Y/N)				
			Habitat Parcel				
			F4	**F6**	**F10**	**F11**	**F12**
A	There are 6-8 vascular plant species per m^2 present, including at least 2 forbs. **Note – this criterion is essential for achieving Moderate or Good condition.**		No	No	Yes	No	No
B	Sward height is varied (at least 20% of the sward is less than 7cm and at least 20% is more than 7cm) creating microclimates which provide opportunities for vertebrates and invertebrates to live and breed.		No	No	No	No	No
C	Any scrub present accounts for less than 20% of the total grassland area. (Some scattered scrub such as bramble *Rubus fruticosus* agg. may be present). Note – patches of scrub with continuous (more than 90%) cover should be classified as the relevant scrub habitat type.		Yes	Yes	Yes	Yes	Yes
D	Physical damage evident in less than 5% of total grassland area. Examples of physical damage include excessive poaching, damage from machinery use or storage, erosion caused by high levels of access, or any other damaging management activities.		Yes	Yes	Yes	Yes	Yes
E	Cover of bare ground between 1% and 10%, including localised areas (for example, a concentration of rabbit warrens).		Yes	Yes	No	No	Yes
F	Cover of bracken *Pteridium aquilinum* is less than 20%.		Yes	Yes	Yes	Yes	Yes
G	There is an absence of invasive non-native species (as listed on Schedule 9 of WCA, 1981).		Yes	Yes	Yes	Yes	Yes
Condition Assessment Result							
Passes 6 or 7 criteria including essential criterion A		Good (3)					
Passes 4 or 5 criteria including essential criterion A		Moderate (2)			✓		
Passes 3 or fewer criteria; **OR** Passes 4 – 6 criteria (excluding criterion A)		Poor (1)	✓	✓		✓	✓

Habitat Condition Sheet: **WOODLAND**

Condition Assessment Criteria					**Score per indicator**
					Habitat Parcel
Indicator		**Good (3 points)**	**Moderate (2 points)**	**Poor (1 point)**	
A	Age distribution of trees	Three age-classes present.	Two age-classes present.	One age-class present.	2
B	Wild, domestic and feral herbivore damage	No significant browsing damage evident in woodland.	Evidence of significant browsing pressure is present in less than 40% of whole woodland.	Evidence of significant browsing pressure is present in 40% or more of whole woodland.	1
C	Invasive plant species	No invasive species present in woodland.	Rhododendron *Rhododendron ponticum* or cherry laurel *Prunus laurocerasus* not present, and other invasive species <10% cover.	Rhododendron or cherry laurel present, or other invasive species ≥10% cover.	3
D	Number of native tree species	Five or more native tree or shrub species found across woodland parcel.	Three to four native tree or shrub species found across woodland parcel.	Two or less native tree or shrub species across woodland parcel.	3
E	Cover of native tree and shrub species	>80% of canopy trees and >80% of understory shrubs are native.	50 - 80% of canopy trees and 50 - 80% of understory shrubs are native.	<50% of canopy trees and <50% of understory shrubs are native.	3
F	Open space within woodland	10 - 20% of woodland has areas of temporary open space. Unless woodland is <10ha, in which case 0 - 20% temporary open space is permitted.	21 - 40% of woodland has areas of temporary open space.	<10% or >40% of woodland has areas of temporary open space. But if woodland <10ha has <10% temporary open space, please see Good category.	3
G	Woodland regeneration	All three classes present in woodland; trees 4 - 7 cm Diameter at Breast Height (DBH), saplings and seedlings or advanced coppice regrowth.	One or two classes only present in woodland.	No classes or coppice regrowth present in woodland.	2

H	Tree health	Tree mortality 10% or less, no pests or diseases and no crown dieback.	11% to 25% tree mortality and or crown dieback or low-risk pest or disease present.	Greater than 25% tree mortality and or any high-risk pest or disease present.	3
I	Vegetation and ground flora	Recognisable NVC plant community at ground layer present, strongly characterised by ancient woodland flora specialists.	Recognisable woodland NVC plant community at ground layer present.	No recognisable woodland NVC plant community at ground layer present.	1
J	Woodland vertical structure	Three or more storeys across all survey plots, or a complex woodland.	Two storeys across all survey plots.	One or less storey across all survey plots.	2
K	Veteran trees	Two or more veteran trees per hectare.	One veteran tree per hectare.	No veteran trees present in woodland.	1
L	Amount of deadwood	50% of all survey plots within the woodland parcel have deadwood, such as standing and fallen deadwood, large dead branches and or stems, branch stubs and stumps, or an abundance of small cavities.	Between 25% and 50% of all survey plots within the woodland parcel have deadwood, such as standing and fallen deadwood, large dead branches and or stems, stubs and stumps, or an abundance of small cavities.	Less than 25% of all survey plots within the woodland parcel have deadwood, such as standing and fallen deadwood, large dead branches and or stems, stubs and stumps, or an abundance of small cavities.	2
M	Woodland disturbance	No nutrient enrichment or damaged ground evident.	Less than 1 hectare in total of nutrient enrichment across woodland area, and or less than 20% of woodland area has damaged ground.	1 hectare or more of nutrient enrichment, and or 20% or more of woodland area has damaged ground.	3
Total score (out of a possible 39)					**29**
Condition Assessment Result					
Total score >32 (33 to 39)		Good (3)			
Total score 26 to 32		Moderate (2)			✓
Total score <26 (13 to 25)		Poor (1)			

Habitat Condition Sheet: **HEDGEROW**

Condition Assessment Criteria							
A series of ten attributes, representing key physical characteristics are used for this assessment. Each attribute is assigned to one of five functional groups (A – E) and the condition of a hedgerow is assessed according to the number of attributes from these functional groups which pass or fail the 'favourable condition' criteria. This assessment is based on the Hedgerow Survey Handbook and Favourable Conservation Status document. For further clarification please refer to the Hedgerow Survey Handbook. Best practice would be to record the species, age, spacing and other key information about all trees present along a hedgerow within the 'Habitat Description' box, as well as other key features of the hedgerow.							
Hedgerow favourable condition attributes				**Pass? (Y/N)**			
Attributes and functional groupings (A, B, C, D & E)*		**Criteria (the minimum requirements for 'favourable condition'**	**Description**	**Hedgerow Ref.**			
Core groups - applicable to all hedgerow types				**H7**	**H11**	**H12**	**H31**
A1.	Height	>1.5 m average along length	The average height of woody growth estimated from base of stem to the top of the shoots, excluding any bank beneath the hedgerow, any gaps or isolated trees. Newly laid or coppiced hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice). A newly planted hedgerow does not pass this criterion (unless it is >1.5 m height).	Yes	Yes	Yes	Yes
A2.	Width	>1.5 m average along length	The average width of woody growth estimated at the widest point of the canopy, excluding gaps and isolated trees. Outgrowths (such as blackthorn *Prunus spinosa* suckers) are only included in the width estimate when they are >0.5 m in height. Laid, coppiced, cut and newly planted hedgerows are indicative of good management and pass this criterion for up to a maximum of four years (if undertaken according to good practice).	Yes	Yes	Yes	No
B1.	Gap - hedge base	Gap between ground and base of canopy <0.5 m for >90% of length	This is the vertical 'gappiness' of the woody component of the hedgerow, and its distance from the ground to the lowest leafy growth. Certain exceptions to this criterion are acceptable (see page 65 of the Hedgerow Survey Handbook).	Yes	No	Yes	Yes
B2.	Gap - hedge	Gaps make up <10% of total length; and No canopy gaps >5 m	This is the horizontal 'gappiness' of the woody component of the hedgerow. Gaps are complete breaks in the woody canopy (no matter how small).	No	Yes	No	Yes

	canopy continuity		Access points and gates contribute to the overall 'gappiness' but are not subject to the >5 m criterion (as this is the typical size of a gate).				
C1.	Undisturbed ground and perennial vegetation	>1 m width of undisturbed ground with perennial herbaceous vegetation for >90% of length: · Measured from outer edge of hedgerow; and · Is present on one side of the hedgerow (at least).	This is the level of disturbance (excluding wildlife disturbance) at the base of the hedgerow. Undisturbed ground is present for at least 90% of the hedgerow length, greater than 1 m in width and must be present along at least one side of the hedgerow. This criterion recognises the value of the hedgerow base as a boundary habitat with the capacity to support a wide range of species. Cultivation, heavily trodden footpaths, poached ground etc. can limit available habitat niches.	Yes	No	Yes	Yes
C2.	Nutrient-enriched perennial vegetation	Plant species indicative of nutrient enrichment of soils dominate <20% cover of the area of undisturbed ground.	The indicator species used are nettles *Urtica* spp., cleavers *Galium aparine* and docks *Rumex* spp. Their presence, either singly or together, does not exceed the 20% cover threshold.	Yes	Yes	No	Yes
D1.	Invasive and neophyte species	>90% of the hedgerow and undisturbed ground is free of invasive non-native plant species (including those listed on Schedule 9 of WCA) and recently introduced species.	Recently introduced species refer to plants that have naturalised in the UK since AD 1500 (neophytes). Archaeophytes count as natives. For information on archaeophytes and neophytes see the JNCC website, as well as the BSBI website where the 'Online Atlas of the British and Irish Flora' contains an up-to-date list of the status of species. For information on invasive non-native species see the GB Non-Native Secretariat website.	Yes	Yes	Yes	Yes
D2.	Current damage	>90% of the hedgerow or undisturbed ground is free of damage caused by human activities.	This criterion addresses damaging activities that may have led to or lead to deterioration in other attributes. This could include evidence of pollution, piles of manure or rubble, or inappropriate management practices (for example, excessive hedgerow cutting).	Yes	No	Yes	Yes
Additional group - applicable to hedgerows with trees only							
E1.	Tree class	There is more than one age-class (or morphology) of tree present (for example: young, mature, veteran and or ancient), and there is on average at least one mature, ancient or veteran tree present per 20 - 50m of hedgerow.	This criterion addresses if there are a range of age-classes or morphologies which allow for replacement of trees and provide opportunities for different species.	No	Yes	No	-
E2.	Tree health	At least 95% of hedgerow trees are in a healthy condition (excluding veteran features valuable for	This criterion identifies if the trees are subject to damage which compromises the survival and health of the individual specimens.	Yes	Yes	No	-

		wildlife). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.					
Condition categories for hedgerows without trees							
No more than 2 failures in total; **AND** No more than 1 failure in any functional group.			Good (3)	-			✓
No more than 4 failures in total; **AND** Does not fail both attributes in more than one functional group (for example, fails attributes A1, A2, B1 and C2 = Moderate condition).			Moderate (2)	-			
Fails a total of more than 4 attributes; **OR** Fails both attributes in more than one functional group (for example, fails attributes A1, A2, B1 and B2 = Poor condition).			Poor (1)	-			
Condition categories for hedgerows with trees							
No more than 2 failures in total; **AND** No more than 1 failure in any functional group.			Good (3)	✓	✓	✓	-
No more than 5 failures in total; **AND** Does not fail both attributes in more than one functional group (for example, fails attributes A1, A2, B1, C2 and E1 = Moderate condition).			Moderate (2)				-
Fails a total of more than 5 attributes; **OR** Fails both attributes in more than one functional group (for example, fails attributes A1, A2, B1 and B2 = Poor condition).			Poor (1)				-

Habitat Condition Sheet: **LINE OF TREES**

Condition Assessment Criteria		**Pass? (Y/N)**		
		Ref.		
		H6	**H9a**	**H9b**
A	At least 70% of trees are native species.	Yes	Yes	Yes
B	Tree canopy is predominantly continuous with gaps in canopy cover making up <10% of total area and no individual gap being >5 m wide.	No	Yes	Yes
C	One or more trees has veteran features and or natural ecological niches for vertebrates and invertebrates, such as presence of standing and attached deadwood, cavities, ivy or loose bark.	Yes	Yes	Yes
D	There is an undisturbed naturally-vegetated strip of at least 6 m on both sides to protect the line of trees from farming and other human activities (excluding grazing). Where veteran trees are present, root protection areas should follow standing advice.	Yes	No	No
E	At least 95% of the trees are in a healthy condition (deadwood or veteran features valuable for wildlife are excluded from this). There is little or no evidence of an adverse impact on tree health by damage from livestock or wild animals, pests or diseases, or human activity.	Yes	Yes	Yes
Passes 5 criteria	Good (3)			
Passes 3 or 4 criteria	Moderate (2)	✓	✓	✓
Passes 2 or fewer criteria	Poor (1)			

A3

N

0 7.5 15 30 45 60 75 150

Scale Bar (M)

HAMMERPOND ROAD

104.7m

101.6m

107.2m

Hammer Cottage

Wagtail Farm

Track

Cattery

Spring

Jacksons Farmhouse

Silo

Jackson's Farm

Keepers

High Plovers

Pond

Willis Farm House

Benacre

Hammer Barn

Track

ETL

Proposed Footpath

Existing Footpath

Tanks

Tanks

Track

Drain

InCo Surveys

Project	STONEHOUSE FARM&LAKES HANDCROSS ROAD HORSHAM, RH13 6NZ
Figure	Footpath Diversion Plan

Rev		Date
Project No.	S24830	Date: February '25
Scales	1:2500@A3	Status: INFORMATION
Figure No.	S24830-010	Rev

STONEHOUSE FARM, WEST SUSSEX

BASELINE SOIL ASSESSMENT

Prepared on behalf of:

HUNTER DEVELOPMENT HOLDINGS LTD

TOHA Document Ref:	TOHA/24/4515/HM
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CONTENTS

1.0 INTRODUCTION

Tim O'Hare Associates LLP (TOHA) was commissioned by Hunter Development Holdings Limited to undertake a Baseline Soil Assessment at The Stonehouse Farm in West Sussex.

1.1 Purpose

It is proposed to enhance the diversity and structure of the existing grassland across the farm and create new areas of woodland, heathland, scrub and reed bed planting as part of a wider Biodiversity Net Gain (BNG) Habitat Scheme.

The site is approximately 35 hectares and includes eleven fields of varying sizes, referenced *Field 1 to Field 8* and *Field 10 to Field 12* and four ponds adjacent to each other.

No information was available on the basic chemistry and fertility status of the soils within the proposed habitat areas or their suitability for the proposed habitat type. As such, a baseline soil assessment was requested.

This report issues the findings of the baseline soil assessment, including site observations and soil descriptions, results and interpretation of all analyses, discussion on topsoil quality and implications for the current habitat establishment proposals.

2.0 SOIL REQUIREMENTS

2.1 Landscape Proposals

The supplied CSA Environmental *Site-wide Masterplan (Stonehouse Farm, Handcross Road Horsham – Drawing No. CSA/6476/111 – April 2024)* and *Post-Development Habitats Plan (Land at Stonehouse Farm, Plumbers Plain, Horsham)* drawings indicate the following landscape types are intended:

- Tree planting (extra heavy, standard and multi-stem);
- Woodland planting;
- Thicket / scrub planting;
- Heathland and shrub planting;
- Wildflower grassland (other neutral grassland and modified grassland);
- Reed bed planting;
- Aquatic marginal vegetation;
- Wetland habitats;

The requirements for the proposed habitat types are outlined below:

Extra Heavy Standard Tree Planting

Extra heavy standard trees are a demanding planting environment to construct. Trees of this size and age have grown accustomed to optimum growing conditions in the nursery, and these need to be replicated when the rootballed or containerised tree is planted in the pit. In particular, aeration and drainage around the rootball as well as moderate to high fertility status are critical. Without these properties, trees will very quickly suffer and possibly die during their first few growing seasons after planting.

Given their demanding nature all rootballed trees should be planted with well-aerated and free-draining soils to the full rooting depth (normally considered to be 1.0m).

Standard and Multi-Stem Tree Planting

Rootballed trees prefer well drained / aerated and nutritious soil. Smaller tree stock such as these do not tend to compact the underlying soils and have relatively compact rootballs, requiring less extensive planting pits.

Woodland and Thicket / Scrub

Woodland and thicket / scrub planting comprises of indigenous woodland plant species, usually planted as whips and feathered trees. These are less demanding than containerised stock. As such, a broader range of soil types may be re-used for these, provided the species selected do not

require any specific growing conditions. The soils must possess a satisfactory structure to support plant growth. The topsoil and subsoil should have suitable pH and drainage characteristics for the selected species.

Heathland and Shrub

Lowland heath typically grows best in mineral soils or shallow peat (<0.5m) with well drained, acid soils. Low nutrient contents are preferable to minimise the risk of colonisation from more competitive species, particularly during establishment. Ongoing management is also required to prevent the growth and establishment of native woodland species such as silver birch or braken, which in unmanaged environments are liable to succeed and outcompete the heathland environment.

Wildflower Grassland

It is understood that the wildflower grassland is to comprise of areas of Other Neutral Grassland and Modified Grassland.

The soil requirements for wildflower grassland enhancement and enhancement of existing grassland, and their continued presence, are soils which provide the following key properties:

- Low plant available phosphorus;
- At least moderate reserves of organic matter and total (organic) nitrogen.

Plant available phosphorus is regarded as the key nutrient when considering the fertility status of soil in relation to species-rich grasslands. Whereby, a low phosphorus level is preferred to maximise floral diversity and prevent domination of the sward by grasses and aggressive weeds such broad-leaved dock (*Rumex obtusifolius*) and stinging nettle (*Urtica dioica*).

In addition to this, the species selected for establishment should be tolerant of the pH of the soils as well as their textural properties and anticipated soil moisture regime. In particular, the species-rich wet meadow would require soils which remain moist/wet for the majority of the year.

Reed Bed, Aquatic Marginal Vegetation and Wetland Habitats

Reed bed and aquatic marginal vegetation planting and wetland habitats consist of various submergent and emergent plants. Appropriate soils are needed for these purposes, which normally have a relatively low fertility status to avoid impact on water quality by *eutrophication*. Inert soil with low organic matter content is normally required to be placed below the water line.

3.0 SITE INVESTIGATION

3.1 Site Visit

The site visit was conducted on 6th August 2024 during a period of cool, wet weather.

3.2 Site Overview

The site is located to the southwest of Ashfold Crossways and was accessed via Handcross Road.

The site sloped from the north to the south and was reasonably level in the southeast section. It was bordered by mature trees, with farm buildings to the west and south extent. The site comprised 11 No. fields (*Field 1 to Field 8* and *Field 10 to Field 112*) with the majority of fields comprising grassland with occasional mature trees. *Field 8* comprised of adventitious weeds and sparse grass. There were 4 No. ponds with reed beds and other aquatic marginal planting at the southeast section of the site.

Farm buildings were located south of *Field 8* as well adjacent to the ponds and *Field 1*.

Field 3 was not surveyed as it could not be accessed due to overgrown vegetation and a barbed wire fence.

Plate 1: View across *Field 1* from the northwest to the southeast.

Plate 2: View across *Field 2* from south to north.

Plate 3: View from south to north across *Field 4*.

Plate 4: View from the north to south across *Field 5.*

Plate 5: View across *Field 8* from east to west.

Plate 6: View north across *Field 10.*

3.3 Soil Sampling and Assessment

The site was sampled in accordance with Natural England Technical Information Note 035 – *Soil sampling for habitat recreation and restoration (TIN 035)*. Whereby, sub-samples of the topsoil were taken from along a 'W' pattern to the depth of 75mm. A hand driven soil auger was used to collect the topsoil samples.

Where consistent in soil type, these sub-samples were combined to form composite topsoil samples for laboratory analysis. A single composite sample was collected per field.

Furthermore, 11 No. trial pits were constructed at representative locations using a spade and hand driven soil auger to a maximum depth of 600mm for the purpose of soil profile description. At these locations, soils were examined with reference to the Soil Survey Field Handbook. Important physical soil characteristics were recorded, including soil texture, soil structure, compaction, moisture status, drainage characteristics, stone content and the presence of deleterious materials. The location of each Sampling Area and trial pits are indicated on the site plan in **Appendix 1**.

3.4 Soil Conditions

From the site work, 1 No. topsoil profile and 3 No. subsoil profiles were observed. The soil profiles were described as below:

Topsoil GL – 190/510 mm Average: 330mm	Dark brown (Munsell Colour 10YR 3/3), dry to slightly moist, friable, non-calcareous to moderately calcareous SILTY CLAY LOAM / CLAY LOAM. The topsoil was moderately developed, fine to coarse granular and subangular blocky structure. The topsoil was virtually stone free to slightly stony with no observable deleterious materials recorded.
Subsoil 1 190/510mm - 600mm *Field 1-2, Field 6-7 & Field 10-12*	Yellow (Munsell Colour 2.5Y 7/6) slightly moist, friable to slightly plastic, non-calcareous to slightly calcareous SILTY CLAY LOAM with a moderately developed, medium to coarse sub-angular structure. Virtually stone free, with no observable deleterious materials recorded. Strong ochreous mottling was observed throughout.
Subsoil 2 360/370mm - 600mm *Field 4 & 5*	Yellowish brown (Munsell Colour 10YR 5/6), slightly moist, friable, non-calcareous FINE SANDY LOAM / SANDY SILT LOAM, moderately developed, fine to medium, granular structure. Slightly stony with no observable deleterious materials recorded.
Subsoil 3 230mm - 600mm *Field 8*	Very dark greyish brown (Munsell Colour 10YR 3/2), slightly moist, slightly plastic, very calcareous SILTY CLAY LOAM with a moderately developed, medium to coarse sub-angular structure. Moderately stony including frequent fragments of chalk, with no observable deleterious materials recorded.

The subsoil at the *Ponds* was not able to be surveyed due to a solid obstruction.

Plate 7: Typical topsoil horizon (TH10).

Plate 8: Typical topsoil arisings.

Plate 9: Typical *Subsoil 1* arisings

Plate 10: Typical *Subsoil 2* arisings

Plate 11: Typical *Subsoil 3* arisings

4.0 LABORATORY ANALYSIS

4.1 Analytical Schedule

A total of 11 No. composite topsoil and 6 No. composite subsoil samples were submitted to the laboratory for chemical analysis to confirm their soil reaction and fertility status. The following parameters were determined:

- pH value;
- organic matter;
- total nitrogen;
- extractable phosphorus;
- extractable potassium;
- extractable magnesium.

The results of this testing are presented on the Certificate of Analysis in **Appendix 3** and an interpretation of the results is given below.

4.2 Results of Analysis

pH Values

The pH range of the topsoil samples was broad, ranging from slightly acid to moderately alkaline in reaction (pH 6.3 – 7.8).

- Samples from *Field 4, Field 5, Field 7, Field 10, Field 11* and *Field 12* were **slightly acid**.
- Samples from *Field 1, Field 2* and *Field 8* were **slightly alkaline**.
- Samples from *Field 6* and *Ponds* were **moderately alkaline**.

The subsoil samples ranged from acid to strongly alkaline in reaction (pH 5.9 – 8.0).

- Samples representing *Field 4+5* and *Field 7+10* were **slightly acid**.
- Samples representing *Field 11+12* was **slightly alkaline**.
- Samples representing *Field 1+2, Field 6* and *Field 8* were **moderately alkaline**.

Organic Matter and Total Nitrogen

The organic matter contents of each topsoil sample were quite variable and ranged from moderate to moderately high. The total nitrogen levels corresponded well with the organic matter contents.

The organic matter contents of the subsoil samples were even more variable, ranging from 1.6% to 4.9%.

Phosphorus, Potassium and Magnesium

Topsoil samples from *Field 1, Field 2*, *Field 4, Field 7* and *Field 10* contained moderate to high levels of extractable phosphorus, and low to moderate levels of extractable potassium and extractable magnesium.

The topsoil samples from *Field 5*, *Field 6, Field 8, Field 11, Field 12* and the *Ponds* contained low levels of extractable phosphorus and extractable potassium, and low to moderately high levels of extractable magnesium.

The fertility status of the topsoil is summarised on the site plan in **Appendix 2** and discussed in the Discussion and Recommendations section.

5.0 DISCUSSION AND RECOMMENDATIONS

The purpose of this baseline topsoil assessment was to assess the fertility status, basic chemistry and physical characteristics of the existing topsoil conditions with the proposed BNG habitat scheme. The findings from this exercise will feed into the new design, including tree planting, woodland planting, thicket/scrub planting, heathland and shrub planting, wildflower grasslands, reed bed planting, aquatic marginal vegetation and wetland habitats.

5.1 Summary of Findings

Based on the site assessment and laboratory analysis, the topsoils across the farm could be described as a slightly acid/non-calcareous to moderately alkaline/calcareous *silty clay loam* to *clay loam* (*heavy* soil texture) with low stone contents and adequate soil structure.

The topsoil samples typically contained moderately high levels of organic matter and extractable magnesium. The extractable phosphorus and extractable potassium values varied from low to moderately high.

The overall fertility status of each Field is summarised in the table below and shown on the site plan in **Appendix 2**.

Field Reference	Topsoil Fertility Status
1	High
2	High
4	High
5	Low
6	Low
7	High
8	Low
10	High
11	Low
12	Low
Ponds	Low

The majority of the subsoil encountered would also be considered as *heavy* in texture (*Subsoil 1* and *Subsoil 3*) with a very low to moderate stone content and adequate soil structure. *Subsoil 2* was found within *Field 4* and *Field 5* only and was described as medium in texture, with a low stone content.

5.2 Soil Suitability for Species-rich Habitats

Soil Reaction

The pH levels of the topsoils across the farm were noticeably variable and ranged from slightly acid to moderately alkaline. This may be associated with the underlying geological parent material from which the soils are derived and/or past farming practices where agricultural lime was applied to certain fields to raise soil pH.

It will be important to ensure that the plant species and seed mixes selected for these habitats are tailored to match the pH range of each field. For example, *Other Neutral Grassland* habitat would be suited to the fields where soil pH is *slightly acid* to *slightly alkaline*.

Fertility Status

The overall fertility status of the topsoil samples in *Fields 5, 6, 8, 11, 12* and *Ponds* could be described as 'low', and as such, would have a better potential for establishing species-rich habitats.

The fertility status of the topsoil at *Fields 1, 2, 4, 7* and *10* were categorised as 'high', and as such, the topsoil has a lower potential for establishing the desired habitats.

However, these soils may not achieve the highest levels of plant biodiversity and such as ryegrass, nettle and dock. No application of either compost or fertiliser should be made to areas of wet or dry meadow.

In this instance, the sward produced is less likely to achieve the highest levels of plant biodiversity as the desired species would be more at risk of being outcompeted by aggressive weeds and grasses, such as ryegrass, nettle and dock. If the topsoil is to be utilised for wildflower grassland establishment, the limitations and reduced potential biodiversity should be considered. Appropriate management of the sward will be necessary to maximise the numbers of species produced and prevent the colonisation by aggressive species, especially during the establishment period.

The levels of magnesium and potassium are considered to be of less influence with respect to wildflower grassland establishment, with their levels having a greater benefit on 'high fertility' planting environments (e.g. tree and shrub planting).

The test results should be forwarded to the project ecologist for confirmation of their final suitability, in relation to the target habitats.

Physical Properties

The *Topsoil*, *Subsoil 1* and *Subsoil 3* fell into the *silty clay loam* or *clay loam* soil texture classes, would be described as *heavy* in texture.

Subsoil 2 was slightly lighter in texture, and classed as a *fine sandy loam* to *sandy silt loam* (based on hand textural assessment).

All of the soils are regarded as moisture-retentive and slow-draining. The ochreous mottling observed within the subsoil horizon in *Subsoil 1* and *Subsoil 3* indicates some degree of seasonal waterlogging in these soils. These conditions are suitable for the target habitats which thrive on heavier, moisture retentive soils.

5.3 Considerations for Tree, Woodland, Thicket and Scrub Habitats

Soil Reaction

The slightly acid to moderately alkaline pH levels suit a broad range of native plant species. Where any species have a narrow pH tolerance, it will be important to ensure that it is located in an Field with a suitable pH level.

Fertility Status

The topsoil fertility status at *Fields 4 and Field 7* would be considered adequate for tree, woodland, thicket and scrub planting and, as such, no additional compost or fertiliser amelioration would be considered necessary for planting.

The topsoil test results for the remaining fields and *Ponds* identified deficiencies in extractable potassium, extractable phosphorus and occasionally extractable magnesium. As such, amelioration with a suitable organic soil improver (e.g. green compost) would be recommended for the proposed planting.

Physical Considerations

The medium to heavy texture of the site soils will suit plant species that prefer, or at least tolerate moisture retentive, slower draining soils that become seasonally waterlogged.

Such soils are heavily reliant on their inherent soil structure for adequate aeration, drainage , water attenuation and plant root growth and function. They are however also especially prone to structural degradation and compaction if disturbed (e.g. vehicle trafficking, any form of cultivation, compost amelioration, during planting) when most and *plastic* in consistency. See *Soil Handling Recommendations* below.

5.4 Site Hydrology

The site sloped in *Fields 10, 11* and *12* from north to south, making the areas at the base of the slope wetter. As such, habitat and plant species which prefer persistently moist soil conditions would be better suited to these areas.

5.5 Soil Handling Recommendations

The heavy texture of the site soils will make them particularly vulnerable to physical degradation (compaction) during all phases of soil amelioration and landscape works, including cultivations, planting and seeding. It is important to ensure that the soil is not unnecessarily compacted by trampling or trafficking, and soil handling should be stopped during and after heavy rainfall, and not continued until the soil has returned to a non-plastic (friable) state.

If the soil is structurally damaged and compacted at any stage during the course of soiling or landscaping works, it should be cultivated appropriately to relieve the compaction and to restore the soil's structure prior to any planting, turfing or seeding.

5.6 Soil Amelioration

To address the nutrient deficiencies identified in *Field 1-3, Fields 5-6, Field 8, Fields 9-11 and Ponds*, we recommend applying and incorporating suitable compost (e.g. PAS100:2018 /Landscape Institute/WRAP grade (10mm screened) green compost) into the upper 200mm of topsoil (ensuring the soil is suitable dry and non-plastic (friable)) at a rate of 15% by volume.

We would like to thank Hunter Development Holdings Limited and CSA Environmental Ltd for entrusting our practice with this commission. We trust this report meets with your approval and provides the necessary information. Please do not hesitate to contact the undersigned if we can be of further assistance.

Harriet MacRae
BSc MSc
Soil Scientist

Tim O'Hare
BSc MSc FISoilSci FBIAC CSci
Principal Consultant

For & on behalf of Tim O'Hare Associates LLP

Report Qualifications

TOHA's interpretation of the soil conditions is based on observations made during the site investigation and the results of laboratory tests. This report presents TOHA's site observations and test results and the interpretation of those observations and results. On any site there may be variations in soil conditions between these exploratory positions. TOHA can therefore not accept any responsibility for soil conditions that have not been exposed by this investigation.

This investigation considers the re-use of the site soils for species-rich grassland improvement at Stonehouse Farm, West Sussex. It should not therefore be relied on for alternative end-uses or for other schemes. This report has been prepared solely for the benefit of our client Hunter Development Holdings Limited. No warranty is provided to any third party and no responsibility or liability will be accepted for any loss or damage in the event that this report is relied upon by a third party or is used in circumstances for which it was not originally intended.

Appendix 1

Site Plan Showing Sampling Areas

- Trial Hole Location (approx.)

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	Hunter Development Holdings Limited		
Project:	Stonehouse Farm, West Sussex		
Job ref no.:	TOHA/24/4515/HM		
Drawing no.:	4515/1		
Drawing title	Site Plan showing Trial Hole Locations		
Date:	Aug 24	Scale:	NTS
Drawn by:	HM	Checked by:	TOH

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Appendix 2

Site Plan Showing Topsoil Fertility Status Distribution

Low Fertility Areas

High Fertility Areas

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	Hunter Development Holdings Limited		
Project:	Stonehouse Farm, West Sussex		
Job ref no.:	TOHA/24/4515/HM		
Drawing no.:	4515/2		
Drawing title	Site Plan showing Trial Hole Locations		
Date:	Aug 24	Scale:	NTS
Drawn by:	HM	Checked by:	TOH

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Appendix 3

Laboratory Analysis Results

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	**Hunter Development Holdings Limited**
Project:	**Stonehouse Farm, West Sussex**
Job:	**Baseline Soil Assessment**
Date:	**August 2024**
Job Ref No:	**TOHA/24/4515/HM**

Sample Reference			**Topsoil Sample 1**	**Topsoil Sample 2**	**Topsoil Sample 3**	**Topsoil Sample 4**	**Topsoil Sample 5**	**Topsoil Sample 6**
Field Reference			**Field 1**	**Field 2**	**Field 12**	**Field 4**	**Field 5**	**Field 6**
		Accreditation						
pH Value (1:2.5 water extract)	units	UKAS	7.3	7.2	6.3	6.8	6.3	7.7
Organic Matter (LOI)	%	UKAS	8.2	8.3	6.1	7.9	5.9	4.6
Total Nitrogen (Dumas)	%	UKAS	0.33	0.32	0.25	0.34	0.23	0.17
Extractable Phosphorus	mg/l	UKAS	35	41	15	28	17	17
Extractable Potassium	mg/l	UKAS	103	124	90	255	85	85
Extractable Magnesium	mg/l	UKAS	44	52	58	86	55	55

Results of analysis should be read in conjunction with the report they were issued with

H.MacRae

Harriet MacRae
BSc MSc
Soil Scientist

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	**Hunter Development Holdings Limited**
Project:	**Stonehouse Farm, West Sussex**
Job:	**Baseline Soil Assessment**
Date:	**August 2024**
Job Ref No:	**TOHA/24/4515/HM**

Sample Reference			**Topsoil Sample 7**	**Topsoil Sample 8**	**Topsoil Sample 9**	**Topsoil Sample 10**	**Topsoil Sample 11**
Field Reference			**Field 7**	**Field 8**	**Ponds**	**Field 10**	**Field 11**
		Accreditation					
pH Value (1:2.5 water extract)	units	UKAS	6.7	7.4	7.8	6.9	6.4
Organic Matter (LOI)	%	UKAS	7.2	3.7	6.0	7.2	6.2
Total Nitrogen (Dumas)	%	UKAS	0.31	0.13	0.21	0.28	0.26
Extractable Phosphorus	mg/l	UKAS	28	16	7	25	18
Extractable Potassium	mg/l	UKAS	272	134	110	226	103
Extractable Magnesium	mg/l	UKAS	83	52	43	76	78

Results of analysis should be read in conjunction with the report they were issued with

H.MacRae

Harriet MacRae
BSc MSc
Soil Scientist

TIM O'HARE ASSOCIATES
SOIL & LANDSCAPE CONSULTANCY

Client:	**Hunter Development Holdings Limited**
Project:	**Stonehouse Farm, West Sussex**
Job:	**Baseline Soil Assessment**
Date:	**August 2024**
Job Ref No:	**TOHA/24/4515/HM**

Sample Reference			**Subsoil Sample 1**	**Subsoil Sample 2**	**Subsoil Sample 3**	**Subsoil Sample 4**	**Subsoil Sample 5**	**Subsoil Sample 6**
Field Reference			**Field 1 + 2**	**Field 4 + 5**	**Field 6**	**Field 8**	**Field 7 + 10**	**Field 11 + 12**
		Accreditation						
pH Value (1:2.5 water extract)	units	UKAS	7.8	5.9	7.9	8.0	6.3	7.1
Organic Matter (LOI)	%	UKAS	4.9	1.6	3.1	4.0	1.8	2.0
Total Nitrogen (Dumas)	%	UKAS	0.17	0.04	0.11	0.10	0.03	0.06
Extractable Phosphorus	mg/l	UKAS	22	7	15	9	2	2
Extractable Potassium	mg/l	UKAS	215	156	146	148	55	71
Extractable Magnesium	mg/l	UKAS	39	30	70	109	39	34

Results of analysis should be read in conjunction with the report they were issued with

Stonehouse Farm
Handcross Road, Horsham, RH13 6NZ

Flood Risk Assessment and Drainage Strategy

For

Lake Investments Limited

motion

Document Control Sheet

Stonehouse Farm

Handcross Road, Horsham, RH13 6NZ

Lake Investments Limited

This document has been issued and amended as follows:

Date	Issue	Prepared by	Approved by
26th February 2025	Final A	Phil Allen MCIWEM C.WEM	Neil Jaques
27th February 2025	Final B	Phil Allen MCIWEM C.WEM	Neil Jaques
28th February 2025	Final C	Phil Allen MCIWEM C.WEM	Neil Jaques

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Contents

Appendices

1.0 Introduction

1.1 This Flood Risk Assessment (FRA) and Drainage Strategy report has been produced by Motion on behalf of their client, Lake Investments Limited. It supports the planning application for three tranches of proposed development on the Stonehouse Farm site, which is located on Handcross Road, Plummers Plain, West Sussex.

1.2 The three tranches of development are on distinctly separate areas of the former farm, which is no longer viable. Each tranche of the mixed-use development will have its own red line boundary and are as follows:

- The 'Stonehouse Business Park' site will demolish 2no. redundant farm buildings (Unit 3 and Unit 5), with a single new commercial unit reserved for small-scale, rurally based enterprises being erected in place of Unit 3. Unit 5 will be replaced with an area that will be reserved for staff and visitor parking to the commercial site. An existing office building will also be refurbished and expanded to supplant office space currently provided on site by 2no. portacabins.
- 'Lot 8', which is an anaerobic digestion (AD) plant and livestock facility with permission to operate as a robotic dairy, will be sensitively converted to rural offices alongside a storage facility.
- 'Jackson's Ridge' seeks to replace two current redundant farm buildings with 3no. high quality residential dwellings designed to a high level of energy efficiency and built from sustainably sourced, low-impact materials.

1.3 A site location and layout plan for Stonehouse Farm, Stonehouse Business Park, Lot 8 and Jacksons Ridge can be found in Appendix A.

1.4 Alongside the above-named developments, the wider Stonehouse Farm site will look to renature much of the local landscape, with biodiversity-led habitat schemes, formed of newly planted woodland, hedgerows, scrubland, wildflower meadows, and wetland scrapes. This newly formed area of habitat will be available for recreation with nature walks accessed from the existing public rights of way across the land.

1.5 The existing and proposed site layouts for each of the three development tranches described above can be seen in Appendix B.

1.6 This FRA and Drainage Strategy will focus on the three tranches of development, ensuring that where there are to be changes to each of the development areas that need to be positively drained, that a sustainable drainage option is provided that supports all four SuDS pillars, where this applicable and suitable.

1.7 This will ensure that the proposed developments will not increase surface water runoff and flood risk in the area and will also provide a net reduction in surface water runoff over the existing situation.

1.8 According to the Environment Agency's (EA's) Flood Map for Planning, all sites are within Flood Zone 1 so are not at risk of fluvial (or tidal) flooding. The updated (January 2025) EA Risk of Flooding from Surface Water (RoFSW) mapping also shows no surface water flood risk within any of the redline boundaries of the three tranches of development. However, because of the combined scale of the three tranches of development, two of which are over 1ha in area, a review of flood risk will be prepared.

1.9 The drainage strategy will demonstrate how the development will manage and discharge surface water generated in all rainfall events up to and including the 1 in 100-year + 45% storm, as is required by the NPPF.

1.10 This FRA and drainage strategy follows the guidance set out in:

- West Sussex LLFA Policy for the Management of Surface Water (November 2018)
- National Planning Policy Framework (NPPF)

- Planning Practice Guidance (PPG) to the National Planning Policy Framework
- CIRIA SuDS Manual 2015 (C753)
- Environment Agency Rainfall Runoff Management for Developments
- Non-Statutory Technical Standards for SuDS (NSTSfS)

1.11 The proposed development falls within the administrative boundary of Horsham District Council (HDC) and West Sussex County Council (WSCC).

1.12 This FRA and drainage strategy report pertains only to the drainage strategy for the development. It does not provide details of how the site will be drained during the construction phase. This report is also not a drainage verification report, which can only be produced post-construction.

1.13 Similarly, this report does not provide information on how the drainage infrastructure will be protected during the construction phase of the project. The provision of this information is the responsibility of the appointed contractor.

2.0 Site Description

Table 2.1 – Site Summary

Site Name	Stonehouse Farm
Location	Handcross Road, Plummers Plain, West Sussex, RH13 6NZ
Grid Reference(s)	TQ232281 (Stonehouse Business Park) TQ227282 (Lot 8) TQ227287 (Jacksons Ridge)
Site Area	1.083 ha (Stonehouse Business Park) 2.294 ha (Lot 8) 0.477 ha (Jacksons Ridge)
Development Type	As described in Paragraphs 1.2 – 1.5
Flood Zone	1
Surface Water Flood Risk	Very Low
Local Water Authority	Southern Water
Local Planning Authority	Horsham District Council (HDC)
Lead Local Flood Authority	West Sussex County Council (WSCC)

Site Location and Description

2.1 A brief description of the three existing areas of the site that are being developed are as follows:

Stonehouse Business Park

2.2 The Stonehouse Business Park site is at the southern extent of Stonehouse Farm and is arranged around the primary access to the farm from Handcross Road, as can be seen in the site layout and location plan in Appendix A.

2.3 The Stonehouse Business Park site is made up of two redundant farm buildings that are in a poor state of repair (Units 3 and 5) and three relatively new and occupied commercial units (Units 1, 2 and 4). All buildings are loosely arranged a central tarmacked access with concreate aprons to the sides. Some areas are not formally surfaced and have used material akin to 6F2/6F5 as a running surface.

2.4 There are 2no. portacabins currently used as office space for the team managing and operating the Stonehouse Farm site.

2.5 An existing small office building exists near the site entrance, which is currently used for storage.

2.6 An existing site layout of Stonehouse Business Park can be seen in Appendix B and photos of the site can be seen in Appendix C.

Lot 8

2.7 Lot 8 is situated on the western side of Stonehouse Farm and possesses its own access from the B2110 Handcross Road. It contains two large commercial warehouses that were formally used as an AD plant and livestock facility. The warehouse units are now empty and some of the infrastructure associated with the AD plant still exists on site such as the rainwater harvesting tanks, which supplied water required in the AD process.

2.8 The site currently has a mixture of surfacing. A large tarmac apron exists to the south of the two units and the area between the two units is made up of concrete hardstanding. The rest of the site is informally surfaced with a mixture of compacted earth and vehicle tracks.

2.9 The existing site layout can be seen in Appendix B and site photos of Lot 8 can be seen in Appendix D.

Jacksons Ridge

2.10 Jacksons Ridge sits at the northern extent of Stonehouse Farm and is accessed from Hammerpond Road, which runs west-east from the B2110 Handcross Road towards Mannings Heath and Horsham.

2.11 The site is occupied by two redundant farm buildings that are in a poor state of repair and are surrounded by concrete hardstanding.

2.12 The existing site layout can be seen in Appendix B and site photos of Jacksons Ridge can be seen in Appendix E.

Topography

2.13 The topographic characteristics of each of the three sites and how they relate to the overall Stonehouse Farm topography is discussed below.

2.14 Stonehouse Farm spans a broad valley feature, with a watercourse in the bottom of the valley that runs east-west and is a tributary of the Goldings Stream, which itself is a tributary of the River Arun. This is highlighted in the site location and layout plan in Appendix A.

2.15 The Stonehouse Business Park and Lot 8 sites sit on the southern side of the valley, with Lot 8 being adjacent to the watercourse, and the Stonehouse Business Park site further away on the most elevated part of Stonehouse Farm on the southern side of the valley. Jacksons Ridge is at the northernmost extent of Stonehouse Farm and the topographically highest point within Stonehouse Farm's landholding.

Stonehouse Business Park

2.16 No topographical surveys are available for the Stonehouse Business Park site and so LiDAR data was used to review the site's topography. A LiDAR topography (contour) plan for Stonehouse Business Park can be seen in Appendix F.

2.17 The site entrance is at approximately 89 metres Above Ordnance Datum (mAOD). Levels remain at 88 mAOD or higher for much of the Stonehouse Business Park site. Levels fall from the centre of the site to a low point of approximately 85 mAOD on the northwestern extent of Stonehouse Business Park' red line boundary. Following this, land continues to fall to the north/northwest down towards the valley bottom and the watercourse, as denoted by the evenly spaced contour lines shown on the LiDAR contour plan.

Lot 8

2.18 A topographic survey has been provided for the Lot 8 site, and this can be seen in Appendix G. Lot 8 is in an area of Stonehouse Farm that falls from south to north, with the highest topographic levels being approximately 78 mAOD towards the gated entrance to Lot 8, and 70 mAOD on the northern red line boundary.

2.19 Where the existing hardstanding is located levels are maintained at 75.5 mAOD. To accommodate the change in levels across Lot 8, the finished floor levels (FFL's) of the two warehouse units and the hardstanding around them are stepped downwards to the north. Where there is not currently any hardstanding the levels fall more naturally to the north with even gradients.

2.20 The level of the valley and watercourse to the north of Lot 8 is approximately 65 mAOD.

Jacksons Ridge

2.21 As mentioned above, Jacksons Ridge is in an elevated position. It holds views across the valley to the south and the whole of Stonehouse Farm, including the Lot 8 and Stonehouse Business Park sites.

2.22 The topographic survey for Jacksons Ridge (Appendix H) shows that it sits on developed platform with a maintained level of approximately 105 mAOD across the concrete hardstanding. This level is marginally lower than that of Hammerpond Road to the north and the site access, which is at 105.5 mAOD to 106.0 mAOD.

2.23 Immediately south of the Jacksons Ridge site and red line boundary (where the concrete hardstanding stops) the land falls away to the valley bottom and the watercourse therein. As mentioned above, the watercourse is at approximately 65 mAOD. It is circa 400m south of Jacksons Ridge, so the gradient of the field between the southern boundary of Jacksons Ridge and the watercourse is 1 in 10.

Geology

2.24 The British Geological Survey (BGS) online 1:50,000 Geoindex maps show that the site's geology is in an area of Upper Tunbridge Wells Sand bedrock geology. This is described as interbedded mudstone, siltstone and sandstone. In the lowest part of the valley where the watercourse cuts through the landscape the geology is shown to be Weald Clay.

2.25 No BGS boreholes are available in the local area to confirm the geological horizons discussed above.

Hydrogeology and Groundwater

2.26 Groundwater Source Protection Zones (SPZ's) are defined around groundwater abstraction sources such as wells, boreholes and springs that are used for public drinking water supply.

2.27 SPZ's show the risk of contamination to groundwater from any activities that might cause pollution in the area. The closer the activity to the source of abstraction, the greater the risk. The maps show three main zones; inner – Zone 1; outer – Zone 2 and; total catchment – Zone 3.

2.28 Defra's Magic Map was reviewed, and none of the sites are within in any SPZ's.

2.29 Where the Upper Tunbridge Wells Sand is sandstone/siltstone the bedrock is described as being a 'Secondary A' Aquifer, which means that it comprises permeable layers that can support local water supplies, and may form an important source of base flow to rivers. The interbedded mudstone layers and Weald Clay are not a primary or secondary aquifer.

2.30 Groundwater levels are currently unknown, but noting the topography, land gradients, and location of surface water features, it is unlikely that groundwater is close to the surface where the developments are located.

Infiltration Potential

2.31 Because the site is underlain by interbedded sandstone, siltstone and mudstone and Weald Clay, and because of the presence of surface water features locally, the local soils are not expected to have infiltration coefficients that are conducive to the discharge of surface water to ground. On this basis, infiltration has not been explored at this stage of the development and the drainage strategy.

2.32 It is noted that WSCC as the Lead Local Flood Authority (LLFA) would ordinarily require site specific BRE365 soakage testing results to support the decision not to use infiltration but noting that soakage testing is unlikely to offer a solution for the drainage strategy, our client would be willing to accept a condition on this matter.

2.33 Defra's Magic Map confirms that the Secondary A aquiferous geology (sandstone/siltstone) has a high level of groundwater vulnerability. The non-aquiferous interbedded layers of mudstone and Weald Clay are described as hydraulically unproductive

Existing Drainage Regime

2.34 This section will present the existing drainage features and infrastructure that serve the three sites. The existing drainage systems will not be altered going forwards, nor will the areas or inflows that contribute to them, thus this is not presented for regulatory review. However, the existing drainage regime is discussed for full transparency of how the existing areas of the three sites manage both surface and foul water.

2.35 Prior to this discussion, it is worth highlighting that Southern Water's Asset Location Plans have been obtained and are included in Appendix I of this drainage strategy. They confirm that there is no public sewerage in the Stonehouse Farm area. All foul waste is managed through the use of packaged sewage treatment plants and the discharge of treated sewage effluent to a suitable receiving water body.

Stonehouse Business Park

2.36 The Stonehouse Business Park site has a compound drainage system that has evolved over time and been added to as the site and its environs has developed.

2.37 The existing drainage system also accommodates land drainage from the field that lies to the south of B2110 Handcross Road, as well as some highway drainage from the B2110 Handcross Road itself. The outflow from the field's land drainage crosses under the B2110 and joins the site drainage adjacent to the Stonehouse Farm site entrance. From here, surface water is piped northwest through the Stonehouse Business Park site and is joined by existing surface water drainage from the commercial units and hardstanding areas, as well as effluent from packaged sewage treatment plants that serve the foul waste needs of the occupied commercial units and Stonehouse Farmhouse.

2.38 All surface water and treated sewage effluent is directed to the northwest corner of the Stonehouse Business Park site towards a large pre-cast concrete (PCC) chamber, which also receives treated effluent from another sewage treatment plant that sits immediately to the south of the track in the northwest corner of the site. From here, all surface water and treated sewage effluent flows northwards in a single pipe towards an existing outfall to the watercourse that sits at the bottom of the valley.

Lot 8

2.39 Lot 8 currently has a complex surface water system that relates to its erstwhile use as an AD plant. Large above-ground rainwater harvesting tanks were installed on the warehouse units to provide water for use as part of the AD process. Below ground concrete rainwater harvesting tanks are also present between the two warehouse units on Lot 8. When these rainwater harvesting tanks were functional and water was being drawn from them, these would have provided some surface water attenuation, but they are now redundant and will not be required by the rural offices and commercial storage.

2.40 The site also has a surface water attenuation 'pit' (it presents much like a concrete-sided open-topped storage tank) that was installed to store surface water emanating from the existing hardstanding areas and some of the roof areas of the warehouse units. The topographic and site survey in Appendix G shows that this tank measures approximately 16m x 14m x 1.2m (L x W x D) thus offers a significant amount of surface water storage (circa 270m^3). Outflow from the attenuation 'pit' drains to the north under the larger of the two warehouse units and has an existing outfall into the watercourse at the bottom of the valley, which is immediately to the north and downslope of Lot 8.

2.41 Lot 8 also has an existing sewage treatment plant that is situated to the north of the site adjacent to the watercourse. This sewage treatment plant discharges treated effluent to the watercourse via an existing outfall.

Jacksons Ridge

2.42 The two remaining farm buildings and the surrounding concrete hardstanding does not appear to have any existing or positive drainage systems. It is thought that the existing roof drainage falls onto the adjacent hardstanding, which drains off via surface flow to the field to the south.

Existing Runoff Rates

2.43 For comparison with the proposed drainage strategy for the areas of the site that are to be developed, it is worth setting out what the existing surface water runoff rates are likely to be from each of the sites.

2.44 While all areas of the sites that are to be developed will attenuate surface water to the equivalent greenfield runoff rate to be in accordance with the NPPF and WSCC's LLFA guidance, the existing runoff rates can be compared to those proposed in order to appreciate the 'betterment' that the drainage strategies for each of the developed areas will provide.

Stonehouse Business Park

2.45 The area of the Stonehouse Business Park site that is to undergo development totals 2,086m^2 (0.209 ha). This includes 2,039m^2 for the areas surrounding Units 3 and 5, and 47m^2 for the new office extension. These areas are shown in the proposed impermeable area plan in Appendix J by the areas highlighted.

2.46 Because there are existing buildings in this area of the site (Units 3 and 5), these can be considered as having a 'brownfield' runoff rate. Units 3 and 5 are 423m^2 in area and this is the area that will currently generate surface water runoff.

2.47 The areas surrounding Units 3 and 5, as described earlier in this report, are of informally surfaced ground with compacted material akin to 6F2/6F5. It is assumed that existing surface water runoff will be very little from these areas because of the open and unstructured nature of the material, thus it is most appropriate to treat these areas as greenfield and having greenfield runoff rates. These parts of the site total 1,663m^2 in area.

2.48 The brownfield runoff rates have been calculated using the Modified Rational Method with rainfall intensities for different return periods extracted from Table 1(a) of the Transport and Road Research Laboratory Report – Estimated Rainfall for Drainage Calculations in the United Kingdom (TRRL Report LR 595) by C. P. Young.

2.49 The Modified Rational Method Equation is:

$$Q_n = 2.78CiA$$

Where:

C = Runoff Coefficient (which is assumed to be '1' in this case to represent impermeable areas)

i_n = Rainfall intensity for a n return period (mm/hr) as prescribed by Table 1(a) of TRRL LR 595

A = Impermeable Area

Q_n = Runoff for n return period

The rainfall intensities for different return periods extracted from Table 1(a) of TRRL Report LR 595 are:

i_1 = 50.8 mm/hr

i_{30} = 113.02 mm/hr

i_{100} = 143.9 mm/hr

2.50 Using the above calculation and inputs, the brownfield runoff rate for the existing impermeable areas of 423m^2 are as follows in Table 2.2.

Table 2.2 – Brownfield Runoff Rate From Existing Impermeable Areas

Return Period	1 in 1	1 in 30	1 in 100
Discharge Rate (l/s)	5.97 l/s	13.29 l/s	16.92 l/s

2.1 The greenfield runoff rates have been calculated using FEH2022 QMED values in MicroDrainage using the catchment descriptors methodology, which includes the following input variables:

- Site Location
- SAAR – Standard Average Annual Rainfall 1961 – 1990 (mm)
- SPR Host - Standard percentage runoff derived from HOST soils data
- URBEXT - The extent of urban and suburban cover
- BFIHOST - Baseflow index derived from Hydrology of Soil Types (HOST) soils data
- FARL - Index of flood attenuation due to reservoirs and lakes
- Catchment Area - Hectares

2.2 The QMED calculation sheet from MicroDrainage can be seen in Appendix K, but the outputs for the 111 ha (1.11 km^2) catchment is summarised in Table 2.3, below.

Table 2.3 – QMED Runoff Rate

QMED Rural (l/s)	QMED Urban (l/s)
177.4	177.4

2.3 The calculated QMED Rural value of 177.4 l/s is equivalent to a rate of 1.59 l/s/ha over the 111 ha catchment.

2.4 1.59 l/s/ha is equivalent to 0.26 l/s for the 1,663m^2 (0.167 ha) of unmade ground on the existing site.

2.5 When the brownfield runoff and greenfield runoff rates for the separate areas of the Stonehouse Business Park site are combined, the existing total runoff from the areas that are to be developed are as in Table 2.4, below (note that QMED values are kept consistent across all storm events).

Table 2.4 – Total Existing Runoff Rates from Stonehouse Business Park Site

Return Period	1 in 1	1 in 30	1 in 100
Discharge Rate (l/s)	6.23 l/s	13.55 l/s	17.18 l/s

Lot 8

2.6 The same methodology has been used to understand existing runoff rates on the areas of Lot 8 that are to undergo development. It has been discussed that the existing units and hardstanding areas are to remain unchanged, so these positively drained areas are not included in current or future calculations of surface water runoff.

2.7 The areas of Lot 8 that are to undergo development total 4,411m^2 (0.441 ha). These areas are shown in the proposed impermeable area plan in Appendix J by the areas highlighted.

2.8 The existing areas covered by the impermeable area plan are predominantly unsurfaced tracks and ground. These areas are absent of vegetation and are compacted through vehicle use and, although they will not respond to surface water runoff as true greenfield land, these areas have been presumed as greenfield for the calculation of existing runoff rates in order to employ the precautionary principle.

2.9 Using the QMED runoff rate in Appendix K and discussed in Paragraphs 2.1 to 2.5 (1.59 l/s/ha), the 0.441 ha of areas to be surfaced and undergo development on Lot 8 have a greenfield runoff rate of 0.70 l/s.

Jacksons Ridge

2.10 The areas of Jacksons that are to undergo development encompass the entire site area of 0.477 ha. The areas highlighted in the proposed impermeable area plan in Appendix J represent the areas of the site that will be impermeable following development, but they don't represent the total areas of the site that are currently contributing to surface water runoff. Indeed, the entire site area of 0.477 ha is currently either surfaced with concrete hardstanding or covered by the roof areas of the redundant farm buildings. As such, the existing runoff rate for Jacksons Ridge has been calculated for the full site area of 0.477 ha using the Modified Rational Method for brownfield runoff and the results of this calculation are in Table 2.5, below.

Table 2.5 – Brownfield Runoff Rates From Jacksons Ridge

Return Period	1 in 1	1 in 30	1 in 100
Discharge Rate (l/s)	67.36 l/s	149.87 l/s	190.82 l/s

2.11 These runoff rates are significant, even in the 1 in 1-year rainfall event, and the proposed drainage strategy will represent a substantial improvement over these figures.

3.0 Flood Risk Legislative and Policy Framework

3.1 As of April 2015, the LLFA became a statutory consultee on all major planning applications. The LLFA is required to assess planning applications in respect of surface water drainage and sustainable drainage systems. WSCC is the LLFA for the Stonehouse Farm and Horsham area.

3.2 LLFA's including WSCC have a responsibility under the FWMA to develop, maintain, apply and monitor the application of a strategy for local flood risk in their area. Local flood risk is defined as flood risk arising from local sources, such as surface water run-off, groundwater and ordinary watercourses (i.e. non main rivers). The EA plays a role in managing the watercourses designated as 'main rivers'.

3.3 The only watercourse within the overall landholding of Stonehouse Farm is an ordinary watercourse, thus matters relating to flood risk from or to this water body is within the regulatory responsibility of WSCC as the LLFA.

The Environment Agency Flood Map for Planning

3.4 The Environment Agency's Flood Map for Planning gives an indicative prediction of areas at risk of fluvial and tidal flooding. The mapping is an amalgamation of modelled flood levels and historical flood event outlines.

3.5 The Flood Map is split into 'Flood Zones', which demarcate the extent of flooding from rivers or the sea for different return periods. The Flood Map for Planning shows the extent of the natural floodplain if there were no defences or other man-made structures. They do not provide a definitive picture of where flooding would occur; rather, they provide an indicative prediction of areas at risk.

3.6 Table 3.1, below, lists the flood zone categories and explains the flood risk probabilities they represent.

Table 3.1 – Flood Zone Categories

Flood Zone	Definition
Zone 1 Low Probability	Land having a less than 1 in 1,000 annual probability of river or sea flooding. (Shown as 'clear' on the Flood Map – all land outside Zones 2 and 3)
Zone 2 Medium Probability	Land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding; or land having between a 1 in 200 and 1 in 1,000 annual probability of tidal flooding. (Land shown in light blue on the Flood Map)
Zone 3a High Probability	Land having a 1 in 100 or greater annual probability of river flooding; or Land having a 1 in 200 or greater annual probability of tidal flooding. (Land shown in dark blue on the Flood Map)
Zone 3b The Functional Floodplain	This zone comprises land where water must flow or be stored in times of flood, which is typically the 1 in 30-year flood event or greater. Local planning authorities should identify in their SFRAs areas of functional floodplain and its boundaries accordingly, in agreement with the Environment Agency. (Not separately distinguished from Zone 3a on the Flood Map, but may be distinguished in Product 4 information, for example)

The National Planning Policy Framework

3.7 The NPPF sets out the Government's national policies on different aspects of land use planning in England in relation to flood risk. The Planning Practice Guidance (PPG) to the NPPF provides further information on the policies set out in the NPPF. It encourages development to take place in areas of lower flood risk wherever possible and stresses the importance of preventing increases in flood risk off-site to the wider catchment area. This includes ensuring that flood risk is considered at all stages of the planning process, avoiding inappropriate development in areas at risk of flooding and directing development away from those areas where risks are highest.

3.8 The process of directing development away from those areas where risks are highest is the sequential test. It covers all forms of flooding, and this is covered in Paragraphs 23 and 24 of the NPPF. Following the December 2024 update to the NPPF, Paragraph 175 was added that states that development can be appropriate on sites with flood risk "*in situations where a site-specific flood risk assessment demonstrates that no built development within the site boundary, including access or escape routes, land raising or other potentially vulnerable elements, would be located on an area that would be at risk of flooding from any source, now and in the future*". This essentially means that if a sequential approach is applied within the site boundary, and areas of flood risk now and in the future are avoided, that flood risk should not prevent the development coming forward.

3.9 A site-specific FRA is required for proposals of 1ha or greater in Flood Zone 1, all proposals for development in Flood Zones 2 and 3, or in an area within Flood Zone 1 that has critical drainage problems (as notified to the local planning authority by the EA). Stonehouse Business Park and Lot 8 are greater in size than 1ha and, therefore, an FRA is required, and all three sites will be discussed.

3.10 An FRA should identify and assess the risks of all forms of flooding and demonstrate how these flood risks will be managed so that a development remains safe throughout its lifetime, taking climate change into account.

3.11 Within each Flood Zone, a key factor in determining planning applications for development is the flood risk vulnerability of a development. Table 2 of the PPG to the NPPF categorises different development types according to their vulnerability to flooding. These categories are:

- Essential infrastructure;
- Highly vulnerable development;
- More vulnerable development;
- Less vulnerable development, and;
- Water-compatible development.

3.12 Within the different Flood Zones each of the above development categories are considered appropriate or not permissible. The Technical Guidance to the NPPF lists these as:

Flood Zone 1:

- All the development categories listed above are appropriate.

Flood Zone 2:

- Water-compatible, less vulnerable development, more vulnerable development and essential infrastructure is appropriate in this zone.

Flood Zone 3a:

- Water-compatible and less vulnerable development is appropriate in this zone. Highly vulnerable development should not be permitted in this zone.

Flood Zone 3b:

- Only water-compatible development and essential infrastructure that must be there should be permitted in this zone.

3.13 The above information sets out the basis by which developments must be assessed in terms of flood risk.

3.14 Each of the development sites will be reviewed against the Flood Zone in which they are locate and an assessment will be made of the appropriateness of the proposed developments, as per the advice within

the PPG to the NPPF, and taking account of the proposed site layouts for each development area shown in Appendix B.

4.0 Current Flood Risk

4.1 Flooding can arise from a variety or combination of sources. These may be natural or artificial and may be affected by climate change. These are discussed, below, in the following two sections and summarised in Table 6.1. The probability of any likely impacts is also assessed, where necessary.

Flooding from Rivers and the Sea

4.2 The Environment Agency's Flood Map for Planning (Appendix L) for each of the three site shows that they are all within Flood Zone 1. Consequently, it can be summarised that each of the proposed developments is not within a fluvial flood risk area, now or in the future, and the residual flood risk to the site is zero.

Fluvial Flood Risk and the Appropriateness of the Development in this Location

4.3 The proposed residential development on Jacksons Ridge is considered to be 'more vulnerable' according to the classifications in the NPPF. The commercial developments on Stonehouse Business Park and Lot 8 are 'less vulnerable'.

4.4 Table 3 of the PPG to the NPPF (see below) states that 'more vulnerable' and 'less vulnerable' development are both appropriate in Flood Zone 1, thus the proposed developments are appropriate in their proposed locations with the current and future level of flood risk.

Table 3 of the NPPF - Flood Risk Vulnerability and Flood Zone Compatibility

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

Key:

✓ Development is appropriate

✗ Development should not be permitted.

Surface Water Flooding

4.5 Surface water, or pluvial flooding, results from rainfall-generated overland flow, where rainwater has not yet reached a watercourse or sewer and where the local drainage systems become overwhelmed. Pluvial flooding often occurs during short, very intense storms, but can also occur during longer periods of rainfall when the ground is already saturated, or where land has low permeability due to development.

4.6 In these conditions surface water can build up where the topography allows it to converge or pond. Where it gathers it will travel down prevailing gradients. Pluvial flooding then occurs at locations where significant surface water flow paths converge, at localised low points and/or due to overland obstructions.

In urban areas pluvial flooding often occurs where the built environment channels overland flow routes (down roads that are bounded by kerbs, for example) or where there are obstacles to the natural overland flow routes. Boundary walls and buildings are often the main causes and, hence, the likelihood of pluvial flooding to impact property and gardens.

4.7 Pluvial flooding is exacerbated in many cases by the mistreatment or failure of the below ground infrastructure (including partial or full blockages of gullies and/or within the combined sewers and the accumulation of fats, oils and greases within the sewer networks).

4.8 The EA's Risk of Flooding from Surface Water (RoFSW) map was updated and refined in January 2025. The map uses improvements in data, technology and modelling and includes information and input from LLFAs, where this is available. This New National Model (NNM) for surface water represents a significant improvement over previous national-scale models and, generally speaking, has shown a reduction in overall surface water flood risk (when compared with the previous RoFSW mapping) with more targeted risk areas that tie in better with local land features and overall topography.

4.9 The updated RoFSW mapping includes a present-day risk prediction as well as one for the 2040 – 2060 scenario, i.e., with an inclusion for climate change. Only the 2040 – 2060 scenario maps are included in Appendix M so that current and future surface water flood risk is fully considered.

4.10 It can be seen that Stonehouse Business Park and Jacksons Ridge have no surface water flood risk with their red line boundaries and, therefore, are at very low risk from surface water flood risk now and in the future.

4.11 Lot 8 is also predominantly at very low risk of surface water flooding. The 2040 – 2060 scenario shows a small area of 'low' (1 in 1,000-year) surface water flood risk on the northern side of the existing, smaller commercial unit.

4.12 The areas of Lot 8 where new access and hardstanding is proposed are at very low surface water flood risk in the 2040 – 2060 scenario, which means that surface water is not a constraint to the proposed development. Moreover, the proposed drainage strategy will manage all surface water generated in the developed areas up to and including the 1 in 100-year + 45% rainfall event, so surface water flood risk will not increase.

4.13 On that basis, surface water cannot be an impediment to any of the developments as they are all within areas of 'very low' risk, now and in the future.

Groundwater Susceptibility

4.14 There are no flood risk maps for groundwater, as stated by the Environment Agency in their 2011 guidance note 'flooding from groundwater'. Mapping products currently available only show areas where the geological and hydrogeological conditions *may* combine to cause groundwater flooding, but they should not be considered as groundwater flood risk maps. They only show *susceptibility* to groundwater flooding.

4.15 There are several mapping products that depict areas that may be susceptible to groundwater flooding, but they are not comparable in detail to the risk maps developed for fluvial, tidal and surface water, such as those scrutinised above and used to support planning decisions. The mapping does not show the likelihood of groundwater flooding occurring and can only be considered as a hazard, but not a risk-based dataset.

4.16 As such, the mapping products can be viewed as indicative at best and should only be used as a prompt to review site-based information to determine whether groundwater is a risk factor that should be considered. Indeed, the Environment Agency state that:

"*The susceptibility data should not be used on its own to make planning decisions at any scale and, in particular, should not be used to inform planning decisions at the site scale. The susceptibility data cannot be used on its own to indicate risk of groundwater flooding*."

4.17 To investigate groundwater flooding susceptibility, this FRA will review groundwater flooding susceptibility mapping, which can be seen in Appendix N. There are three different forms of groundwater susceptibility mapping, which are discussed in turn, below.

BGS Geological Indicators of Flooding

4.18 The BGS Geological Indicators of Flooding map shows that all three sites are not within an area considered to have any geological indicators of groundwater flooding.

BGS Groundwater Flooding Susceptibility

4.19 The BGS Groundwater Flooding Susceptibility map shows that Stonehouse Business Park and Jacksons Ridge are in areas with limited potential for groundwater flooding to occur at the surface. Lot 8 appears to be in an area with no groundwater flooding susceptibility.

Geosmart Information Groundwater Flood Map

4.20 The Geosmart Information Groundwater Flood Map places the site in an area of 'negligible' risk.

Groundwater Flooding Susceptibility Summary

4.21 The overall picture created by the three groundwater flooding susceptibility maps is one of low susceptibility to groundwater flooding across all three sites. Therefore, it can be concluded that none of the sites needs to consider groundwater flood risk any further.

Flooding from Infrastructure Failure

4.22 Sewer flooding can occur when the capacity of the infrastructure is exceeded by excessive flows, or because of a reduction in capacity due to collapse, siltation, blockage, or if the downstream system becomes surcharged. This can lead to the sewers flooding onto the surrounding ground via manholes and gullies, which can generate overland flows.

4.23 Typically, sewer systems are constructed to accommodate rainstorms with a 30-year return period or less, depending on their age. Consequently, rainstorm events greater than 1 in 30-years would be expected to result in surcharging of some parts of the sewer system. In fact, due to most gullies being poorly maintained and often partially blocked with silt, leaves and other debris, their capacity is often estimated to be closer to the 1 in 10-year storm.

4.24 Each of the sites and the areas within them that are to be developed will be designed to attenuate the 1 in 100-year + 45% rainfall event, thus they will be at very low risk of flooding from infrastructure failure due to the capacity and design standard of proposed systems.

4.25 Moreover, a drainage management and maintenance plan will also be provided, which will prescribe how the onsite drainage infrastructure should be looked after so that it works at optimum capacity. This will ensure that residual flood risks to the site from its internal drainage systems will be minimised.

Flooding from Artificial sources

4.26 The EA provides a map showing the maximum potential flood extent should all reservoirs with a capacity of greater than 25,000 cubic metres fail and release the water they hold.

4.27 The map shows that all parts of Stonehouse Farm would not experience flooding in this scenario.

4.28 There are no canals in the local area to create flood risk either.

5.0 Future Flood Risk & Climate Change

5.1 The NPPF and the supporting Planning Practice Guidance document sets out how flood risk should be considered over the lifetime of a development. This requires an increase in flood risk due to climate change to be taken into account. Both peak river flows and rainfall intensity should be assessed.

Peak River Flows

5.2 The site is within Flood Zone 1 and there are no significant watercourses within or on the site boundary. Therefore, the site will continue to be at low risk of fluvial flooding in the future and peak river flows do not need to be discussed any further.

Peak Rainfall Intensity and Climate Change

5.3 With climate change, peak rainfall intensities are expected to increase, which would result in increased surface water flows and, potentially, flooding.

5.4 The discussion of surface water flooding in this report referred to the future surface water flood risk scenarios and the data in the updated RoFSW mapping shows that surface water flood risk on the site is not expected to increase. Therefore, future peak rainfall intensity has already been addressed in terms of surface water flood risk.

5.5 The drainage strategy for the development will also be designed to fully account for future peak rainfall intensities. A climate change increase for the 1 in 30-year and 1 in 100-year rainfall events will be applied to the hydraulic model and drainage design, plus additional hydraulic inputs due to urban creep will be included on the Jacksons Ridge development, to ensure that all surface water loads, for the lifetime of the development, are fully considered.

5.6 This approach ensures that the development will not be at risk of flooding from surface water now or in the future.

6.0 Summary of Flood Risk

6.1 Table 6.1, below, summarises the level of flood risk to the three site.

Table 6.1: Summary of Flood Risk

Flood Source	Risk Level				Comment
	High	Medium	Low	Very Low	
Fluvial				X	Flood Zone 1 (present day and in the future)
Tidal				X	Not within a tidal flood risk area
Groundwater				X	Groundwater susceptibility mapping indicates very low risk
Surface Water				X	Sites all at very low risk of surface water flooding. Areas of low surface water flood risk are away from development
Canals				X	There are no canals in the vicinity
Reservoirs				X	The Reservoir Flood Risk Map places the site well outside a maximum extent of flooding
Infrastructure Failure				X	The site's infrastructure will be properly managed and maintained, as per the prescription in the drainage management and maintenance plan, which will minimise the risk of flooding due to infrastructure failure.
Increase due to Climate Change				X	Future fluvial flood risk has been discussed, and the drainage strategy will accommodate surface water generated in the 1 in 100 + 45% rainfall event.

7.0 Surface Water Drainage Strategy

Sustainable Drainage Overview

7.1 Current planning policy and Environment Agency guidance requires developments to employ SuDS (Sustainable Drainage Systems) techniques wherever feasible. Careful design of SuDS features can ensure that a development's surface water drainage closely reflects the natural hydrology of the pre-developed site.

7.2 SuDS will attenuate and treat surface water run-off quantities at the source (source control) in line with current guidance and best practice.

7.3 Source control systems treat surface water close to the point of origin, in features such as soakaways, permeable paving and swales, to name a few.

7.4 The key benefits of SuDS are as follows:

- Improving water quality over a conventional piped system by removing pollutants from diffuse pollutant sources (e.g., roads);
- Improving amenity through the provision of open green space;
- Improving biodiversity through increased areas for wildlife habitat; and
- Enabling a natural drainage regime that recharges groundwater (where possible).

7.5 SuDS provide a flexible approach to drainage, with a wide range of components from soakaways to large-scale basins or ponds. The individual techniques should be used where possible in a management train that mimics the natural pre-developed pattern of drainage.

Target Runoff Rates for the Developments

7.6 The greenfield runoff rates for each of the developments need to be calculated using the QMED runoff rate, which has already been discussed and presented in Appendix K of this report.

7.7 The calculated QMED Rural value of 177.4 l/s is equivalent to a rate of 1.59 l/s/ha over the 111 ha catchment. The value of 1.59 l/s/ha has been applied to the impermeable area plans presented in Appendix J of this report to determine that greenfield runoff rates for each of the developable areas within each site and these are as per Table 7.1, below.

Table 7.1 – Greenfield Runoff Rates for Each Development Area

Development Area	Impermeable Area (ha)	Current Runoff Rate (1 in 1-year)	Greenfield Runoff Rate
Stonehouse Business Park	0.209 ha	6.23 l/s	0.33 l/s
Lot 8	0.441 ha	0.70 l/s	0.70 l/s
Jacksons Ridge	0.203 ha	67.36 l/s	0.32 l/s

7.8 The calculated greenfield runoff rates from each of the development areas are very low – too low to realistically be achieved in open flowing systems and where small-aperture, very low flow control devices would carry an excessive blockage risk. With this in mind, the proposed development will not prescribe any flow control device for surface water runoff with individual discharge rates of less than 1 l/s in order to reduce future flood risk.

Drainage Strategy Overview

7.9 The drainage strategies for the proposed developments on Stonehouse Farm will use a mixture of SuDS features. These have been selected according to what is most appropriate to the commercial/residential site requirements and the geoenvironmental and topographical characteristics of each area to be developed.

7.10 The proposed drainage strategies for each area of Stonehouse Farm to be developed are discussed below and should be read in conjunction with the drainage strategy plans in Appendix O of this report.

Stonehouse Business Park

7.11 The area of the Stonehouse Business Park site that is to be developed includes a new commercial unit to replace the existing Unit 3 and the demolition of Unit 5, which will be replaced by a staff and visitor parking area. The existing small office unit near the Stonehouse Business Park site entrance is also to be extended.

7.12 This development requires the provision of a formal access for commercial vehicles around the new Unit 3. With this in mind, permeable surfaces such as porous asphalt and permeable paviours are not appropriate due to the detrimental effect that commercial vehicles (with standard axles of 7.5 tonnes or more) turning from lock to lock would have on them. The accesses and parking areas will therefore be surfaced with tarmacadam and positively drained to a SuDS basin located in the northwest of the Stonehouse Business Park site.

7.13 Water butts have been considered for use, but due to the commercial nature of the site and the fact that there would be no external water uses on site, these would be unlikely to be used or positively contribute to a reduction in surface water runoff. Consequently, water butts are not recommended on the Stonehouse Business Park site.

7.14 The drainage strategy plan for Stonehouse Business Park in Appendix O shows that the SuDS basin is located in the field to the northwest of the Stonehouse Business Park site. This SuDS basin will be 250m^2 in area, 1.2m deep and will have side slopes of 1 in 4. This SuDS basin provides 182m^3 of attenuation, which allows surface water generated from the developed area in the 1 in 100-year + 45% rainfall event to be attenuated, without flooding.

7.15 The SuDS basin will discharge by gravity to the northeast and will join the existing discharge from the Stonehouse Business Park site to the watercourse. This approach minimises excavation and disturbance of greenfield land and also means that the bank of the watercourse does not have another headwall installed, which causes the least degradation to the natural watercourse corridor.

7.16 As stated in Paragraph 7.8, the discharge rate from the attenuation basin will be a maximum of 2 l/s to ensure that the open flowing (up- and downstream) system works efficiently and with a minimum blockage risk. While 2 l/s is greater than the greenfield runoff rate for the Stonehouse Business Park site, it is only 32% of the current 1 in 1-year runoff rate 6.23 l/s, thus offers significant betterment.

7.17 The SuDS basin compliments the overall landscaping strategy and supports the aspirations to renature much of the local landscape. It also provides a SuDS solution to the drainage strategy that provides all four SuDS pillars (quantity, quality, amenity and biodiversity). On this matter, a proprietary treatment device is required to fully mitigate the pollution hazards that may be generated through the site use, alongside the SuDS basin. This is discussed further in Section 9 of this report.

Lot 8

7.18 Much like the Stonehouse Business Park site, the development at Lot 8 is for access and aprons that will be used for commercial vehicles. This requires a robust surface that can withstand being used and manoeuvred upon by commercial vehicles with minimal maintenance or damage. This means that, like

the Stonehouse Business Park site, the hardstanding areas on Lot 8 must be surfaced with tarmac to ensure an appropriate running surface and its longevity.

7.19 The new tarmacadam hardstanding areas on Lot 8 will be positively drained and attenuated in a number of drainage features across the site. Two SuDS basins will be located in the greenspaces created within the access/parking areas, and geocellular attenuation tanks will be located in the corridor to the north of the hardstanding and the existing larger warehouse. Swales were considered in this space, but they are unable to provide the requisite attenuation once design depth, side slope requirements, and maintenance easements were built into the design.

7.20 Please refer to the drainage strategy layout plan in Appendix O to see the location, form and details of the SuDS basins and attenuation tanks.

7.21 The discharge rate from the western side of the site will be controlled to 2 l/s and the discharge rate from the eastern side of the site will be controlled to 1 l/s, which means that the total discharge rate from the areas to be developed on Lot 8 will be 3 l/s, which is the practicable minimum for the site. The runoff rate from the western side of the site cannot be reduced further, because lower flow rates meant much greater half drain times for the system, which would fail the LLFA requirement for it to be under 24-hours.

Jacksons Ridge

7.22 Water butts are recommended for the three residential properties. These will reduce the reliance on potable water supplies during activities such as gardening and car washing. Water butts can also provide small amounts of storage for surface water and can often assist in achieving zero discharge for rainfall depths up to 5mm, which covers 50% of annual rainfall events (according to the EA's Rainfall Runoff Management for Developments report – SC030219).

7.23 It has been described that Jacksons Ridge lies on an elevated and topographically level platform to the south of Hammerpond Road. This allows permeable paviours to be specified for the driveway and accesses to the three units, which provides useful attenuation and pollution mitigation opportunities for the drainage system

7.24 The driveway areas are constrained by Root Protection Areas (RPA's) associated with the trees that line the southern side of Hammerpond Road. This means that the areas where permeable paviours and excavations are possible is limited, but the drainage strategy will continue to use permeable paviours where possible outside of the RPA constraints. This allows surface water falling directly onto the driveways areas to be attenuated at source, as well as surface water falling onto northwards-draining roof areas and pathways/patios to be stored within the permeable paviours.

7.25 Outflow will be restricted from each area of permeable paviours, and will drain to the south via piped systems and be joined by surface water from the southwards-facing roof areas, the balconies and patios of each of the three properties.

7.26 Because of the limited extent of permeable paviours on each property, further attenuation is required. The areas to the south of each property and within the red line boundary are gardens and because of this it would not be suitable to locate surface level SuDS features in these privately-owned spaces.

7.27 It has been decided to place geocellular tanks below each of the patio areas, which provide the residual attenuation requirements for each property following the permeable paviours.

7.28 The attenuation requirements of each property are defined by the maximum outflow from each plot, which will be set at 1 l/s. This means that the maximum overall discharge from the site will be 3 l/s, which is just 4.5% of the 1 in 1-year brownfield runoff rate from the site (67.36 l/s). This will reduce flood risk locally and within the Goldings Stream/River Arun catchments.

7.29 The Jacksons Ridge development will discharge directly to the south and to the watercourse at the bottom of the valley.

7.30 The drainage strategy proposed for the Jacksons Ridge development can be seen in the drainage strategy layout in Appendix O.

Design Criteria

7.31 Each of the drainage strategies have been designed in accordance with the design criteria outlined in West Sussex County Council's LLFA Policy for the Management of Surface Water[1].

7.32 This ensures that the drainage strategies accord with local policy requirements (as well as those of the NPPF). In brief, this includes:

- Using FEH 2022 Annual Maximum Catchment data rather than FSR data. It should be noted that the dropdown menu in MicroDrainage's Network module only allows the choice of 1999 data and 2013 data but allows the upload of any data – including FEH 2022. Therefore, the user can use FEH 2022 data but is forced to do it under the label of 2013 data. As such, the MicroDrainage results included with this report state that FEH 2013 data has been used, but we would like to assure that LLFA that FEH 2022 has been used. The LLFA are aware of this issue as it has been discussed with them on a number of other sites.
- Using a runoff coefficient (CV) value of 1.0 in all hydraulic modelling (for both summer and winter storms)
- Reducing the MADD Factor (which assumes $10m^3$ of pipe storage per hectare) to zero.
- Urban Creep at a rate of 10% has been included on the Jacksons Ridge residential development. It has not been applied to the developments on the Stonehouse Business Park and Lot 8 sites because Urban Creep is not relevant to commercial developments.
- The full suite of rainfall events has been used (up to the 5,760-minute storm, which is maximum allowable when using FEH data).
- The maximum rainfall intensity has been raised to 550mm/hr to ensure that the full hydrograph is included in the hydraulic calculations.
- The maximum half-drain times for each of three drainage strategies do not exceed the 1,440-minute (24-hour) requirement for this metric for the 1 in 30-year + 40% storm. Paragraphs 13.4.1 and 25.7 of the CIRIA C753 SuDS Manual state that, for systems with very low discharge rates, the half drain time for the 1 in 30-year rainfall event should be less than 24-hours, but it is appropriate to allow longer half-drain times in the 1 in 100-year + CC rainfall event to avoid excessively large storage requirements. Indeed, because the Lot 8 is utilising a runoff rate of 2 l/s for the larger of the two catchments, it would require an unfeasibly large attenuation volume to get the half-drain times down below 24-hours (1,440 minutes) in the 1 in 100-year plus 45% rainfall event. As noted above, where low flow rates increase the half drain time to unsatisfactory levels, the flow rates have been increased so that half drain times stay within the acceptable range.

Urban Creep

7.33 As stated above, Urban Creep has been applied to the residential development at Jacksons Ridge. This ensures that an appropriate allowance is made for increases in impermeable areas that occur over time on privately owned land, as per 'BS 8582:2013 Code of Practice for Surface Water Management for Developed Sites'.

7.34 WSCC have produced their own guidance on the percentage of urban creep that should be applied. They state that the consideration of urban creep should be assessed on a site-by-site basis but is limited to individual residential development only. The allowances set out in Table 5.2 of WSCC LLFA Policy for the

[1] https://www.horsham.gov.uk/__data/assets/pdf_file/0019/65017/West-Sussex-Surface-Water-Management-Policy.pdf

Management of Surface Water must be applied to the impermeable area within the property curtilage according to the proposed development density. Table 5.2 of WSCC LLFA Policy is shown below.

Table 5.2 of WSCC LLFA Policy for the Management of Surface Water

Residential development density (Dwellings per hectare)	Change allowance (% of impermeable area)
≤25	10
30	8
35	6
45	4
≥50	2
Flats & Apartments	0

7.35 A full increase of 10% has been used as a precautionary approach, especially because the dwellings cannot expand their driveways further and already have extensive patio areas.

7.36 The 10% uplift has been applied to the proposed private impermeable areas in the Jacksons Ridge MicroDrainage model, and how they have been uplifted is detailed in Table 7.2, below. This has been presented in terms of which pipes in the hydraulic model the uplift has been applied.

Table 7.2 – Urban Creep Increases Applied in Jacksons Ridge Hydraulic Model

Pipe No.	Private Impermeable Areas (ha)	10% of Private Impermeable Areas (ha)	Increased Impermeable Area Applied to Pipe (ha)
1.001	0.033	0.003	0.036
1.004	0.028	0.003	0.031
2.001	0.039	0.004	0.043
2.004	0.034	0.003	0.037
3.001	0.042	0.004	0.046
3.004	0.028	0.003	0.031

Summary

7.37 The approach to the layout and design of the three surface water drainage strategies has been outlined and presented in Appendix O of this report. With specific reference to the drainage hierarchy, the proposed drainage strategies are discussed, below.

The Drainage Hierarchy

7.38 The NPPF states that opportunities to reduce overall flood risk should be sought and achieved through sustainable development and careful drainage design. This can be achieved through the layout and form of development, including green infrastructure and the appropriate application of sustainable drainage systems (SuDS). SuDS are designed to control surface water runoff close to where it falls and mimic natural drainage as closely as possible. They provide opportunities to:

- Reduce the causes and impacts of flooding;
- Remove pollutants from urban run-off at source;

- Combine water management with green space with benefits for amenity, recreation and biodiversity.

7.39 To deliver SuDS benefits and ensure that a development reduces overall flood risk, there is an established hierarchy of surface water drainage methods that should be considered. The most preferable and sustainable are at the top and the least preferable and least sustainable at the bottom.

7.40 The drainage hierarchy is a sequential check that intends to ensure that all practical and reasonable measures are taken to manage surface water as high up the hierarchy (with '1' being the highest) as possible, and that the amount of surface water managed at the bottom of the hierarchy is minimised. The Planning Practice Guidance to the National Planning Policy Framework (NPPF) states that "*Generally, the aim should be to discharge surface run off as high up the following hierarchy of drainage options as reasonably practicable*".

7.41 The drainage hierarchy presented in the NPPF presents only four tiers of drainage options. This has been expanded on and adopted by others and now can be viewed as the following:

1. Store rainwater for later use
2. Use infiltration techniques, such as porous surfaces in non-clay areas
3. Attenuate rainwater in ponds or open water features for gradual release
4. Attenuate rainwater by storing in tanks or sealed water features for gradual release
5. Discharge rainwater direct to a watercourse
6. Discharge rainwater to a surface water sewer/drain
7. Discharge rainwater to the combined sewer
8. Discharge rainwater to the foul sewer

7.42 Developers should not choose the method that is the most convenient or represents the lowest cost. LPA's, LLFA's and Water Authorities may enforce the surface water drainage hierarchy and demand that the highest practicable tier of the hierarchy is used before accepting the use of lower, less sustainable tiers.

7.43 The first two tiers of the drainage hierarchy ensure that surface water is retained within the site boundary and does not increase flood risk to others. This is always the most preferable method of surface water management.

7.44 The next six tiers of the hierarchy provide regional control, but with decreasing levels of pollution removal and reduced potential for amenity and habitat creation.

7.45 Within the lower six tiers of the drainage hierarchy, there must be some form of flow restriction, so that off-site surface water discharge is reduced, as much as is reasonably practicable. This requires on-site storage facilities, which may include ponds, swales, subsurface storage tanks and System C (non-infiltration) permeable paviours with flow control devices. Again, methods that provide the most potential for amenity and pollution removal should be favoured.

7.46 With regards to the proposed developments, the tiers of the drainage hierarchy that have been achieved are outlined in Table 7.3, below:

Table 7.3 - Compliance with the Drainage Hierarchy

Tier	Discharge Method	Stonehouse Business Park	Lot 8	Jacksons Ridge
1	Store rainwater for later use	û (n/a)	û (n/a)	ü
2	Use infiltration techniques	û (n/a)	û (n/a)	û (n/a)
3	Attenuate rainwater in ponds or open water features	ü	ü	ü
4	Attenuate rainwater by storing in tanks or sealed water features	û	ü	ü
5	Discharge rainwater direct to a watercourse	ü	ü	ü
6	Discharge rainwater to a surface water sewer/drain	û	û	û
7	Discharge rainwater to the combined sewer	û	û	û
8	Discharge rainwater to the foul sewer	û	û	û

Summary

7.47 Because infiltration is not viable, the drainage strategies use the highest available tiers of the drainage hierarchy for both attenuation and surface water discharge, with the drainage strategy for Jacksons Ridge also using the 1st and highest tier of the drainage hierarchy through water butts.

MicroDrainage Hydraulic Modelling

7.48 The drainage strategies for each development area have been designed in MicroDrainage's Network hydraulic modelling module.

7.49 The results of the MicroDrainage hydraulic modelling for each development can be seen in Appendices P, Q and R.

7.50 The results of the hydraulic modelling confirm that the drainage strategies as outlined above can attenuate and discharge all surface water generated in the 1 in 100-year + 45% rainfall event, inclusive of all LLFA requirements and design criteria, without flooding.

8.0 Foul Water Drainage

8.1 It has been discussed earlier in this report that there is no public sewerage in the Stonehouse Farm area and all the site's foul waste is treated and discharged as treated effluent via packaged sewage treatment plants.

8.2 There are currently three packaged sewage treatments plant within Stonehouse Farm; two on the Stonehouse Business Park site and one serving Lot 8.

8.3 These sewage treatment plants are functioning well and the most recent service record for all three packaged sewage treatment plants can be seen in Appendix S.

8.4 The watercourse that receives treated effluent from these packaged sewage treatment plants has baseflow on a year-round basis, thus is a suitable receptor.

8.5 While the existing surface water drainage on the Stonehouse Business Park and Lot 8 sites will be unaffected and unchanged by the proposed development, the foul waste outputs of the two sites may change because of the number of staff/personnel on site. Because of this, the requirements of the existing packaged sewage treatment plants are currently under review. The outputs of this review will be made available in a separate report from this one, but it can be stated at this time that the future capacity of all sewage treatment plants will be in accordance with the requirements of British Water's Flows and Loads. The packaged sewage treatment plants will also meet the requirements of BS EN:12566 (small wastewater treatment systems for up to 50 PT), as well as the General Binding Rules for small sewage discharges to surface waters, which means that a consent will not be required from the Environment Agency.

8.6 This applies to the existing packaged sewage treatment plants on site, as well as those that will be installed to serve the Jacksons Ridge development. It is proposed to have three packaged sewage treatment plants, one serving each property, and a combined outflow that takes treated effluent to the watercourse at the bottom of the valley. As per design guidance, the proposed surface water discharge from Jacksons Ridge and the foul effluent outflow will maintain separate pipework until the final discharge to the watercourse.

9.0 Surface Water Runoff Quality

9.1 The NPPF states that development should not have a detrimental impact on the environment, including the water environment. The technical guidance to the NPPF provides further advice on the benefits of ensuring runoff quality is to an appropriate standard.

9.2 The CIRIA SuDS Manual provides guidance on the treatment of surface water runoff. The expected pollution hazards and what is required to mitigate them has been reviewed for each of the development sites and is discussed below.

9.3 Because the site uses (in terms of pollution hazard) and the drainage strategies for Stonehouse Business Park and Lot 8 are the same, these two sites will be considered together. The different site use and drainage strategy for Jacksons Ridge means it will be considered separately.

Stonehouse Business Park and Lot 8

9.4 With regards to these two proposed developments, Table 4.3 of the CIRIA SuDS Manual rates the pollution hazard from roof water runoff as 'very low'. The only requirement for roof water runoff is the removal of gross solids and sediments, which would be achieved using catchpits placed strategically within the drainage network, but especially ahead of any flow control structures.

9.5 With regards to the access roads and aprons of these commercial (light industrial) sites, Table 26.2 of the CIRIA SuDS Manual rates the pollution hazard from "*commercial yards and delivery areas, non-residential car parking with frequent change*" as 'medium'. To mitigate 'medium' pollution hazards, the CIRIA SuDS Manual recommends using a simple index approach in line with Section 26.7.1. This is discussed, below.

9.6 Table 26.2 of the CIRIA SuDS Manual provides pollution hazard indices for different land use classifications. The land use classification that requires consideration for 'commercial yards and delivery areas and non-residential parking with frequent change' is in Table 9.1 below.

Table 9.1 - Excerpt from Table 26.2 of CIRIA SuDS Manual

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Commercial yards and delivery areas, non-residential car parking with frequent change.	Medium	0.7	0.6	0.7

9.7 To deliver adequate pollution treatment and mitigation, the CIRIA SuDS Manual recommends using a SuDS component that has a total pollution mitigation index (for each contaminant type) that equals or exceeds the pollution hazard index (for each contaminant type).

9.8 Table 26.3 of the CIRIA SuDS Manual provides indicative SuDS mitigation indices for each SuDS type when discharging to surface waters. Table 9.2, on the next page, which is an excerpt from Table 26.3, shows the mitigation index for SuDS (Detention) basins.

Table 9.2 - Pollution Mitigation Indices for SuDS (Detention) Basins

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
SuDS (Detention) Basins	0.5	0.5	0.6

9.9 The mitigation indices for SuDS (Detention) basins do not meet the pollution hazard index figures from Table 9.1. Consequently, another pollution removal device will be required in the system to ensure that all pollutants are removed from the surface water load prior to its discharge to the watercourse.

9.10 It is proposed to precede the SuDS basins on Stonehouse Business Park and Lot 8 with a proprietary pollution removal device such as an SDS Aqua-Swirl.

9.11 SDS's Aqua-Swirls use hydrodynamic separation, which operate under gravity flow, to maximise the removal of pollutants that are typically found attached to silts and debris within surface water runoff. Details and the pollution mitigation indices of SDS's Aqua-Swirl can be seen in Appendix T.

9.12 Where two mitigation components are used in series, the C753 SuDS manual states that:

Total SuDS mitigation index = mitigation index (component one) + 0.5 mitigation index (component two)

9.13 Thus, the SuDS basins when they follow an SDS Aqua-Swirl will provide the below mitigation indices as in Table 9.3:

Table 9.3 - Pollution Mitigation Indices for Secondary SuDS Feature (SuDS Basin)

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
SuDS Basin	0.25 (0.5 ÷ 2)	0.25 (0.5 ÷ 2)	0.30 (0.6 ÷ 2)

9.14 And the total mitigation indices for the Stonehouse Business Park site is as per Table 9.4, below:

Table 9.4 - Total Pollution Mitigation Offered by SuDS Aqua-Swirl and SuDS Basin:

Contaminant Type	Pollution Hazard Index	Pollution Mitigation Index	Difference
Total Suspended Solids	0.5	1.05 (0.8 + 0.25)	+ 0.45
Metals	0.4	0.75 (0.5 + 0.25)	+ 0.45
Hydrocarbons	0.4	1.00 (0.7 + 0.30)	+ 0.60

9.15 The above evidence shows how the SDS Aqua-swirls and the SuDS Basins combine to ensure all pollution hazards on the Stonehouse Business Park and Lot 8 sites are completely mitigated.

Jacksons Ridge

9.16 The Jacksons Ridge site has a lower pollution hazard rating than the commercial sites. Table 9.5 on the next page shows the pollution hazard indices for 'Low' risk sites.

Table 9.5 – Pollution Hazard Indices at Jacksons Ridge

Land Use	Pollution Hazard Level	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Individual property driveways, residential car parks, low traffic roads (e.g. cul-de-sacs, homezones and general access roads) with less than 300 traffic movements per day.	Low	0.5	0.4	0.4

9.17 The Jacksons Ridge development will use permeable paviours and a geocellular tanks. Table 9.6 shows the mitigation index for permeable paviours.

Table 9.6 - Pollution Mitigation Indices for Permeable Pavements

Type of pollution removal component	Total Suspended Solids (TSS)	Metals	Hydro-Carbons
Permeable Pavements	0.7	0.6	0.7

9.18 Permeable pavements exceed the 'Low' pollution hazard indices of the driveway, and there is no need for pollution mitigation to the rear of the properties as it is only roof and patio water draining in this direction, thus all possible pollution hazards are mitigated no further pollution mitigation is required at Jacksons Ridge.

10.0 Residual Risk

10.1 Whilst the drainage strategies for the three developments have been designed to attenuate surface water from the 1 in 100-year plus 45% rainfall event (plus an inclusion for urban creep on Jacksons Ridge), there could be a small residual risk of flooding due to blockage or failure or poor performance of on-site infrastructure. Therefore, appropriate and regular maintenance of the drainage infrastructure should be undertaken by Lake Investments Limited or their site management agents.

10.2 To assist with this process, a Drainage Management and Maintenance Plan has been prepared, which sets out the principles for the long-term management and maintenance of the proposed surface water drainage components specified across the three developments. The Drainage Management and Maintenance Plan can be seen in Appendix U.

10.3 The purpose of this document is to ensure that there is a robust inspection and maintenance plan going forwards. This will help ensure the optimum operation of the surface water drainage systems and that they will be regularly maintained for the lifetime of the developments. This will contribute to reducing the risk of surface water flooding both on- and off-site.

11.0 Exceedance Events

11.1 Exceedance events are those greater than the design rainfall event (i.e., greater than the 1 in 100-year rainfall event plus 45% for climate change).

11.2 Any rainfall events greater than the design rainfall event may cause flooding due to them 'exceeding' the capacity of the drainage system. In this situation it is imperative to check whether flooding would occur and, if so, whether it needs to be contained on site. Exceedance flows should not ingress into any properties on site and should not cause nuisance to any neighbouring sites or buildings.

11.3 The drainage system as designed has a large attenuation capacity available and, because of the LLFA's design criteria, it assumes zero losses due to vegetation interception, evaporation and surface roughness, and cannot include for storage/conveyance within the pipes around/between the plots and the main drainage system. Therefore, the drainage system, as designed, represents an *extremely* conservative strategy that, in a real-world scenario, would not receive the surface water that has been catered for in the MicroDrainage hydraulic model. As such, the designed drainage system would, in operation, have capacity for events beyond that of the 1 in 100-year rainfall event plus 45% for climate change, i.e. 'exceedance events'.

11.4 Notwithstanding this, a high-level plan of exceedance flows has been produced to show the pathways exceedance flows would take across each of the development areas. These can be seen in Appendix V.

12.0 Summary and Conclusion

12.1 This Flood Risk Assessment (FRA) and Drainage Strategy report has been produced by Motion on behalf of their client, Lake Investments Limited. It supports the planning application for three tranches of proposed development on the Stonehouse Farm site.

12.2 The EA's Flood Map for Planning shows that all development sites are within Flood Zone 1 and are not at risk of fluvial (or tidal) flooding. The updated 2025 RoFSW mapping also show that the development sites are at 'very low' risk of surface water flooding. All other forms of flooding do not show that any site is at an elevated risk and, therefore, all the developments can be concluded as not being at risk of flooding, from any source, and are appropriate in their locations.

12.3 The drainage strategies for the proposed developments have been produced in line with the drainage hierarchy, the NPPF, and WSCC's LLFA design criteria. A mixture of SuDS features have been proposed to provide attenuation, source control and pollution mitigation, and are discharging at the lowest practicable rates to surface waters via established private drainage outfalls from the site.

12.4 The drainage strategies for the three developments have been hydraulically modelled in MicroDrainage's Network module. The modelling has shown that the proposed drainage strategies can attenuate the 1 in 100-year + 45% rainfall event without flooding, with an inclusion for urban creep where this is applicable.

12.5 A drainage management and maintenance plan has been produced that shows how the drainage components proposed in the drainage strategies will be maintained in perpetuity.

12.6 Exceedance flows have been considered and an exceedance plan for each site has produced. Because of the rural nature of the developments and because there are no downslope receptors, exceedance flows are not a constraint on the developments.

12.7 Stonehouse Business Park and Lot 8 will reuse the existing method of foul waste treatment and disposal, which is packaged sewage treatment plants. These units currently discharge their treated effluent to the watercourse and will continue to do so. The capacity of the units has been formalised against BS EN:12566 and the discharges are in accordance with the General Binding Rules. Jacksons Ridge will also use packaged sewage treatment plants for each property and will also discharge the treated effluent to the watercourse. A consent is not required for any of the discharges.

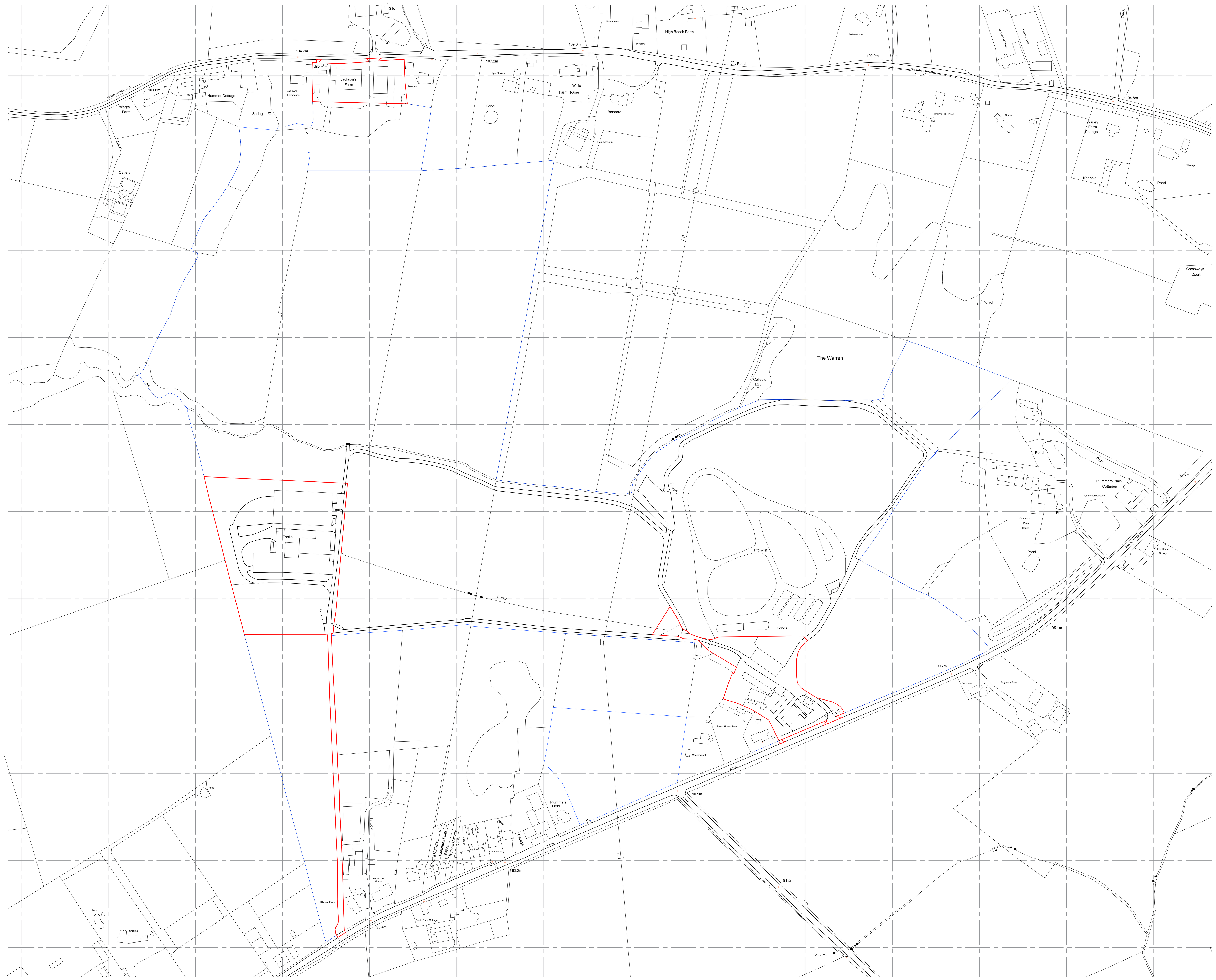
12.8 In conclusion, the drainage strategies for each development area have used the highest available and practicable tiers of the drainage hierarchy. The surface water attenuation and discharge proposals are in accordance with the NPPF and WSCC's local policies, and can attenuate surface water generated up to and including the 1 in 100-year + 45% rainfall event without flooding while discharging at the lowest viable rates to the watercourse. Pollution hazards can be suitable mitigated, exceedance flows have been considered, urban creep has been included on Jacksons Ridge and a drainage management and maintenance plan has been produced.

12.9 The proposed sustainable drainage strategies and the very low flood risk from all sources means that the proposed developments are appropriate in their locations and flood risk and drainage should not be an impediment to their progress.

Appendix A

Site Location Plan

comply with ALL standards as required by the relevant Trade Associations, British Standards, Codes of Practice, Manufacturers Specifications (BBA Certification, etc). All works to be carried out fully in accordance with any Engineer's Calculations, Details, & Instructions, as and where applicable.



Site Layout Plan (1:2500)

0 20 40 60 80 100

Scale bar measured in meters

PLANNING

3D ARCHITECTURE Limited

3-D Architecture Limited
15 Horsted Square, Bellbrook Industrial Estete,
Uckfield, East Sussex. TN22 1QG
Tel: 01825 764455 Fax: 01825 764455
Email: info@3d-architecture.co.uk

CLIENT

Lee Goossens

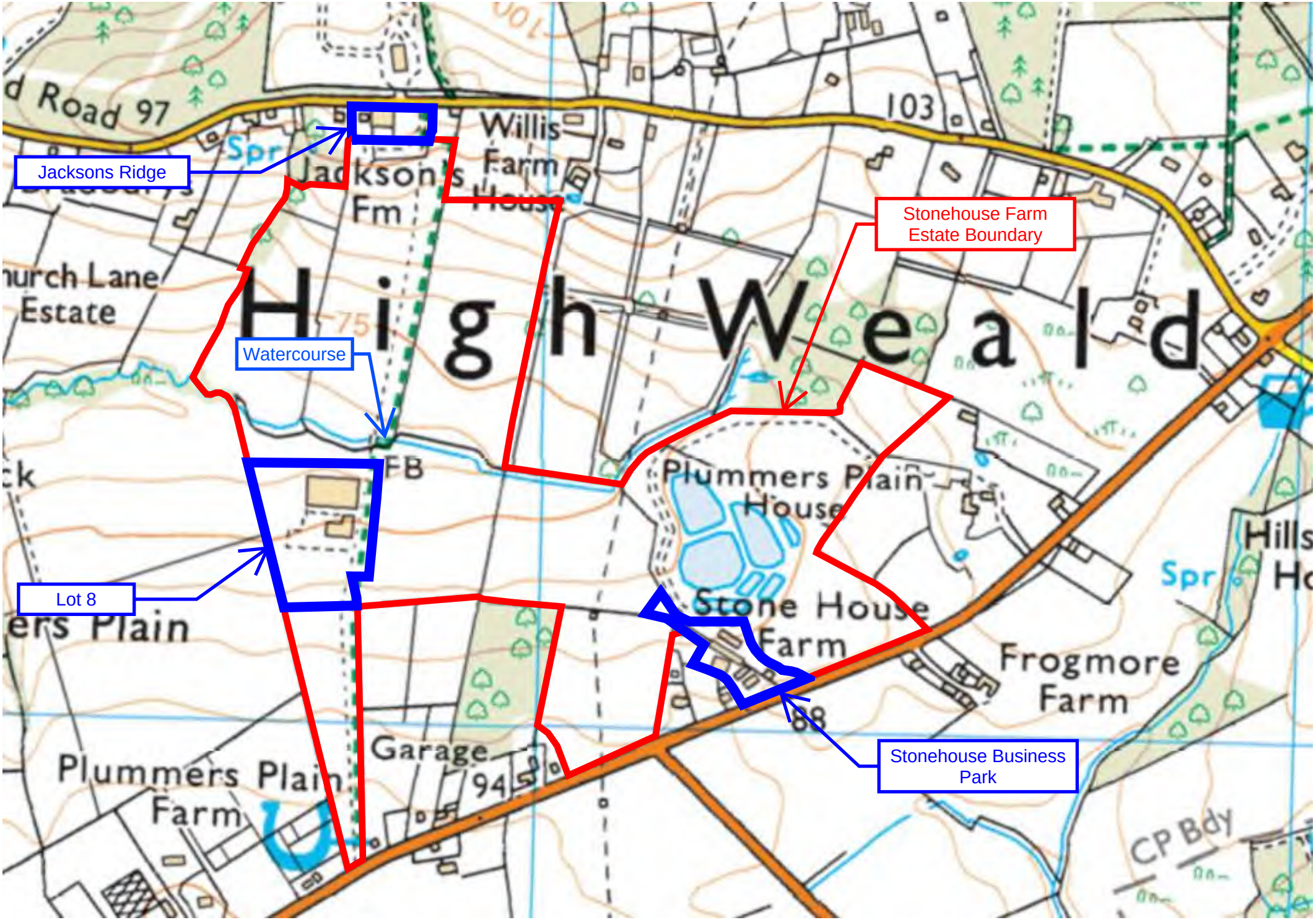
PROJECT

Stonehouse Farm
Handcross Road, Plummers Plain,
Horsham, West Sussex
RH13 6NZ

DRAWING TITLE

Site Location Plan

SCALE	DATE	DRAWN BY
1:2500	February 2025	ANH
DRAWING NO.		REVISION
2025/PL1		-


Jacksons Ridge
Stonehouse Farm Estate Boundary
Watercourse
Lot 8
Stonehouse Business Park
High Weald
Road 97
103
Willis Farm
Jacksons Fm
Estate
Plummers Plain House
Stone House Farm
Frogmore Farm
Plummers Plain Farm
Garage
94
88
FB
Spr
CP Bdy

Appendix B

Existing and Proposed Site Layouts

A1

Contractor to CHECK all dimensions & report any discrepancies. All works and materials used are to fully comply with ALL standards as required by the relevant Trade Associations, British Standards, Codes of Practice, Manufacturers Specifications (BBA Certification, etc). All works to be carried out fully in accordance with any Engineer's Calculations, Details, & Instructions, as and where applicable.

Site Location Plan - As Proposed (1:1250)

0 10 20 30 40 50

Scale bar measured in meters

Site Location Plan - As Existing (1:1250)

0 10 20 30 40 50

Scale bar measured in meters

0 1 2 3 4 5

Scale bar measured in meters

PLANNING

3-D Architecture Limited
15 Horsted Square, Bellbrook Industrial Estate,
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CLIENT

Lee Goossens

PROJECT

Stonehouse Farm
Handcross Road, Plummer Plain,
Horsham, West Sussex
RH13 6NZ

DRAWING TITLE

Site Location Plans
As Existing & As Proposed

SCALE	DATE	DRAWN BY
1:1250 @ A1	January 2024	ANH

DRAWING NO.	REVISION
2024/PL11	A

A1

Site Location Plan - As Existing (1:1250)

0 10 20 30 40 50

Scale bar measured in meters

Site Location Plan - As Proposed (1:1250)

0 10 20 30 40 50

Scale bar measured in meters

0 2 4 6 8 10

Scale bar measured in meters

PLANNING

3-D Architecture Limited
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CLIENT

Lee Goossens

PROJECT

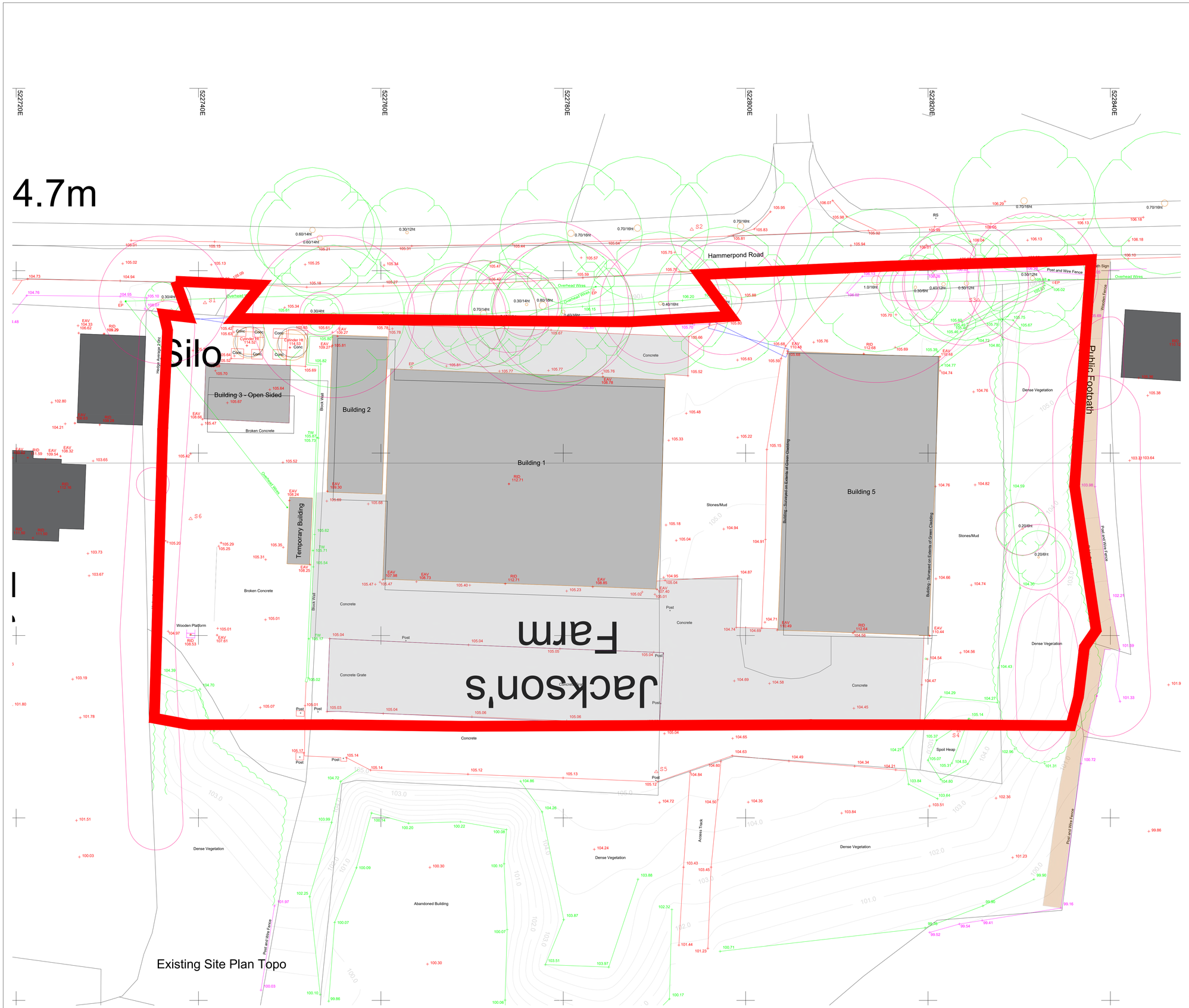
Stonehouse Farm
Handcross Road, Plummer Plain,
Horsham, West Sussex
RH13 6NZ

DRAWING TITLE

Site Location Plans
As Existing & As Proposed

SCALE	DATE	DRAWN BY
1:1250	October 2024	ANH

DRAWING NO.	REVISION
2024/PL8	A



LLOYD HARDEN

Design • Planning • Architecture

N

REV	BY	DATE	DETAILS

SCALE @ A1 -1:200

0 2.5m 5m 7.5m 10m 1:200

CLIENT

Lee Goossons

Hammerpond Lane, Horsham, RH13 6PE

PROJECT

Jackson's Farm - Demolition of Barns - 3 new Build Houses

DRAWN BY	CHECKED BY
LKH	LKH

PLANNING

DRAWING TITLE

Existing Site Plan - Topo

DATE	DRAWING NUMBER	REVISION
05.01.24	259101-108	--

+44 (0)116 482 9284 www.lloydharden.co.uk

N

522740E 522760E 522780E 522800E 522820E 522840E

Hammerpond Road

T1 -B1
T2 -C1
T3 -C1
T4 -B1
T5 -B2
T6 -B2
T7 -B2
T8 -B2
T9 -B2
T10 -B2
T11 -B2
T12 -B2
T13 -B2
T14 -C1
T15 -B2
T16 -B2
T17 -C1
T18 -B2
T19 -C1
T20 -B1
H1 -B2
H2 -C2
H3 -B2
G1 -B2
G2 -C1

C B A

Public Footpath
Overhead Wires
Wooden Fence
Post and Wire Fence
Access Track
Dense Vegetation
Abandoned Building
Patio
Awning
BALCONY

Proposed Site Plan

LLOYD HARDEN
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- Proposed Grass
- Proposed Wild Flowers and Grass
- Existing Grass Verge
- Proposed Permeable Paviours - SUDS Refer To Drainage drawing
- Patio and Paths
- Existing Footpath to remain
- Retaining Walls
- Balconies
- Proposed Trees
- Existing Trees To Remain
- Proposed Bushes
- Proposed Estate Fencing
- Proposed Sliding Gate
- Proposed Inward Opening Gate

REV BY DATE DETAILS

SCALE @ A1 -1:200

0 2.5m 5m 7.5m 10m 1:200

CLIENT
Lee Goossons
Hammerpond Lane, Horsham, RH13 6PE

PROJECT
Jackson's Farm - Demolition of Barns - 3 new Build Houses

DRAWN BY LKH
CHECKED BY LKH

PLANNING

DRAWING TITLE
Proposed Site Plan

DATE	DRAWING NUMBER	REVISION
05.01.24	259101-110	--

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Appendix C

Stonehouse Business Park Site Photos

Plate 1: Aerial view of Stonehouse Business Park site looking northwest. The Office Building is in the foreground and Building 5 is in the middle picture with the rusted corrugated iron roof and semi-clad walls. The portacabins that will be replaced by the refurbished and extended office can be seen.

Plate 2: Aerial view of Stonehouse Business Park site looking west. The office can be seen in the left of the picture and Unit 5 is in the centre of the view. Building 3 is visible behind the green, pent-roofed structure to the right of the picture. The surfacing around Unit 5 can be seen in this picture.

Plate 3: View of the southern end of Unit 3. The material used to make the surface can be seen, which is akin to 6F2/6F5 capping material

Plate 4: The northern edifice of Unit 5, which is to be demolished with parking for staff and visitors in its place.

Appendix D

Lot 8 Site Photos

Plate 1: Aerial view of Lot 8 looking west. The layout and external form of the units is not changing. The current surfacing can be seen around the units, which is a mixture of tarmac and concrete.

Plate 2: Aerial view of Lot 8 looking north. The tarmac apron can clearly be seen, and Jacksons Ridge can be seen in the distance.

Plate 3: View of Lot 8 looking south. The informal/compacted earth surfacing and the rainwater harvesting tanks can be seen in the foreground

Appendix E

Jacksons Ridge Site Photos

Plate 1: Aerial view of Jacksons Ridge looking north. The two existing redundant farm buildings can be seen as well as the external concrete hardstanding.

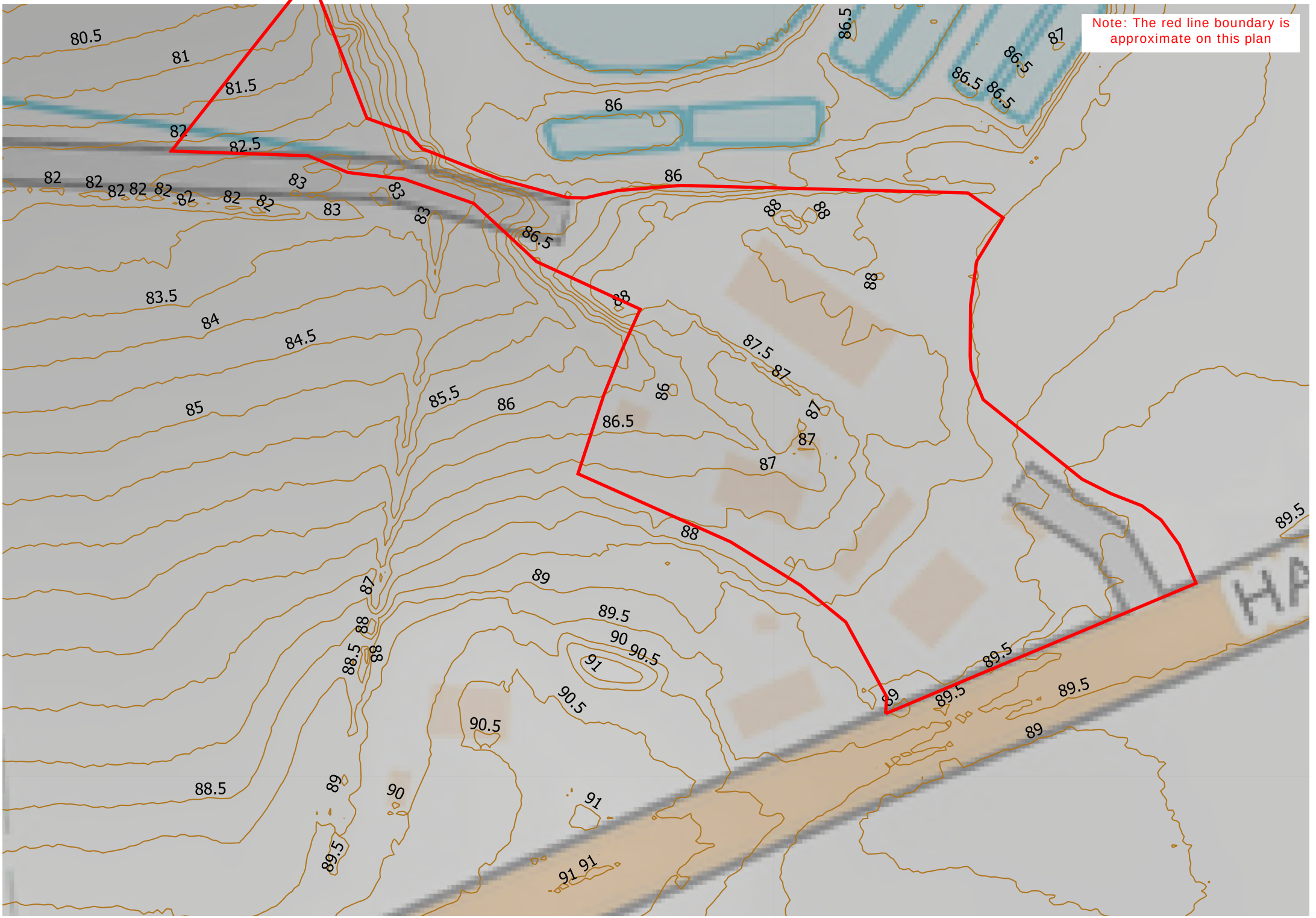
Plate 2: View of the western redundant farm building and the concrete hardstanding.

Plate 3: View of the eastern redundant farm building and the concrete hardstanding

Plate 4: View of the concrete hardstanding on Jacksons Ridge looking southeast back towards Stonehouse Business Park

Appendix F

Stonehouse Business Park LiDAR Topography Plan


Note: The red line boundary is approximate on this plan

Appendix G

Lot 8 Topographic Survey

A1

Contractor to CHECK all dimensions & report any discrepancies. All works and materials used are to fully comply with ALL standards as required by the relevant Trade Associations, British Standards, Codes of Practice, Manufacturers Specifications (BBA Certification, etc). All works to be carried out fully in accordance with any Engineer's Calculations, Details, & Instructions, as and where applicable.

N

0 1 2 3 4 5

Scale bar measured in meters

PLANNING

3-D Architecture Limited
15 Horsted Square, Bellbrook Industrial Estete,
Uckfield, East Sussex. TN22 1QG
Tel: 01825 764455 Fax: 01825 764455
Email: info@3d-architecture.co.uk

CLIENT

Lee Goossens

PROJECT

Stonehouse Farm
Handcross Road, Plummer Plain,
Horsham, West Sussex
RH13 6NZ

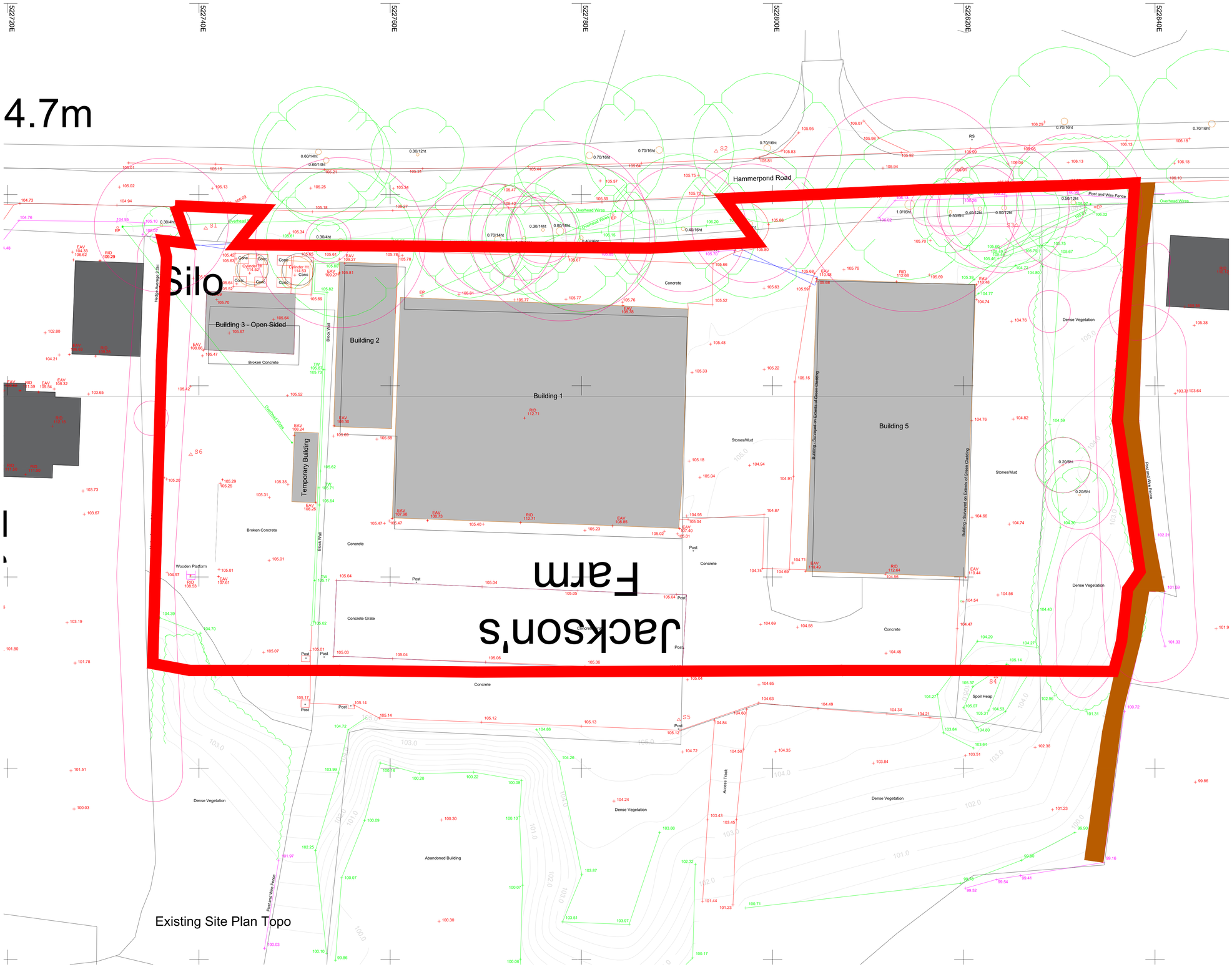
DRAWING TITLE

Topographical Survey
As Existing

SCALE	DATE	DRAWN BY
1:200	October 2024	ANH
DRAWING NO.		REVISION
2024/PL1		-

Appendix H

Jacksons Ridge Topographic Survey



LLOYD HARDEN

Design • Planning • Architecture

REV	BY	DATE	DETAILS

SCALE @ A1 -1:200

0 2.5m 5m 7.5m 10m 1:200

CLIENT

Lee Goossons

Hammerpond Lane, Horsham, RH13 6PE

PROJECT

Jackson's Farm - Demolition of Barns - 3 new Build Houses

DRAWN BY	CHECKED BY
LKH	LKH

PLANNING

DRAWING TITLE

Existing Site Plan - Topo

DATE	DRAWING NUMBER	REVISION
05.01.24	259101-108	--

+44 (0)116 482 9284 www.lloydharden.co.uk

Appendix I

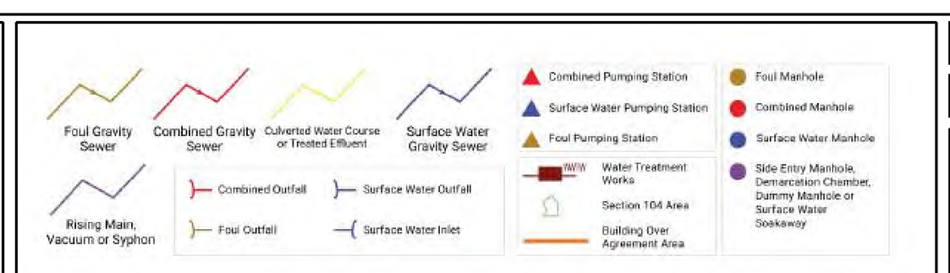
Southern Water Asset Location Plans

(c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122 | Date: 12/02/25 | Scale: 1:1250 | Map Centre: 523250,128043 | Data updated: 21/01/25 | Our Ref: 1688365 - 1 | Wastewater Plan A0 Powered by digdat

The positions of pipes shown on this plan are believed to be correct, but Southern Water Services Ltd accept no responsibility in the event of inaccuracy. The actual positions should be determined on site. This plan is produced by Southern Water Services Ltd (c) Crown copyright and database rights 2025 Ordnance Survey AC0000808122 .This map is to be used for the purposes of viewing the location of Southern Water plant only. Any other uses of the map data or further copies is not permitted.

WARNING: BAC pipes are constructed of Bonded Asbestos Cement.

WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement.



ljagiela@motion.co.uk

1ecst3 - Lot 8 C

Lot 8 and Commercial

WATER for LIFE from Southern Water.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert

Appendix J

Impermeable Area Plans


Impermeable Areas: 0.209 ha
Stone House Farm

A1

Site Layout Plan

0 5 10 15 20
Scale bar measured in meters

PLANNING

3-D Architecture Limited
15 Horsted Square, Bellbrook Industrial Estete,
Uckfield, East Sussex, TN22 1QG
Tel: 01825 764455 Fax: 01825 764455
Email: info@3d-architecture.co.uk

CLIENT
Lee Goossens

PROJECT
Stonehouse Farm
Handcross Road, Plummer Plain,
Horsham, West Sussex
RH13 6NZ

DRAWING TITLE
Site Layout Plan
As Proposed

SCALE	DATE	DRAWN BY
1:500	October 2024	ANH

DRAWING NO.	REVISION
2024/PL7	C

LLOYD HARDEN

Design • Planning • Architecture

Garden Area

Existing Grass Verge

Existing Footpath to remain

Proposed Resin Gravel Drives

Retaining Walls

Patio and Paths

Balconies

Proposed Wild Flowers and Grass

Proposed Trees

Proposed Bushes

Existing Trees To Remain

Proposed Estate Fencing To Front and Closed Board Fencing To Rear
Proposed Sliding Gate

Proposed Inward Opening Gate

REV BY DATE DETAILS

SCALE @ A1 -1:200

CLIENT
Lee Goossons
Hammerpond Lane, Horsham, RH13 6PE

PROJECT
Jackson's Farm - Demolition of Barns - 3 new Build Houses

DRAWN BY LKH

CHECKED BY LKH

PLANNING

DRAWING TITLE
Proposed Site Plan

DATE	DRAWING NUMBER	REVISION
05.01.24	259101-110	–

+44 (0)116 482 9284 www.lloydharden.co.uk

Appendix K

QMED Calculation

FEH Mean Annual Flood

Input

QMED Method	2008	URBEXT (1990)	0.0000
Site Location	GB 522650 128400 TQ 22650 28400	SPRHOST	26.650
Area (ha)	111.000	BFIHOST	0.734
SAAR (mm)	823	FARL	1.000

Results

QMED Rural (l/s) 177.4 QMED Urban (l/s) 177.4

Appendix L

Environment Agency Flood Map for Planning

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**523230/128114**	**26 Feb 2025 9:08**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
523230/128114

Scale
1:2500

Created
26 Feb 2025 9:08

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**522692/128248**	**26 Feb 2025 9:10**

Your selected location is in flood zone 1, an area with a low probability of flooding.

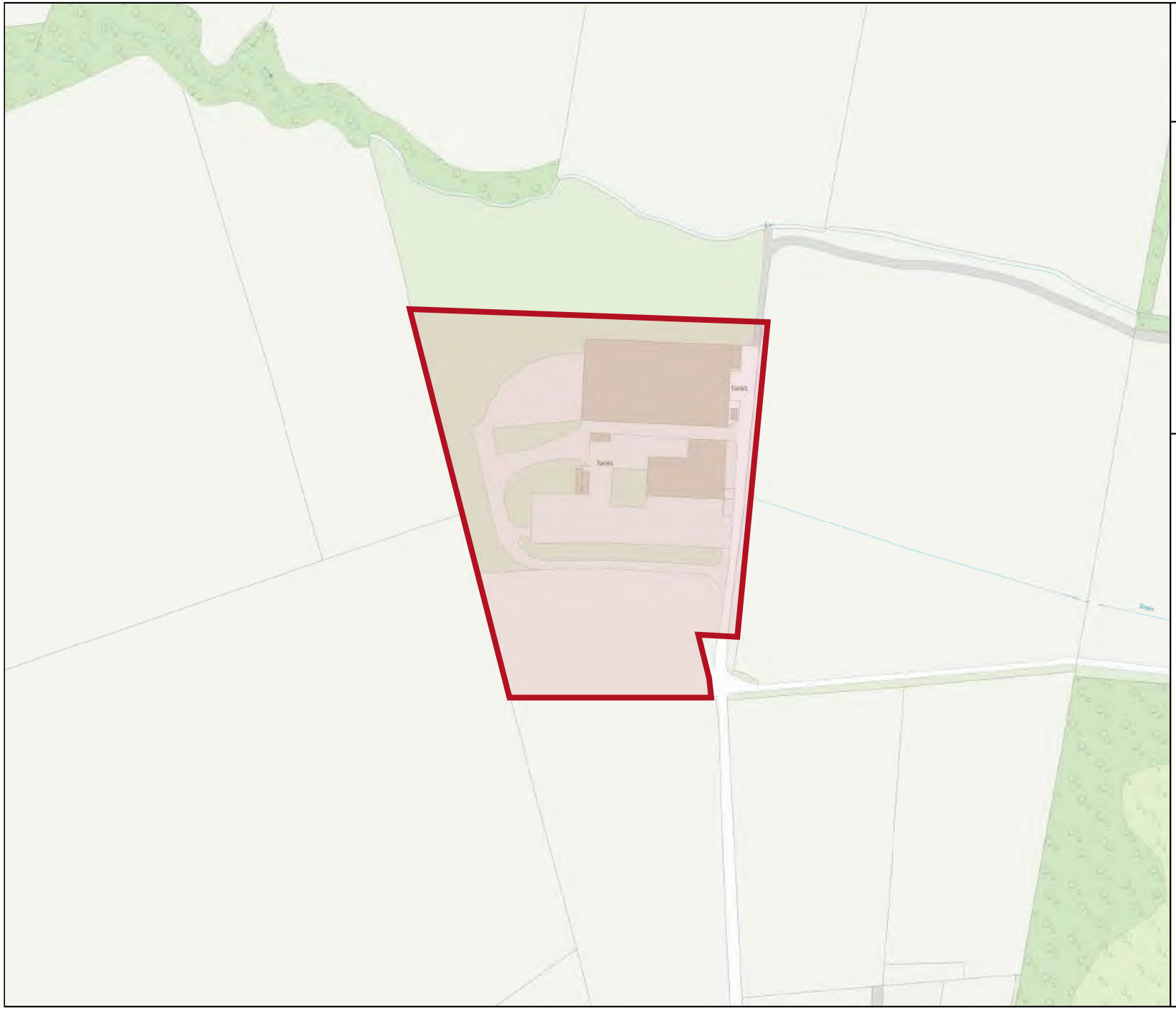
You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.



Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
522692/128248

Scale
1:2500

Created
26 Feb 2025 9:10

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

0 20 40 60m

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**522781/128791**	**16 Feb 2025 17:04**

Your selected location is in flood zone 1, an area with a low probability of flooding.

You will need to do a flood risk assessment if your site is **any of the following:**

- bigger that 1 hectare (ha)
- In an area with critical drainage problems as notified by the Environment Agency
- identified as being at increased flood risk in future by the local authority's strategic flood risk assessment
- at risk from other sources of flooding (such as surface water or reservoirs) and its development would increase the vulnerability of its use (such as constructing an office on an undeveloped site or converting a shop to a dwelling)

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

Flood risk data is covered by the Open Government Licence **which** sets out the terms and conditions for using government data. https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/

Use of the address and mapping data is subject to Ordnance Survey public viewing terms under Crown copyright and database rights 2024 OS AC0000807064. https://flood-map-for-planning.service.gov.uk/os-terms

Environment Agency

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
522781/128791

Scale
1:2500

Created
16 Feb 2025 17:04

- Selected area
- Flood zone 3
- Flood zone 2
- Flood zone 1
- Flood defence
- Main river
- Water storage area

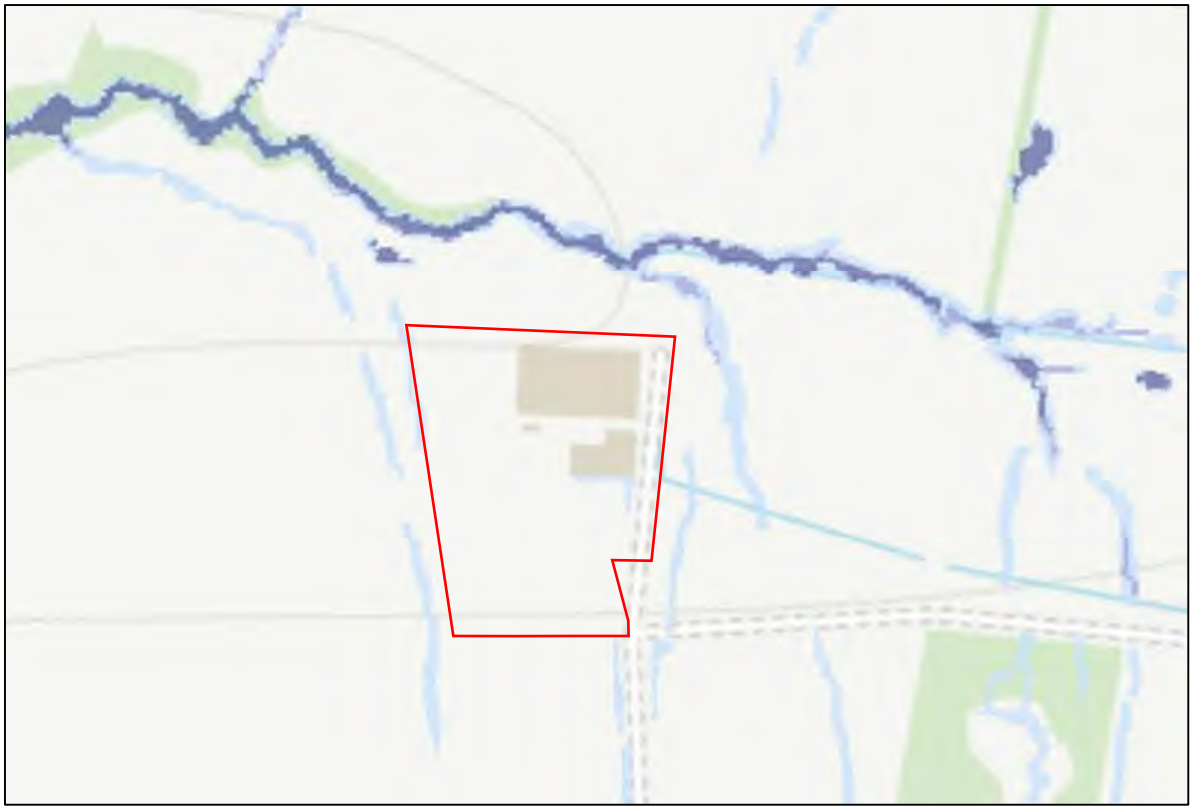
0 20 40 60m

Appendix M

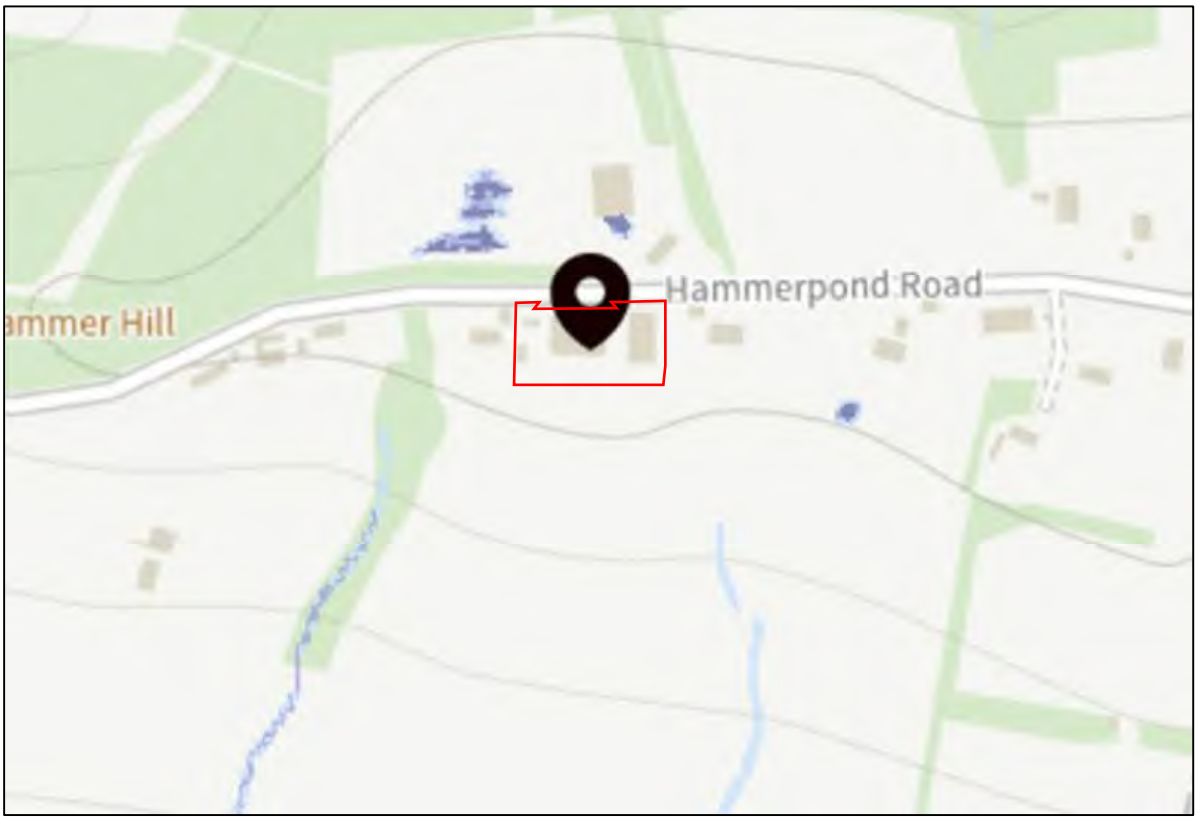
2025 Risk of Flooding from Surface Water (RoFSW) Map

Surface Water Flood Risk on Stonehouse Business Park Site

Surface Water Flood Risk on Lot 8

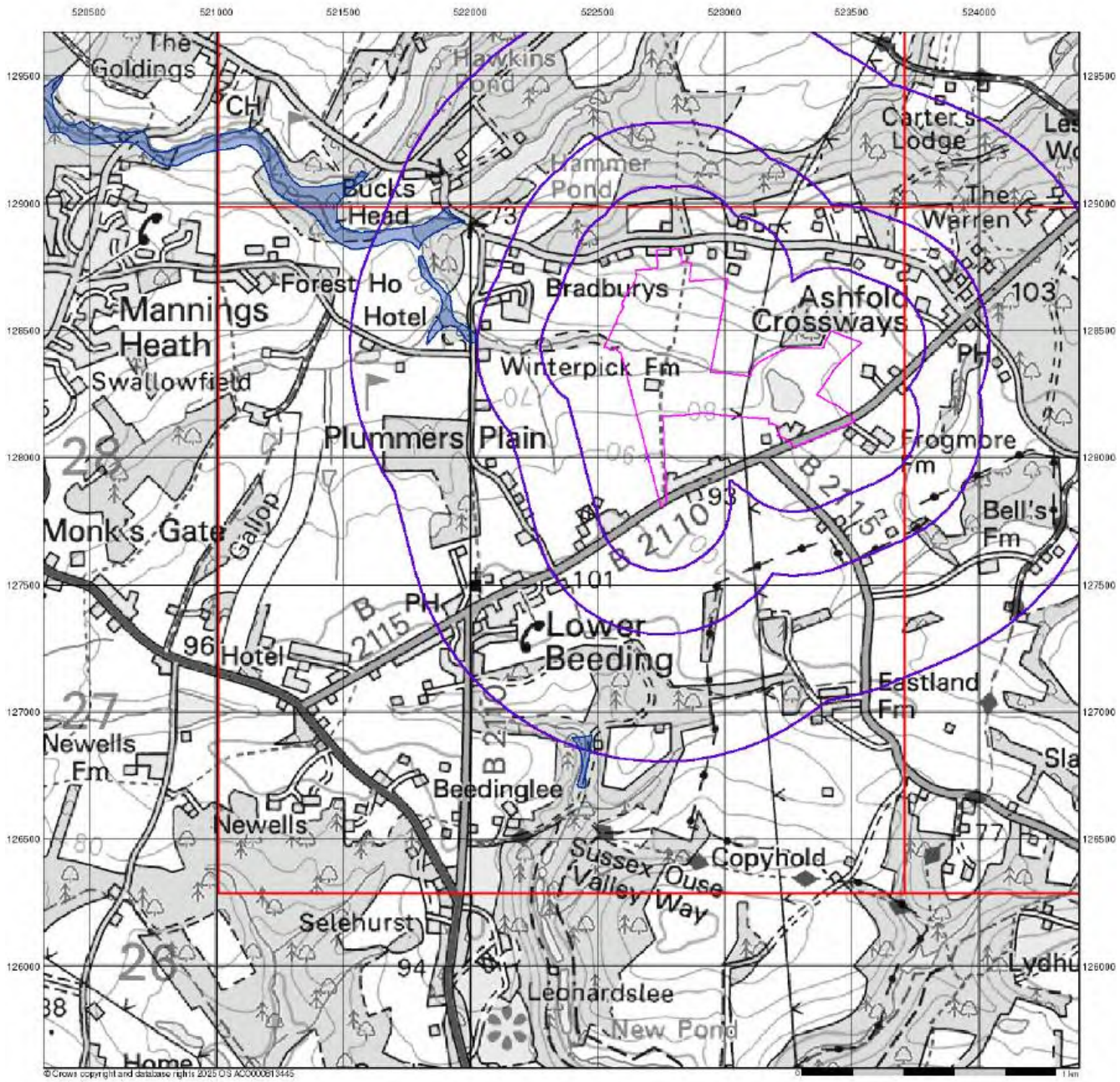


Surface Water Flood Risk on Jacksons Ridge



Appendix N

Groundwater Susceptibility Mapping



motion

BGS Flood Data (1:50,000)

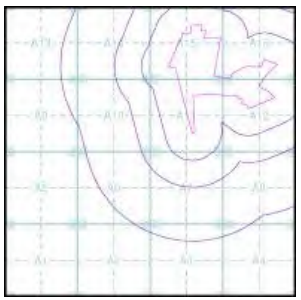
General

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

BGS Geological Indicators of Flooding

- Coastal
- Inland
- Bodies of Water

BGS Flood Data Map - Slice A



N

Order Details

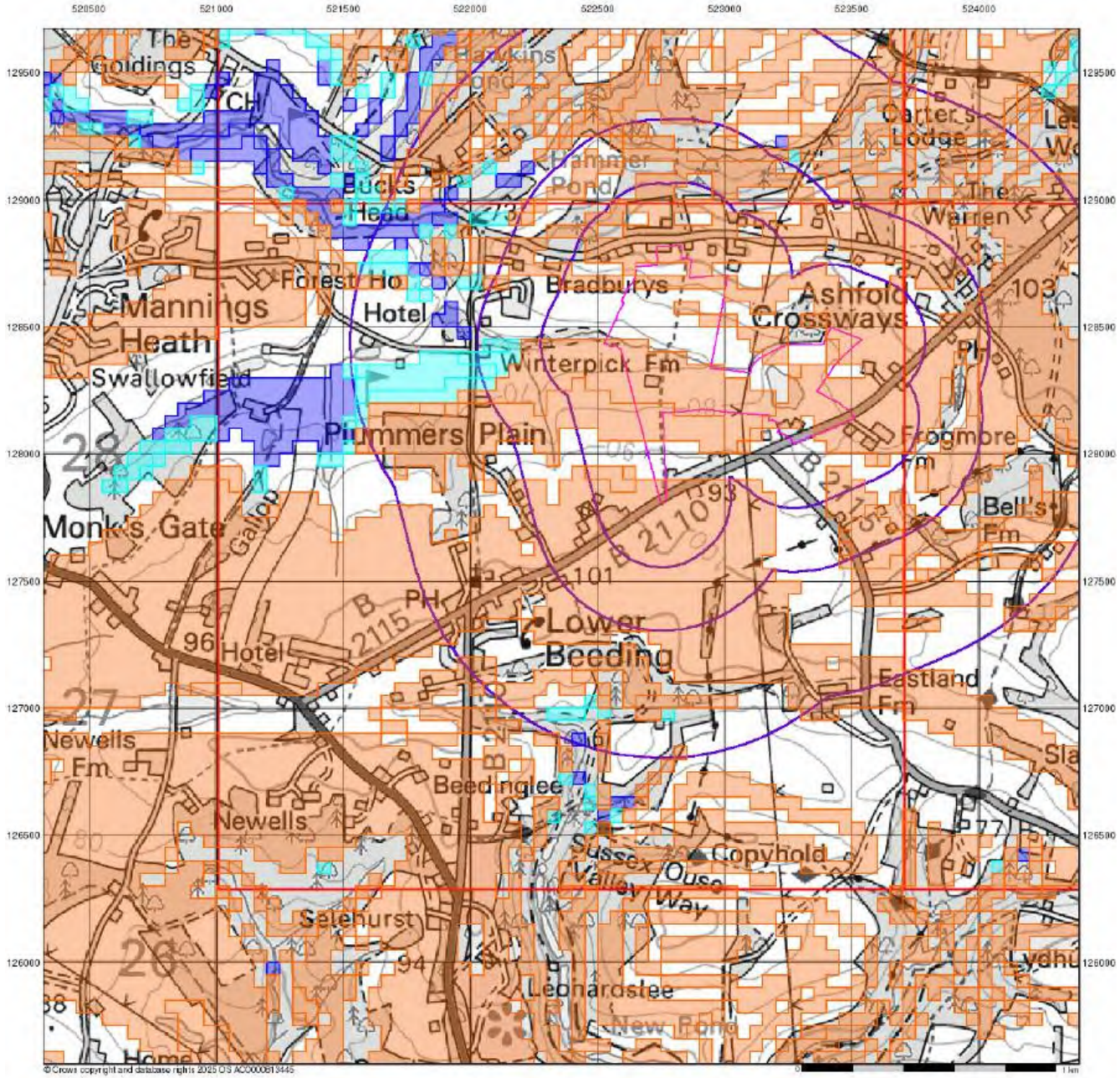
Order Number:	369891876_1_1
Customer Ref:	1ecst2/2410067
National Grid Reference:	522690, 128000
Slice:	A
Site Area (Ha):	37.3
Search Buffer (m):	1000

Site Details

Site at, Plummers Plain, West Sussex

Landmark INFORMATION GROUP

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



motion

BGS Flood Data (1:50,000)

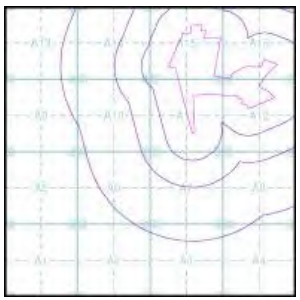
General

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

BGS Groundwater Flooding Susceptibility

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

BGS Flood Data Map - Slice A



N

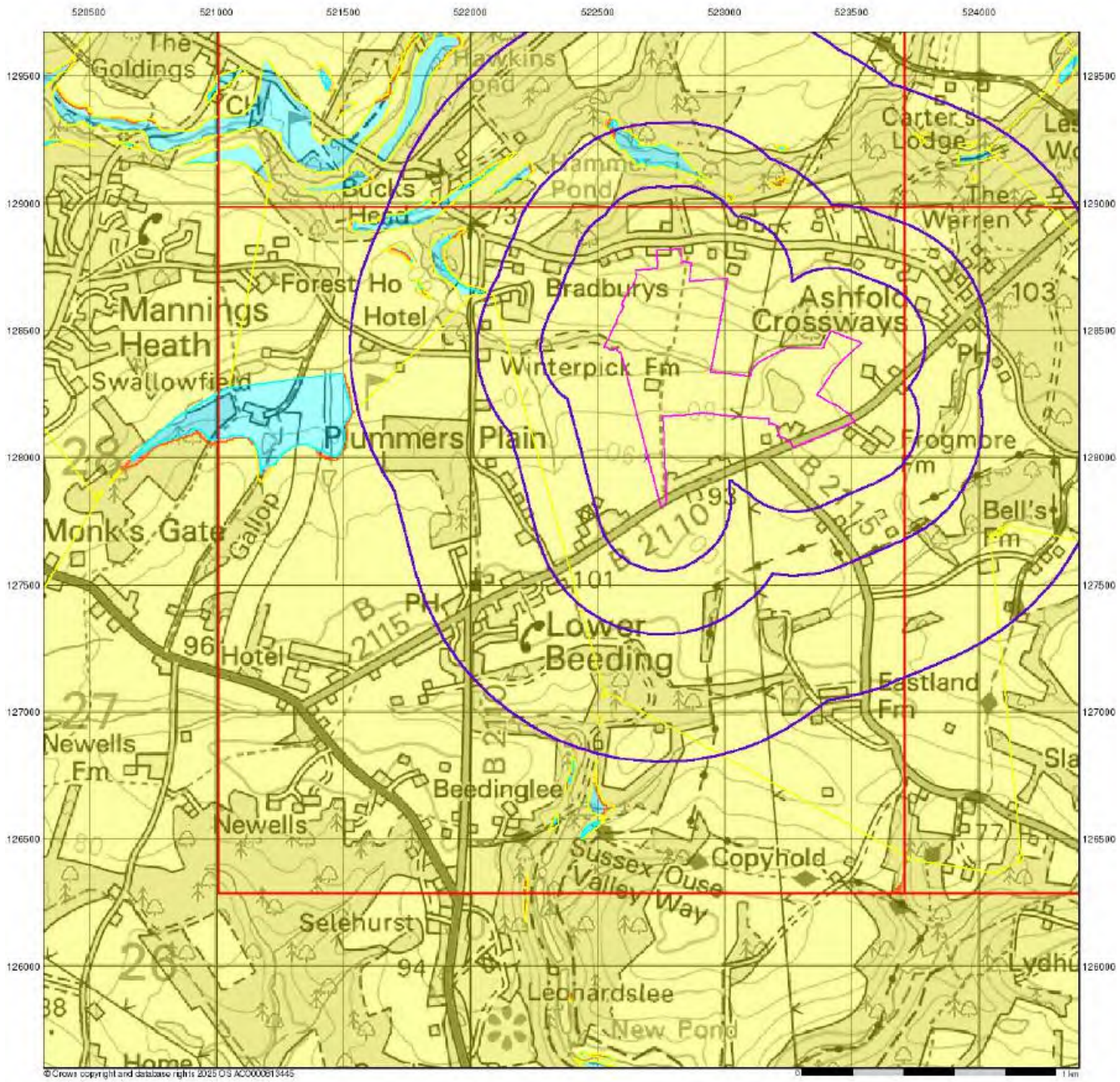
Order Details

Order Number:	369891876_1_1
Customer Ref:	1ecst2/2410067
National Grid Reference:	522690, 128000
Slice:	A
Site Area (Ha):	37.3
Search Buffer (m):	1000

Site Details

Site at, Plummers Plain, West Sussex

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



motion

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

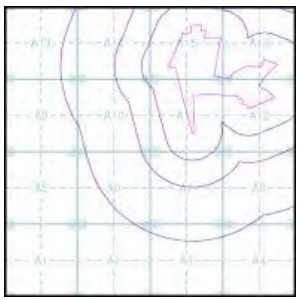
General

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

GeoSmart Information Groundwater Flooding Risk

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

GeoSmart Information Groundwater Flood Map - Slice A



Order Details

Order Number:	369891876_1_1
Customer Ref:	1ecst2/2410067
National Grid Reference:	522690, 128000
Slice:	A
Site Area (Ha):	37.3
Search Buffer (m):	1000

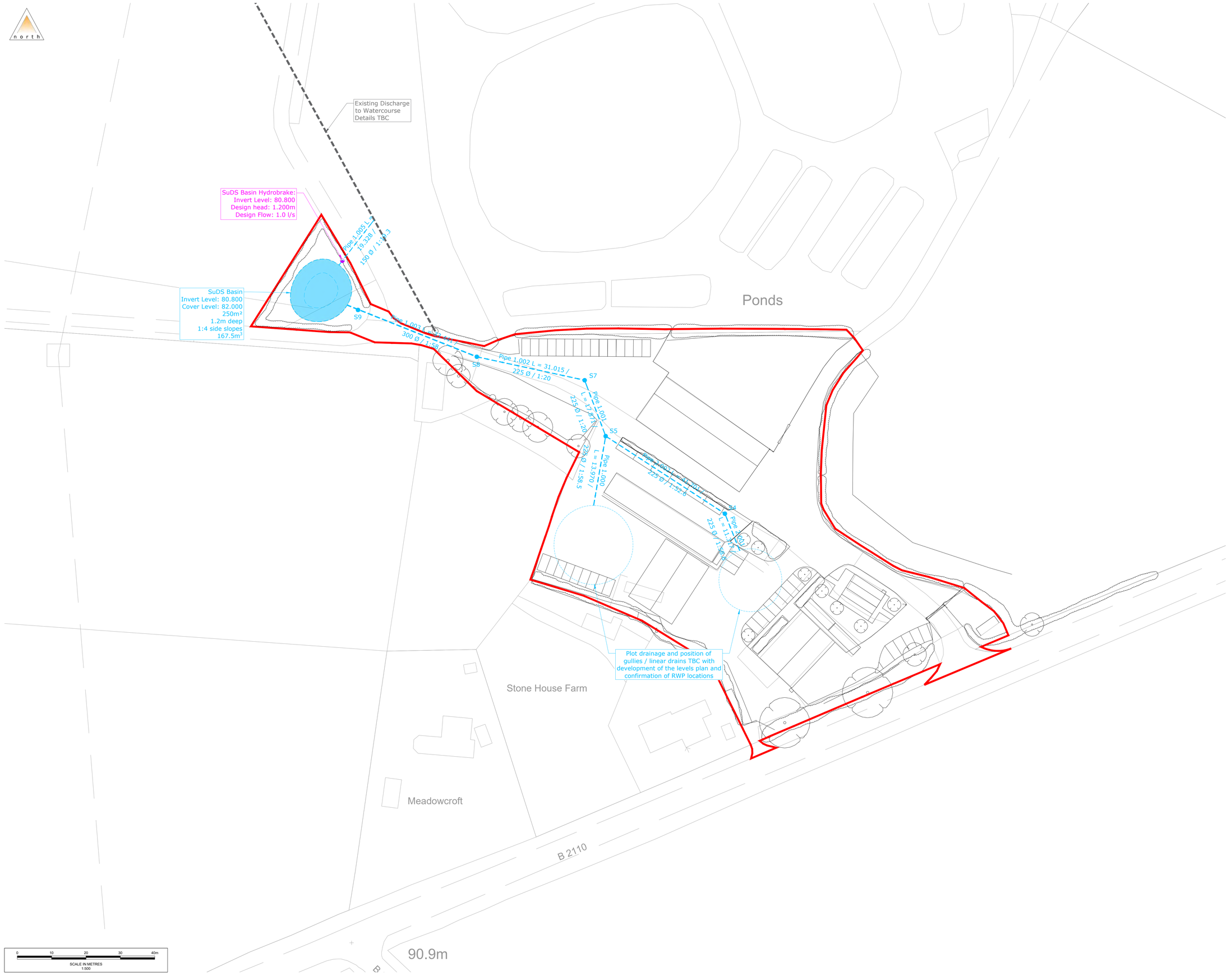
Site Details

Site at, Plummers Plain, West Sussex

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

Appendix O

Drainage Strategy Layouts



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
5. All works to the adopted system are to be carried out in accordance with Sewers for Adoption, 7th Edition.
6. All works to the private drainage system to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
7. 350mm min cover to be provided for private pipes laid in soft/paved areas. 900mm min cover to be provided for private pipes laid beneath roads/driveways unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
8. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- New SuDS Basin
- New Surface Water Gravity Pipe
- Existing Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure

Rev.	Description	Drn	Chk	App	Date
P02	Second Issue	PA	PA	PA	28/02/2025
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

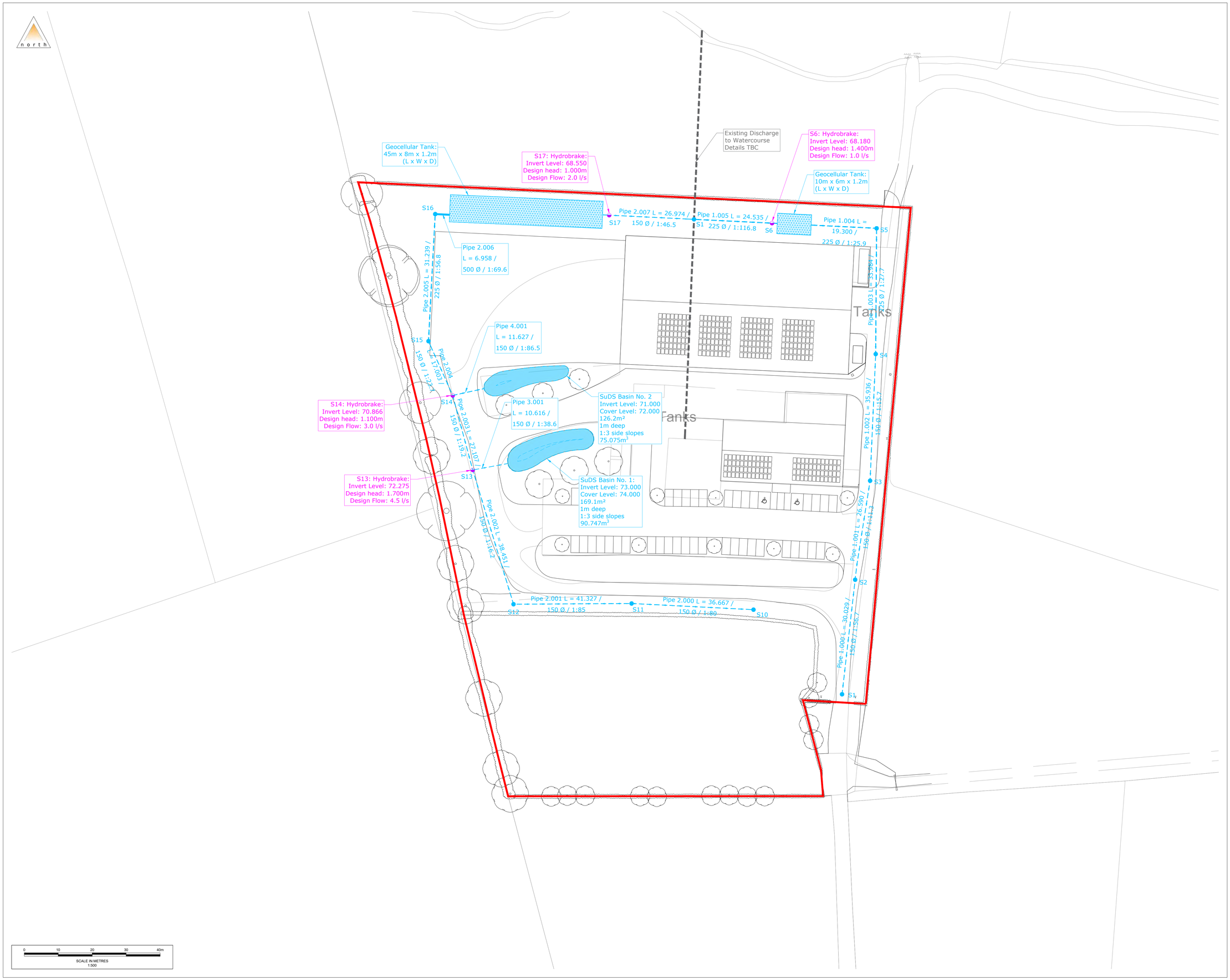
Client:
Lakeside Investments Limited

Project:
Stonehouse Farm

Title:
Stonehouse Business Park
Drainage Strategy

Scale: 1:500 (@ A1)

Drawing: 2501022-0502
Revision: P02



Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
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8. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- Gecellular Attenuation Tank
- New SuDS Basin
- New Surface Water Gravity Pipe
- Existing Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure

Rev.	Description	Drn	Chk	App	Date
P02	Second Issue	PA	PA	PA	28/02/2025
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lakeside Investments Limitied

Project:
Stonehouse Farm

Title:
Lot 8
Drainage Strategy

Scale: 1:500 (@ A1)

Drawing: 2501022-0501

Revision: P02

C:\Users\phillen\Motion\Staff\Site - 1ecsd3 2501022\Drawings\2501022-0501-P01 [Drainage Strategy - Lot 8].dwg

north

104.7m

Hammerpond Road

Silo

Building 3 - Open Sided

Building 2

Building 1

Building 5

Temporary Building

Jackson's Farm

Public Footpath

Kee

Permeable Paviours:
Total Area: 130m²
Total Subbase Depth: 450mm
Total Volume: 17.550m³

Permeable Paviours:
Total Area: 130m²
Total Subbase Depth: 450mm
Total Volume: 17.550m³

Permeable Paviours:
Total Area: 120m²
Total Subbase Depth: 450mm
Total Volume: 16.200m³

S2: Orifice Plate:
Dia.: 0.037m
Design Head: 0.40m
Design Flow: 1.8 l/s

S7: Orifice Plate:
Dia.: 0.050m
Design Head: 0.45m
Design Flow: 3.5 l/s

S10: Orifice:
Dia.: 0.066m
Design Head: 0.45m
Design Flow: 6.0 l/s

Pipe 1.001 L = 11.219 / 150 Ø / 1:584

Pipe 1.002 L = 4.691 / 150 Ø / 1:99.9

Pipe 1.003 L = 4.920 / 150 Ø / 1:12.9

Pipe 1.004 L = 9.886 / 150 Ø / 1:90.3

Pipe 1.005 L = 42.280 / 150 Ø / 1:148

Pipe 1.006 L = 4.397m / 225 Ø / c1.10

Pipe 2.001 L = 22.776 / 150 Ø / 1:100

Pipe 2.002 L = 10.128 / 150 Ø / 1:100

Pipe 2.003 L = 16.385 / 150 Ø / 1:25.8

Pipe 3.001 L = 22.776 / 150 Ø / 1:100

Pipe 3.002 L = 6.675 / 150 Ø / 1:100

Pipe 3.003 L = 10.323 / 150 Ø / 1:60.0

Pipe 3.004 L = 31.857 / 150 Ø / 1:61.7

Geocellular Tank:
8m x 3m x 1.2m
(L x W x D)
95% porosity
Volume 31.929m³

Geocellular Tank:
12m x 3m x 1.2m
(L x W x D)
95% porosity

Geocellular Tank:
12m x 3m x 1.2m
(L x W x D)
95% porosity

S1: Hydrobrake:
CL: 105.000 mAOD
IL: 102.725mAOD
Design Head: 2.40m
Design Flow:1.0 l/s

S9: Hydrobrake:
CL: 105.000 mAOD
IL: 103.141mAOD
Design Head: 2.00m
Design Flow:1.0 l/s

S12: Hydrobrake:
CL: 105.000 mAOD
IL: 103.194mAOD
Design Head: 1.85m
Design Flow:1.0 l/s

Discharge to watercourse at bottom of valley

A

B

C

S1 S2 S3 S4 S5 S6 S7 S8 S9 S10 S11 S12 S13 S14

0 4 8 12 16m
SCALE IN METRES
1:200

Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
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8. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- Permeable Paviours
- Gecellular Attenuation Tank
- New Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure
- New Manhole

Rev.	Description	Drn	Chk	App	Date
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lakeside Investments Limited

Project:
Stonehouse Farm - Jacksons Ridge

Title:
Jackson's Farm
Drainage Strategy

Scale: 1:200 (@ A1)

Drawing: 2410067-0501

Revision: P01

C:\Users\phillen\Motion\SaffStie - 1ecst2 2410067\Drawings\2410067-0501-P01 [Drainage Strategy].dwg

Appendix P

Stonehouse Business Park MicroDrainage Modelling Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 522650 128400 TQ 22650 28400
Data Type	Catchment
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	0.600
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.052	4-8	0.055	8-12	0.051	12-16	0.050	16-20	0.002

Total Area Contributing (ha) = 0.209

Total Pipe Volume (m^3) = 8.464

Network Design Table for Storm

« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	13.970	0.239	58.5	0.110	15.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	7.475	0.178	42.0	0.045	15.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	11.300	0.628	18.0	0.035	15.00	0.0	0.600	o	100	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	92.74	15.14	85.800	0.110	0.0	0.0	0.0	1.71	68.1	36.8
2.000	92.92	15.08	86.800	0.045	0.0	0.0	0.0	1.56	27.5	15.1
3.000	92.85	15.10	87.300	0.035	0.0	0.0	0.0	1.83	14.4	11.6

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
2.001	11.317	0.193	58.6	0.011	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.002	41.701	0.793	52.6	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.001	17.871	0.894	20.0	0.008	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.002	31.015	1.551	20.0	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.003	33.441	0.577	58.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.004	13.184	1.465	9.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	
1.005	19.247	1.000	19.2	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
2.001	92.48	15.21	86.547	0.091	0.0	0.0	0.0	1.71	68.1	30.4
2.002	91.25	15.60	86.354	0.091	0.0	0.0	0.0	1.81	71.9	30.4
1.001	90.93	15.70	85.561	0.209	0.0	0.0	0.0	2.94	116.9	68.5
1.002	90.39	15.87	84.668	0.209	0.0	0.0	0.0	2.94	116.9	68.5
1.003	89.58	16.14	83.042	0.209	0.0	0.0	0.0	2.07	146.2	68.5
1.004	89.46	16.19	82.465	0.209	0.0	0.0	0.0	5.27	372.6	68.5
1.005	89.05	16.33	80.800	0.209	0.0	0.0	0.0	2.31	40.8«	68.5

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.015	0.015	0.015
	User	-	100	0.095	0.095	0.110
2.000	User	-	100	0.015	0.015	0.015
	User	-	100	0.030	0.030	0.045
3.000	User	-	100	0.005	0.005	0.005
	User	-	100	0.030	0.030	0.035
2.001	User	-	100	0.011	0.011	0.011
2.002	-	-	100	0.000	0.000	0.000
1.001	User	-	100	0.008	0.008	0.008
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.000	0.000	0.000
1.005	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.209	0.209	0.209

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.005	Outfall	81.000	79.800	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	0.840
Data Type	Catchment	Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: SuDS Basin, DS/PN: 1.005, Volume (m³): 2.2

Unit Reference	MD-SHE-0064-2000-1200-2000
Design Head (m)	1.200
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	64
Invert Level (m)	80.800
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	2.0	Kick-Flo®	0.573	1.4
Flush-Flo™	0.282	1.8	Mean Flow over Head Range	-	1.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.5	0.800	1.7	2.000	2.5	4.000	3.5	7.000	4.5
0.200	1.7	1.000	1.8	2.200	2.6	4.500	3.7	7.500	4.7
0.300	1.8	1.200	2.0	2.400	2.7	5.000	3.9	8.000	4.8
0.400	1.7	1.400	2.1	2.600	2.8	5.500	4.0	8.500	5.0
0.500	1.6	1.600	2.3	3.000	3.0	6.000	4.2	9.000	5.1
0.600	1.5	1.800	2.4	3.500	3.3	6.500	4.4	9.500	5.2

Storage Structures for Storm

Tank or Pond Manhole: SuDS Basin, DS/PN: 1.005

Invert Level (m) 80.800

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	53.3	1.200	250.0

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	6	0.792	0.555	0.000	1.347
2.000	1	0.792	0.132	0.000	0.924
3.000	2	0.792	0.089	0.000	0.880
2.001	3	1.078	0.450	0.000	1.528
2.002	4	1.296	1.658	0.000	2.954
1.001	5	1.345	0.711	0.000	2.055
1.002	7	1.507	1.233	0.000	2.740
1.003	8	1.932	2.364	0.000	4.296
1.004	9	1.170	0.932	0.000	2.102
1.005	SuDS Basin	1.357	0.340	167.499	169.196
Total		12.060	8.464	167.499	188.022

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	6	30 Summer	2	+0%					85.865	-0.160
2.000	1	30 Summer	2	+0%					86.844	-0.106
3.000	2	30 Summer	2	+0%	100/30 Summer				87.334	-0.066
2.001	3	30 Summer	2	+0%					86.607	-0.165
2.002	4	30 Summer	2	+0%					86.409	-0.170
1.001	5	30 Summer	2	+0%					85.629	-0.157
1.002	7	30 Summer	2	+0%					84.734	-0.158
1.003	8	30 Summer	2	+0%					83.121	-0.221
1.004	9	30 Summer	2	+0%					82.517	-0.248
1.005	SuDS Basin	360 Summer	2	+0%	2/15 Summer				81.240	0.290

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	0.000	0.19			11.0	OK	
2.000	1	0.000	0.19			4.5	OK	
3.000	2	0.000	0.26			3.5	OK	
2.001	3	0.000	0.16			9.3	OK	
2.002	4	0.000	0.14			9.3	OK	
1.001	5	0.000	0.20			21.1	OK	
1.002	7	0.000	0.19			21.1	OK	
1.003	8	0.000	0.16			21.1	OK	
1.004	9	0.000	0.07			21.1	OK	
1.005	SuDS Basin	0.000	0.05			1.8	SURCHARGED	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 1 Number of Storage Structures 1 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	6	30 Summer	30	+40%					85.922	-0.103
2.000	1	30 Summer	30	+40%					86.883	-0.067
3.000	2	30 Summer	30	+40%	100/30 Summer				87.368	-0.032
2.001	3	30 Summer	30	+40%					86.660	-0.112
2.002	4	30 Summer	30	+40%					86.456	-0.123
1.001	5	30 Summer	30	+40%					85.690	-0.097
1.002	7	30 Summer	30	+40%					84.792	-0.100
1.003	8	30 Summer	30	+40%					83.189	-0.153
1.004	9	30 Summer	30	+40%					82.559	-0.207
1.005	SuDS Basin	480 Winter	30	+40%	2/15 Summer				81.795	0.845

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	0.000	0.57			34.1	OK	
2.000	1	0.000	0.59			13.9	OK	
3.000	2	0.000	0.80			10.8	OK	
2.001	3	0.000	0.50			28.7	OK	
2.002	4	0.000	0.42			28.7	OK	
1.001	5	0.000	0.62			64.5	OK	
1.002	7	0.000	0.59			64.6	OK	
1.003	8	0.000	0.48			64.6	OK	
1.004	9	0.000	0.21			64.6	OK	
1.005	SuDS Basin	0.000	0.05			1.8	FLOOD RISK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	1	Number of Storage Structures	1	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment	
FEH Rainfall Version	2013	Cv (Summer)	1.000	
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000	

Actually FEH2022. Please refer to Section 7 of report for details.

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	6	30 Summer	100	+45%					85.947	-0.078
2.000	1	30 Summer	100	+45%					86.900	-0.050
3.000	2	30 Summer	100	+45%	100/30 Summer				87.452	0.052
2.001	3	30 Summer	100	+45%					86.682	-0.091
2.002	4	30 Summer	100	+45%					86.475	-0.104
1.001	5	30 Summer	100	+45%					85.716	-0.070
1.002	7	30 Summer	100	+45%					84.818	-0.074
1.003	8	30 Summer	100	+45%					83.216	-0.126
1.004	9	30 Summer	100	+45%					82.573	-0.192
1.005	SuDS Basin	600 Winter	100	+45%	2/15 Summer				81.999	1.049

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	6	0.000	0.76			44.9	OK	
2.000	1	0.000	0.78			18.4	OK	
3.000	2	0.000	1.04			14.1	SURCHARGED	
2.001	3	0.000	0.65			37.7	OK	
2.002	4	0.000	0.55			37.8	OK	
1.001	5	0.000	0.81			85.0	OK	
1.002	7	0.000	0.78			85.0	OK	
1.003	8	0.000	0.64			85.2	OK	
1.004	9	0.000	0.28			85.1	OK	
1.005	SuDS Basin	0.000	0.05			2.0	FLOOD RISK	

Appendix Q

Lot 8 MicroDrainage Modelling Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 522650 128400 TQ 22650 28400
Data Type	Catchment
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	1.200
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.337	4-8	0.072	8-12	0.015	12-16	0.015	16-20	0.001

Total Area Contributing (ha) = 0.440

Total Pipe Volume (m³) = 12.465

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	30.029	0.530	56.7	0.004	15.00	0.0	0.600	o	150	Pipe/Conduit	
1.001	26.590	2.350	11.3	0.020	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.002	35.936	2.290	15.7	0.019	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	33.984	1.225	27.7	0.018	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.004	19.300#	0.746	25.9	0.025	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	91.96	15.37	76.270	0.004	0.0	0.0	0.0	1.34	23.7	1.3
1.001	91.49	15.52	75.740	0.024	0.0	0.0	0.0	3.01	53.2	7.9
1.002	90.76	15.76	73.390	0.043	0.0	0.0	0.0	2.56	45.2	14.0
1.003	90.07	15.98	71.025	0.061	0.0	0.0	0.0	2.49	99.2	19.9
1.004	89.70	16.11	69.800	0.086	0.0	0.0	0.0	2.58	102.7	28.0

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	24.535#	0.210	116.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.000	36.667	0.458	80.0	0.011	15.00	0.0	0.600	o	150	Pipe/Conduit	
2.001	41.327	0.486	85.0	0.013	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	38.451	2.370	16.2	0.014	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	3.169	0.044	72.1	0.011	15.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	10.616	0.275	38.6	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.003	27.107	1.409	19.2	0.025	0.00	0.0	0.600	o	150	Pipe/Conduit	
4.000	3.108	0.042	73.8	0.031	15.00	0.0	0.600	o	100	Pipe/Conduit	
4.001	11.627	0.134	86.5	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.004	17.003	0.716	23.7	0.032	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.005	31.239	0.550	56.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
2.006	6.958#	0.100	69.6	0.217	0.00	0.0	0.600	o	500	Pipe/Conduit	
2.007	26.974#	0.580	46.5	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	
1.006	10.960	0.731	15.0	0.000	0.00	0.0	0.600	o	300	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	88.71	16.45	68.180	0.086	0.0	0.0	0.0	1.21	48.1	28.0
2.000	91.42	15.54	76.040	0.011	0.0	0.0	0.0	1.12	19.9	3.6
2.001	89.49	16.17	75.582	0.024	0.0	0.0	0.0	1.09	19.3	7.8
2.002	88.75	16.43	75.095	0.038	0.0	0.0	0.0	2.51	44.4	12.2
3.000	93.00	15.06	73.044	0.011	0.0	0.0	0.0	0.91	7.1	3.6
3.001	92.63	15.17	73.000	0.011	0.0	0.0	0.0	1.62	28.7	3.6
2.003	88.19	16.63	72.275	0.074	0.0	0.0	0.0	2.31	40.8	23.4
4.000	93.00	15.06	71.042	0.031	0.0	0.0	0.0	0.90	7.0«	10.4
4.001	92.40	15.24	71.000	0.031	0.0	0.0	0.0	1.08	19.1	10.4
2.004	87.81	16.76	70.866	0.136	0.0	0.0	0.0	2.08	36.7«	43.3
2.005	86.98	17.06	70.075	0.136	0.0	0.0	0.0	1.74	69.1	43.3
2.006	86.86	17.11	69.300	0.353	0.0	0.0	0.0	2.61	511.9	110.8
2.007	86.23	17.34	68.550	0.353	0.0	0.0	0.0	1.92	76.5«	110.8
1.006	86.11	17.38	67.970	0.440	0.0	0.0	0.0	4.08	288.4	136.7

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	User	-	100	0.004	0.004	0.004
1.001	User	-	100	0.020	0.020	0.020
1.002	User	-	100	0.019	0.019	0.019
1.003	User	-	100	0.018	0.018	0.018
1.004	User	-	100	0.025	0.025	0.025
1.005	-	-	100	0.000	0.000	0.000
2.000	User	-	100	0.011	0.011	0.011
2.001	User	-	100	0.013	0.013	0.013
2.002	User	-	100	0.014	0.014	0.014
3.000	User	-	100	0.011	0.011	0.011
3.001	-	-	100	0.000	0.000	0.000
2.003	User	-	100	0.025	0.025	0.025
4.000	User	-	100	0.031	0.031	0.031
4.001	-	-	100	0.000	0.000	0.000
2.004	User	-	100	0.032	0.032	0.032
2.005	-	-	100	0.000	0.000	0.000
2.006	User	-	100	0.217	0.217	0.217
2.007	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.440	0.440	0.440

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	Outfall	70.500	67.239	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	0.840
Data Type	Catchment	Storm Duration (mins)	30

Online Controls for Storm

Hydro-Brake® Optimum Manhole: 6, DS/PN: 1.005, Volume (m³): 3.6

Unit Reference	MD-SHE-0043-1000-1400-1000
Design Head (m)	1.400
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	43
Invert Level (m)	68.180
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.400	1.0	Kick-Flo®	0.383	0.6
Flush-Flo™	0.189	0.7	Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.6	0.800	0.8	2.000	1.2	4.000	1.6	7.000	2.1
0.200	0.7	1.000	0.9	2.200	1.2	4.500	1.7	7.500	2.1
0.300	0.7	1.200	0.9	2.400	1.3	5.000	1.8	8.000	2.2
0.400	0.6	1.400	1.0	2.600	1.3	5.500	1.9	8.500	2.3
0.500	0.6	1.600	1.1	3.000	1.4	6.000	1.9	9.000	2.3
0.600	0.7	1.800	1.1	3.500	1.5	6.500	2.0	9.500	2.4

Hydro-Brake® Optimum Manhole: 13, DS/PN: 2.003, Volume (m³): 2.8

Unit Reference	MD-SHE-0090-4500-1700-4500
Design Head (m)	1.700
Design Flow (l/s)	4.5
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	90
Invert Level (m)	72.275
Minimum Outlet Pipe Diameter (mm)	150
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.700	4.5	Kick-Flo®	0.806	3.2
Flush-Flo™	0.398	4.0	Mean Flow over Head Range	-	3.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.8	0.600	3.8	1.600	4.4	2.600	5.5	5.000	7.5
0.200	3.7	0.800	3.2	1.800	4.6	3.000	5.9	5.500	7.8
0.300	3.9	1.000	3.5	2.000	4.8	3.500	6.3	6.000	8.1
0.400	4.0	1.200	3.8	2.200	5.1	4.000	6.7	6.500	8.4
0.500	3.9	1.400	4.1	2.400	5.3	4.500	7.1	7.000	8.7

Hydro-Brake® Optimum Manhole: 13, DS/PN: 2.003, Volume (m³): 2.8

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
7.500	9.0	8.000	9.3	8.500	9.6	9.000	9.9	9.500	10.1

Hydro-Brake® Optimum Manhole: 14, DS/PN: 2.004, Volume (m³): 1.9

Unit Reference	MD-SHE-0081-3000-1100-3000
Design Head (m)	1.100
Design Flow (l/s)	3.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	81
Invert Level (m)	70.866
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.100	3.0	Kick-Flo®	0.682	2.4
Flush-Flo™	0.333	3.0	Mean Flow over Head Range	-	2.6

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	2.4	0.800	2.6	2.000	4.0	4.000	5.5	7.000	7.1
0.200	2.9	1.000	2.9	2.200	4.1	4.500	5.8	7.500	7.3
0.300	3.0	1.200	3.1	2.400	4.3	5.000	6.1	8.000	7.6
0.400	3.0	1.400	3.4	2.600	4.5	5.500	6.3	8.500	7.8
0.500	2.9	1.600	3.6	3.000	4.8	6.000	6.6	9.000	8.0
0.600	2.7	1.800	3.8	3.500	5.1	6.500	6.9	9.500	8.2

Hydro-Brake® Optimum Manhole: 17, DS/PN: 2.007, Volume (m³): 4.5

Unit Reference	MD-SHE-0067-2000-1000-2000
Design Head (m)	1.000
Design Flow (l/s)	2.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	67
Invert Level (m)	68.550
Minimum Outlet Pipe Diameter (mm)	100
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.000	2.0	Kick-Flo®	0.599	1.6
Flush-Flo™	0.296	1.9	Mean Flow over Head Range	-	1.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	1.6	0.300	1.9	0.500	1.8	0.800	1.8	1.200	2.2
0.200	1.9	0.400	1.9	0.600	1.6	1.000	2.0	1.400	2.3

Hydro-Brake® Optimum Manhole: 17, DS/PN: 2.007, Volume (m³): 4.5

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
1.600	2.5	2.400	3.0	4.000	3.8	6.000	4.6	8.000	5.2
1.800	2.6	2.600	3.1	4.500	4.0	6.500	4.7	8.500	5.4
2.000	2.7	3.000	3.3	5.000	4.2	7.000	4.9	9.000	5.5
2.200	2.9	3.500	3.5	5.500	4.4	7.500	5.1	9.500	5.7

Storage Structures for Storm

Cellular Storage Manhole: 6, DS/PN: 1.005

Invert Level (m) 68.180 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	60.0	60.0	1.200	60.0	98.4	1.201	0.0	98.4

Tank or Pond Manhole: SuDS Basin 1, DS/PN: 3.001

Invert Level (m) 73.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	30.9	1.000	169.1

Tank or Pond Manhole: SuDS Basin 2, DS/PN: 4.001

Invert Level (m) 71.000

Depth (m)	Area (m²)	Depth (m)	Area (m²)
0.000	33.8	1.000	126.2

Cellular Storage Manhole: 17, DS/PN: 2.007

Invert Level (m) 68.550 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.95
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	360.0	360.0	1.200	360.0	487.2	1.201	0.0	487.2

Volume Summary (Static)

Length Calculations based on Centre-Centre

Pipe Number	USMH Name	Manhole Volume (m³)	Pipe Volume (m³)	Storage Structure Volume (m³)	Total Volume (m³)
1.000	1	1.470	0.531	0.000	2.001
1.001	2	1.470	0.470	0.000	1.940
1.002	3	1.821	0.635	0.000	2.456
1.003	4	2.799	1.351	0.000	4.150
1.004	5	1.357	0.767	0.000	2.125
1.005	6	2.907	0.976	68.419	72.301
2.000	10	3.348	0.648	0.000	3.996
2.001	11	1.604	0.730	0.000	2.334
2.002	12	1.588	0.679	0.000	2.268
3.000	19	1.081	0.025	0.000	1.106
3.001	SuDS Basin 1	1.131	0.188	90.747	92.066
2.003	13	1.951	0.479	0.000	2.430
4.000	21	1.083	0.024	0.000	1.108
4.001	SuDS Basin 2	1.131	0.205	75.075	76.412
2.004	14	1.283	0.300	0.000	1.583
2.005	15	1.329	1.242	0.000	2.571
2.006	16	2.121	1.366	0.000	3.487
2.007	17	3.446	1.073	410.514	415.032
1.006	18	2.861	0.775	0.000	3.636
Total		35.781	12.465	644.755	693.002

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Actually FEH2022. Please refer to Section 7 of report for details.

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	2	+0%					76.282
1.001	2	15 Summer	2	+0%					75.766
1.002	3	15 Summer	2	+0%					73.429
1.003	4	15 Summer	2	+0%					71.073
1.004	5	15 Summer	2	+0%					69.857
1.005	6	360 Summer	2	+0%	2/120 Summer				68.457
2.000	10	30 Summer	2	+0%					76.063
2.001	11	30 Summer	2	+0%					75.622
2.002	12	30 Summer	2	+0%					75.130
3.000	19	30 Summer	2	+0%	30/15 Summer				73.073
3.001	SuDS Basin 1	30 Summer	2	+0%	30/15 Summer				73.060
2.003	13	30 Summer	2	+0%	2/15 Summer				73.193
4.000	21	180 Summer	2	+0%	2/30 Summer				71.248
4.001	SuDS Basin 2	180 Summer	2	+0%	2/30 Summer				71.246
2.004	14	180 Summer	2	+0%	2/15 Summer	100/1440 Summer			71.253
2.005	15	180 Summer	2	+0%					70.106
2.006	16	15 Summer	2	+0%					69.439
2.007	17	720 Summer	2	+0%	2/360 Summer				68.785
1.006	18	600 Summer	2	+0%					67.987

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.138	0.000	0.02			0.4	OK	
1.001	2	-0.124	0.000	0.07			3.5	OK	
1.002	3	-0.111	0.000	0.15			6.5	OK	
1.003	4	-0.177	0.000	0.10			9.4	OK	
1.004	5	-0.168	0.000	0.14			13.4	OK	
1.005	6	0.052	0.000	0.02		288	0.7	SURCHARGED	
2.000	10	-0.127	0.000	0.06			1.1	OK	
2.001	11	-0.110	0.000	0.16			2.9	OK	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	12	-0.116	0.000	0.12			5.0	OK	
3.000	19	-0.071	0.000	0.18			1.1	OK	
3.001	SuDS Basin 1	-0.090	0.000	0.11			2.7	OK	
2.003	13	0.768	0.000	0.10			4.0	SURCHARGED	
4.000	21	0.106	0.000	0.37			2.1	SURCHARGED	
4.001	SuDS Basin 2	0.096	0.000	0.16			2.8	SURCHARGED	
2.004	14	0.237	0.000	0.09			3.0	SURCHARGED	
2.005	15	-0.194	0.000	0.05			3.0	OK	
2.006	16	-0.361	0.000	0.17			37.8	OK	
2.007	17	0.010	0.000	0.03		528	1.9	SURCHARGED	
1.006	18	-0.283	0.000	0.01			2.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 4 Number of Storage Structures 4 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	30	+40%					76.292
1.001	2	15 Summer	30	+40%					75.794
1.002	3	15 Summer	30	+40%					73.475
1.003	4	15 Summer	30	+40%					71.126
1.004	5	15 Summer	30	+40%					69.926
1.005	6	480 Winter	30	+40%	2/120 Summer				69.065
2.000	10	30 Summer	30	+40%					76.082
2.001	11	15 Summer	30	+40%					75.666
2.002	12	15 Summer	30	+40%					75.168
3.000	19	60 Winter	30	+40%	30/15 Summer				73.377
3.001	SuDS Basin 1	60 Winter	30	+40%	30/15 Summer				73.375
2.003	13	15 Summer	30	+40%	2/15 Summer				73.573
4.000	21	360 Winter	30	+40%	2/30 Summer				71.746
4.001	SuDS Basin 2	360 Winter	30	+40%	2/30 Summer				71.745
2.004	14	360 Winter	30	+40%	2/15 Summer	100/1440 Summer			71.753
2.005	15	360 Winter	30	+40%					70.106
2.006	16	15 Summer	30	+40%					69.599
2.007	17	1440 Summer	30	+40%	2/360 Summer				69.273
1.006	18	120 Winter	30	+40%					67.988

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.128	0.000	0.05			1.2	OK	
1.001	2	-0.096	0.000	0.28			14.2	OK	
1.002	3	-0.065	0.000	0.61			26.6	OK	
1.003	4	-0.124	0.000	0.42			38.8	OK	
1.004	5	-0.099	0.000	0.60			55.7	OK	
1.005	6	0.660	0.000	0.02		632	0.8	SURCHARGED	
2.000	10	-0.108	0.000	0.18			3.4	OK	
2.001	11	-0.066	0.000	0.56			10.5	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	12	-0.078	0.000	0.46			19.6	OK	
3.000	19	0.233	0.000	0.44			2.6	SURCHARGED	
3.001	SuDS Basin 1	0.225	0.000	0.14			3.5	SURCHARGED	
2.003	13	1.148	0.000	0.10			3.9	SURCHARGED	
4.000	21	0.604	0.000	0.45			2.5	FLOOD RISK	
4.001	SuDS Basin 2	0.595	0.000	0.17			3.0	FLOOD RISK	
2.004	14	0.737	0.000	0.09			3.0	FLOOD RISK	
2.005	15	-0.194	0.000	0.05			3.0	OK	
2.006	16	-0.201	0.000	0.67			147.1	OK	
2.007	17	0.498	0.000	0.03		1392	1.9	SURCHARGED	
1.006	18	-0.282	0.000	0.01			2.7	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	4	Number of Storage Structures	4	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm)	300.0	DVD Status	ON
Analysis Timestep	Fine	Inertia Status	ON
DTS Status	OFF		

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 600, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)
1.000	1	30 Summer	100	+45%					76.296
1.001	2	15 Summer	100	+45%					75.803
1.002	3	15 Summer	100	+45%					73.492
1.003	4	15 Summer	100	+45%					71.143
1.004	5	15 Summer	100	+45%					69.951
1.005	6	600 Winter	100	+45%	2/120 Summer				69.391
2.000	10	30 Summer	100	+45%					76.089
2.001	11	15 Summer	100	+45%					75.682
2.002	12	15 Summer	100	+45%					75.180
3.000	19	60 Winter	100	+45%	30/15 Summer				73.499
3.001	SuDS Basin 1	60 Winter	100	+45%	30/15 Summer				73.496
2.003	13	15 Summer	100	+45%	2/15 Summer				73.909
4.000	21	480 Winter	100	+45%	2/30 Summer				71.919
4.001	SuDS Basin 2	480 Winter	100	+45%	2/30 Summer				71.918
2.004	14	480 Winter	100	+45%	2/15 Summer	100/1440 Summer			71.925
2.005	15	2880 Summer	100	+45%					70.106
2.006	16	15 Summer	100	+45%					69.659
2.007	17	2160 Summer	100	+45%	2/360 Summer				69.549
1.006	18	1440 Winter	100	+45%					67.989

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	1	-0.124	0.000	0.07			1.6	OK	
1.001	2	-0.087	0.000	0.36			18.5	OK	
1.002	3	-0.048	0.000	0.80			34.7	OK	
1.003	4	-0.107	0.000	0.54			50.6	OK	
1.004	5	-0.074	0.000	0.78			72.6	OK	
1.005	6	0.986	0.000	0.02		750	0.9	SURCHARGED	
2.000	10	-0.101	0.000	0.24			4.5	OK	
2.001	11	-0.050	0.000	0.73			13.7	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Surcharged Depth (m)	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
2.002	12	-0.065	0.000	0.59			25.5	OK	
3.000	19	0.355	0.000	0.59			3.5	SURCHARGED	
3.001	SuDS Basin 1	0.346	0.000	0.14			3.7	SURCHARGED	
2.003	13	1.484	0.000	0.11			4.4	FLOOD RISK	
4.000	21	0.777	0.000	0.47			2.7	FLOOD RISK	
4.001	SuDS Basin 2	0.768	0.000	0.18			3.1	FLOOD RISK	
2.004	14	0.909	0.000	0.09			3.0	FLOOD RISK	
2.005	15	-0.194	0.000	0.05			3.0	OK	
2.006	16	-0.141	0.000	0.87			190.6	OK	
2.007	17	0.774	0.000	0.03		1944	2.0	SURCHARGED	
1.006	18	-0.281	0.000	0.01			2.9	OK	

Appendix R

Jacksons Ridge MicroDrainage Modelling Results

STORM SEWER DESIGN by the Modified Rational Method

Design Criteria for Storm

Pipe Sizes STANDARD Manhole Sizes STANDARD

FEH Rainfall Model

Return Period (years)	100
FEH Rainfall Version	2013
Site Location	GB 522650 128400 TQ 22650 28400
Data Type	Catchment
Maximum Rainfall (mm/hr)	550
Maximum Time of Concentration (mins)	30
Foul Sewage (l/s/ha)	0.000
Volumetric Runoff Coeff.	1.000
PIMP (%)	100
Add Flow / Climate Change (%)	0
Minimum Backdrop Height (m)	0.200
Maximum Backdrop Height (m)	1.500
Min Design Depth for Optimisation (m)	0.900
Min Vel for Auto Design only (m/s)	1.00
Min Slope for Optimisation (1:X)	500

Designed with Level Soffits

Time Area Diagram for Storm

Time (mins)	Area (ha)	Time (mins)	Area (ha)
0-4	0.095	4-8	0.129

Total Area Contributing (ha) = 0.224

Total Pipe Volume (m³) = 18.799

Network Design Table for Storm

- Indicates pipe length does not match coordinates
« - Indicates pipe capacity < flow

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.000	2.168	0.100	21.7	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
1.001	11.219	0.192	58.4	0.036	0.00	0.0	0.600	o	100	Pipe/Conduit	
1.002	11.691	0.117	99.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.003	4.970#	0.386	12.9	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.004	9.886	0.110	90.3	0.031	0.00	0.0	0.600	o	150	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.000	93.12	15.02	104.520	0.000	0.0	0.0	0.0	1.67	13.1	0.0
1.001	92.50	15.21	104.420	0.036	0.0	0.0	0.0	1.01	7.9«	12.0
1.002	91.87	15.40	104.178	0.036	0.0	0.0	0.0	1.01	17.8	12.0
1.003	91.78	15.43	104.061	0.036	0.0	0.0	0.0	2.82	49.9	12.0
1.004	91.28	15.59	102.725	0.067	0.0	0.0	0.0	1.06	18.7«	22.1

Network Design Table for Storm

PN	Length (m)	Fall (m)	Slope (1:X)	I.Area (ha)	T.E. (mins)	Base Flow (l/s)	k (mm)	HYD SECT	DIA (mm)	Section Type	Auto Design
1.005	16.280	0.110	148.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.000	1.893	0.100	18.9	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
2.001	22.776	0.228	100.0	0.043	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.002	10.128#	0.101	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
2.003	16.383	0.635	25.8	0.037	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.000	2.799	0.100	28.0	0.000	15.00	0.0	0.600	o	100	Pipe/Conduit	
3.001	20.949	0.209	100.3	0.046	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.002	6.675#	0.067	100.0	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.003	10.323	0.172	60.0	0.031	0.00	0.0	0.600	o	150	Pipe/Conduit	
3.004	31.857	0.516	61.7	0.000	0.00	0.0	0.600	o	150	Pipe/Conduit	
1.006	397.278	36.862	10.8	0.000	0.00	0.0	0.600	o	225	Pipe/Conduit	

Network Results Table

PN	Rain (mm/hr)	T.C. (mins)	US/IL (m)	Σ I.Area (ha)	Σ Base Flow (l/s)	Foul (l/s)	Add Flow (l/s)	Vel (m/s)	Cap (l/s)	Flow (l/s)
1.005	90.27	15.92	102.616	0.067	0.0	0.0	0.0	0.82	14.6«	22.1
2.000	93.14	15.02	104.520	0.000	0.0	0.0	0.0	1.78	14.0	0.0
2.001	91.89	15.40	104.420	0.043	0.0	0.0	0.0	1.00	17.8	14.3
2.002	91.35	15.56	104.192	0.043	0.0	0.0	0.0	1.00	17.8	14.3
2.003	90.93	15.70	103.141	0.080	0.0	0.0	0.0	1.99	35.2	26.3
3.000	93.09	15.03	104.520	0.000	0.0	0.0	0.0	1.46	11.5	0.0
3.001	91.94	15.38	104.420	0.046	0.0	0.0	0.0	1.00	17.7	15.3
3.002	91.58	15.49	104.211	0.046	0.0	0.0	0.0	1.00	17.8	15.3
3.003	91.17	15.62	103.194	0.077	0.0	0.0	0.0	1.30	23.0«	25.3
3.004	89.90	16.04	103.022	0.077	0.0	0.0	0.0	1.28	22.7«	25.3
1.006	85.32	17.69	102.506	0.224	0.0	0.0	0.0	4.01	159.4	69.0

Area Summary for Storm

Pipe Number	PIMP Type	PIMP Name	PIMP (%)	Gross Area (ha)	Imp. Area (ha)	Pipe Total (ha)
1.000	-	-	100	0.000	0.000	0.000
1.001	-	-	100	0.036	0.036	0.036
1.002	-	-	100	0.000	0.000	0.000
1.003	-	-	100	0.000	0.000	0.000
1.004	-	-	100	0.031	0.031	0.031
1.005	-	-	100	0.000	0.000	0.000
2.000	-	-	100	0.000	0.000	0.000
2.001	-	-	100	0.043	0.043	0.043
2.002	-	-	100	0.000	0.000	0.000
2.003	-	-	100	0.037	0.037	0.037
3.000	-	-	100	0.000	0.000	0.000
3.001	-	-	100	0.046	0.046	0.046
3.002	-	-	100	0.000	0.000	0.000
3.003	-	-	100	0.031	0.031	0.031
3.004	-	-	100	0.000	0.000	0.000
1.006	-	-	100	0.000	0.000	0.000
				Total	Total	Total
				0.224	0.224	0.224

Free Flowing Outfall Details for Storm

Outfall Pipe Number	Outfall Name	C. Level (m)	I. Level (m)	Min I. Level (m)	D,L (mm)	W (mm)
1.006	Outfall	66.500	65.644	0.000	0	0

Simulation Criteria for Storm

Volumetric Runoff Coeff	1.000	Additional Flow - % of Total Flow	0.000
Areal Reduction Factor	1.000	MADD Factor * 10m³/ha Storage	0.000
Hot Start (mins)	0	Inlet Coeffiecient	0.800
Hot Start Level (mm)	0	Flow per Person per Day (l/per/day)	0.000
Manhole Headloss Coeff (Global)	0.500	Run Time (mins)	60
Foul Sewage per hectare (l/s)	0.000	Output Interval (mins)	1

Number of Input Hydrographs	0	Number of Offline Controls	0	Number of Time/Area Diagrams	0
Number of Online Controls	6	Number of Storage Structures	6	Number of Real Time Controls	0

Synthetic Rainfall Details

Rainfall Model	FEH	Summer Storms	Yes
Return Period (years)	100	Winter Storms	No
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	0.840
Data Type	Catchment	Storm Duration (mins)	30

Online Controls for Storm

Orifice Manhole: 2, DS/PN: 1.001, Volume (m³): 0.7

Diameter (m) 0.037 Discharge Coefficient 0.600 Invert Level (m) 104.420

Hydro-Brake® Optimum Manhole: 5, DS/PN: 1.004, Volume (m³): 2.6

Unit Reference	MD-SHE-0038-1000-2400-1000
Design Head (m)	2.400
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	38
Invert Level (m)	102.725
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.400	1.0	Kick-Flo®	0.337	0.4
Flush-Flo™	0.164	0.5	Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.5	0.800	0.6	2.000	0.9	4.000	1.3	7.000	1.6
0.200	0.5	1.000	0.7	2.200	1.0	4.500	1.3	7.500	1.7
0.300	0.5	1.200	0.7	2.400	1.0	5.000	1.4	8.000	1.7
0.400	0.5	1.400	0.8	2.600	1.0	5.500	1.5	8.500	1.8
0.500	0.5	1.600	0.8	3.000	1.1	6.000	1.5	9.000	1.8
0.600	0.5	1.800	0.9	3.500	1.2	6.500	1.6	9.500	1.9

Orifice Manhole: 7, DS/PN: 2.001, Volume (m³): 0.7

Diameter (m) 0.050 Discharge Coefficient 0.600 Invert Level (m) 104.420

Hydro-Brake® Optimum Manhole: 9, DS/PN: 2.003, Volume (m³): 2.3

Unit Reference	MD-SHE-0040-1000-2000-1000
Design Head (m)	2.000
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	40
Invert Level (m)	103.141
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.000	1.0	Kick-Flo®	0.355	0.5
Flush-Flo™	0.173	0.6	Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake®

Hydro-Brake® Optimum Manhole: 9, DS/PN: 2.003, Volume (m³): 2.3

Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.5	0.800	0.7	2.000	1.0	4.000	1.4	7.000	1.8
0.200	0.6	1.000	0.7	2.200	1.0	4.500	1.4	7.500	1.8
0.300	0.5	1.200	0.8	2.400	1.1	5.000	1.5	8.000	1.9
0.400	0.5	1.400	0.9	2.600	1.1	5.500	1.6	8.500	1.9
0.500	0.5	1.600	0.9	3.000	1.2	6.000	1.6	9.000	2.0
0.600	0.6	1.800	1.0	3.500	1.3	6.500	1.7	9.500	2.0

Orifice Manhole: 10, DS/PN: 3.001, Volume (m³): 0.7

Diameter (m) 0.066 Discharge Coefficient 0.600 Invert Level (m) 104.420

Hydro-Brake® Optimum Manhole: 12, DS/PN: 3.003, Volume (m³): 2.1

Unit Reference	MD-SHE-0040-1000-1850-1000
Design Head (m)	1.850
Design Flow (l/s)	1.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	40
Invert Level (m)	103.194
Minimum Outlet Pipe Diameter (mm)	75
Suggested Manhole Diameter (mm)	1200

Control Points	Head (m)	Flow (l/s)	Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.850	1.0	Kick-Flo®	0.360	0.5
Flush-Flo™	0.178	0.6	Mean Flow over Head Range	-	0.7

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake® Optimum as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	0.6	0.800	0.7	2.000	1.0	4.000	1.4	7.000	1.8
0.200	0.6	1.000	0.8	2.200	1.1	4.500	1.5	7.500	1.9
0.300	0.6	1.200	0.8	2.400	1.1	5.000	1.6	8.000	1.9
0.400	0.5	1.400	0.9	2.600	1.2	5.500	1.6	8.500	2.0
0.500	0.6	1.600	0.9	3.000	1.2	6.000	1.7	9.000	2.1
0.600	0.6	1.800	1.0	3.500	1.3	6.500	1.8	9.500	2.1

Storage Structures for Storm

Porous Car Park Manhole: 2, DS/PN: 1.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	36.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	104.420	Cap Volume Depth (m)	0.450

Cellular Storage Manhole: 5, DS/PN: 1.004

Invert Level (m)	102.725	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	28.0	28.0	1.200	28.0	55.6	1.201	0.0	55.6

Porous Car Park Manhole: 7, DS/PN: 2.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	13.0
Max Percolation (l/s)	36.1	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	104.420	Cap Volume Depth (m)	0.450

Cellular Storage Manhole: 9, DS/PN: 2.003

Invert Level (m)	103.141	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	36.0	36.0	1.200	36.0	72.0	1.201	0.0	72.0

Porous Car Park Manhole: 10, DS/PN: 3.001

Infiltration Coefficient Base (m/hr)	0.00000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	12.0
Max Percolation (l/s)	33.3	Slope (1:X)	0.0
Safety Factor	2.0	Depression Storage (mm)	5
Porosity	0.30	Evaporation (mm/day)	3
Invert Level (m)	104.420	Cap Volume Depth (m)	0.450

Cellular Storage Manhole: 12, DS/PN: 3.003

Invert Level (m)	103.194	Safety Factor	2.0
Infiltration Coefficient Base (m/hr)	0.00000	Porosity	0.95
Infiltration Coefficient Side (m/hr)	0.00000		

Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)	Depth (m)	Area (m²)	Inf. Area (m²)
0.000	36.0	36.0	1.200	36.0	72.0	1.201	0.0	72.0

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	J1	240 Summer	2	+0%					104.528	-0.092
1.001	2	240 Summer	2	+0%	2/120 Summer				104.530	0.010
1.002	3	240 Summer	2	+0%	30/720 Winter				104.200	-0.128
1.003	4	240 Summer	2	+0%	30/480 Winter				104.076	-0.135
1.004	5	480 Summer	2	+0%	2/60 Summer				103.108	0.233
1.005	6	30 Winter	2	+0%					102.635	-0.131
2.000	J2	180 Summer	2	+0%					104.526	-0.094
2.001	7	180 Summer	2	+0%	30/15 Summer	100/480 Summer			104.528	-0.042
2.002	8	180 Summer	2	+0%	30/360 Summer				104.223	-0.119
2.003	9	480 Summer	2	+0%	2/60 Summer				103.540	0.249
3.000	J3	120 Summer	2	+0%					104.522	-0.098
3.001	10	120 Summer	2	+0%	30/15 Summer				104.522	-0.048
3.002	11	120 Summer	2	+0%	30/360 Summer				104.251	-0.110
3.003	12	480 Summer	2	+0%	2/60 Summer				103.575	0.231
3.004	13	30 Summer	2	+0%					103.038	-0.134
1.006	14	180 Summer	2	+0%					102.517	-0.214

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	J1	0.000	0.00			0.0	OK*	
1.001	2	0.000	0.12		104	0.9	SURCHARGED	
1.002	3	0.000	0.05			0.9	OK	
1.003	4	0.000	0.02			0.9	OK	
1.004	5	0.000	0.03		288	0.5	SURCHARGED	
1.005	6	0.000	0.04			0.5	OK	
2.000	J2	0.000	0.00			0.0	OK*	
2.001	7	0.000	0.09		63	1.5	OK	6
2.002	8	0.000	0.10			1.5	OK	
2.003	9	0.000	0.02		328	0.6	SURCHARGED	
3.000	J3	0.000	0.00			0.0	OK*	

2 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.001	10	0.000	0.14		48	2.4	OK	
3.002	11	0.000	0.16			2.4	OK	
3.003	12	0.000	0.03		320	0.6	SURCHARGED	
3.004	13	0.000	0.03			0.6	OK	
1.006	14	0.000	0.01			1.6	OK	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	J1	360 Winter	30	+40%					104.620	0.000
1.001	2	180 Summer	30	+40%	2/120 Summer				104.749	0.229
1.002	3	720 Winter	30	+40%	30/720 Winter				104.400	0.072
1.003	4	720 Winter	30	+40%	30/480 Winter				104.398	0.187
1.004	5	720 Winter	30	+40%	2/60 Summer				104.397	1.522
1.005	6	720 Winter	30	+40%					102.640	-0.126
2.000	J2	15 Summer	30	+40%					104.620	0.000
2.001	7	120 Summer	30	+40%	30/15 Summer	100/480 Summer			104.756	0.186
2.002	8	360 Winter	30	+40%	30/360 Summer				104.497	0.155
2.003	9	360 Winter	30	+40%	2/60 Summer				104.496	1.205
3.000	J3	15 Summer	30	+40%					104.620	0.000
3.001	10	60 Summer	30	+40%	30/15 Summer				104.743	0.173
3.002	11	480 Winter	30	+40%	30/360 Summer				104.424	0.063
3.003	12	480 Winter	30	+40%	2/60 Summer				104.424	1.080
3.004	13	480 Winter	30	+40%					103.041	-0.131
1.006	14	720 Winter	30	+40%					102.523	-0.208

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	J1	0.000	0.00			0.0	SURCHARGED*	
1.001	2	0.000	0.21		123	1.6	FLOOD RISK	
1.002	3	0.000	0.08			1.3	SURCHARGED	
1.003	4	0.000	0.03			1.3	SURCHARGED	
1.004	5	0.000	0.05		540	0.8	SURCHARGED	
1.005	6	0.000	0.06			0.8	OK	
2.000	J2	0.000	0.01			0.1	SURCHARGED*	
2.001	7	0.000	0.17		76	2.9	FLOOD RISK	6
2.002	8	0.000	0.15			2.4	SURCHARGED	
2.003	9	0.000	0.03		624	0.8	SURCHARGED	
3.000	J3	0.000	0.01			0.1	SURCHARGED*	

30 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.001	10	0.000	0.29		38	4.9	FLOOD RISK	
3.002	11	0.000	0.19			2.9	SURCHARGED	
3.003	12	0.000	0.04		560	0.8	SURCHARGED	
3.004	13	0.000	0.04			0.8	OK	
1.006	14	0.000	0.02			2.5	OK	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

Simulation Criteria

Areal Reduction Factor	1.000	Additional Flow - % of Total Flow	0.000
Hot Start (mins)	0	MADD Factor * 10m³/ha Storage	0.000
Hot Start Level (mm)	0	Inlet Coeffiecient	0.800
Manhole Headloss Coeff (Global)	0.500	Flow per Person per Day (l/per/day)	0.000
Foul Sewage per hectare (l/s)	0.000		

Number of Input Hydrographs 0 Number of Offline Controls 0 Number of Time/Area Diagrams 0
Number of Online Controls 6 Number of Storage Structures 6 Number of Real Time Controls 0

Synthetic Rainfall Details

Rainfall Model	FEH	Data Type	Catchment
FEH Rainfall Version	2013	Cv (Summer)	1.000
Site Location	GB 522650 128400 TQ 22650 28400	Cv (Winter)	1.000

Actually FEH2022. Please refer to Section 7 of report for details.

Margin for Flood Risk Warning (mm) 300.0 DVD Status ON
Analysis Timestep Fine Inertia Status ON
DTS Status OFF

Profile(s)	Summer and Winter
Duration(s) (mins)	15, 30, 60, 120, 180, 240, 360, 480, 720, 960, 1440, 2160, 2880, 4320, 5760
Return Period(s) (years)	2, 30, 100
Climate Change (%)	0, 40, 45

PN	US/MH Name	Storm	Return Period	Climate Change	First (X) Surcharge	First (Y) Flood	First (Z) Overflow	Overflow Act.	Water Level (m)	Surcharged Depth (m)
1.000	J1	15 Summer	100	+45%					104.620	0.000
1.001	2	180 Summer	100	+45%	2/120 Summer				104.859	0.339
1.002	3	480 Winter	100	+45%	30/720 Winter				104.786	0.458
1.003	4	480 Winter	100	+45%	30/480 Winter				104.787	0.576
1.004	5	480 Winter	100	+45%	2/60 Summer				104.787	1.912
1.005	6	480 Winter	100	+45%					102.642	-0.124
2.000	J2	15 Summer	100	+45%					104.620	0.000
2.001	7	480 Winter	100	+45%	30/15 Summer	100/480 Summer			105.001	0.431
2.002	8	720 Winter	100	+45%	30/360 Summer				104.983	0.641
2.003	9	720 Winter	100	+45%	2/60 Summer				104.983	1.692
3.000	J3	15 Summer	100	+45%					104.620	0.000
3.001	10	480 Winter	100	+45%	30/15 Summer				104.863	0.293
3.002	11	480 Winter	100	+45%	30/360 Summer				104.844	0.483
3.003	12	480 Winter	100	+45%	2/60 Summer				104.843	1.499
3.004	13	480 Winter	100	+45%					103.042	-0.130
1.006	14	480 Winter	100	+45%					102.525	-0.206

PN	US/MH Name	Flooded Volume (m³)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
1.000	J1	0.000	0.00			0.0	SURCHARGED*	
1.001	2	0.000	0.25		144	1.9	FLOOD RISK	
1.002	3	0.000	0.10			1.7	FLOOD RISK	
1.003	4	0.000	0.04			1.7	FLOOD RISK	
1.004	5	0.000	0.06		912	0.9	FLOOD RISK	
1.005	6	0.000	0.07			0.9	OK	
2.000	J2	0.000	0.01			0.1	SURCHARGED*	
2.001	7	0.972	0.16		224	2.7	FLOOD	6
2.002	8	0.000	0.14			2.3	FLOOD RISK	
2.003	9	0.000	0.03		1092	1.0	FLOOD RISK	
3.000	J3	0.000	0.01			0.1	SURCHARGED*	

100 year Return Period Summary of Critical Results by Maximum Level (Rank 1) for Storm

PN	US/MH Name	Flooded Volume (m^3)	Flow / Cap.	Overflow (l/s)	Half Drain Time (mins)	Pipe Flow (l/s)	Status	Level Exceeded
3.001	10	0.000	0.21		184	3.6	FLOOD RISK	
3.002	11	0.000	0.24			3.6	FLOOD RISK	
3.003	12	0.000	0.05		864	0.9	FLOOD RISK	
3.004	13	0.000	0.04			0.9	OK	
1.006	14	0.000	0.02			2.8	OK	

Appendix S

Package Sewage Treatment Plant Inspection Certificates

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Customer	HUNTER GROUP - STONEHOUSE FARM	Resource	Ashley Headon
Contact	Lee Goossens		
Address	Handcross Road, Plummers Plain Horsham RH13 6NZ	Job type	Matrix Service
		Reference	SM0000-0377
		Date	01/10/2024 10:00
Billing address	Hunter Group - Parent Contact Lower Nash, Nutbourne Lane, Nutbourne PULBOROUGH RH20 2HS		

Notes Service the Office tank - JDK200 - Diaphragms last changed 28/12/23

Lee Goossens

Stock items

				Pickup		Drop-off	
Product category	**Model**	**Serial number**	**Usage**	**Quantity**	**Location**	**Quantity**	**Location**
Air Pump	Bibus SE41 Diaphragm Kit JDK 150 - 500 5700014					1.000	Hunter Group - Stonehouse Farm
Air Pump	Bibus SE42 JDK-150 - 500 Air Filters 5700012					1.000	Hunter Group - Stonehouse Farm

STP SERVICE REPORT

	Answer	Notes
Purpose of Visit	Routine Service	

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Check Chamber, Kiosk & Manhole Security & Condition	Completed (All OK)
Visually Inspect System. Listen for Unusual Noises.	Completed (All OK)
Check for any significant odours	Completed (All OK)
Remove Cover from Plant	Yes
Take Sample of the Final Effluent and Visually Inspect	Visually Poor
Comments	Aeration poorly distributed. I have adjusted the aeration to each section
DMS/DMC/MATRIX: Check Colour of Aeration Chamber	Good
Check for Excessive Suds,Rags & Other Non-Biodegradable Material	Good
Check Sludge Density is Less than 70%	
Remove and Clean Diffuser	Completed
Remove Cover from Airbox	Yes
Existing Air Pump Type	JDK200
Existing Air Pump Serial Number	U2487
Carry out Air Pressure Test	0.22
Date of Last Overhaul or Replacement	Diaghragms replaced on this service
Replacement Air Pump Type	
Replacement Air Pump Serial No.	
Check Air Alarm	Checked
Clean Filter or Replace as Required	Replaced
Clean Out Airbox [END DMS/DMC/MATRIX]	Completed
Check Outlet Manhole	All Clear
Check Outlet to Ditch	N/A
Remove and Clean Submersible Pump	N/A
Replace all Covers	Yes
Site Cleaned & Tidied	Yes

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Checked System is Operational	Yes
New Parts Fitted	Yes
Temporary Equipment Fitted	No
NOTES:	I've adjusted the aeration to improve how well its distributed across the plant. New diaghragms and air filter fitted to compressor. Working ok.
Engineer Signature	Ashley Headon 
Incident or First Aid To Report?	No

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102642

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102640

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102108

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102103

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_110211

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_104626

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102646

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_102644

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Customer	HUNTER GROUP - STONEHOUSE FARM	Resource	Ashley Headon
Contact	Lee Goossens		
Address	Handcross Road, Plummers Plain Horsham RH13 6NZ	Job type	Matrix Service
		Reference	SM0000-0378
		Date	01/10/2024 11:00
Billing address	Hunter Group - Parent Contact Lower Nash, Nutbourne Lane, Nutbourne PULBOROUGH RH20 2HS		

Notes: Complete service to Matrix system, ET60 - Service last changed 19/2/24 - the commercial yard W3W cadet.blaring.pitching

Lee Goossens

STP SERVICE REPORT

	Answer	Notes
Purpose of Visit	Routine Service	
Check Chamber, Kiosk & Manhole Security & Condition	Completed (All OK)	
Visually Inspect System. Listen for Unusual Noises.	Completed (All OK)	
Check for any significant odours	Completed (All OK)	
Remove Cover from Plant	Yes	
Take Sample of the Final Effluent and Visually Inspect	Visually Good	
Comments		

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

DMS/DMC/MATRIX: Check Colour of Aeration Chamber	Good
Check for Excessive Suds,Rags & Other Non-Biodegradable Material	Good
Decant Sludge into Aeration Chamber	Yes
Check Sludge Density is Less than 70%	
Remove and Clean Diffuser	Completed
Remove Cover from Airbox	Yes
Existing Air Pump Type	ET60
Existing Air Pump Serial Number	30/22/1475
Carry out Air Pressure Test	0.18
Date of Last Overhaul or Replacement	
Replacement Air Pump Type	
Replacement Air Pump Serial No.	
Check Air Alarm	Checked
Clean Filter or Replace as Required	Checked
Clean Out Airbox [END DMS/DMC/MATRIX]	Completed
Check Condition of the Pipework	OK
Check Outlet Manhole	All Clear
Check Outlet to Ditch	N/A
Remove and Clean Submersible Pump	N/A
Replace all Covers	Yes
Site Cleaned & Tidied	Yes
Checked System is Operational	Yes
New Parts Fitted	No
Temporary Equipment Fitted	No

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

NOTES:	Some damage inside the tank. The final chamber section wall has broken and now out of place. It is not movable so am unable to repair. Damage does not look repairable. Otherwise system working ok. Thin layer of sludge and clean effluent going out.
Engineer Signature	Ashley Headon 
Incident or First Aid To Report?	No

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_091851

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_090952

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_091236

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_091233

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

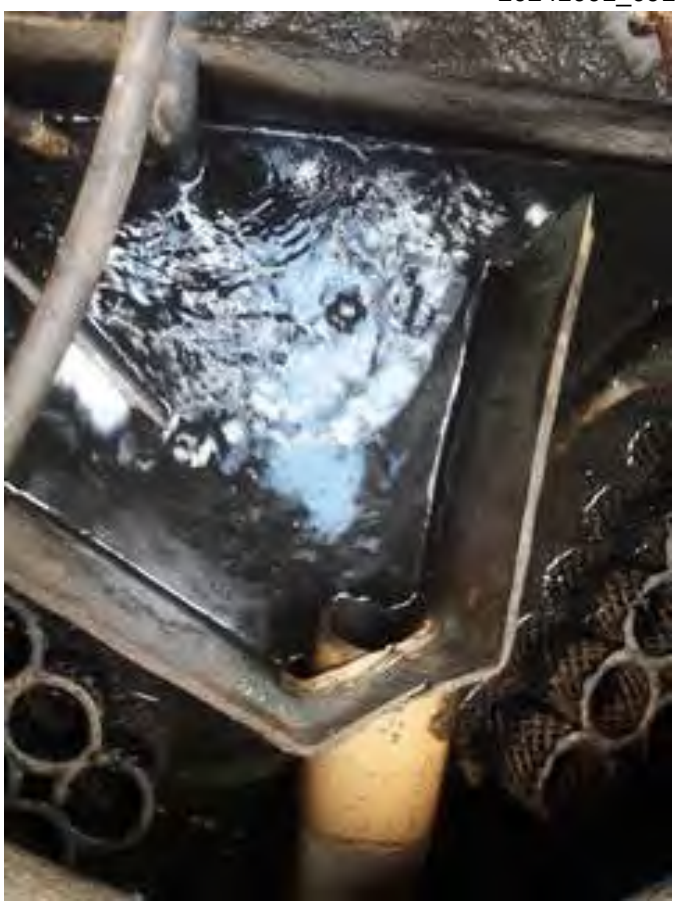
20241001_091006

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_090959

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_091808



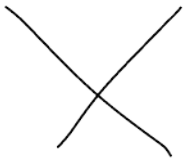
Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_091804

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Customer	HUNTER GROUP - STONEHOUSE FARM	Resource	Ashley Headon
Contact	Lee Goossens		
Address	Handcross Road, Plummers Plain Horsham RH13 6NZ	Job type	Matrix Service
		Reference	SM0000-0379
		Date	01/10/2024 12:00
Billing address	Hunter Group - Parent Contact Lower Nash, Nutbourne Lane, Nutbourne PULBOROUGH RH20 2HS		

Notes: Complete service to the Matrix system and ET60 Compressor - Service kit last changed 19/2/24



Lee Goossens

Stock items

				Pickup		Drop-off	
Product category	**Model**	**Serial number**	**Usage**	**Quantity**	**Location**	**Quantity**	**Location**
Air Pump	Bibus SE41 Diaphragm Kit JDK 150 - 500 5700014					1.000	Hunter Group - Stonehouse Farm
Air Pump	Bibus SE42 JDK-150 - 500 Air Filters 5700012					1.000	Hunter Group - Stonehouse Farm

STP SERVICE REPORT

	Answer	Notes
Purpose of Visit	Routine Service	

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

Check Chamber, Kiosk & Manhole Security & Condition	Completed (All OK)
Visually Inspect System. Listen for Unusual Noises.	Completed (All OK)
Check for any significant odours	Completed (All OK)
Remove Cover from Plant	Yes
Take Sample of the Final Effluent and Visually Inspect	Visually Good
Comments	
DMS/DMC/MATRIX: Check Colour of Aeration Chamber	Good
Check for Excessive Suds,Rags & Other Non-Biodegradable Material	Good
Check Sludge Density is Less than 70%	
Remove and Clean Diffuser	Completed
Remove Cover from Airbox	Yes
Existing Air Pump Type	JDK200
Existing Air Pump Serial Number	T5012
Carry out Air Pressure Test	0.22
Date of Last Overhaul or Replacement	Diaghragms replaced on this service
Replacement Air Pump Type	
Replacement Air Pump Serial No.	
Check Air Alarm	Checked
Clean Filter or Replace as Required	Replaced
Clean Out Airbox [END DMS/DMC/MATRIX]	Completed
Check Outlet Manhole	All Clear
Check Outlet to Ditch	N/A
Remove and Clean Submersible Pump	N/A
Replace all Covers	Yes
Site Cleaned & Tidied	Yes
Checked System is Operational	Yes

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

New Parts Fitted	Yes
Temporary Equipment Fitted	No
NOTES:	I've adjusted the aeration for better distribution. Solenoid working ok. New diaghragms and air filter fitted to compressor. All ok.
Engineer Signature	Ashley Headon 
Incident or First Aid To Report?	No

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_113402

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_113110

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_120110

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_115120

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_113407

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_113406

Wendage Pollution Control Ltd
Rangeways Farm
Conford, Liphook
GU30 7QP

20241001_113107

Appendix T

SDS Aqua-Swirl Details

SDS
Water Infrastructure Systems

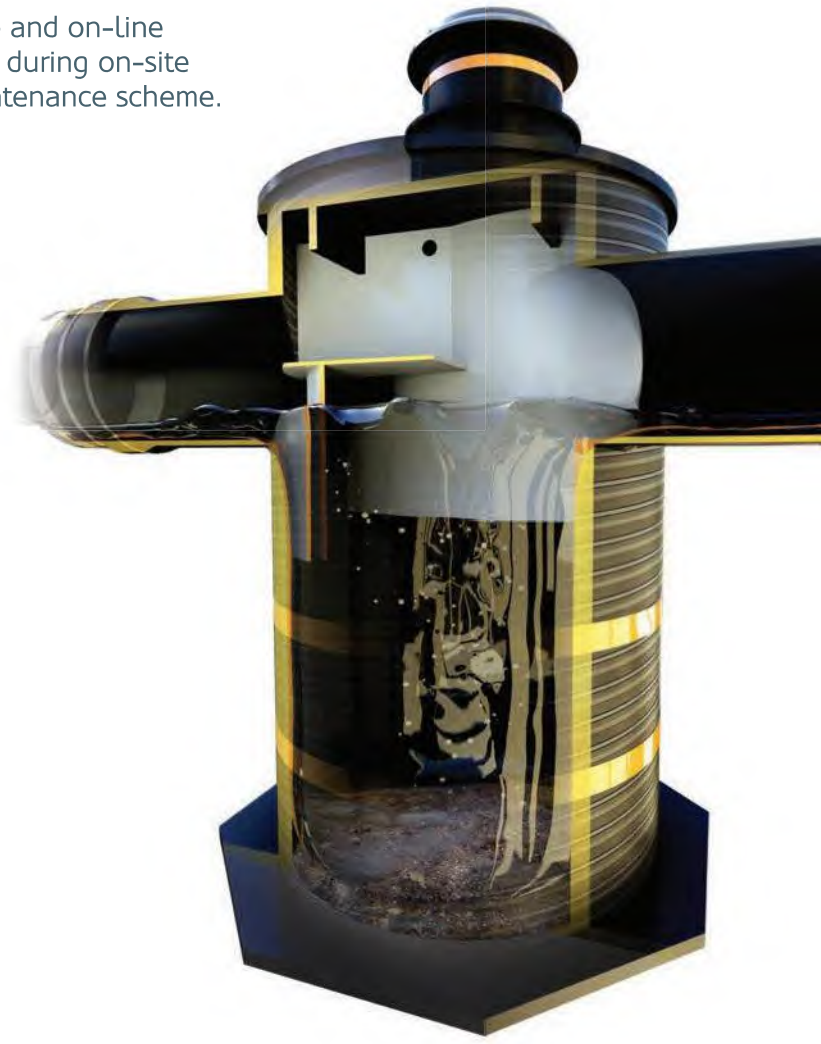
SDS Aqua-Swirl™

Hydrodynamic Vortex Separator

SDS Aqua-Swirl™ is a custom engineered, flow through water quality device that utilises hydrodynamic separation technology to maximise the removal of coarse sediment, debris and free floating oil within surface water runoff.

SDS Aqua-Swirl™ can be installed in both off-line and on-line configurations. It is suitable for use both after and during on-site construction, with the inclusion of a planned maintenance scheme.

- *No moving parts*
- *Sealed baffle vented to surface*
- *Large debris storage chamber*
- *Lifting supports*
- *HDPE plastic construction*
- *Compact dimensions*
- *Available in 9 different sizes*
- *Bespoke sizing available*



SDS Aqua-Swirl™ is sized according to water quality treatment flow rates which are based on the initial movement of pollutants into the storm drainage system. This flow rate typically represents approximately 90% to 95% of the total pollutants in the runoff volume.
The treatment flow rate of the SDS Aqua-Swirl™ system is engineered to meet or exceed the local water quality treatment criteria and form an intrinsic part of the SuDS solution train.

sdslimited.com

SDS Ltd, Clearwater House, Castlemills, Biddisham, Somerset, BS26 2RE

T: +44 (0)1934 751303
E: info@sdslimited.com

Features	Benefits
Manufactured from high strength plastic components with no moving parts included.	Offers a durable, light weight and low cost alternative to concrete. Easy and quick to install resulting in substantial cost savings.
Specialised sealed baffle vented to the surface.	Delivers the most effective performance of any vortex separator.
Large debris and sediment storage capacity.	Limits the amount of maintenance required.
Single swirl chamber.	Simplifies inspection and maintenance facilities with no special equipment required.
Compact dimensions.	Reduces ground excavation and product installation costs.
Small footprint design.	Can be retro-fitted with minimal disruption to existing infrastructure utilities or surface features, extending the ability to meet new regulations.
Suitable for use during site construction programme.	Can be put into operation prior to completion of the site build, with the inclusion of a planned maintenance schedule.
Installation lifting supports.	Easy installation without the need for large, expensive cranes.
Available in 9 different standard sizes.	Provides greater design flexibility and assists the removal of sediments at a greater rate than comparable systems.
Bespoke units can be manufactured.	Satisfies even the most demanding installations.

SPECIFICATIONS

Aqua-Swirl Model No.	Aquashield Chamber Diameter mm	Swirl chamber diameter mm	Maximum internal diameter pipe connection mm		Water Quality Treatment Flowrate litres/sec	Oil/debris storage capacity litres	Sediment storage capacity m^3
			Off line	BYP[1]	*OK110		
AS-2	762	750	225	375	30	136	0.3
AS-3	991	1000	300	500	53	416	0.6
AS-4	1295	1200	300	600	77	644	0.8
AS-5	1524	1500	300	750	120	1382	1.3
AS-6	1829	1800	375	900	173	1439	1.8
AS-7	2134	2100	400	900	235	1987	2.5
AS-8	2438	2400	450	1200	307	2612	3.3
AS-9	2743	2800	600	1200	418	3596	4.4
AS-10	3048	3000	600	1500	480	4164	5.1

[1]BYP (Internal Bypass) provides full treatment of the first flush of water while the peak design storm is diverted and chanelled through the main conveyance pipe. SDS can supply further details.
*based on OK110 particle size (110 avg micron size).

Notes:
Details of mitigation indices available upon request.
Connection pipe sizes available (mm inner diameter): 150, 225, 300, 375, 400, 450, 500, 600, 750, 900, 1200, 1500.
The sediment storage capacity has been calculated in accordance with the relevant test protocol and is not a physical maximum; any additional sediment capacity required is achieved with bespoke deeper units.
For assistance in design and specific sizing using historical rainfall data, please contact SDS.
CAD details and specifications are available on request.

A-S DS/0818

SDS Ltd, Clearwater House, Castlemills, Biddisham, Somerset, BS26 2RE
T: +44 (0)1934 751303
E: info@sdslimited.com

Installation & Maintenance

SDS Aqua Swirl ™ Hydrodynamic Separator

Aqua-Swirl™ systems are fabricated from high performance HDPE materials; they are durable lightweight and can be installed without use of heavy lifting equipment.

Lifting support Straps are provided to allow easy off loading and installation, resulting in significantly reduced installation costs.

Installation:

1) Excavation to required size and depth allowing for 600mm around each side of the unit

2) Prepare the bed with 20-40mm clean stone to a depth of 300mm

3) Compacted in 150mm layers to ASTM D 2321 to a proctor density of 95%

4) Install the unit and backfill with 20-40mm clean stone in 150mm layers to ASTM D 2321 enough backfill should be placed over components prior to using heavy compaction or construction equipment to prevent damage.

5) Connect to drainage network pipework with rubber couplings like Fernco, Flex Seal or Band Seal.

6) The Aqua Swirl has a round base box section plate extending 100mm from the outside diameter to provide mitigation against buoyancy, concrete can be poured directly over and into the base plate if required to provide additional resistive force.

7) Aqua Swirls of AS-6 and above have both a base plate and top plate

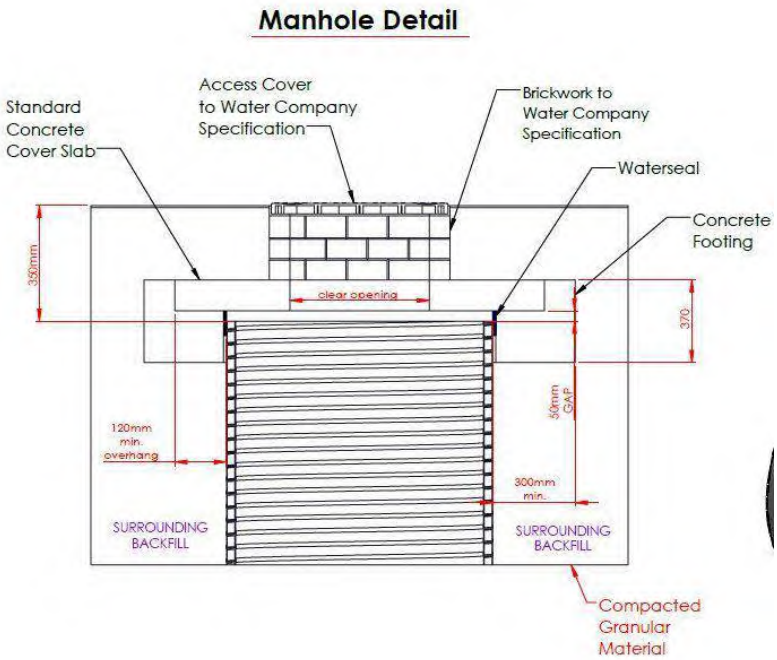
8) The riser pipe is supplied to the required length to allow for a standard UK man hole installation detail and can be cut to size on site to the required depth.

9) Where traffic loading is required a reinforced concrete pad must be placed over the entire Aqua swirl as per design calculated by engineer.

10) If traffic loading is not required, it's recommended that bollards are placed around access risers in non-traffic areas to prevent inadvertent loadings by maintenance vehicles.

Product illustration:



System Operation:

The Aqua-Swirl®

Can be installed in an “off-line” configuration. Or, depending on local regulations, an “in-line” (on-line) conveyance flow diversion system can be used. The CFD model allows simple installation by connecting directly to the existing storm conveyance pipe thereby providing full treatment of the “first flush,” while the peak design storm is diverted and channelled through the main conveyance pipe

The patented Aqua-Swirl® Stormwater Treatment System provides a highly effective means for the removal of sediment, floating debris, and free oil. Swirl technology, or vortex separation, is a proven form of treatment utilized in the Stormwater industry to accelerate gravitational separation.

The treatment operation begins when Stormwater enters the Aqua-Swirl® through a tangential inlet pipe that produces a circular (or vortex) flow pattern that causes contaminates to settle to the base of the unit. Since Stormwater flow is intermittent by nature, the Aqua-Swirl® retains water between storm events providing both dynamic and quiescent settling of solids. The dynamic settling occurs during each storm event while the quiescent settling takes place between successive storms.

A combination of gravitational and hydrodynamic drag forces encourages the solids to drop out of the flow and migrate to the center of the chamber where velocities are the lowest.

The treated flow then exits the Aqua-Swirl® behind the arched outer baffle. The top of the baffle is sealed across the treatment channel, thereby eliminating floatable pollutants from escaping the system. A vent pipe is extended up the riser to expose the backside of the baffle to atmospheric conditions, preventing a siphon from forming at the bottom of the baffle.

Maintenance:

Long term performance of the Aqua Swirl or any other device depends on inspection and maintenance program.

Recommended schedule in line with Ciria C753 guidance

On hand over – 3 months -6 months -12 months and then annually or as deemed necessary from details obtain from previous inspections.

Each site sediment loadings will be different and at its highest just after the build phase, hence why a more frequent visit is required at the start of the programme.

The Aqua-Swirl® has been designed to minimize and simplify the inspection and maintenance process. The single chamber system can be inspected and maintained entirely from the surface thereby eliminating the need for confined space entry. Furthermore, the entire structure (specifically, the floor) is accessible for visual inspection from the surface. There are no areas of the structure that are blocked from visual inspection or periodic cleaning. Inspection of any free- floating oil and floatable debris can be directly observed and maintained through the manhole access provided directly over the swirl chamber.

Inspection:

To inspect the Aqua-Swirl®, remove the manhole cover.

The only tools needed to inspect the Aqua-Swirl® system are a flashlight and a measuring device such as a stadia rod or pole. Given the easy and direct accessibility provided, floating oil and debris can be observed directly from the surface. Sediment depths can easily be determined by lowering a measuring device to the top of the sediment pile and to the surface of the water. When the sediment pile is within 42 to 48 inches of the water surface (or sediment pile thickness is 18 to 24 inches as measured from the base), the system should be maintained. The maximum Sediment storage capacity of the Aqua-Swirl® is reached when the sediment pile is within 30 inches of the water surface (or sediment accumulation is 36 inches thick as measured from the base).

It should be noted that to avoid underestimating the volume of sediment in the chamber, the measuring device must be carefully lowered to the top of the sediment pile. Keep in mind that the finer sediment at the top of the pile may offer less resistance to the measuring device than the larger particles which typically occur deeper within the sediment pile.

The Aqua-Swirl® design allows for the sediment to accumulate in a semi-conical fashion as illustrated above. That is, the depth to sediment as measured below the water surface may be less in the center of the swirl chamber; and likewise, may be greater at the edges of the swirl chamber.

Removal:

Cleaning the Aqua-Swirl® is simple and quick. Free-floating oil and floatable debris can be observed and removed directly through the 750mm service access riser provided. A vacuum truck is typically used to remove the accumulated sediment and debris. An advantage of the Aqua-Swirl® design is that the entire sediment storage area can be reached with a vacuum hose from the surface (reaching all the sides). Since there are no multiple or limited (hidden or “blind”) chambers in the Aqua-Swirl®, there are no restrictions to impede on-site maintenance tasks.

Disposal:

All removed products should be disposed of in line with local council requirements

SDS Limited mitigation indices for stormwater treatment devices November 2018

The pollution mitigation indices are as follows:

Device	Total suspended solids mitigation index	Total metals mitigation index	Soluble metals mitigation index[1]	Hydrocarbons[3]
Aqua-swirl™ vortex grit separator	0.8 (0.5 on trunk roads and motorways where the suspended solids level is very high)	0.5[4]	The Aquaswirl™ is not designed to remove soluble pollutants	0.7[3]
Aqua-filter™ stormwater filtration unit	0.8	0.8	0.6	0.7[3]
Aqua-swirl™ and Aqua-filter™ in sequence	1.2[2]	0.9	0.6	1.0[2,3]
Aqua-Xchange™	0.8 when installed as a layer in a filter drain	0.9	1.0	0.6 when installed as a layer in a filter drain

These indices can only be assumed when the treatment device is properly sized for the anticipated rate of runoff and the level of pollution in the runoff is not unusually high.

[1] When drainage schemes are designed for road developments in accordance with the Design Manual for Roads and Bridges, the mitigation index for soluble metals is required because particulate metals are considered separately in the total suspended solids assessment

[2] When designing in accordance with the SuDS Manual (Ciria C753), when two devices are used in sequence to target the same pollutant, half of the mitigation index of the second component should be allowed in the calculation.

[3] The test procedures applied to manufactured treatment devices do not include measurement of hydrocarbon removal. Therefore, we have estimated that the Aqua-swirl™ removes free-phase hydrocarbons by flotation, and also removes hydrocarbons that are adhered to suspended solids. However, hydrocarbons are known to preferentially adhere to the smaller particles so the Aqua-filter™ will also remove a high proportion of those hydrocarbons as it is more effective at removing smaller suspended particles.

[4] Where metals are present in the runoff in particulate form, particularly from vehicle emissions, the Aqua-swirl™ will effectively remove those particles in admixture with other suspended solids.

Appendix U

Drainage Management and Maintenance Plan

Stonehouse Farm, Handcross Road, Horsham

Drainage Management & Maintenance Plan

For

Lake Investments Limited

motion

Document Control Sheet

Stonehouse Farm, Handcross Road, Horsham

Lake Investments Limited

This document has been issued and amended as follows:

Date	Issue	Prepared by	Approved by
26th February 2025	FINAL	Phil Allen MCIWEM C.WEM	Neil Jaques

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Contents

1.0 Introduction

1.1 This document sets out the suggested principles for the long-term management and maintenance of the surface water drainage systems on the proposed developments on Stonehouse Farm.

1.2 The purpose of this document is to ensure that Lake Investments Limited or the site management company has a robust inspection and maintenance plan in place for the lifetime of the development. This ensures the optimum operation of the surface water drainage system and that it will be maintained in perpetuity. This will contribute to reducing the risk of surface water flooding both on- and off-site.

1.3 All those responsible for maintenance should follow relevant health and safety legislation for all activities listed within this report (including lone working, if relevant). Method statements and risk assessments should always be undertaken and made available, if requested.

1.4 This document has been produced by Motion on behalf of their client, Lake Investments Limited. This document describes the typical management and maintenance tasks that are known at the design stage (maintenance frequencies and typical tasks, for example). These have been drawn from industry guidance such as CIRIA C753 - The SuDS Manual – and manufacturer's own guidance.

1.5 Maintenance is considered as a construction activity under the CDM Regulations 2015. Under the CDM Regulations, it is a requirement that a competent person be appointed to carry out a required role. CDM defines a competent person as an individual with sufficient knowledge of the specific tasks to be undertaken, as well as sufficient experience and ability to carry out their duties in relation to the task in a way that secures health and safety on site.

1.6 In recognition of the requirements of the CDM Regulations 2015, this drainage management and maintenance plan expects that the maintenance work will be carried out by a competent person who must have prior knowledge of the drainage components and SuDS systems on site.

1.7 There are limitations on what this document can prescribe at the planning stage (outline or full). This document cannot name the specific company or individuals who will carry out the maintenance and what equipment is to be used. Related to this, this document is unable to provide method statements for exactly how maintenance practices will be carried out. These can only be determined at the time of the maintenance being carried out through the exact maintenance need and the safe systems of work held by the company carrying out the work. Therefore, this is to be the responsibility of the site management company and/or the individuals carrying out the work. We urge those who are carrying out the maintenance to record this information and make it available to the Local Planning Authority (LPA), if required to do so. This drainage management and maintenance plan needs to be a living document that is owned and maintained by the adopting site management company and should be adhered to for the lifetime of the development.

2.0 Maintenance Categories

2.1 There are three categories of maintenance activities referred to in this report. These are:

Inspection and Monitoring

- Inspection and monitoring tasks should be carried out frequently, nominally once a month, and should include a visual inspection of all components including all inlets and outlets.

Regular Maintenance (Monthly)

- Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management and litter removal.

Seasonal Maintenance (Quarterly)

- Seasonal maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (leaf litter and sediment removal is an example).

Remedial Maintenance

- Remedial maintenance comprises of intermittent tasks that may be required to rectify faults associated with the system that have been identified through visual inspections. The likelihood of faults can be minimised by correct installation, regular inspection and timely maintenance. Where remedial work is found to be necessary, it is likely to be due to site-specific characteristics or unforeseen events and, as such, timings are difficult to predict.

3.0 The Surface Water Drainage System

3.1 The proposed surface water drainage systems specified for the developments on Stonehouse Farm are made up of a number of components/structures. These include:

- Pipes
- Manholes
- Catchpit manholes/silt traps
- Geocellular attenuation tanks
- SuDS basins
- Hydrobrakes/Orifice flow controls
- Water butts (although these will be in private ownership)

3.2 All components should be installed in accordance with the manufacturer's instructions and to the levels/arrangement as defined on the designer's drawings. Not doing so will invalidate any warranty provided by the manufacturer.

3.3 All maintenance and cleaning must be carried out in accordance with manufacturer's recommendations and by competent and suitably qualified staff, as defined in the CDM regulations 2015.

3.4 This document should be read in conjunction with the design drawings of the drainage system, so that the location and type of each feature can be recognised and understood.

3.5 Manufacturer's instructions should be added to this document once specific products have been selected and installed by the contractor. This document will subsequently form the basis for a drainage maintenance regime.

4.0 General Maintenance Principles

4.1 All surface water drainage systems, whether piped gravity systems, Sustainable Drainage Systems (SuDS), or flow control devices and pumps, require regular maintenance to keep them working at optimum efficiency and capacity. The maintenance of the surface water drainage systems at Stonehouse Farm should be carried out alongside other regular maintenance tasks on site.

4.2 Timely and adequate maintenance will increase the lifespan of all the drainage components. Inadequate maintenance will do the reverse. Therefore, the projected lifespan and anticipated replacement date of each drainage component cannot be forecast at the time of this document being produced.

4.3 Lake Investments Limited or their site management agents will be responsible for the maintenance of the surface water drainage system for the lifetime of the development.

4.4 Construction activities can create and discharge significant quantities of sediment that will quickly clog the surface water drainage system. Therefore, construction-stage sediment removal is required immediately post-construction. The construction site manager should assess this and carry out cleaning as necessary.

4.5 Catchpit manholes/silt traps will be specified upstream of the permeable paved areas, as well as other locations on site. They will remove gross solids and the majority of silts. It is important that any debris build-up in the catchpit manholes/silt traps is removed at regular intervals. This will reduce the risk of the permeable paved areas becoming silted up. It will maintain the design capacity and function of this part of the drainage system.

4.6 Cleaning should also take place after large storms when there have been increased surface water flows and visible entrainment and deposition of debris.

4.7 An increased frequency of inspection and maintenance should be programmed into the autumn and winter months in acknowledgement that:

- Leaf fall from deciduous trees in autumn will result in an increased amount of leaf litter and an elevated blockage risk of drainage infrastructure.
- Increased rainfall during winter months will result in greater quantities of water moving through the drainage system and a greater input of silt and other debris.

4.8 Table 4.1, below, gives an overview of required maintenance tasks and the frequency at which they need to be undertaken. Section 5 – Inspection and Maintenance Frequency of Components – will assign typical maintenance frequencies and tasks to the specific components used within the surface water drainage systems proposed at Stonehouse Farm.

Table 4.1: Typical maintenance tasks and frequencies

Activity	Indicative Frequency	Typical Tasks
Inspection and Monitoring	Monthly	▸ Inspection of all inlets, outlets and control structures
Regular Maintenance	Monthly, for the lifetime of the development	▸ Litter picking and debris removal ▸ Weed removal and invasive plant control
Seasonal Maintenance	Quarterly, for the lifetime of the development	▸ Vegetation management around components ▸ Sweeping of pavement areas to remove surface silt ▸ Silt removal from system, including catchpits, cellular storage structures and control structures
Remedial maintenance	As required as a result of inspections, for the lifetime of the development.	▸ Inlet/outlet repairs ▸ Erosion repairs ▸ Reinstatement of edgings ▸ Reinstatement following pollution incidents ▸ Removal of silt build-up and leaf litter after storms ▸ Repair of vandalism ▸ Replacement of any blocked filter membranes/materials

5.0 Inspection and Maintenance Frequency of Components

5.1 Table 5.1 below lists each of the components used within Stonehouse Farm's surface water drainage systems. It suggests an indicative maintenance frequency for each component and ascribes typical maintenance tasks to them.

5.2 This list is not exhaustive, nor is it prescriptive. As mentioned in Section 3, additional, unscheduled maintenance may be required following adverse weather conditions or after autumn leaf falls. Additional maintenance tasks may be required to adequately clean and maintain individual components.

5.3 The list of components should be cross-referenced with the designer's drawings so that the location of each component can be identified.

5.4 It is the responsibility of Lake Investments Limited or their site management agents to ensure that all necessary maintenance activities are carried out in a timely manner and that the design performance of each drainage component is preserved.

5.5 If there is any uncertainty regarding the correct and safe methods of cleaning, or what equipment should be used, the manufacturer should be consulted.

Table 5.1: Maintenance Frequency and Task for Drainage Components

Activity	Indicative Frequency	Anticipated Tasks
Pipes	As required	▸ Identify any pipes that may not be operating properly and employ a competent, qualified contractor to inspect using CCTV. ▸ If the pipe is blocked with silt or debris, the pipe should be jetted clean from an upstream access point. All silt and debris should be captured and removed at a downstream access point. ▸ Inspect once clean. ▸ If any other defects are encountered (cracks, displaced joints, root ingress), appropriate solutions should be discussed with a competent and qualified contractor. These services are usually provided by the same companies that offer CCTV surveys and pipe jetting services.
Manholes	Annually and as required, for the lifetime of the development.	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Catchpit Manholes/Silt Traps	Annually and as required, for the lifetime of the development.	▸ Inspect/identify any damage or areas that are not operating correctly ▸ Remove silt, litter, leaves and other detritus. ▸ Inspect once clean.
Orifice Plates	Inspections at regular intervals (every 3 – 6 months).	▸ Orifice plates have no moving parts to fail and quality units are made of stainless steel to resist scour, degradation and chemical attack. ▸ The orifice plates in this scheme are to be downstream of the permeable paviours, so all contributing flows should be heavily filtered and free of any debris.

		▸ Debris and silt should be removed if present ▸ Check wear on orifice to ensure no enlargement is taking place. ▸ Any visible fixing bolts should be checked. ▸ If there is a suspected blockage, the housing chamber can be inspected internally, the blockage cleared and the orifice returned to its working position.
Hydrobrake chambers	Every three months for the first year, then annually thereafter for the lifetime of the development.	▸ Contact manufacturer for instruction on approved and safe inspection and maintenance practices. ▸ Inspect Hydrobrake and check functionality. Remove any detritus as required. ▸ Inspect once clean.
SuDS Basins	Monthly in Summer, as required in Winter	▸ Responsibility should be with landscape contractors. ▸ Maintenance tasks are not that different from standard public open space. ▸ Adequate access needs to be provided to the area. ▸ Regular mowing should take place across maintenance access routes, amenity areas, across embankments and the main storage area. Remaining areas can remain as 'meadow'. Mowed grass lengths of 75 – 100mm are appropriate. ▸ Grass clippings should be disposed of off-site. ▸ Any dead growth should be cleared before the start of the growing season. ▸ Any permanently wet areas with emergent aquatic vegetation should be managed as ponds or wetlands. ▸ Remove any sediment build-up as required. ▸ Check any inlets and outlets for blockages and clear as required. ▸ Check any flow control devices, if present.
Geocellular Attenuation Tanks	Annually	▸ Contact manufacturer for instruction on approved and safe inspection and maintenance practices. ▸ Inspect/identify any areas that are not operating correctly. ▸ Remove debris from catchment surface. ▸ Remove sediment from pre-treatment structures. ▸ Check for silt build-up and flush and remove as required (in accordance with manufacturer's instructions). ▸ Inspect once clean. ▸ See Table 21.3 of CIRIA C753 for more information. ▸ Most geocellular units have a 60-year creep limited life expectancy, so they should be planned for replacement by 2075 (approx.)

Water Butts (not the responsibility of the adopting site management agency, but individual homeowners)	Annually in Autumn to Winter	▸ Remove falling leaves and seeds from guttering or those that have found their way into the water butt. ▸ Water may stagnate slightly. If so, use a water butt cleaning disc into the tank. ▸ In autumn and winter, drain water off every 10 days (or less) to make sure that water butts don't overflow and that water is kept moving. This will stop larvae and flies from using the water butt. ▸ Use safe products such as vinegar to clean the outside of the tank and the inside of the lid and be careful not to contaminate water with chemicals. ▸ At least once a year, completely empty the water butt and scrub it out with warm soapy water and then rinse thoroughly. This is best done at a time when the water butt is already nearly empty (end of summer) or when it can readily refill (winter).

5.6 Upon completion of maintenance activities, a record should be kept of the work carried out. This should be retained and an annual maintenance report should be compiled, which should include the following:

- Observations resulting from inspections
- Maintenance and operation activities undertaken during the year
- Recommendations for inspections and maintenance programmes for the following year

5.7 On the next page is a table with suggested information should be recorded and included with the maintenance plan. As mentioned in the introduction to this document, this should be a living document and regularly updated, as required and should be kept for the lifetime of the development.

5.8 The Local Planning Authority (Horsham District Council) may request to check and sign off any maintenance activities. Therefore, it is the recommendation that the LPA is contacted prior to any scheduled routine maintenance. The table mentioned above and on the next page, as well as the annual maintenance report, should be offered to the LPA for their records and approval.

Date	Component requiring maintenance	Issues prompting maintenance	Scheduled maintenance (Y/N)	Maintenance carried out	Additional works required (Y/N). If yes, please detail	Next scheduled date of inspection and maintenance

Appendix V

Exceedance Plans

Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
5. All works to the adopted system are to be carried out in accordance with Sewers for Adoption, 7th Edition.
6. All works to the private drainage system to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
7. 350mm min cover to be provided for private pipes laid in soft/paved areas. 900mm min cover to be provided for private pipes laid beneath roads/driveways unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
8. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- New SuDS Basin
- New Surface Water Gravity Pipe
- Existing Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure

Rev.	Description	Drn	Chk	App	Date
P02	Second Issue	PA	PA	PA	28/02/2025
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lakeside Investments Limited

Project:
Stonehouse Farm

Title:
Stonehouse Business Park
Drainage Strategy

Scale: 1:500 (@ A1)

Drawing: 2501022-0502
Revision: P02

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Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
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3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
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9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- Gecellular Attenuation Tank
- New SuDS Basin
- New Surface Water Gravity Pipe
- Existing Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure

Rev.	Description	Drn	Chk	App	Date
P02	Second Issue	PA	PA	PA	28/02/2025
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lakeside Investments Limitied

Project:
Stonehouse Farm

Title:
Lot 8
Drainage Strategy

Scale: 1:500 (@ A1)

Drawing: 2501022-0501

Revision: P02

C:\Users\phillen\Motion\Staff\Site - 1ecsd3 2501022\Drawings\2501022-0501-P01 [Drainage Strategy - Lot 8].dwg

north

104.7m

Hammerpond Road

Silo

Building 3 - Open Sided

Building 2

Building 1

Building 4

Building 5

Temporary Building

Jackson's Farm

Public Footpath

Permeable Paviours:
Total Area: 130m²
Total Subbase Depth: 450mm
Total Volume: 17.550m³

Permeable Paviours:
Total Area: 130m²
Total Subbase Depth: 450mm
Total Volume: 17.550m³

Permeable Paviours:
Total Area: 120m²
Total Subbase Depth: 450mm
Total Volume: 16.200m³

S2: Orifice Plate:
Dia.: 0.037m
Design Head: 0.40m
Design Flow: 1.8 l/s

S7: Orifice Plate:
Dia.: 0.0[illegible]m
Design Head: 0.45m
Design Flow: 3.5 l/s

S10: Orifice:
Dia.: 0.066m
Design Head: 0.45m
Design Flow: 6.0 l/s

Geocellular Tank:
8m x 3m x 1.2m
(L x W x D)
95% porosity
Volume 31.929m³

Geocellular Tank:
12m x 3m x 1.2m
(L x W x D)
95% porosity

Geocellular Tank:
2m x 3m x 1.2m
(L x W x D)
95% porosity

S5: Hydrobrake:
CL: 105.000 mAOD
IL: 102.725mAOD
Design Head: 2.40m
Design Flow:1.0 l/s

S9: Hydrobrake:
CL: 105.000 mAOD
IL: 103.141mAOD
Design Head: 2.00m
Design Flow:1.0 l/s

S12: Hydrobrake:
CL: 105.000 mAOD
IL: 103.194mAOD
Design Head: 1.[illegible]5m
Design Flow:1.[illegible]

Discharge to watercourse
at bottom of valley

A

B

C

Dense Vegetation

Abandoned Building

Spoil Heap

Stones/Muck

Kee

0 4 8 12 16m
SCALE IN METRES
1:200

C:\Users\phillen\Motion\Staff\Site - 1ecdz2 2410067\Drawings\2410067-0501-P01 [Drainage Strategy].dwg

Notes

1. All levels and dimensions are to be checked on site before any work commences. All dimensions are in metres unless stated otherwise.
2. Any discrepancies shall be reported to the engineer immediately, so that clarification can be sought prior to the commencement of works.
3. This drawing shall be read in conjunction with all other relevant engineering details, drawings and specification.
4. The contractor is to keep a record of any variations made on site, including the relocation of sewers or drains, for their "as built" drawings to be prepared upon project completion.
5. All works to the adopted system are to be carried out in accordance with Sewers for Adoption, 7th Edition.
6. All works to the private drainage system to be in accordance with the Building Regulations Approved Document Part "H" 2015 edition.
7. 350mm min cover to be provided for private pipes laid in soft/paved areas. 900mm min cover to be provided for private pipes laid beneath roads/driveways unless not practicable. Where unachievable, shallow private drains may require protection using concrete surround or paving slabs bridging the trench, subject to the NHBC inspector's requirements.
8. All pipes shall be laid soffit to soffit with outgoing pipes unless otherwise stated.
9. Manholes situated within areas accessible to motor vehicles are to be fitted with suitable strength covers and frames. Please refer to the manhole schedule for guidance on this.

Legend

- Permeable Paviours
- Gecellular Attenuation Tank
- New Surface Water Gravity Pipe
- New SW Inspection Chamber
- New Flow Control Structure
- New Manhole

Rev.	Description	Drn	Chk	App	Date
P01	First Issue	RW	PA	PA	26/02/2025

Drawing Status:

FOR PLANNING
NOT FOR CONSTRUCTION

motion
Guildford - Reading - London
www.motion.co.uk

Client:
Lakeside Investments Limited

Project:
Stonehouse Farm - Jacksons Ridge

Title:
Jackson's Farm
Drainage Strategy

Scale: 1:200 (@ A1)

Drawing: 2410067-0501

Revision: P01

Stonehouse Farm, Plummers Plain, Horsham

Arboricultural Briefing Note - tree planting advice for habitat creation

24 April 2024

This briefing note has been prepared by Ian Monger of Barton Hyett Associates Ltd for CSA Environmental on behalf of The Hunter Group to advise on tree and shrub planting for biodiversity enhancements at Stonehouse Farm, Plummers Plain.

1. Introduction

1.1. Extensive habitat creation and enhancements are planned for the site as part of a proposed biodiversity habitat scheme, along with small-scale residential, recreational and business park developments. New and enhanced habitats will include woodland, scrub and hedgerow planting, as well as meadow and mosaic habitat restoration and wetland scrapes. The proposals are shown on the Site-Wide Masterplan.

1.2. The habitat creation will entail a significant investment in new tree and shrub nursery stock, so the correct species choice for the areas of the site is essential to maximise successful plant establishment and minimise losses.

2. Site constraints

2.1. The site's underlying bedrock is shown in Figure 1. It is a series of Weald Clay Formation and Upper Tunbridge Wells Sand mudstones (shaded green and light blue) with larger areas of Upper Tunbridge Wells Sand interbedded sandstone and siltstone (shaded yellow).

2.2. These bedrocks give rise to deep clay to clayey loam over the mudstone and deep to intermediate sandy loam to silty loam over the sandstone/siltstone, as shown in Figure 2. Of most concern for new tree and shrub establishment are the areas of clay to clayey loam soil, as a few native species do not tolerate clay and/or very wet soil.

2.3. An additional complication is the historical landfill and ground restoration which took place in the vicinity of the lakes and has resulted in artificially raised ground levels. Ground levels have also been built up to the east of the decommissioned anaerobic digester unit in the west of the site. A geotechnical assessment of these areas is being carried out. In the meantime, it is presumed that the areas will be locally clayey, compacted and prone to waterlogging and drought. Soil compaction inhibits tree growth by limiting the ability to take up water and nutrients and poor rooting increases the risk of strong winds uprooting trees due to a lack of anchorage. I am not currently aware whether the landfill area of the site includes a clay cap.

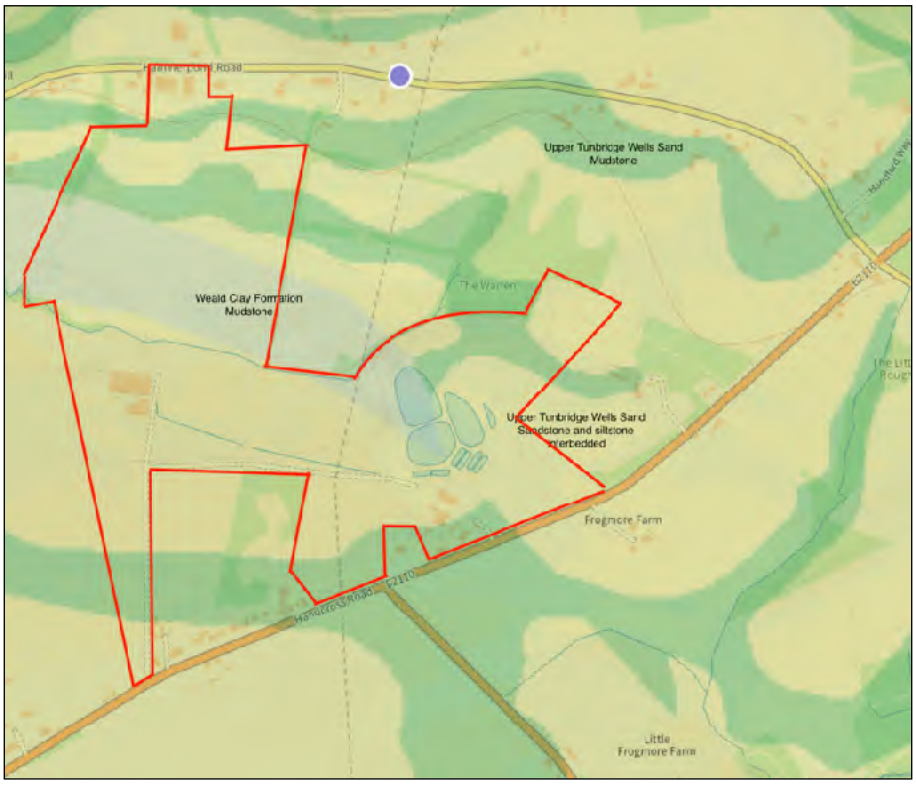


Figure 1: Approximate site boundary showing bedrock types.

Figure 2: Site soil types.

3. Planting considerations

3.1. Nearby St Leonard's Forest, located to the northwest of the site along Hammerpond Road, is a Site of Special Scientific Interest (SSSI) of deciduous woodland dominated by English oak *(Quercus robur)*, silver birch *(Betula pendula)*, downy birch *(Betula pubescens)* and common beech *(Fagus sylvatica)* with an understorey of holly *(Quercus ilex)*, hazel *(Corylus avellana)*, hawthorn *(Crataegus monogyna)*, blackthorn *(Prunus spinosa)* and guelder rose *(Viburnum opulus)*. The SSSI is defined by its location on Tunbridge Wells Sands, which continues into the site.

3.2. For the new woodland planting, the Masterplan lists English oak, beech, birch, hazel and wild cherry as examples of native species. For the scrub planting, the Masterplan lists hawthorn, blackthorn, spindle, buckthorn and elder with field maple, cherry, rowan and crab apple.

3.3. Common beech is **not suitable** for the clay areas of the site as it grows poorly in clay soils. Instead, common hornbeam *(Carpinus betulus)* should be used. Hornbeam grows well on poor soil including clay. Mature trees can reach 30m in height and live for 300+ years. It is the food plant of several moth species and the seeds provide a food source for finches, tits and small mammals.

3.4. Wild cherry *(Prunus avium)*, rowan *(Sorbus aucuparia)*, spindle *(Euonymus europeaus)* and purging buckthorn *(Rhamnus cathartica)* are **not suitable** for waterlogged soil (typically found in the low-lying clay areas of the site) and will prefer the free-draining sandy loam and silty loam soils.

3.5. Hawthorn, blackthorn and hazel are suited to a wide range of soil types and conditions, including very dry and very wet soils. Hazel can be managed on a 5-year coppice cycle carried out in February/March to create a diverse structure and improve overall vitality.

3.6. The degree of ground compaction and any soil contamination should be taken into account, and appropriate remediation devised. Generally, soil compaction is best alleviated by complete cultivation to a depth of 1m before planting, rather than relying on post-planting soil loosening.

3.7. Forest Research have produced general guidance on tree species selection for landfill restoration, which would also apply to areas of the site with very poor clayey or compacted soil: https://www.forestresearch.gov.uk/tools-and-resources/fthr/selecting-tree-species-for-landfill-restoration/

3.8. Areas of landfill and compacted soil can suffer from drought and infertility, while also being prone to waterlogging in very wet weather. The most robust and suitable native tree species for such areas are generally the pioneer species, including common alder *(Alnus glutinosa)*, crack willow *(Salix fragilis)* and white poplar *(Populus alba)*.

3.9. Note, however, that alder, poplar and willow may be more able to penetrate cracks that exist in an underlying landfill clay cap. Unless there is adequate soil cover over an unprotected clay cap, these species may pose a small risk to cap integrity and should not be planted.

3.10. Aspen *(Populus tremula),* black poplar *(Populus nigra),* goat willow *(Salix caprea)* and whitebeam *(Sorbus aria)* are also highly suitable native species. All are fast-growing and are suitable for coppice management where a diversity of canopy structure is desired. Alder additionally fixes nitrogen through its symbiotic relationship with bacteria in its roots, and so improves overall soil fertility.

3.11. These species are generally the least expensive to purchase and establish quickly when planted at a young (feathered whip) age. All whips should be adequately protected from rodent and deer damage, but generally, these species need minimal stabilising (staked) support during early growth because of their low centre of gravity as they develop.

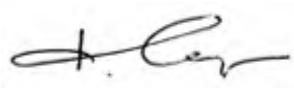
3.12. Some native species, including silver birch and wild cherry, should be avoided altogether in areas of poor soil fertility or compaction. Downy birch is the better choice of birches because it tolerates less fertile soil.

3.13. Before finalising tree planting plans, a site survey for ancient and veteran trees should be carried out to identify any areas where new tree planting could negatively impact their health and longevity. In particular, English oak is a woodland edge tree with a high light demand. New tree planting can overshadow veteran and ancient oaks with time and contribute to their decline. Identifying ancient and veteran oaks will allow halos of unplanted or lower-growing planted species to be designed around them to avoid competition for light.

4. Conclusions

4.1. In conclusion, pioneer species including willow, alder, poplar and whitebeam are best suited to areas of poor soil fertility and compaction. Downy birch should be selected over silver birch in these areas. However, further information on any clay cap and soil cover above the landfill is required to avoid the low risk to cap integrity. Further geotechnical information will inform a soil remediation strategy for affected areas.

4.2. More generally, species choice for the proposed new woodland and scrub areas already reflects those growing in the nearby St Leonard's Forest SSSI. However, hornbeam should be substituted for common beech within areas of clay soil. Wild cherry, rowan, spindle and buckthorn are not suited to waterlogged areas.



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