LANMOR Consulting

Civil Engineers & Transport Planners

Upper Culham Farm

Flood Risk Assessment & Drainage Strategy

August 2024

241842/FRA_DS/OR/RS/01

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CONTENTS

1 INTRODUCTION 1

1.1 Scope 1

1.2 Site Location 2

1.3 Development Proposals 2

1.4 Site Geology 3

1.5 Borehole Records 3

2 SOURCES OF FLOODING 5

2.1 Fluvial / Tidal Flooding 5

2.2 Surface Water Flood Risk 7

2.3 Groundwater Flooding 8

2.4 Reservoir Flooding 9

3 DRAINAGE STRATEGY 10

4 SUDS MITIGATION 12

5 SUDS MANAGEMENT AND MAINTAINENCE 14

Inspection, Manhole, Catchpit Chambers and Pipes 14

Drainage Channels and Gullies 16

6 SUMMARY & CONCLUSION 20

TABLES

TABLE 4.1 – CIRIA SUDS MANUAL C753 (LAND USE CLASSIFICATIONS) 12
TABLE 5.1 – MANHOLE, CATCHPIT AND PIPES MAINTENANCE 15
TABLE 5.2 – CHANNEL AND GULLY MAINTENANCE 16
TABLE 5.3 – SOAKAWAY MAINTENANCE 17
TABLE 5.4 – POND AND WETLAND MAINTENANCE 19

FIGURES

FIGURE 1.1 – SITE LOCATION 2
FIGURE 1.2 – BGS GEOINDEX BOREHOLE RECORDS 4
FIGURE 2.1 – MAPPED FLUVIAL / TIDAL FLOOD RISK 5
FIGURE 2.2 – MAPPED SURFACE WATER FLOOD RISK 7
FIGURE 2.3 – AREAS SUSCEPTIBLE TO GROUNDWATER FLOODING 9
FIGURE 3.1 – SUDS HIERARCHY 10

APPENDICES

APPENDIX A
Topographical Survey
Upper Culham Farm Layout 1.A0 1-1250 – Site Layout

APPENDIX B
Borehole Records

APPENDIX C
241842-DS-01 – Proposed Drainage Strategy

1 INTRODUCTION

1.1 Scope

1.1.1 Lanmor Consulting Ltd has been commissioned to provide a Flood Risk Assessment and Drainage Design report for the proposed development of Upper Culham Farm, Culham Lane, Henley, RG10 8NR.

1.1.2 This report describes the sites existing conditions, development proposals and implications of flooding on the site as described in the governments guidance document; National Planning Policy Framework (NPPF) and its technical guidance. This report will consider the following:

- Development proposals
- Sources of flooding and flood defences
- Flooding extents, depth and climate change predictions
- Impact of flooding on the development
- Dangers presented by flooding

1.1.3 This report has been prepared in accordance with the requirements of the governments National Planning Policy Framework (NPPF) and its planning practice guidance and will demonstrate that the proposed development will be safe and will not increase the risk of flooding in the surrounding area.

1.1.4 This report will also consider the proposed drainage regime for the site. It will assess the site's current Greenfield runoff rate, suitable methods of discharging the runoff from the development and set the drainage strategy for the proposed development, including discharge rates and any requirements for attenuation.

1.2 Site Location

1.2.1 The site is situated off Culham Lane in a rural area of Henley-on Thames. The site currently stands as a farm area, thus is surrounded by vast Greenland (approx. 130 hectares). Within the greenspace, there stands buildings which appear to be used for primarily commercial purposes toward the western site boundary, directly off Culham Lane. Opposing Culham Lane are also some residential properties.

1.2.2 The closest watercourse to the site is the River Thames, which travels around the west and north of the site, approximately 1.3-1.5 km away.

1.2.3 Found below is Figure 1.1, which demonstrates the mapped site location.

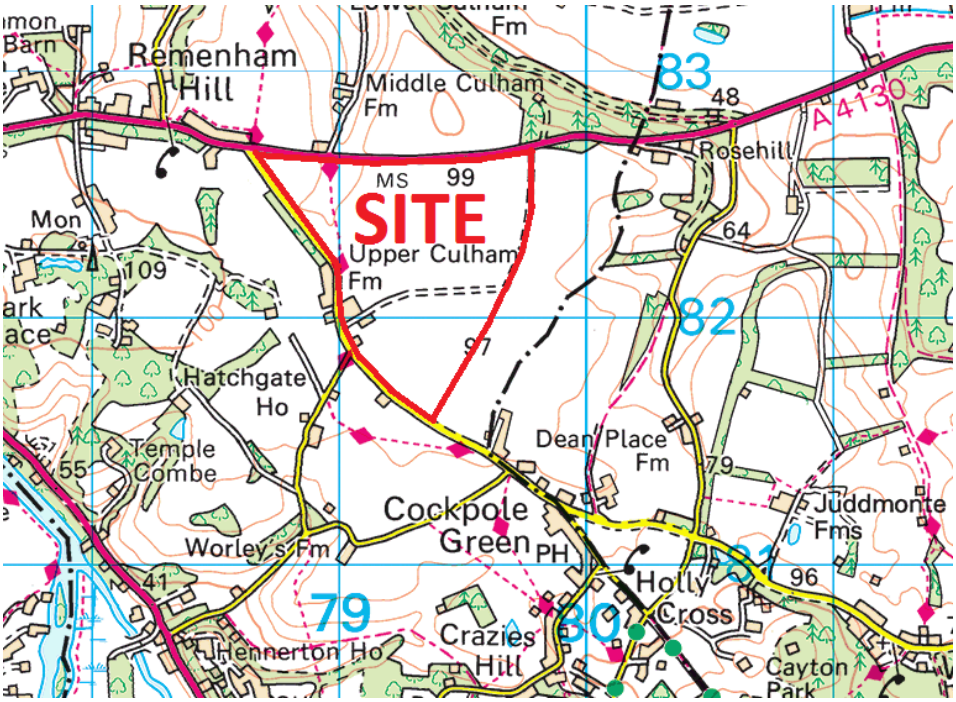


Figure 1.1 – Site Location

1.3 Development Proposals

1.3.1 The proposed development is for the construction of the following: 2 polo fields, exercise track – 400m canter and walking, horse walker, pavilion, American barn, irrigation ponds and an extended estate road. The existing buildings toward the mid-western site boundary are to remain unaltered by the proposal.

1.3.2 The proposed site plan can be found in Appendix A under drawing 'Upper Culham Farm Layout Upper Culham Farm Layout 1.A0 1-1250'.

1.4 Site Geology

1.4.1 The British Geological Survey (BGS) mapping indicates that the site sits upon the Bedrock formation of Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formations consisting of Chalk. The sites sedimentary bedrock was formed between 93.9 and 72.1 million years ago during the Cretaceous period.

1.4.2 The site also contains superficial deposits of clay with flints formation – consisting of clay, silt, sand and gravel. The sedimentary bedrock was said to be formed between 23.03 million and 11.8 thousand years ago during the Neogene and Quaternary periods.

1.5 Borehole Records

1.5.1 Borehole records were obtained via the use of BGS' GeoIndex to observe the sites geology in detail and determine the depth of which the chalk layers lay.

1.5.2 These records include a total of two boreholes that have been undertaken onsite in the past, one being situated toward the north eastern site boundary, known as SU78SE28; the other borehole being toward the southern boundary, known as SU78SE29.

1.5.3 Both boreholes present a similar soil structure, with borehole SE78SE28 hitting upper chalk layer at a depth of 2.5m, whilst borehole SU78SE29 strikes the same layer at a depth of 2m. Both recorded boreholes did not encounter groundwater at their respective depths.

1.5.4 Borehole records detailing these boreholes can be found within Appendix B of this report, and Figure 1.2 below shows the locations of the boreholes in relation to the site.

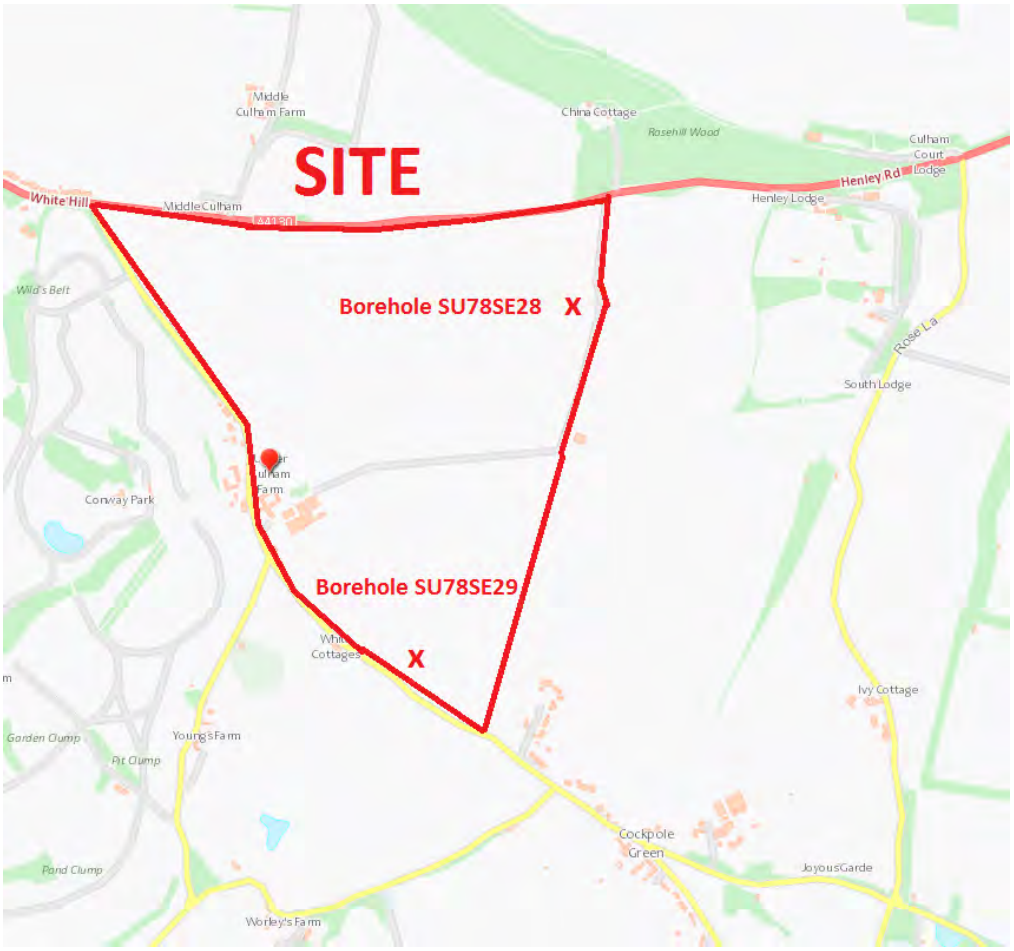


Figure 1.2 – BGS GeoIndex Borehole Records

2 SOURCES OF FLOODING

2.1 Fluvial / Tidal Flooding

2.1.1 Using the flood mapping services provided by the Environmental Agency (EA), which is considered to be an accurate measure of flood risk, we have determined the site is not at any substantial risk from flooding from fluvial or tidal forms.

2.1.2 The closest river to the site is the River Thames, as seen in Figure 2.1 we can see the river does not pose any flood risk to the site. This means that the area has a chance of flooding of less than 0.1% AEP, meaning flood risk from fluvial forms can be considered very low.

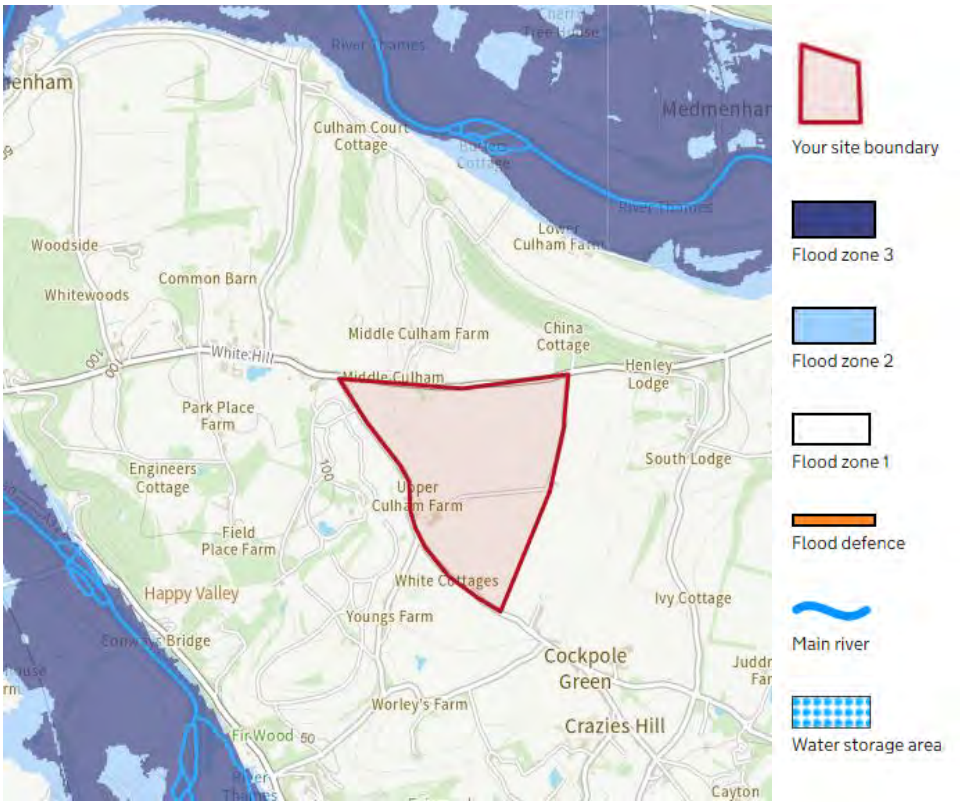


Figure 2.1 – Mapped Fluvial / Tidal Flood Risk

2.1.3 The NPPF and PPG define the Flood Zones as follows:

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

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

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

- Zone 3b: 'The Functional Floodplain' – This zone comprises land where water must flow or be stored in times of flood. SFRAs should identify this Flood Zone (land which would flood with an annual probability of 1 in 20 (5%) or greater in any year or is designed to flood in an extreme (0.1%) flood, or at another probability to be agreed between the LPA and the Environment Agency, including water conveyance routes).

2.1.4 The application site is shown to be within Flood Zone 1. This means that fluvial flood waters will not reach the site during a 1.0% (1 in 100) or a 0.1% (1 in 1000) year event.

2.1.5 The site is located a significant distance from Flood Zones 2 and 3, so even when future climate change allowances are considered, the site will still be some distance from the flooding and will not be affected by flood waters.

2.1.6 As the site is located in Flood Zone 1, it will not be affected by flood waters for the 1% or 0.1% AEP events, including allowances for climate change. Therefore, there will be no impact on the flow of flood water, flood storage volumes, or be affected by flood waters.

2.1.7 Also, a safe and dry access can be provided at all times during a storm event, and the Sequential Test is passed, as the development is located in an area at the lowest risk of flooding.

2.2 Surface Water Flood Risk

2.2.1 The EA also provides data which indicates a sites surface water flood risk, which can be seen below in Figure 2.2.

Figure 2.2 – Mapped Surface Water Flood Risk

2.2.2 In the above mapping, the site only contains 2 very small areas which presents a potential risk of surface water flooding where ground levels are at the lowest. Therefore the risk of surface water flooding to the site is considered very low.

2.2.3 Consequently, we believe it is fair to say the general risk of surface water flooding to the site can be considered to be very low as a result of the majority of the site being permeably surfaced.

2.3 Groundwater Flooding

2.3.1 The local council's mapping indicates that the flood risk from groundwater is unlikely within the area of the site.

2.3.2 The borehole records discussed within section 1.2 of this report and shown in Appendix B demonstrate groundwater is not likely to be encountered at depths of 2 – 2.5m (above the chalk layer).

2.3.3 In order to further investigate the likelihood of groundwater flooding, as the sites bedrock geology consists of several chalk formations, Wokingham Borough Councils' (WBC) Local Flood Risk Management Strategy, April 2015 (LFRMS) was accessed. Mapping provided by WBC within the LFRMS under section D3, Historic Flooding, Groundwater flooding and represented as Figure 6 (provided as Figure 2.3 within this report) shows that the sites represented zone is within an area of none or unmeasured susceptibility to groundwater flooding. This can be seen below within Figure 2.3.

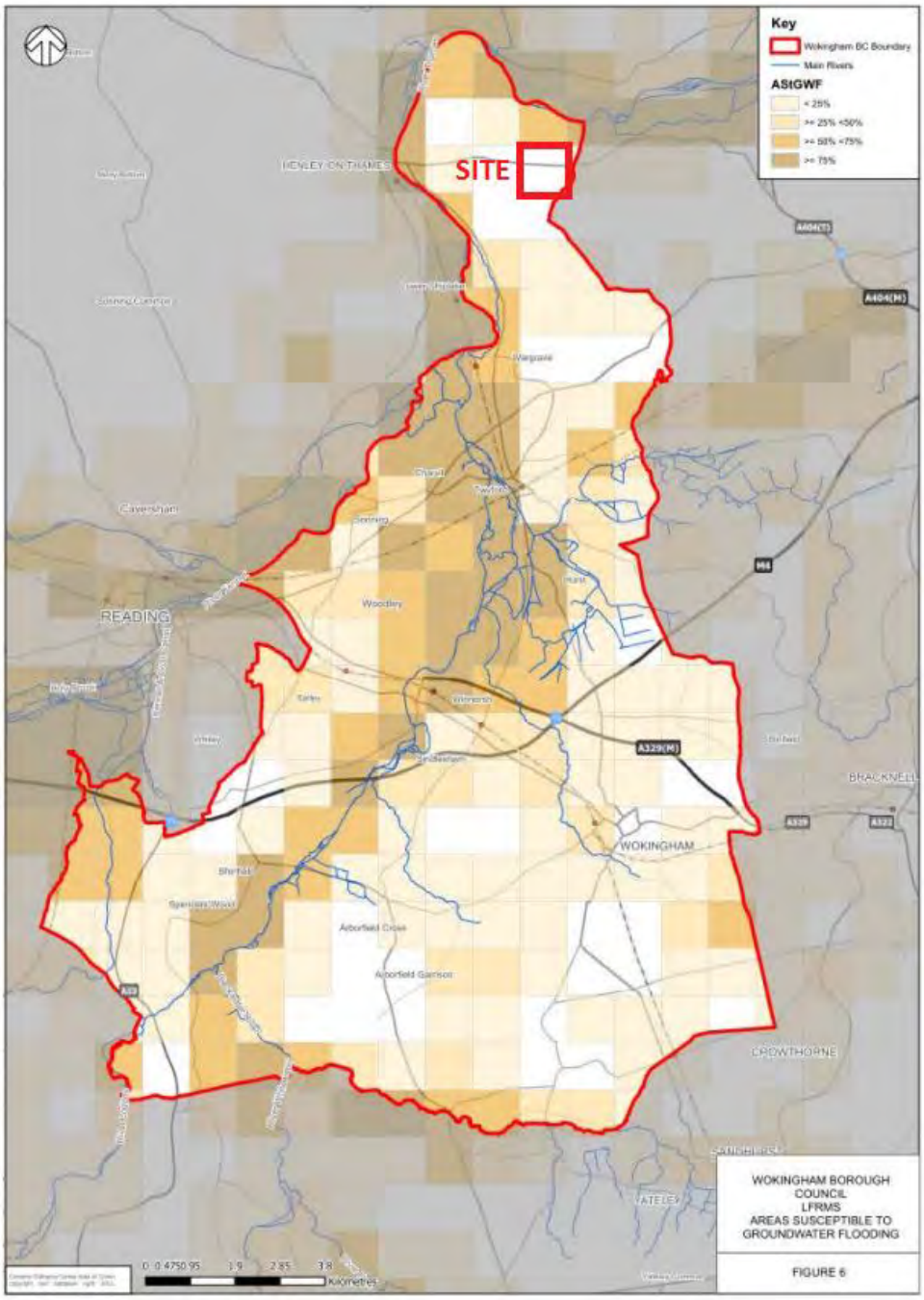


Figure 2.3 – Areas Susceptible to Groundwater Flooding

2.4 Reservoir Flooding

2.4.1 The EA mapping indicates that the flood risk from reservoir is unlikely within the area of the site.

3 DRAINAGE STRATEGY

3.1.1 It has been assumed that there is currently no drainage on site, and that all runoff discharges directly to ground.

3.1.2 Sustainable Drainage Strategy (SuDS) were considered as part of this assessment for disposal of surface water runoff from the development. The site is to contain five respective grounds, a pavilion, a yard and three irrigation ponds. These structures are to allow for any rainwater to be reused in irrigating the grounds. The grounds will use filter drains to direct any intercepted flows toward their respective ponds.

3.1.3 The site proposal also includes the erection of an American barn toward the mid-western site boundary. The storage of rainwater for later use via rainwater harvesting system was considered excessive for this building. This would require the implementation of tanks and pumps to store the rainwater, thus we deem that it would be economically inefficacious as the barn is to only likely to hold equestrian animals/facilities.

3.1.4 The American style barn is to also have a sloped roof, and a green or blue roof is therefore not possible, so intercepted rainfall from the roof is to be collected and transported into a soakaway which will then discharge into the soil.

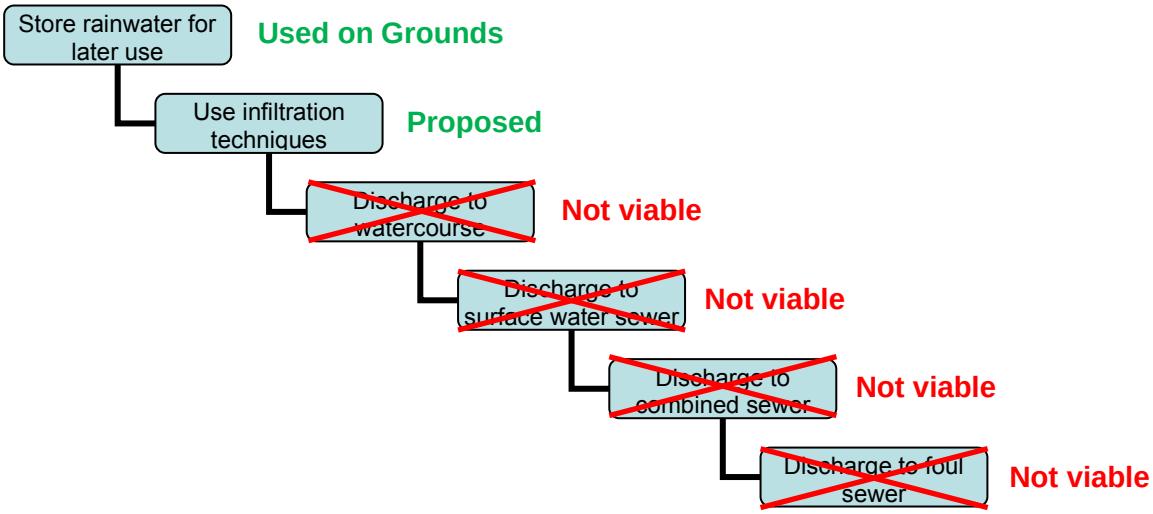


Figure 3.1 – SuDS hierarchy

3.1.5 For the five grounds, a series of filter drains and pipes will be provided to collect and transport excess water to their respective irrigation ponds.

3.1.6 The area by the American Barn is to contain a separate pipe network which transports all intercepted rainwater from the roof of the barn into a soakaway. This soakaway is to be sized at 6.0x20.0x1.2 (WxLxD) to accommodate the storage capacity required for a rainfall storm event of 1 in 100 years with the allowance of a 20% climate change increase.

3.1.7 The proposed drainage strategy drawing can be found under Appendix C.

4 SUDS MITIGATION

4.1.1 As part of the CIRIA SuDS Manual C753, Section 26 provides guidance regarding methods for managing pollution risks from surface water runoff. Part of the assessment is to determine which land use classification the proposed development falls under, Table 26.1 of the report sets the approaches to water quality risk management. For this site the Simple Index Approach will be used.

4.1.2 Table 26.2 in C753 reproduced as Table 4.1 below, shows the potential hazards associated with different land uses and the hazard indices. The development will consist of a barn roof, it is concluded that the site should be classed within the sections shown in Table 4.1 below.

4.1.3 The roof of the equestrian building is considered to have a "low" pollution hazard, generating 0.3 total suspended solids, 0.2 metals and 0.05 hydrocarbons. The grounds are considered to have a "very low" pollution hazard as there will be negligible vehicular access.

TABLE 26.2 Pollution hazard indices for different land use classifications

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/ industrial roofs)	Low	0.3	0.2 (up to 0.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (eg cul de sacs, homezones and general access roads) and non-residential car parking with infrequent change (eg schools, offices) ie < 300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (eg hospitals, retail), all roads except low traffic roads and trunk roads/motorways[1]	Medium	0.7	0.6	0.7
Sites with heavy pollution (eg haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways[1]	High	0.8[2]	0.8[2]	0.9[2]

Table 4.1 – CIRIA SuDS Manual C753 (Land use classifications)

4.1.4 The barn roof is considered to have a “low” level of pollution, and the runoff will be discharged to ground via a soakaway. Catchpits will be provided in the inlets to the soakaway, capturing any silt or other debris in the runoff. This mitigation is considered sufficient for the proposals given the minimal level of pollution in the water.

5 SUDS MANAGEMENT AND MAINTAINENCE

5.1.1 Regular inspection of the surface water drainage network for blockages and clearing unwanted debris/silt from the system should improve the performance of the surface water network and decrease the need for future repairs. In the event of blockages, high pressure water jets can be used to clear the gullies and pipes to ensure they are functioning correctly, this should be undertaken by certified trained professionals.

5.1.2 The level and frequency of maintenance required on site is dependent on the type of facility. The type of maintenance will fall into one of three categories 'regular maintenance', 'occasional maintenance', and 'remedial maintenance'.

5.1.3 Regular Maintenance of the drainage and SuDS features could include, inspections, removal of litter/debris and sweeping of the surfaces. Occasional maintenance will include removal of sediment etc. and remedial maintenance may include structural repairs and infiltration reconditioning if required.

5.1.4 The drainage elements after an initial inspection following construction should be inspected on a monthly basis for the first 12 months and after large storms, thereafter the following maintenance regime should be applied and adjusted if the 12-month monitoring process has identified any issues.

5.1.5 The following maintenance regime is recommended for the SuDS features in the development and should be adjusted suit site requirements flowing the initial inspections if required.

Inspection, Manhole, Catchpit Chambers and Pipes

5.1.6 The appropriate health and safety equipment must be used when accessing manholes. Confined space certificates must be held by any personnel entering a manhole and the appropriate permits should be obtained.

5.1.7 Pipes are intended to be the main conveyance across the development. They are intended to be dry except for during rainfall events. These have been designed to be self-cleaning where possible for smaller diameter pipes, and for larger diameters the risk is reduced due to the overall pipe size.

5.1.8 For the Inspection, Manhole, Catchpit Chambers and Pipes, the following maintenance will be required.

Manhole / Pipe Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Inspect for evidence of poor operation via water level in chambers. If required, take remedial action.	3-monthly, 48 hours after large storms.
	Check and remove large vegetation growth near pipe runs.	Monthly or as required
	Remove sediment from structures.	Annually or as required
Remedial Actions	Rod through poorly performing runs as initial remediation.	As required
	If continued poor performance jet and CCTV survey poorly performing runs.	As required
Monitoring	Inspect/check all inlets, outlets, to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of pipe manholes for sediment build-up and remove if necessary	Every 5 years or as required

Table 5.1 – Manhole, Catchpit and Pipes Maintenance

Drainage Channels and Gullies

5.1.9 For the Inspection, drainage channel and gullies, the following maintenance will be required.

Channel and Gully Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Litter and debris removal	Monthly or as required
	Check and remove large vegetation growth near channel runs	Monthly or as required
	Inspect for evidence of poor operation and/or weed growth. If required, take remedial action. Inspect silt accumulation rates and establish appropriate brushing frequencies. Silt can also be caused by adjacent landscaping areas which should be reprofiled to provide a flat area or berm adjacent to the paving	3-monthly, 48 hours after large storms
Remedial Actions	Inspect access/outlet boxes and rod through poorly performing channels and outlets as initial remediation.	As required
Monitoring	Inspect/check all inlets, outlets, to ensure that they are in good condition and operating as designed.	Annually
	Survey inside of gullies for sediment build-up and remove if necessary	Every year or as required

Table 5.2 – Channel and Gully Maintenance

Soakaways

5.1.10 For the soakaways, the following maintenance is recommended.

Soakaway Maintenance Schedule		
	Required Action	Typical Frequency
Regular maintenance	Inspect for sediment debris in pre-treatment components and floor of inspection tube / chamber and inside soakaway	Annually
	Cleaning of gutters and any filters on downpipes	Annually (or as required based on inspections)
	Trimming any roots that may be causing blockages	Annually (or as required)
Occasional maintenance	Remove sediment and debris from pre-treatment components and floor of inspection tube / chamber and inside soakaway	As required, based on inspections
Remedial Actions	Reconstruct soakaway and/or replace or clean void fill, if performance deteriorates or failure occurs	As required
	Replacement of clogged geotextile (will require reconstruction of soakaway)	As required
Monitoring	Inspect silt traps and note rate of sediment accumulation	Monthly in the first year and then annually
	Check soakaway to ensure emptying is occurring	Annually

Table 5.3 – Soakaway Maintenance

Ponds and Wetlands

5.1.11 For ponds and wetlands, the following maintenance is recommended.

Ponds and Wetlands Maintenance Schedule		
	Required Action	**Typical Frequency**
Regular maintenance	Remove litter and debris	Monthly (or as required)
	Cut the grass – public area	Monthly (During growing season)
	Cute the meadow grass	Half yearly (spring, before nesting season, and autumn)
	Inspect marginal and bankside vegetation and remove nuisance plants (for first 3 years)	Monthly (at start, then as require)
	Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage	Monthly
	Inspect water body for signs of poor water quality	Monthly (May-October)
	Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies; undertake contamination testing once some build-up has occurred, to inform management and disposal	Half Early
	Check any mechanical devices, eg penstocks	Half early
	Hand cut submerged and emergent aquatic plants (at minimum of 1.0m above pond and base; include max 25% of pond surface)	Annually
	Remove 25% of bank vegetation from water's edge to a minimum of 1m above water level	Annually
	Tidy all dead growth (scrub clearance) before start of growing season (note: tree maintenance is usually part of overall landscape management contract)	Annually
	Remove sediment from any forebay	Every 1-5, or as required
	Remove sediment and planting from one quadrant of the main body of ponds	Every 5 years, or as required

Remedial Actions	Remove sediment from the main body of big ponds when pool volume is reduced by 20%	With effective pre-treatment, this will only be required rarely, e.g every 25-50 years
Monitoring	Repair erosion or other damage	As required
	Replant, where necessary	As required
	Aerate pond when signs of eutrophication are detected	As required
	Realign rip-rap or repair other damage	As required
	Repair/rehabilitate inlets outlets and overflows	As required

Table 5.4 – Pond and Wetland Maintenance

6 SUMMARY & CONCLUSION

6.1.1 This report has been prepared in accordance with the requirements of the governments National Planning Policy Framework (NPPF) and its planning practice guidance and has demonstrated that the proposed development will be safe and will not increase the risk of flooding in the surrounding area.

6.1.2 The site is situated off Culham Lane in a rural area of Henley-on Thames. The site currently stands as a farm area, thus is surrounded by vast Greenland (approx. 130 hectares). Within the greenspace, there stands buildings which are primarily used for commercial purposes, toward the western site boundary, directly off Culham Lane. Opposing Culham Lane are also some residential properties.

6.1.3 Geology records indicate that the site sits upon the Bedrock formation of Lewes Nodular Chalk Formation, Seaford Chalk Formation and Newhaven Chalk Formations consisting of Chalk. Therefore, the use of infiltration techniques will be viable for the discharge of runoff.

6.1.4 Boreholes on-site present a similar soil structure to one another, with borehole SE78SE28 hitting upper chalk layer at a depth of 2.5m, whilst borehole SU78SE29 strikes the same layer at a depth of 2m. Both recorded boreholes did not encounter groundwater at their respective depths.

6.1.5 For the five grounds, a series of filter drains and pipes will be provided to collect and transport rainwater to their respective irrigation ponds.

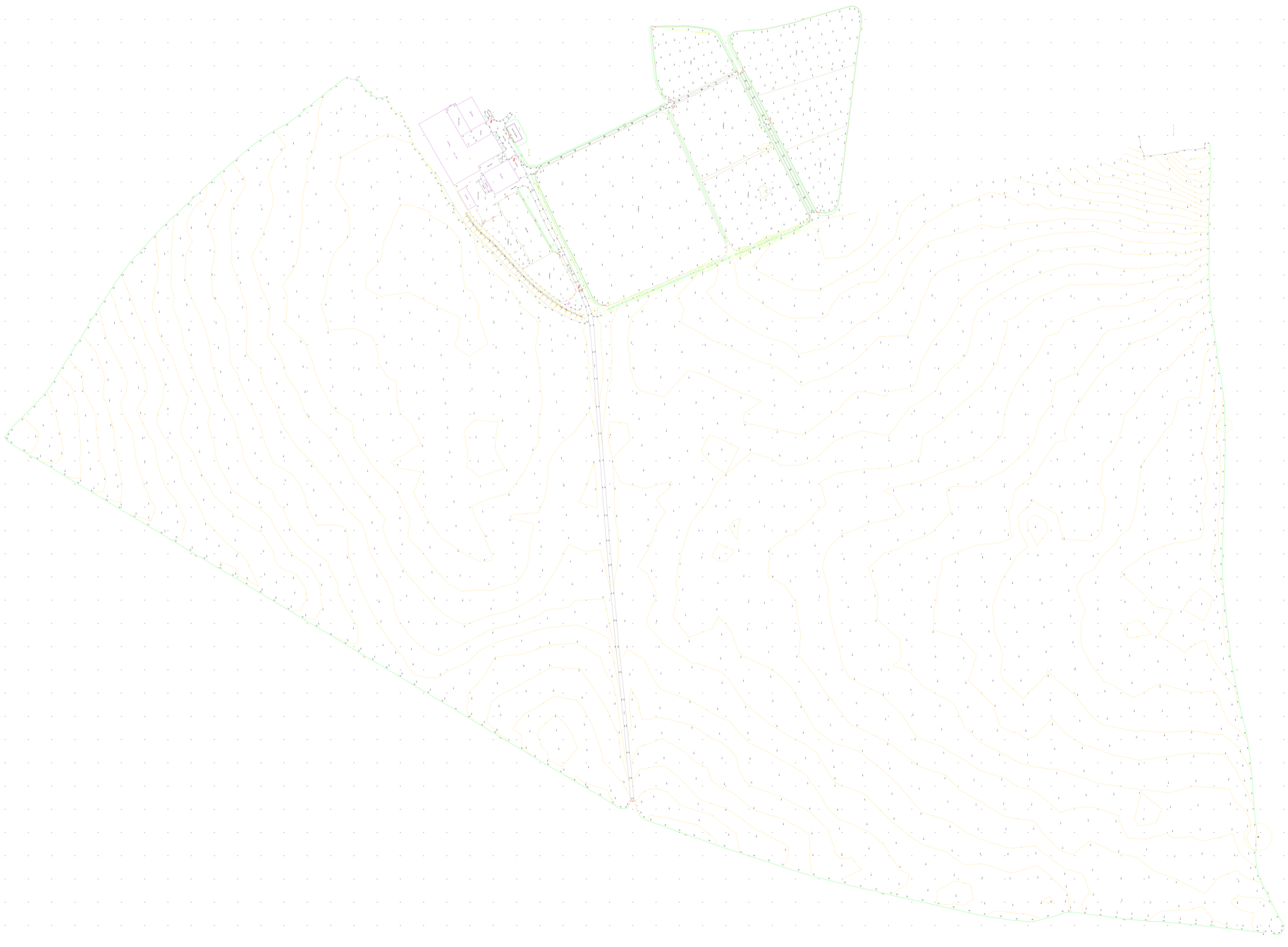
6.1.6 The American barn is to have a separate pipe network to drain rainwater from the roof of the barn into a soakaway. This soakaway is to be sized at 6.0x20.0x1.2 (WxLxD) to accommodate the storage capacity required for a rainfall storm event of 1 in 100 years with the allowance of a 20% climate change increase.

6.1.7 As demonstrated, the site is at very low risk of flooding, a suitable drainage strategy can be provided. Therefore, we see no reason to refuse this planning application on the grounds of flooding or drainage.

APPENDIX A

Topographical Survey

Upper Culham Farm Layout 1.A0 1-1250 – Site Layout



APPENDIX B

Borehole Records

SU 78 SE 28 7971 8245 Near Rosehill Wood, east of Remenham Hill

Surface level (+ 97.2 m) + 319 ft
Water not struck
Shell and auger (modified) 6 in (152 mm) diameter

Waste 1.5 m (5.0 ft)
Bedrock 1.0 m+ (3.5 ft+)

LOG

Geological Classification	Lithology	Thickness m	Thickness ft	Depth m	Depth ft
	Soil	0.3	(1.0)	0.3	(1.0)
Clay-with-flints	Clay, brown, silty, with large subangular to rounded flints	0.5	(1.5)	0.8	(2.5)
	Clay, light brown and grey, silty, with pebbles of flint and chalk	0.7	(2.5)	1.5	(5.0)
Upper Chalk	Chalk, with flints	1.0+	(3.5+)	2.5	(8.0)

SU 78 SE 29 7936 8162 Near Goulders Cottages, Cockpole Green

Surface level (+ 96.6 m) + 307 ft
Water not struck
Shell and auger (modified) 6 in (152 mm) diameter
January 1973

Waste 1.3 m (4.5 ft)
Bedrock 0.7 m+ (2.5 ft+)

LOG

Geological Classification	Lithology	Thickness m	Thickness ft	Depth m	Depth ft
	Soil	0.3	(1.0)	0.3	(1.0)
Clay-with-flints	Clay, brown, with fine to medium pebbles of sub-angular to subrounded flint and some chalk	0.3	(1.0)	0.6	(2.0)
	Clay, chalky, yellowish brown with abundant fine to medium pebbles of chalk and some flint	0.7	(2.5)	1.3	(4.5)
Upper Chalk	Chalk, with flints	0.7+	(2.5+)	2.0	(6.5)

Contact BGS: ngdc@bgs.ac.uk

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Upper Chalk	Chalk, with flints	0.7+	(2.5+)	2.0	(6.5)

APPENDIX C

241842-DS-01 – Proposed Drainage Strategy