FLOOD RISK ASSESSMENT AND DRAINAGE STRATEGY

FOR

LVS HASSOCKS, LONDON ROAD, SAYERS COMMON

CLIENT

LICENSED TRADE CHARITY
Helping licensed trade people

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Revision	Date	Notes	Author	Checked	Approved
A	15.08.23	First issue	DW	NS	NM

1. INTRODUCTION

1.1. Background

It is proposed to re-develop the site of the current LVS Hassocks, an independent SEN school for autism and allocate the land for housing and accompanying infrastructure of parking spaces, access roads and drainage.

This Flood Risk Assessment and Drainage Strategy has been prepared for Licensed Trade Charity to support the allocation application for the redevelopment of the site.

1.2. Relevant legislation and guidance

Government policy with respect to development in flood risk areas is set out in the Department for Communities and Local Government *National Planning Policy Framework* (NPPF) published in March 2012. The Planning Practice Guidance (PPG) suite was launched on 6th March 2014 and provides guidance on Flood Risk and Coastal Change. This guidance has superseded the Technical Guidance to the NPPF however it follows similar policies.

Statutory Instrument 2006 No. 2375: *The Town and Country Planning (General Development Procedure) (Amendment) (No. 2) (England) Order 2006*, which came into force on 1st October 2006, made the Environment Agency (EA) a statutory consultee for planning applications where flood risk is a key issue. The EA has published a set of advisory comments and guidance notes on the requirements of a site specific FRA for applicants and their agents.

The Government laid a statutory instrument making the Lead Local Flood Authority a statutory consultee by adding the consultation requirement to Schedule 4 of the Development Management Procedure Order. This came into effect from 15 April 2015.

Mid Sussex District Council are the LPA, and West Sussex Council are the relevant Lead Local Flood Authority for this site. The surface water drainage scheme should be developed in accordance with the Guide to Sustainable Drainage Systems in West Sussex, and the West Sussex LLFA Policy for Management of Surface Water. The standing advice for brownfield sites in the area is to use infiltration techniques where possible or reduce the discharge rate and provide water quality improvements.

2. DEVELOPMENT SITE

2.1. Site location

The site is located at LVS Hassocks, London Road, Sayers Common, BN6 9HT. Refer to Appendix A for Location plan.

2.2. Existing Site Features

The total site area is approximately 14.55ha. The area for the proposed development totals 10.12ha. The site is bounded by open fields to the north and west, Hickstead Park and the B2118 to the east and the Kingsland Laines housing development to the South. There is a general fall across the site from North to South, with the highest levels of approximately 24.69m AOD at the north of the site and the lowest levels at approximately 15.5m AOD in the south of the site. Refer to Appendix B for Topographical survey.

There are no public drainage systems within the site boundary. Existing surveys do not show the extent of the private drainage systems within the site boundary, but it is known that there are surface and foul systems present on site serving the existing school building.

2.3. Development proposals

It is proposed to construct a residential development of up to 250 units on the site currently occupied by the existing LVS Hassocks school. This will include the proposed residential properties along with the associated parking spaces and access roads.

3. SUITABILITY OF THE SITE FOR DEVELOPMENT

3.1. Flood Zone

The EA's online flood map shows that the site is in Flood Zone 1. Flood Zone 1 is classified as an area assessed as having less than 1 in 1000 annual probability of river or sea flooding in any year. Refer to Appendix C for the EA's Flood Map for Planning.

3.2. Sequential Test

The sequential test aims to guide development towards areas of lowest flood risk in preference to areas of higher risk. It tests the suitability of a development within a particular flood risk area. As the proposed development is located within Flood Zone 1, it is deemed to have passed the sequential test.

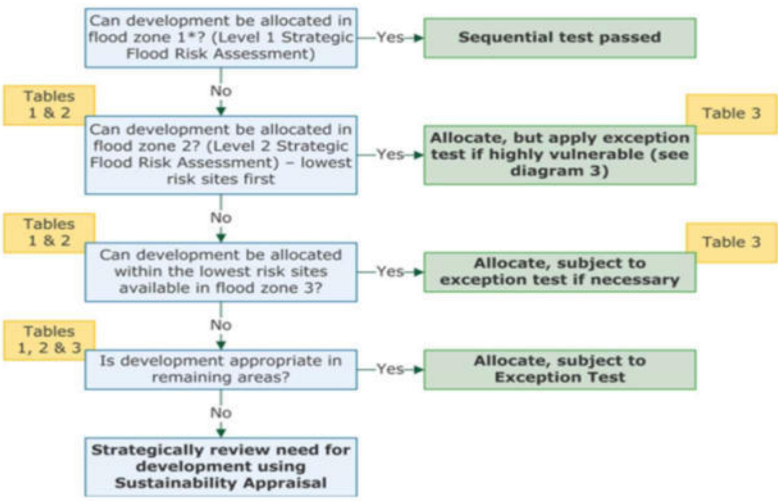


Diagram 1: Application of the Sequential Test for Local Plan Preparation

3.3. Vulnerability / Proposed Land Use

The extract below from Annex 3: Flood Risk Vulnerability Classification under the Flood Risk and Coastal Change section of the online suite of Planning Practice Guidance confirms that the proposed residential land use falls under the "More Vulnerable" classification.

More vulnerable

- Hospitals
- Residential institutions such as residential care homes, children's homes, social services homes, prisons and hostels.
- Buildings used for dwelling houses, student halls of residence, drinking establishments, nightclubs and hotels.
- Non–residential uses for health services, nurseries and educational establishments.
- Landfill* and sites used for waste management facilities for hazardous waste.
- Sites used for holiday or short-let caravans and camping, subject to a specific warning and evacuation plan.

Extract from Annex 3: Flood risk Vulnerability Classification from Flood Risk and Coastal Change Section of PPG

3.4. Exception Test

As the table below shows, the fact that the development is both located in Flood Zone 1 and classified as "More Vulnerable" means it is deemed compatible and the exception test is not required.

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 *	✗	✗	✗	✓*

Table 2: Flood Risk Vulnerability and Flood Zone Compatibility

4. ASSESSMENT OF FLOOD RISK

4.1. Data Sources

The "Flood map for planning" and the "Long term flood risk information" service on the GOV.UK website have been used as a source of information. EA published datasets are available online as part of the Government's "Open Data" project have also been downloaded to inform this flood risk assessment.

4.2. Environment Agency Fluvial and Tidal Map for Planning

The proposed site is located within the Environment Agency's Flood Zone 1. Refer to Appendix C for the EA's flood map. However, due to the site area being larger than 1.0ha, a flood risk assessment is required.

4.3. Other Flood Sources

i) *Flooding from overland flows and small surface water sources*

According to the EA the site is at an overall low risk of flooding from surface water, although it is noted as being in an area of critical drainage problems by the EA. An area of critical drainage is identified as being within flood zone 1 where man made drainage infrastructure has been identified as at critical risk of failure, resulting in runoff causing problems downstream. The government website surface water flood map shows the overwhelming majority of the site to be at "very low" risk of flooding, however there are localised areas of "high" risk of flooding along the southern site boundary, and at a few isolated areas around the LVS Hassocks buildings. These areas of higher risk flooding within the central site are likely due to localised low points as part of the existing building areas, which can be removed during the development.

ii) *Groundwater Flooding*

According to the EA, flooding from groundwater is unlikely in this area. The SFRA for Mid Sussex states that only 0.049% of the total area of the district is affected by groundwater flooding. It is therefore anticipated that the development will not be affected by groundwater flooding. There is no known history of groundwater flooding on site. Refer to Appendix D for the Mid Sussex SFRA extracts.

iii) *Sewer Flooding*

There are no public surface water sewers on site or within proximity of the site boundary. There is an existing public Southern Water sewer located within London Road beyond the entrance towards the east of the boundary. The site owner has confirmed that all on site surface and foul drainage drains via gravity to a combined system pump before being pumped to the public foul system in London Road. It should be noted that, according to the Southern Water asset map, the public system is identified as a foul system, not a combined system. Refer to Appendix E for Southern Water Asset Map. The FRA for the housing development located to the immediate south of the proposed site notes that there has historically been flooding issues with the public foul system within London Road in heavy rainfall events. The public foul system is located entirely within London Road, which is a crowned road with B125 kerbs along the footway adjacent to the site boundary. It is therefore considered that any flooding occurring from the foul water system surcharging will be contained within London Road and not pose a risk to the site.

iv) *Flooding from Reservoirs/Canals*

The nearest reservoir is the Ardingly Reservoir located 7.6miles to the north east of the site. There are no existing canals in proximity to the site.

v) *Increase in rate of runoff as a result of the site development.*

The proposed development will increase the total impermeable areas on site, leading to an increase in surface water run-off from site. This will need to be attenuated in line with SuDS guidance.

vi) *Flooding from Other Sources*

No other natural or artificial sources of flooding have been identified for this development.

5. SURFACE WATER DRAINAGE STRATEGY

5.1. Design criteria.

The drainage strategy was reviewed in accordance with all relevant Codes of Practice and Design Guides. These include, but are not limited to the following:

- CIRIA C753: SUDS Manual (For environmental and sustainability assessment of different surface water management options and discharge points).
- West of England Developers SUDS Guidance (For local SUDS guidance)
- Building Regulations Approved Document Part H: Drainage and Waste Disposal (To adhere to UK building regulations).
- BS EN752:2018 Drain and Sewer Systems Outside Buildings.
- BS EN124:2015 Gully Tops and Manhole Tops for Vehicular and Pedestrian Areas (To specify manhole covers).

5.2. Existing Discharge Rates

The existing LVS Hassocks buildings on site drain to a combined system located towards the north east of the existing buildings which is then pumped to the public foul system within London Road. The existing discharge rate from site needs to be confirmed, but it has been noted in previous reports that flooding occurs within the public foul system during heavy rainfall events. The public system is also not shown to be a combined system on the existing asset map.

5.3. Proposed Discharge Rates

The proposed area of the site for the development at this stage totals 10.12ha which includes the current location of the LVS Hassocks buildings. The Greenfield run-off rate (QBar) can be calculated as 52 l/s. The West Sussex LLFA policy for the Management of Surface Water states that "in all cases, including on brownfield sites, runoff where possible should be restricted to the greenfield 1 in 1 year runoff rate during all events up to and including the 1in100 year rainfall event with an allowance for climate change". It is therefore proposed to discharge at the 1 in 1 year Greenfield runoff rate of 45 l/s. Refer to Appendix F for the Greenfield run-off rate calculation and LLFA Management of Surface Water extracts.

5.4. **Surface Water Discharge Point**

In-line with SuDS drainage hierarchy surface water must be discharged first through infiltration, then by connection to a watercourse, and finally through connections to an existing sewer system.

Infiltration. While a full ground investigation is yet to be carried out, the investigation for the site immediately to the south of the proposed developments site boundary states that the ground is unsuitable for infiltration, although it does not specify whether this is due to the ground strata composition or high groundwater. Given the number of tributaries and ponds in proximity to the southern site boundary, either is likely. Infiltration is therefore not considered likely, although further investigation may be required. Refer to Appendix G for pages from the Ground Investigations Report from Kingsland Laines.

Connections to Watercourses. There is an existing tributary of the River Adur along the southern site boundary, draining from east to west. This tributary has previously been used by the Kingsland Laines development to the south of the site as an appropriate method of surface water discharge.

Of the available discharge options, and with regards to SuDS hierarchy, discharging at an attenuated rate to the existing watercourse located along the southern site boundary is the most appropriate option with regards to the hierarchy.

The 1in1 year Greenfield runoff rate has been previously calculated as 45 l/s. The proposed development has an anticipated impermeable area of approximately 3.951 hectares, determined using the indicative site layout originally provided by Homes England. Based on the calculated attenuated discharge rate, a total of 2655m^3 of attenuation will be required for all storm events up to and including the 1in100 year return period with a 45% allowance for climate change. Refer to Appendix H for the Source Control Storage Estimate.

Due to the steep nature of the site it is proposed to divide the site into five separate catchment areas. Each catchment area will feature its own flow control device and attenuation volume. This will allow the attenuation to be provided via five separate storage tanks, each with a volume of 531m^3. The final catchment area located along the southern site boundary will discharge to the existing watercourse at the total attenuated rate of 45 l/s. Refer to Appendix I for the Drainage Catchment Areas.

6. FOUL WATER DRAINAGE STRATEGY

6.1. It is proposed to drain the buildings for the new development to a pumped chamber within the site boundary which will then discharge to the existing public system within London Road. The total discharge rate is to be confirmed with Southern Water (a foul water capacity assessment is currently being carried out by Southern Water). Refer to Appendix E for the Southern Water Asset Map.

7. OPERATION AND MAINTENANCE

Where appropriate drainage will be offered for adoption by Southern Water with the remaining private drainage being maintained by a management company. Refer to Appendix J for the Operation and Maintenance Manual.

8. SUMMARY AND CONCLUSIONS

The site is designated by the EA flood map for planning as being located in Flood Zone 1, with a likelihood of flooding less than 0.1% each year.

The proposed development does add impermeable area to the existing site, but the discharge rate will be limited to the 1in1 year Greenfield runoff rate with an allowance for climate change, in line with the West Sussex LLFA policy for Management of Surface Water.

The site does not benefit from flood defences.

There are no historical records showing the site to be at risk from groundwater flooding.

The proposed surface system will discharge at an attenuated rate to the existing watercourse along the southern site boundary.

The proposed foul system will drain via a pumped system to the existing public system within London Road. This will be the same method as the existing foul system, and the same brake chamber locations.

This report concludes that the development is appropriate in line with the latest government guidance as it does not increase the risk of flooding to the site or the surrounding properties.

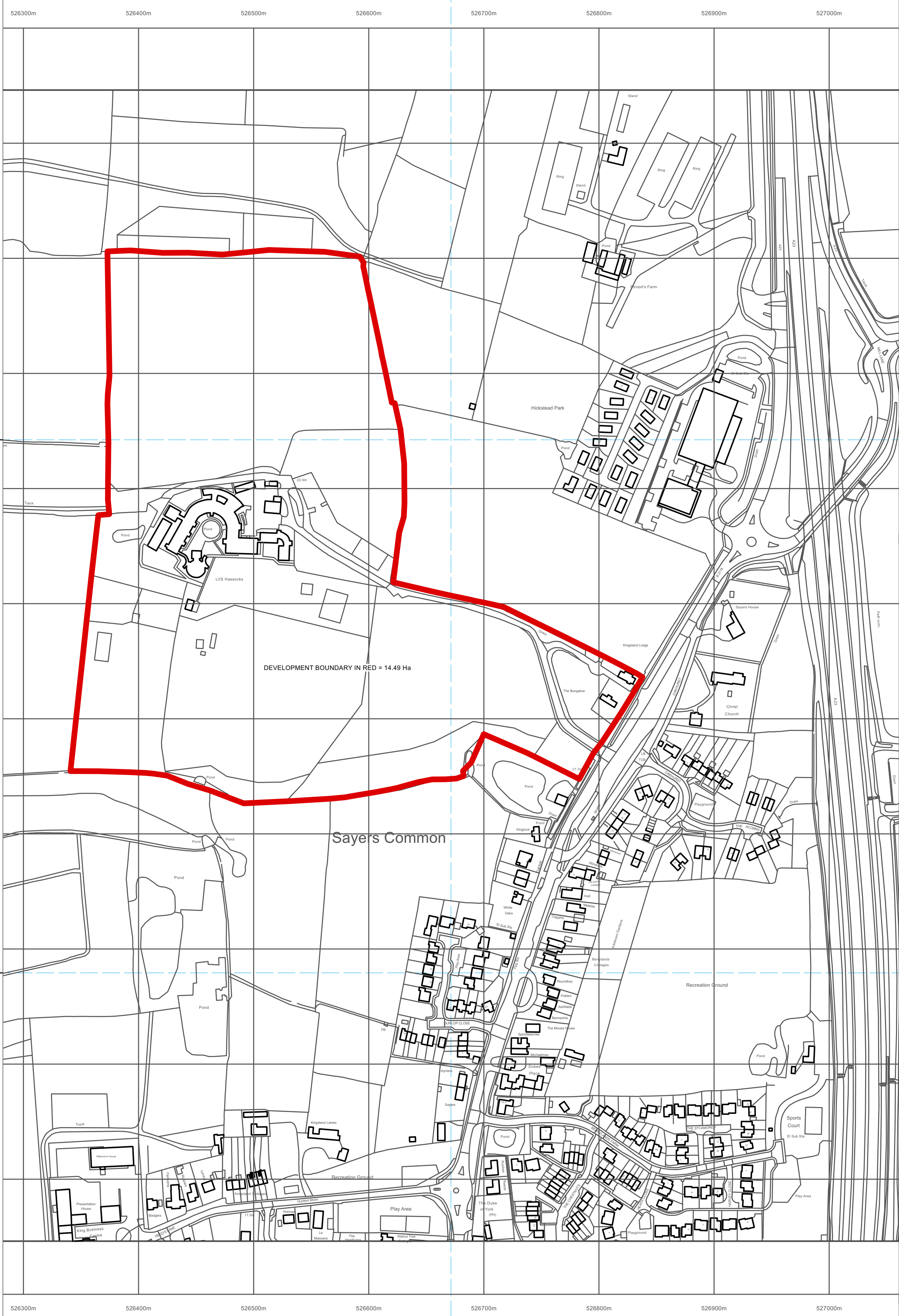
APPENDIX A
Location Plan

2 | 1

A

B

C



0 50 100 150 200 m

N

Architect

ECA

SECOND FLOOR
14 HIGH STREET
POOLE
BH15 1BP

Address

London Road, Sayers Common, Hassocks, West Sussex BN6 8HT

REV.	DATE	DESCRIPTION

Project ID 110	Drawn By AC
Date 07.06.23	Reviewed By MC
Scale 1:5000 @ A4	

Sheet Title

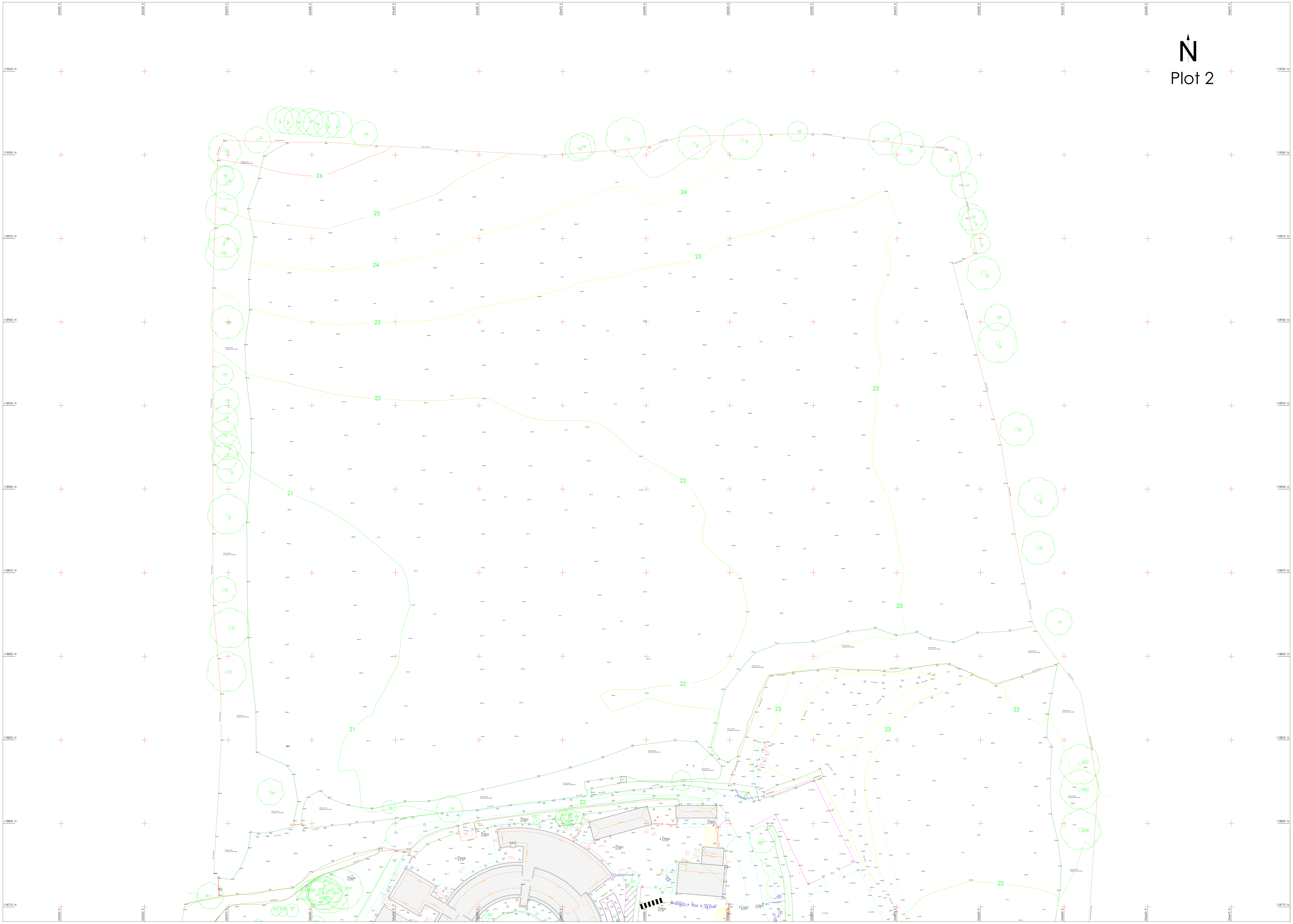
110_1_003

Sheet No.

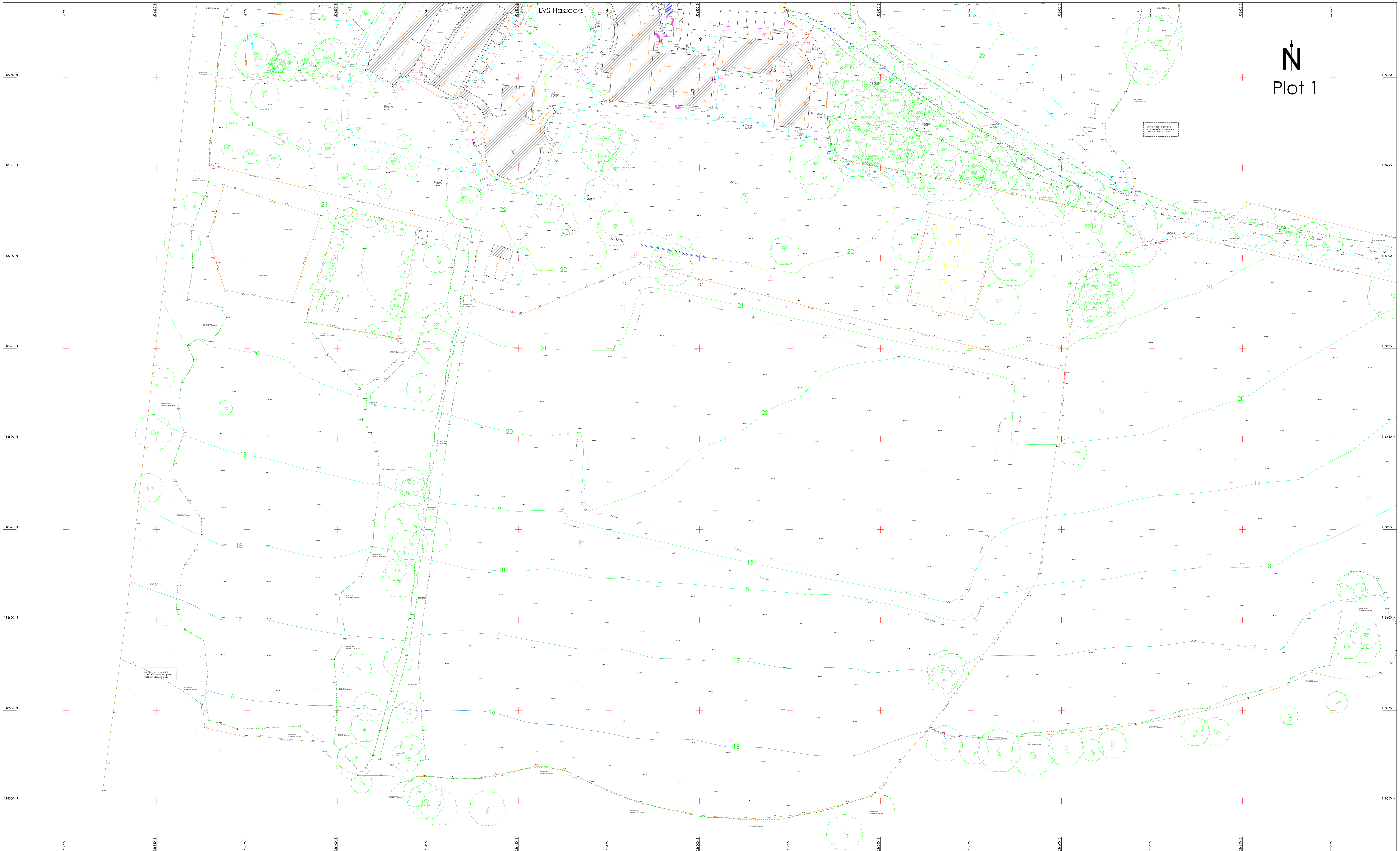
SITE AREA FOR DEVELOPMENT

2 | 1

APPENDIX B
Topographical Survey



Plot 2



Redline Surveys

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Client:
The Licensed Trade Charity

Survey at:
LVS Hassocks
London Road
Sayers Common
Hassocks
BN6 9HT

Plot 1. 23- 142
Date: 04/07/2023
Scale 1 : 500 A1
Desc: Topographical Survey

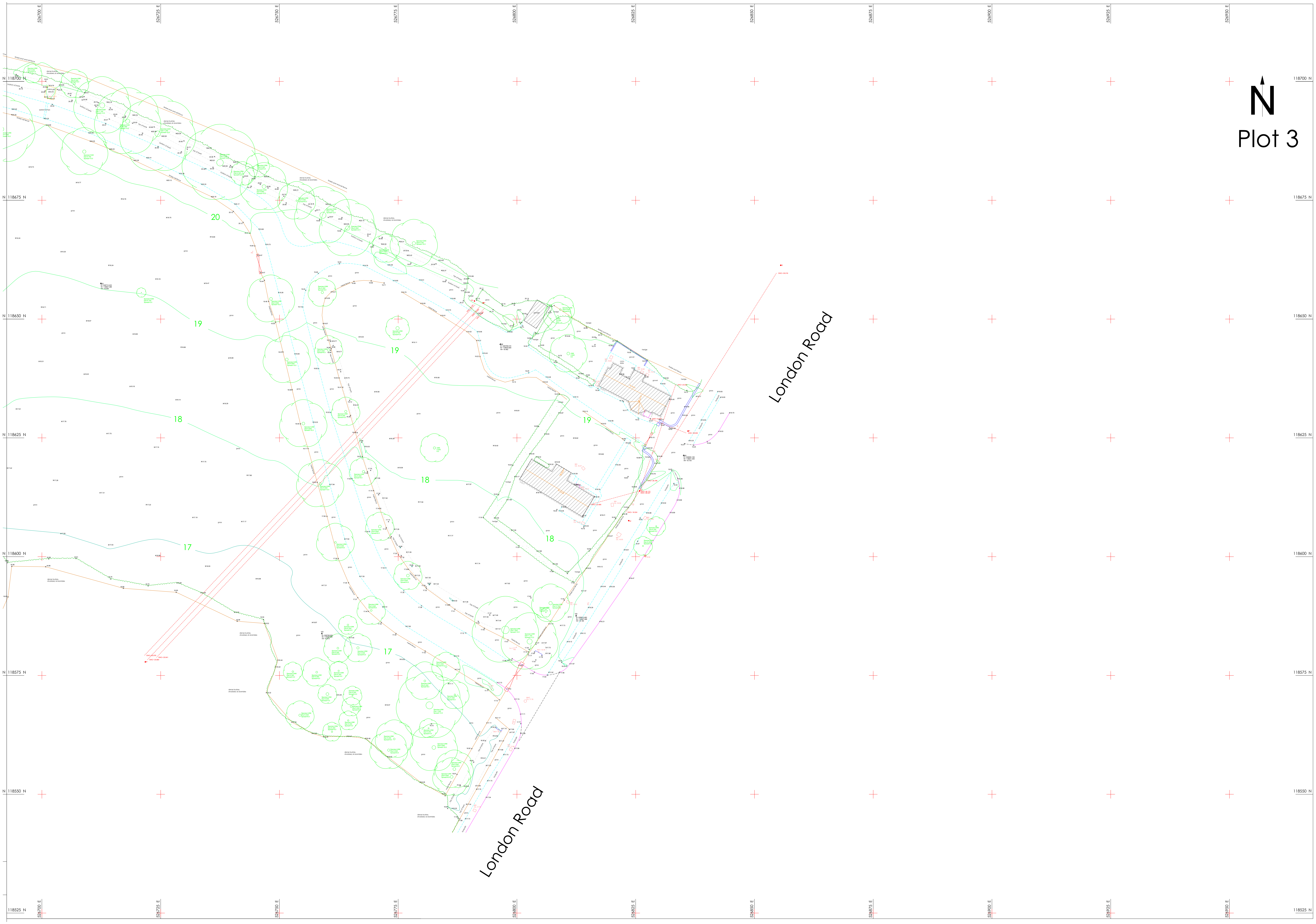
Comp by: C. Booker
Surveyed by: S. Booker

All data has been recorded using a Trimble R12i GPS system

All levels relative to OSBM

Symbols & Linetypes

Manhole types	Traverse Station	Building
Gully	Sign	Wall
Lamp post	Tree	Kerb
Telegraph Pole	Hedge	Drop Kerb
Electric Pole	Overhead Wire	Footpath
Gas Cover		Ridge
Water Cover		Step
Electric Cover		Fence
British Telecom		



N
Plot 3
London Road
London Road
526700 E
526725 E
526750 E
526775 E
526800 E
526825 E
526850 E
526875 E
526900 E
526925 E
526950 E
118700 N
118675 N
118650 N
118625 N
118600 N
118575 N
118550 N
118525 N
20
19
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19
18
18
18
17
17

APPENDIX C
EA Flood Map for Planning

Environment Agency

Flood map for planning

Your reference	Location (easting/northing)	Created
<Unspecified>	**526594/118767**	**13 Jun 2023 13:09**

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

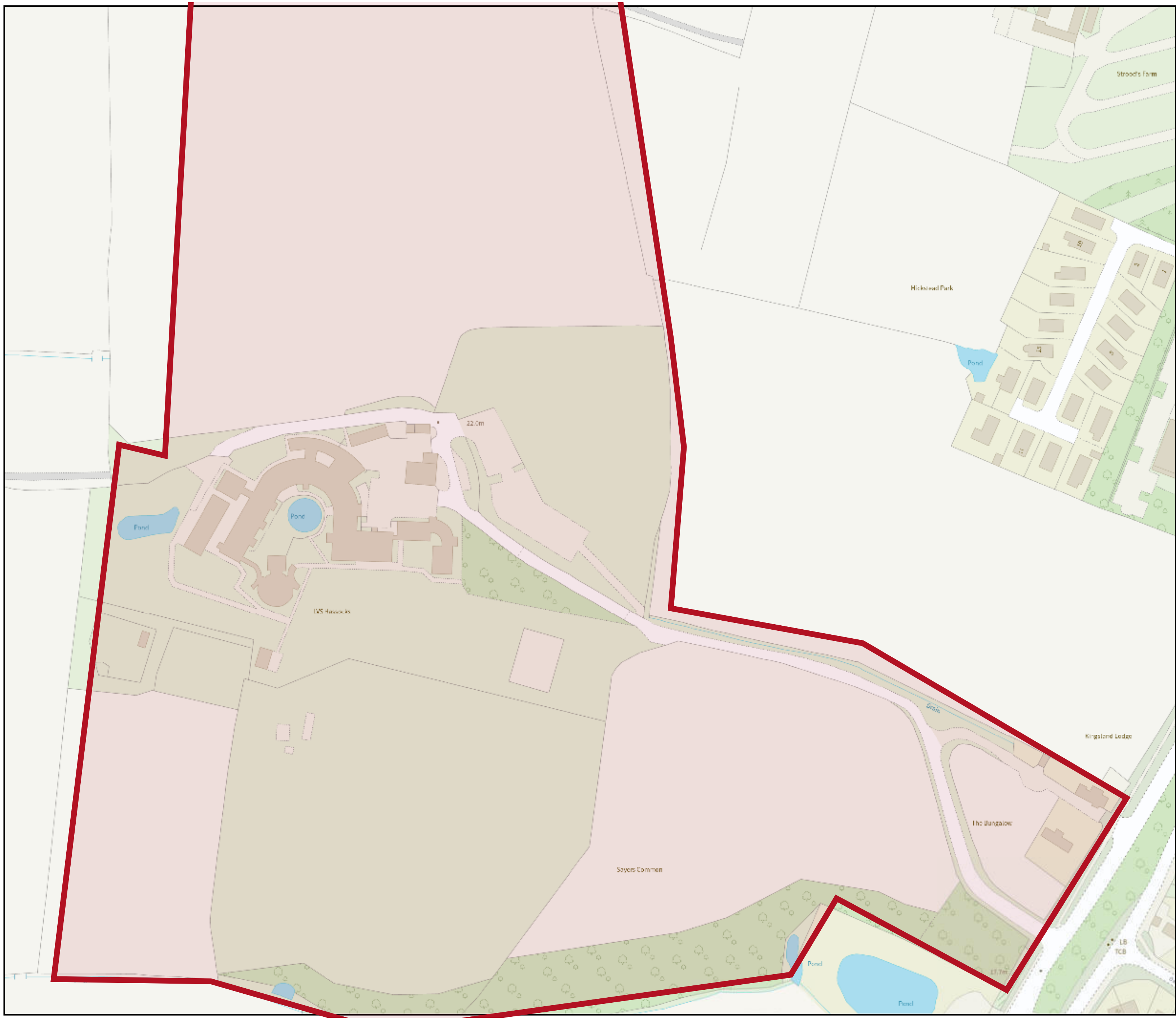
You will need to do a flood risk assessment if your site is **any of the following:**

- 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)
526594/118767

Scale
1:2500

Created
13 Jun 2023 13:09

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

0 20 40 60m

APPENDIX D
Mid Sussex SFRA Extracts

Strategic Flood Risk Assessment

Level 1

June 2015

3.2 Coarse Assessment

The first stage of the SFRA was to undertake the 'Coarse Assessment'. This assessment entailed obtaining sufficient information on flood risk in the district to enable the Sequential Test to be undertaken for the Core Strategy and any other LDD's that the District Council will be preparing. Information that was gathered included the following:

- The Local Planning Authority boundary
- Location of main rivers
- Location of all other watercourses
- Locations of flood defences
- Areas with flood warnings
- Land that is classified as Flood Zone 2 or 3 (fluvial and tidal)
- Land that has been subject to flooding from overland flow, groundwater and sewers.
- Land at risk of flooding from reservoirs, canals and other artificial sources.
- Areas with flood management strategies.
- Areas of groundwater vulnerability.
- Areas of surface water flood risk.
- Locations and details of historical flood incidents.
- Geology within the district.
- Topographical data within the district.
- Environmental problems and/or strategies that are sensitive to flood management activities.
- Information from the District Council's Emergency Planning function.
- Reports in the local press (Mid Sussex Times and East Grinstead Courier) of flooding incidents and events.

The findings and methodology for collecting this information/data is detailed in Appendix A – Coarse Assessment data sources. This includes the sources for the information/data, difficulties in collecting it and any uncertainties/gaps in knowledge. All information/data has been plotted on the District Council's GIS using the most up to date version of Ordnance Survey's (OS) Landline Basemap as a guide while digitising. This is the same basemap used when viewing the SFRA layers on the

District Council's GIS. Where individual properties have been highlighted, OS AddressPoint was used in order to determine the location.

3.3 Other steps taken to obtain information on flood risk

The District Council has sought to make the SFRA as comprehensive as possible but in some cases it has not been possible to acquire all the information that would otherwise have been included. Steps were taken to obtain the following data:

- Requests for updated flood incident data and modelling from Southern Water and Thames Water were made but no additional information was received.
- Several Parish and Town Councils did not respond to the District Council's requests for information on historic flood incidents.

However, as the SFRA is a live document any subsequent information or data that becomes available will be added.

3.4 Have all hazards been sufficiently defined?

The District Council consider that they have identified all flood risk hazards as far as practically possible. It is accepted that as the SFRA is a 'living document' there will be further flood risk hazards identified over time, which will be added to the information/data that has already been identified in this SFRA and the mapping that accompanies this SFRA will be kept up-to-date. Any subsequent flood risk hazards will therefore be taken into consideration in undertaking the Sequential Test for future Local Development Documents.

3.5 Overview of flood risk in the district

The following table summarises aspects of this data and thereby provides an overview of the district's flood risk characteristics.

Table 5 – Overview of Mid Sussex flood risk characteristics

No	Question	Area (km^2)	% of Area
1	Size of District	334.029	N/A
2	Area in Zone 3 (High flood risk)	7.78	2.233 % of Total Area
3	Area in Zone 2 (Moderate flood risk)	9.72	2.91 % of Total Area
4	Existing development in Zone 3	0.215	2.763 % of Zone 3
5	Existing development in Zone 2	0.356	3.768 % of Zone 2
6	Area of Zone 3 that is defended	0.011	0.141 % of Zone 3

7	Total Developed Area	32.306	9.672 % of Total Area
8	Required new development*	3.683	1.103 % of Total Area
9	Likely Development in Zones 3 and 2	0	0.000 % of Zones 3 and 2
10	Area affected by drainage problems	1.108	0.332 % of Total Area
11	Area affected by groundwater flooding	0.164	0.049 % of Total Area
12	Area affected by overland flows	0.427	0.128 % of Total Area
13	Area affected by surface water flood risk (1 in 30 year)	7.25	2.17 % of Total Area
14	Area affected by surface water flood risk (1 in 100 year)	12.22	3.658 % of Total Area
15	Area affected by surface water flood risk (1 in 1000 year)	33.502	10.03 % of Total Area

* Takes the required housing delivery of approximately 11,050 new homes over the period until 2031 and assumes this housing will be built at an average of 30 dwellings per hectare. It should be recognised that a considerable amount of this development will be on previously developed land. In addition, no allowance is given for new employment developments or any other uses.

APPENDIX E
Southern Water Asset Map

 Date: 29/06/23 Scale: 1:1250 Map Centre: 526499,118683 Data updated: 05/05/23 Our Ref: 1213410 - 1 Wastewater Plan A1

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 2023 Ordnance Survey 100031673 .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.

Foul Gravity Sewer | Combined Gravity Sewer | Culverted Water Course or Treated Effluent | Surface Water Gravity Sewer | Rising Main, Vacuum or Syphon

Combined Outfall | Foul Outfall | Surface Water Outfall | Surface Water Inlet

Combined Pumping Station | Surface Water Pumping Station | Foul Pumping Station | Water Treatment Works | Section 104 Area | Building Over Agreement Area

Foul Manhole | Combined Manhole | Surface Water Manhole | Side Entry Manhole, Decantation Chamber, Dummy Manhole or Surface Water Soakaway

rob.hunt@craddys.co.uk

50402-London Road

WATER for LIFE from Southern Water.

Manhole Reference	Liquid Type	Cover Level	Invert Level	Depth to Invert
6301	F	16.97	15.42	
7301	F	17.61	14.02	
7302	F	17.49	14.27	
7401	F	18.01	15.39	
7402	F	17.83	16.36	
7501	F	17.84	16.24	
8501	F	17.77	16.64	
8502	F	18.00	17.23	
8503	F	17.79	17.04	
8601	F	20.32	18.20	
8701	F	24.00	18.87	
9500	F	18.22	17.56	
9701	F	24.47	19.56	
9801	F	23.77	19.65	
9802	F	22.28	20.10	
8550	S	17.99	16.54	
8551	S	17.64	0.00	
9550	S	18.63	16.78	

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 F
Greenfield Run-off Rate Calculation and LLFA Management of Surface Water Extract

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	10.120	Urban	0.000
SAAR (mm)	812	Region Number	Region 7

Results	**l/s**
QBAR Rural	52.9
QBAR Urban	52.9
Q1 year	45.0
Q1 year	45.0
Q30 years	119.9
Q100 years	168.7

West Sussex LLFA Policy for the Management of Surface Water

Updated November 2018.

SuDS Policy 1: Follow the drainage hierarchy

1. **Surface runoff not collected for use must be discharged according to the following discharge hierarchy:**
   - **to ground,**
   - **to a surface water body,**
   - **to a surface water sewer, highway drain, or another drainage system, or**
   - **to a combined sewer where there are absolutely no other options, and only where agreed in advance with the relevant sewerage undertaker.**
2. **The selection of a discharge point should be clearly demonstrated and evidenced.**

5.2 SuDS Policy 1: Discharge Hierarchy

5.2.1 When development occurs, the urbanisation process within a catchment affects the natural hydrology; if the destination of the water is altered this may result in:

- a reduced supply of rainfall to groundwater;
- an accelerated passage of flow to the receiving watercourses; and
- water directed away from existing receiving catchments.

In order to maintain the natural balance of the water cycle, the above discharge hierarchy[4] must be observed. Where development results in changes in runoff destinations, the design must account for how the surface flows are managed and demonstrate it does not exacerbate off-site flood risk.

5.2.2 Infiltration structures (to ground) include soakaways, basins, swales and permeable paving. Infiltration rates for soakage structures are to be based on percolation tests undertaken in the winter period at the location and depth of the proposed structures. The percolation tests must be carried out in accordance with BRE DG 365, CIRIA R156 or a similar approved method, and cater for the 1 in 10 year design storm event[5] between the invert of the lowest entry pipe into the infiltration structure and the base. Tests should be undertaken during winter / early spring when ground water levels are typically highest; if groundwater levels are influenced by the tide then tests should be undertaken over a high-water spring tide.

[4] SuDS selection hierarchy based on: CIRIA C753 - The SuDS Manual; BS8582:2013 – Code of Practice for Surface Water Management for Development Sites; and Approved Document H of the Building Regulations.
[5] The design event will vary according to the storage design and the contribution the storage component makes to the overall SuDS for the site; as a minimum for traditional soakaways the design event will be for a 1:10 year event plus allowance for climate change.

For the purpose of design, the percolation rate must be applied to the sides of the infiltration structure only and the rate for the base must be zero, unless otherwise agreed with the LPA engineer. This does not apply to infiltration basins or permeable pavements, whereby the percolation rate is applied to the base only. The infiltration structure should drain 50% of its total volume in 24 hours or less for the 1 in 10 year event and for the 1 in 100 year event (unless otherwise agreed with the LPA engineer) in order to provide spare capacity for subsequent storms. Flood risk assessments: climate change allowances can be viewed via the following link: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

5.2.3 Any infiltration drainage design must include adequate winter groundwater monitoring data in areas of known groundwater issues, to determine the highest winter groundwater table. Residential developments in excess of five properties will require ground water monitoring to be carried out between October and March inclusive. The extent of monitoring required for smaller developments will be subject to agreement with the District or Borough Council Engineers. Adequate freeboard must be provided between the base of the soakaway structure and the highest recorded groundwater level identified in that location; ideally this should be 1m where possible.

5.2.4 Deep bore soakaways should only be considered after other forms of infiltration attenuation have been explored and in all cases, the applicant will be required to consult the EA hydrogeologist before their inclusion in a drainage strategy.

5.2.5 Infiltration is not always appropriate, and the advice of the drainage engineer should be sought: for developments in or close to source protection zones (SPZs); in areas with a known history of land contamination; or in areas with known high seasonal groundwater levels.

5.2.6 Surface water must not be discharged into the foul sewer system. Discharge to a watercourse or surface water sewer must be restricted to the estimated mean greenfield runoff rate (Q1) by means of a controlled outflow (but see paragraph 5.4.4 regarding restrictions on runoff rates for brownfield sites). Flood Estimation Handbook (FEH) methods should be the preferred approach for developing runoff estimates used in surface water design[6]. There is also a tool available on www.ukSuDS.com that allows calculation of Q1 by both FEH and IH124. Both the point of connection and discharge rate must be agreed with the relevant owner or

[6] SuDS Manual paragraph 24.3.

responsible body including internal drainage boards, highway authorities, sewerage undertakers, riparian owner, Environment Agency, Canals and River Trust and others (see also paragraph 4.3 Ordinary Watercourses).

SuDS Policy 2: Manage Flood Risk Through Design

1. **The drainage scheme proposed is to:**
    a. **protect people and property on the development site from flooding; and,**
    b. **avoid creating any additional flood risk outside of the development in any part of the catchment, either upstream or downstream.**
2. **Any drainage scheme must manage all sources of surface water, including exceedance flows and surface flows from offsite, provide for emergency ingress and egress and ensure adequate connectivity.**
3. **For large sites where development is to be phased, there will need to be a strategic site surface water management system that allows different parts of the site to be developed at different times while ensuring that each of the design criteria can be met.**

5.3 SuDS Policy 2: Manage Flood Risk through Design

5.3.1 The natural drainage catchment for the site needs to be mapped including the water that drains down into / through the site from outside the site boundary. The pre and post development drainage is to be based upon the whole catchment demonstrating how off-site drainage is being managed within the proposed strategy.

5.3.2 The drainage system must be designed to operate without any flooding occurring during any rainfall event up to (and including) the critical 1 in 30 year storm (3.33% AEP). The system must also be able to accommodate the rainfall generated by events of varying durations and intensities up to (and including) the critical, climate change adjusted 1 in 100 year storm (1% AEP) without any on-site property flooding and without exacerbating the off-site flood-risk. Sufficient steps are to be taken to ensure that any surface flows between the 1 in 30 and 1 in 100 year events are retained on site. Storage should be based upon analyses of a range of winter and summer storm profiles to determine a critical storm event.

5.3.3 The LLFA will wish to review the input values and calculations for storage design and the greenfield run-off rates upon which they are based. Where computer models have been used to underpin design, the drainage strategy should be accompanied by the full results and design criteria.

Where calculations involve use of the **Coefficient for Volumetric Run-off** (**Cv**) Sewers for Adoption (7th Edition) recommends that a Cv of 1.0 should be used whenever calculating runoff from impermeable surfaces (roofs and paved areas should have an impermeability of 100%). When making an application the designer should demonstrate to the LLFA that Cv has been suitably determined.

5.3.4 The choice of where storage volumes are accommodated may be within the drainage system itself or within other areas designated within the site for conveyance and storage.

5.3.5 The drainage design should show flow routes through the proposed development, demonstrating where surface water will be conveyed for three types of flow:

1. Low flow routes

Regular flow from source control features such as permeable pavements should travel in low flow channels through the development in a controlled way contributing to landscape quality.

2. Overflows

In the event of local blockages or surcharge a simple overflow arrangement should allow water to bypass the obstruction and return to the main SuDS drainage system when conditions return to normal.

3. Exceedance routes

Should SuDS be overwhelmed by exceptional rainfall (1:100 + allowance for climate change) then exceedance routes are required to protect people and property. These provide unobstructed overland flow routes from the development and should be considered for all drainage schemes. Exceedance routes should also be protected from future changes in land use.

5.3.6 The primary consideration shall be risks to people and property on and off site.

5.3.7 Wholesale land raising should not be undertaken, for example, by the spreading of excavated material on site or the importation of additional fill. Such action increases the possibility of changing natural flows and increasing flood risk beyond the development area.

5.3.8 Access should be maintained into and through the site for emergency vehicles. The drainage application must give consideration to flood risk vulnerability classifications (as defined through Planning Practice Guidance to the NPPF), as specific measures or protections may be necessary and need to be agreed with the appropriate authority.

5.3.9 The time required for the storage to accept further storm flows should be considered, especially if downstream flood levels can affect the outfall. Attenuation storage volume provided by any drainage area should half empty within 24 hours so that it can receive runoff from subsequent storms. If the drain down time (full to empty) is more than 24 hours, then long duration events should be assessed to ensure that drainage is not compromised by inundation.

5.3.10 If the proposed system connects to an existing drainage system, whether it is a sewer, highway drain, water body or sustainable drainage system, consideration must be given to the operational capacity and functionality of the existing system to ensure that no adverse impacts result or flood risk is increased either on-site or off-site.

5.3.11 For large sites involving phased development, the strategic surface water management system will need to be designed to manage the flows from the final developed site, and specific conditions will need to be set for each development plot so that the original design assumptions are not invalidated[7].

SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

1. **Drainage schemes should be designed to match greenfield discharge rates and follow natural drainage routes as far as possible; pumps should therefore not form part of drainage schemes.**
2. **Greenfield runoff should be calculated from FEH or a similar approved method. SAAR and any other rainfall data used in run-off storage calculations should be based upon FEH rainfall values.**

5.4 SuDS Policy 3: Mimic Natural Flows and Drainage Flow Paths

5.4.1 Runoff rates should match Greenfield runoff rates, follow natural or existing drainage routes, utilise existing natural low-lying areas or conveyance pathways, and match infiltration rates and discharges as far as possible for all events up to and including the climate-change adjusted 1 in 100 year (1% AEP) design event.

[7] For further details on this subject, see chapter 7 of the SuDS manual.

5.4.2 By mimicking the natural drainage flow paths and working within the landscape, more effective and cost-efficient design can be developed and drainage systems can be kept shallower.

5.4.3 Working with existing natural gradients also avoids any reliance on pumped drainage, with its associated energy use and failure risk. The natural environment including woods, trees and hedgerows can play a part in water management.

5.4.4 Redevelopment on brownfield land has the potential to rectify or reduce flood risk. In all cases, including on brownfield sites, runoff should where possible be restricted to the greenfield 1 in 1 year runoff rate during all events up to and including the 1 in 100 year rainfall event with climate change. An alternative approach would be for discharge rates to be limited to a range of greenfield rates, based on the 1 in 1, 1 in 30 and 1 in 100 year storm events. However, the use of this method to restrict discharge rates requires the inclusion of on-line long-term storage, sized to take account of the increased post development volumes, discharging at no greater than 2l/s/ha. While discharging at no greater than 2 l/s/ha is acceptable, it is still the LLFA's preference that the former approach is used wherever possible. If it is deemed that this is not achievable, evidence must be provided and developers should still seek to achieve no increase in runoff from greenfield sites and a 50% betterment of existing run off rates on brownfield sites (provided this does not result in a runoff rate less than greenfield). For further guidance see Susdrain Fact sheet on Designing attenuation storage for redeveloped sites: http://www.susdrain.org/files/resources/fact_sheets/01_15_fact_sheet_attenuation_for_redeveloped.pdf

5.4.5 Storage, where space permits, should be on or as close to the surface as possible. Where cellular storage is opted for then the system should be designed in such a way as to minimise the risk of siltation e.g. by incorporating silt traps and to be filled via a distribution pipe to stop silt entering the units or by incorporating the storage tank off line whereby it only fills when the system surcharges. The cellular units should be manufactured from a recycled material such as PVC.

APPENDIX G
Kingsland Laines Ground Investigation Extracts

Kingsland Laines,

Sayers Common

Surface & Foul Water Drainage Design –

Discharging Conditions 10 & 11

Prepared by:

Escher Silverman

Roughton, A2 Omega Park, Electron Way,
Chandlers Ford, Hampshire. SO53 4SE

Tel: 023 8027 8659

ES1848/DoC

3.0 PROPOSED DEVELOPMENT SITE AND DRAINAGE STRATEGY

3.1 The layout of the proposed development showing the proposed drainage strategy can be seen on the plan contained in **Appendix C.**

3.2 The approved FRA put forward a drainage strategy that incorporated the construction of two new ditches, one inside the site, along the northern boundary and another inside the site along the western boundary. These are referred to as the new northern ditch (NND) and the new Reeds Lane Ditch (NRLD). In addition the Dunlop Close ditch crossing the site would be increased in size with some re-alignment along its route.

3.3 The inclusion of NND and NRLD would mean that the original ditches near these locations would not be a part of the new development drainage strategy and no additional flows into them would be produced. In fact with the drainage proposals there would be negligible flow into these ditches from the development site.

3.4 The widening of the Dunlop Drive ditch would also have a beneficial effect upstream of this ditch network in producing better flow and storage characteristic through the site.

3.5 The drainage strategy of the site is to embrace the '*Sustainable Drainage System'* (SuDS) philosophy. A SuDS system is designed to reduce the potential impact of new developments with respect to surface water drainage discharges. The ideal SuDS strategy is to utilise infiltration methods, however site investigations undertaken showed that the underlying ground was totally unsuitable for such a solution.

3.6 The next appropriate means of surface water disposal in the SuDS hierarchy is to discharge surface water into a watercourse at a no greater rate than the pre-development discharge, known as *'greenfield run-off'.* In doing so it is necessary to store or 'attenuate' the volume of water that will be produced for a greater storm event than that of the discharge rate. The discharge rate into the receiving watercourse will be controlled and restricted to the *'greenfield run-off'*

APPENDIX H
Storage Estimate

Summary of Results for 100 year Return Period (+45%)

Half Drain Time : 470 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	0.583	0.583	0.0	44.6	44.6	980.2	O K
30 min Summer	0.774	0.774	0.0	44.9	44.9	1302.0	O K
60 min Summer	0.969	0.969	0.0	44.9	44.9	1628.7	O K
120 min Summer	1.146	1.146	0.0	44.9	44.9	1926.8	O K
180 min Summer	1.224	1.224	0.0	44.9	44.9	2057.5	O K
240 min Summer	1.259	1.259	0.0	44.9	44.9	2116.7	O K
360 min Summer	1.284	1.284	0.0	44.9	44.9	2158.4	O K
480 min Summer	1.278	1.278	0.0	44.9	44.9	2149.2	O K
600 min Summer	1.266	1.266	0.0	44.9	44.9	2128.2	O K
720 min Summer	1.248	1.248	0.0	44.9	44.9	2098.7	O K
960 min Summer	1.205	1.205	0.0	44.9	44.9	2025.8	O K
1440 min Summer	1.102	1.102	0.0	44.9	44.9	1853.8	O K
2160 min Summer	0.947	0.947	0.0	44.9	44.9	1592.0	O K
2880 min Summer	0.806	0.806	0.0	44.9	44.9	1354.5	O K
4320 min Summer	0.583	0.583	0.0	44.6	44.6	981.1	O K
5760 min Summer	0.436	0.436	0.0	43.0	43.0	732.4	O K
7200 min Summer	0.342	0.342	0.0	41.0	41.0	574.3	O K
8640 min Summer	0.284	0.284	0.0	39.1	39.1	477.0	O K
10080 min Summer	0.256	0.256	0.0	36.0	36.0	430.2	O K
15 min Winter	0.654	0.654	0.0	44.9	44.9	1100.5	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	136.286	0.0	969.1	19
30 min Summer	91.635	0.0	1312.3	33
60 min Summer	58.739	0.0	1719.7	62
120 min Summer	36.288	0.0	2128.0	122
180 min Summer	26.937	0.0	2370.9	182
240 min Summer	21.660	0.0	2542.7	242
360 min Summer	15.950	0.0	2809.2	360
480 min Summer	12.815	0.0	3009.7	414
600 min Summer	10.804	0.0	3171.8	476
720 min Summer	9.393	0.0	3308.8	536
960 min Summer	7.524	0.0	3532.8	666
1440 min Summer	5.493	0.0	3864.4	938
2160 min Summer	4.002	0.0	4255.3	1336
2880 min Summer	3.192	0.0	4523.9	1704
4320 min Summer	2.316	0.0	4913.7	2424
5760 min Summer	1.843	0.0	5234.6	3120
7200 min Summer	1.545	0.0	5482.5	3816
8640 min Summer	1.338	0.0	5693.0	4488
10080 min Summer	1.184	0.0	5870.4	5144
15 min Winter	136.286	0.0	1088.8	18

Summary of Results for 100 year Return Period (+45%)

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Σ Outflow (l/s)	Max Volume (m³)	Status
30 min Winter	0.870	0.870	0.0	44.9	44.9	1463.4	O K
60 min Winter	1.092	1.092	0.0	44.9	44.9	1835.6	O K
120 min Winter	1.298	1.298	0.0	44.9	44.9	2182.0	O K
180 min Winter	1.394	1.394	0.0	44.9	44.9	2343.5	O K
240 min Winter	1.443	1.443	0.0	44.9	44.9	2426.2	O K
360 min Winter	1.491	1.491	0.0	44.9	44.9	2507.3	O K
480 min Winter	1.496	1.496	0.0	44.9	44.9	2514.9	O K
600 min Winter	1.475	1.475	0.0	44.9	44.9	2479.8	O K
720 min Winter	1.440	1.440	0.0	44.9	44.9	2421.4	O K
960 min Winter	1.376	1.376	0.0	44.9	44.9	2313.6	O K
1440 min Winter	1.218	1.218	0.0	44.9	44.9	2048.0	O K
2160 min Winter	0.974	0.974	0.0	44.9	44.9	1638.3	O K
2880 min Winter	0.761	0.761	0.0	44.9	44.9	1279.4	O K
4320 min Winter	0.462	0.462	0.0	43.4	43.4	776.8	O K
5760 min Winter	0.305	0.305	0.0	39.8	39.8	512.6	O K
7200 min Winter	0.250	0.250	0.0	35.2	35.2	419.9	O K
8640 min Winter	0.222	0.222	0.0	30.7	30.7	372.8	O K
10080 min Winter	0.203	0.203	0.0	27.3	27.3	341.4	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
30 min Winter	91.635	0.0	1472.6	33
60 min Winter	58.739	0.0	1927.8	62
120 min Winter	36.288	0.0	2385.0	120
180 min Winter	26.937	0.0	2656.9	178
240 min Winter	21.660	0.0	2849.1	236
360 min Winter	15.950	0.0	3147.4	350
480 min Winter	12.815	0.0	3371.6	460
600 min Winter	10.804	0.0	3553.0	566
720 min Winter	9.393	0.0	3706.2	598
960 min Winter	7.524	0.0	3956.9	732
1440 min Winter	5.493	0.0	4327.8	1024
2160 min Winter	4.002	0.0	4767.2	1444
2880 min Winter	3.192	0.0	5068.7	1816
4320 min Winter	2.316	0.0	5507.5	2508
5760 min Winter	1.843	0.0	5863.7	3120
7200 min Winter	1.545	0.0	6141.8	3752
8640 min Winter	1.338	0.0	6378.4	4488
10080 min Winter	1.184	0.0	6579.8	5152

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.348	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+45

Time Area Diagram

Total Area (ha) 3.951

Time From:	**(mins) To:**	**Area (ha)**
0	4	3.951

Model Details

Storage is Online Cover Level (m) 2.500

Cellular Storage Structure

Invert Level (m) 0.000 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)
0.000	1770.0	1770.0	1.501	0.0	2022.5
1.500	1770.0	2022.4			

Hydro-Brake® Optimum Outflow Control

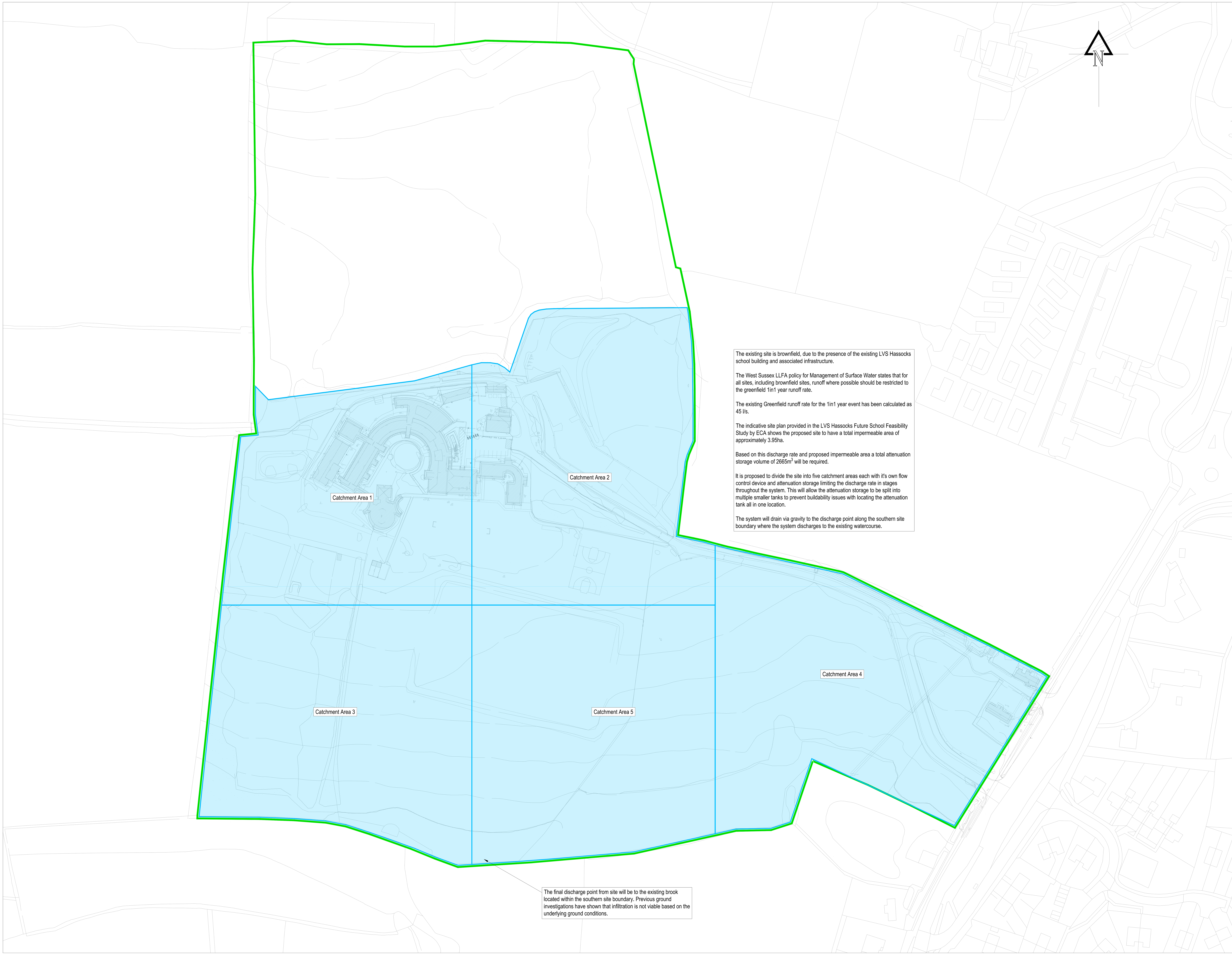
Unit Reference	MD-SHE-0261-4500-2500-4500
Design Head (m)	2.500
Design Flow (l/s)	45.0
Flush-Flo™	Calculated
Objective	Minimise upstream storage
Application	Surface
Sump Available	Yes
Diameter (mm)	261
Invert Level (m)	0.000
Minimum Outlet Pipe Diameter (mm)	300
Suggested Manhole Diameter (mm)	2100

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	2.500	45.0
Flush-Flo™	0.722	44.9
Kick-Flo®	1.556	35.8
Mean Flow over Head Range	-	39.0

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)
0.100	8.4	1.200	42.7	3.000	49.1	7.000	74.0
0.200	26.8	1.400	39.9	3.500	52.9	7.500	76.6
0.300	39.7	1.600	36.3	4.000	56.4	8.000	79.0
0.400	42.3	1.800	38.4	4.500	59.7	8.500	81.4
0.500	43.9	2.000	40.4	5.000	62.9	9.000	83.7
0.600	44.7	2.200	42.3	5.500	65.9	9.500	85.9
0.800	44.9	2.400	44.1	6.000	68.7		
1.000	44.1	2.600	45.8	6.500	71.4		

APPENDIX I
Proposed Drainage Catchment Areas



The existing site is brownfield, due to the presence of the existing LVS Hassocks school building and associated infrastructure.

The West Sussex LLFA policy for Management of Surface Water states that for all sites, including brownfield sites, runoff where possible should be restricted to the greenfield 1in1 year runoff rate.

The existing Greenfield runoff rate for the 1in1 year event has been calculated as 45 l/s.

The indicative site plan provided in the LVS Hassocks Future School Feasibility Study by ECA shows the proposed site to have a total impermeable area of approximately 3.95ha.

Based on this discharge rate and proposed impermeable area a total attenuation storage volume of 2665m^3 will be required.

It is proposed to divide the site into five catchment areas each with it's own flow control device and attenuation storage limiting the discharge rate in stages throughout the system. This will allow the attenuation storage to be split into multiple smaller tanks to prevent buildability issues with locating the attenuation tank all in one location.

The system will drain via gravity to the discharge point along the southern site boundary where the system discharges to the existing watercourse.

The final discharge point from site will be to the existing brook located within the southern site boundary. Previous ground investigations have shown that infiltration is not viable based on the underlying ground conditions.

IF YOU HAVE A QUERY CALL US
SCALING FROM THIS DRAWING OR OBTAINING DIMENSIONS ELECTRONICALLY MAY NOT PROVIDE ACCURATE INFORMATION AND SHOULD BE AVOIDED. WORK ONLY FROM FIGURED DIMENSIONS.

GENERAL NOTES

DRAWINGS AND SPECIFICATIONS: This drawing is to be read in conjunction with all relevant Architects, Engineers and Specialists drawings together with the specification.

BUILDING REGULATIONS AND WARRANTY PROVIDER APPROVALS: Please note that it is the responsibility of the Client/Main Contractor to ensure that Building Regulations and warranty provider (e.g. NHBC) approval of all design and construction details is achieved prior to construction on site.

C D M : SIGNIFICANT HAZARDS

THE FOLLOWING HEALTH AND SAFETY HAZARDS ARE IDENTIFIED BY THE DESIGNER AS ABNORMAL IN PURSUANCE OF THE CURRENT CONSTRUCTION DESIGN AND MANAGEMENT REGULATIONS.

RISKS DURING CONSTRUCTION:
- No abnormal risks have been identified relating to this design element.

OPERATION / MAINTENANCE RISKS:
- No abnormal risks have been identified relating to this design element.

RISKS DURING DEMOLITION / DECOMMISSIONING / DISMANTLING / ALTERATIONS:
- No abnormal risks have been identified relating to this design element.

IT IS ASSUMED THAT ALL WORKS WILL BE CARRIED OUT BY COMPETENT & ADEQUATELY RESOURCED CONTRACTOR(S) WORKING TO SAFE SYSTEMS OF WORK.

REV	REVISION DETAILS	BY	DATE
P01	1ST ISSUE	DW	15.08.23

CRADDYS
Consulting Civil and Structural Engineers
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PROJECT TITLE
LONDON ROAD
SAYERS COMMON

DRAWING TITLE
PROPOSED SITE DRAINAGE
CATCHMENT AREAS

CLIENT
LICENSED TRADE CHARITY

STATUS
INFORMATION

SCALE AT A1	DRG SIZE	DRAWN	CHECKED	APPROVED
1:1000	A1	DW	NS	NM

JOB NO.	DRAWING NUMBER	REV
50402	CDY-XX-XX-DR-C-SK0002	P01

APPENDIX J
Operation and Maintenance Manual

1. INTRODUCTION

1.1. **Purpose of this Report.** This document provides the client with all relevant information required for the operation and maintenance of the private drainage on site. The operation and maintenance of adoptable drainage is not covered in this report.

1.2. **CDM Regulations.** The information provided is in line with the requirements of the CDM regulations (2015). For unusual or unforeseeable residual risks associated with the operation, maintenance and decommissioning / dismantling of the drainage, reference should be made to the CDM boxes on the individual drawings.

1.3. **Maintenance.** Refer to sections 4 for full maintenance requirements.

1.4. **Supporting information**. The as-built drawings will be provided in electronic format to accompany this document as part of the H&S file.

2. DESCRIPTION OF THE PROJECT

2.1. **Site location**. LVS Hassocks, London Road, Sayers Common, BN6 9HT.

2.2. **Brief**. Construction of a new housing development with associated infrastructure on the existing brownfield site. The existing LVS Hassocks buildings are to be demolished.

2.3. **Foul Water Drainage**. The foul water drainage for the site will discharge off site via a pumped system to the existing public foul system in London Road. The existing foul drainage also discharges via a pumped system to the public system. The proposed development will necessitate the location of the pumped chamber to be different than the existing pumped chamber which is located to the north of the site.

2.4. **Surface Water Drainage**. The surface water drainage will discharge at an attenuated rate to the existing watercourse located along the southern site boundary.

3. DRAINAGE MAINTENANCE RESPONSIBILITIES

3.1. Where appropriate drainage will be offered for adoption by Southern Water with the remaining private drainage being maintained by a management company with a quantified regime.

4. PRIVATE DRAINAGE OPERATION AND MAINTENANCE ACTIVITIES AND SCHEDULES

4.1. **Overview.** The following information details the drainage items which will require periodic maintenance, and sets out how often they should be maintained to achieve their maximum design life in accordance with CIRIA C753 guidance. All maintenance should be carried out by suitably trained individuals using the appropriate equipment.

4.2. **Inspection chambers and manholes.** Inspection chambers and manholes should be inspected annually for build-up of silt and general debris. Should silt/debris be identified in the drainage system, the services of a specialist drainage engineer should be enlisted.

4.3. **Unusual / unresolved problems.** If problems persist even after following the following guidelines including the jet-cleaning if necessary, this might indicate greater issues within the system. At this point, a CCTV survey is likely to be required and further advice should be sought from a drainage engineer

4.4. **Attenuation Storage Tanks.** The underground offline attenuation tanks provide the attenuation storage on the project. Ensuring that the attenuation system is free from silt and material build-up is important to prevent potential surface water flooding. Table 21.3 from CIRIA C753 is shown below detailing the maintenance requirements for attenuation storage tanks.

O&M Requirements for Attenuation Storage Tanks		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly or 3 months, then annually
	Remove debris from the catchment surface (where it may cause risks to performance).	Monthly
	For systems where rainfall infiltrates into the tank from above, check surface of filter for blockage by sediment algae or other matter; remove and replace surface infiltration medium as necessary.	Annually
	Remove sediment from pre-treatment structures and/ or internal forebays.	Annually or as required
Remedial actions	Repair/ rehabilitate inlets, outlet, overflows and vents.	As required
Monitoring	Inspect/ check all inlets, outlets, vents and overflows to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of tank for sediment build-up and remove if necessary.	Every 5 years or as required

4.5. Pumping stations

Pumping stations should be maintained as per the manufacturer's recommendations; however, an indicative outline schedule is included below:

O&M Requirements for Pumping Station		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect lifting chain or rope	6 Monthly
	Lift cover at outfall manhole and check for normal flow	6 Monthly
	Inspect cables, oil, mechanical seals, bearings, wearing parts (*Note: rubber parts must be replaced if disassembled during inspection)*	Annually
	Change oil	Biannually
	Change mechanical seals	Biannually
	Complete overhaul/service	Every 5 years
Remedial actions	Remove any foreign objects attached to lifting chain/ rope.	As required
	Replace lifting chain/rope if damaged	As required
	Jet-clean rising main	As required
Monitoring	Measure operating current – to be within the rated current	Daily (automatically monitored)
	Measure power voltage variation – to be within ±10% of the rated voltage	Daily (automatically monitored)

4.6. Flow Control Device

Flow Control Devices should be maintained as per the manufacturer's recommendations; however, an indicative outline schedule is included below:

O&M Requirements for Flow Control Device		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required take remedial action.	Monthly for 3 months, then annually
	Remove sediment from internal sump	Annually
	Inspect cables, mechanical seals, bearings (*Note: rubber parts must be replaced if disassembled during inspection)*	Yearly
Remedial actions	Replace operating rope for pivoting bypass door if required.	As required

4.7. Watercourse

The existing watercourse should be maintained following the guidance from CIRIA C753 with regards to Swales and Filter Strips, Tables 15.1 and 17.1 respectively.

O&M Requirements for Existing Watercourses		
Maintenance schedule	**Required action**	**Typical frequency**
Regular maintenance	Remove litter and debris.	Monthly (or as required)
	Inspect watercourse to identify evidence of erosion, sedimentation or contamination (e.g. oils).	Monthly (at start, then half yearly)
	Inspect outlets for blockages and clear if required.	Monthly
	Inspect silt accumulation rates and establish appropriate removal frequencies	Monthly (at start, then half yearly)
Occasional Maintenance	Reseed areas of poor vegetation growth, alter plant types to better suit conditions, if required.	As required or if bare soil is exposed over an area of the embankment.
Remedial actions	Remove and dispose of oils or petrol residues using safe standard practices.	As required
	Remove build-up of sediment.	As required