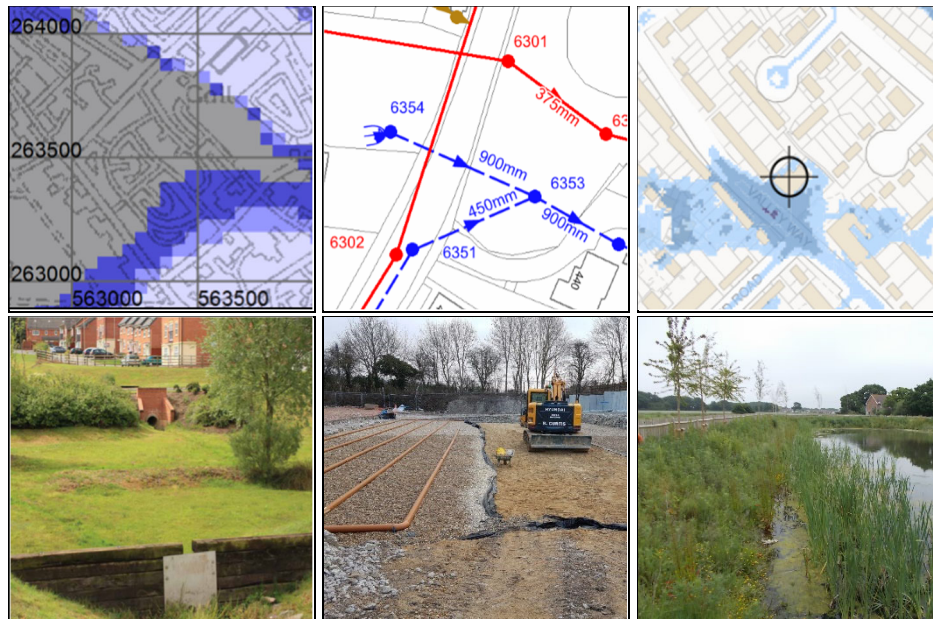




Flood Risk Assessment and Drainage Strategy

**Land at Allington Lane,
West End, Hants**

Reference: 24025

Issue: **Date:**

1 13/3/2024

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A	Existing Layout & Proposed Site Layout
B	EA Flood Mappings, SFRA Map Data & Soils Data
C	Surface Water Assessment
D	Conditions & Limitations

1. Introduction

- 1.1 Instructions were received from Mr T Peters to undertake a Flood Risk Assessment (FRA) and set out a Drainage Strategy (DS) for change of use of land from agricultural to equestrian use and construction of a small building for stables at Allington Lane, west End, Hants.
- 1.2 This assessment has been undertaken by A P Traves BSc CEng MStructE MCIHT.
- 1.3 The client's attention is drawn to the conditions and limitations contained in Appendix D.

2. Development Description & Location

- 2.1 The site is some 1.2 Ha and comprises the part of a grazing paddock at Allington Lane, west End, Hants (grid ref 447375 116200). The site extents are indicated on the annotated aerial photograph in Appendix A. and drawing 592-100 contained in Appendix A of this report.
- 2.2 It is proposed to change the use of the paddock to equestrian use and to construct a small stable building of some 90m² approximate footprint with some 400m² of unbound granular pavement. The proposed layout is identified on site plan 592-102 contained in Appendix A of this report.

3. Local Development Documents & Strategic Flood Risk Assessment

- 3.1 The Strategic Flood Risk Assessment (SFRA) for Partnership for South Hampshire adopted by Eastleigh BC has been reviewed and this indicates the following:
- 3.2 SFRA mapping indicates the site lies in FZ1 (<0.1% AEP) in the River Itchen catchment.
- 3.3 The site is elevated above the extent of tidal flood influence on the River Itchen and is therefore at very low risk of tidal flooding (<0.1% AEP)
- 3.4 SFRA mapping indicates the ditch/watercourse within the front of the site is at high risk (3.3% AEP) of containing surface flood water as would be inherently expected for a watercourse. The ditch already has a number of crossing points and the proposed development includes one of these crossing points over the ditch. The access point into the site lies immediately south of the indicated flood extents.

An area of approximately 20 x 20m within the site and immediately north of the proposed access is also indicated to be at high risk of surface water flooding (3.3%AEP). This area being about 0.2m lower than the adjacent surrounding field levels.

The local terrain fall east to west through the site and continues falling west on the far side of Allington Lane. The remainder of the site including the unbound pavement and stables are indicated to be at very low risk of surface water flooding (<0.1% AEP)

- 3.5 The site is not at a location served by public sewer network and the SFRA mapping does not indicate any record of sewer flood risk at the site.
- 3.6 The design lifespan for a non residential commercial development is 75 years. The SFRA mapping does not indicate the site to lie within 2115 flood zones FZ2/FZ3 and therefore will remain in FZ1 (<0.1%AEP)
- 3.7 The HCC Eastleigh surface Water Management Plan does not identify any surface water flooding issues to Allington Lane.
- 3.8 Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues at this location.

- 3.9 Flood mapping data has been reviewed from the Environment Agency (EA) website. (refer to Appendix B). This indicates the following:
- 3.10 The EA mapping indicates the site lies in FZ1 in the River Itchen catchment
- 3.11 The EA mapping indicates the site is generally at very low risk (<0.1%AEP) of surface water flooding. A small area 20 x 20m area of high surface water flood risk (1%AEP) is immediately north of the site access, where the ground in this part of the field is slightly lower. The ditch in the front of the site inherently contains surface water and is also indicated as a high surface water flood risk. The proposed pavement and stables are not located in these areas and are at very low risk of surface water flooding (<0.1% AEP). It is not proposed to undertake any building in the watercourse/ditch or on the small high surface water flood risk area. (see also 3.4)
- 3.12 The EA mapping indicates the site is not in an area of reservoir flood risk.

4. Catchment Flood Management & Shoreline Management Plans

- 4.1 The site is at an elevation of some 20-25 m AOD and is remote from the influence of tidal flooding. Shoreline Management Plans are not applicable at this location.
- 4.2 The Test and Itchen Hampshire Catchment Flood Management Plan summary – December 2009 (CFMP) indicates the site falls within sub-area 7 Lower itchen. The CFMP states that policy 4 is the preferred policy approach:
- “Areas of low, moderate or high flood risk where we are already managing existing flood risk effectively but where we may need to take further actions to keep place with climate change.”*
- 4.3 Overall the CFMP does not present any issues that would prohibit the development of this site with respect to flood issues provided the surface water drainage is based on SuDS principles.

5. Catchment Data

- 5.1 The site lies within the Itchen catchment just upstream of NRFA gauging station 42023. The catchment is described as follows: Principally a rural, Chalk catchment but with appreciable urban growth near the outfall.
- 5.2 A BGS Infiltration SuDS Georeport for the site is contained in Appendix B and identifies particular attributes described in the following paragraphs.
- 5.3 Section 1 of Part 2 of the SuDS Georeport indicates no very significant constraints for infiltration SUDs for the listed characteristics.
- 5.4 Section 2 of Part 2 of the SuDS Georeport indicates that groundwater is likely to be less than 3m below the surface for at least part of the year This classification is determined from the bedrock and superficial deposits, generic permeabilities, site topography and superficial deposit thickness. No superficial deposits are indicated to be present. Bedrock is indicated to of spatially variable permeability with low to high generic permeability.
- 5.5 Section 3 of Part 2 of the SuDS Georeport considers the impact of increased infiltration upon potential ground stability hazards (soluble rocks, landslides, shallow mining, running sands, swellings clays, compressible ground and collapsible ground). Increased infiltration is reported to be generally unlikely to cause geo hazards with respect to the listed characteristics except for swelling clays.
- 5.6 Section 4 of Part 2 of the SuDS Georeport considers groundwater quality protection. The report identifies that the site is not in a Source Protection Zone (SPZ). The report also

identifies that the predominant flow mechanism is through either pore space in granular media or pore space and fractures, a process which has some potential for contaminant removal and breakdown. No made ground is reported to be at the surface on the site.

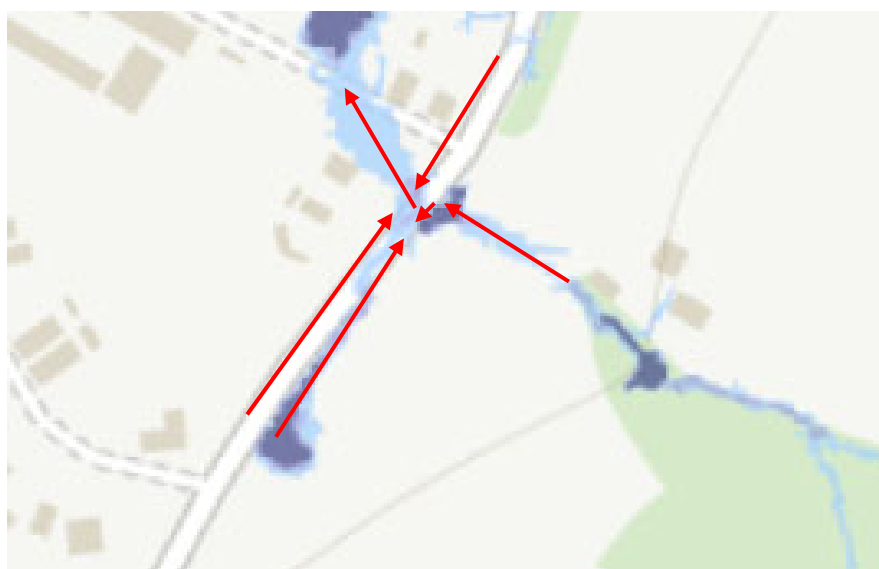
- 5.7 Section 5 of Part 2 of the SuDS Georeport considers the geological mapping at the site location. Superficial deposits are not indicated to be present. The bedrock is indicated to comprise the Wittering Formation comprising Clay silt and Sand.
- 5.8 The BGS Infiltration SuDS Georeport indicates within the report limitations that the report is based on 1:50,000 digital geological maps and not site-specific data. It also identifies that the report is not an alternative for an on-site investigation or soakaway test which might reach a different conclusion.
- 5.9 Surface water drainage must accord with a receptor hierarchy in which Tier 1 (infiltration) must be considered first.
- 5.10 The site geology is sufficiently permeable to facilitate a Tier 1 (infiltration) discharge strategy. A combination of soakaways and permeable pavement is proposed.

6. Sewage Authority Data

- 6.1 The site is remote public foul sewer.
- 6.2 The development does not require foul water discharge.

7. Site Particulars

- 7.1 The site is some 1.2 Ha and comprises the part of a grazing paddock at Allington Lane. The land falls east to west towards Allington Lane from around 25m AOD to around 20m AOD.
- 7.2 There is a ditch inside the front of the site. This falls northwards to a point some 100m north of the site where this makes confluence with the ditch running westwards down the access to Oakland Farm. There is an intermittent ditch falling north of the west side of Allington Lane and we assume the infilled cross over section on the western side have been culverted. There is an inspection chamber with grated cover on the western ditch line approximately 100m north of the site, just north of 'Little Acre'. This chamber then directs the aggregate flow into a culvert running westwards under the land parcel behind the inspection chamber. The schematic below illustrates the local drainage onto the surface water flood risk background.



- 7.3 During the site reconnaissance with the applicant it was noted that the eastern ditches were well maintained but full of standing water and that flow was occurring across the carriageway and entering the grating to the inspection chamber in the western ditch line. The applicant has been in dialogue with officers at Hampshire CC who have confirmed to him that they are aware that the blockage of the culvert under the public highway is their responsibility and are aware that they need to undertake maintenance action to it.
- 7.4 The surrounding land use to the east is agricultural fields. The land use to the west comprises a mix of residential and commercial properties.
- 7.5 The current blockage in the highway culvert (7.3 refers) has backed up water in the ditch in the front of the site to carriageway level and it was noted during the reconnaissance that the 20 x 20m surface water flood risk area within the site (being about 200mm lower than the adjacent paddock) was saturated to ground level with about 25-50mm of standing water in places in this area. It is evident that the carriageway level at the low point on Allington Lane therefore limits the level to which surface water flooding can occur at this location and that this limit is to around 50mm depth in this 20 x 20m area.

8. Source-Pathway-Receptor Assessments

- 8.1 The site is at an elevation of above 20m AOD and is not susceptible to tidal flooding.
- 8.2 The site is remote from rivers and is at low risk of fluvial flooding <0.1% AEP. FZ1.
- 8.3 The site is generally at very low risk of surface water flooding (<0.1%AEP) including the access and proposed stable building. The ditch in the front of the site inherently contains water and it is not proposed to undertake any building in the ditch. It is not proposed to locate any built development in the 20 x 20m high surface flood risk area in the site. The proposed asset avoids the surface water flood risk and are at very low risk of surface water flooding <0.1% AEP.
- 8.4 The EA mapping indicates the site is not in an area of reservoir flood risk.
- 8.5 Hampshire CC Groundwater Management Plan (GWMP) does not identify groundwater issues at the site.
- 8.6 The critical flood source is surface water flow within the site.
- 8.7 The flood receptors of the development would be:
- Outdoor recreation essential facility building (stable)
 - Users of the outdoor recreation facilities
- 8.8 The proposed development and existing site classifications to NPPF Annex 3 are as follows:
- | | |
|--|------------------|
| • Existing agricultural use | Less vulnerable |
| • Proposed outdoor recreation facility | Water compatible |

9. Flood Probability

- 9.1 The EA flood zones shown on the outputs and included in Appendix B represents current best estimates of zone 2 and zone 3 flooding. It does not take account of potential climate change impacts. The flood zone definitions to Table 1 (NPPG Reference ID: 7-078-20220825) are as follows:

Zone 1	Low probability of flooding (<0.1% AEP)
Zone 2	Medium probability of tidal flooding (0.1-0.5% AEP)
	Medium probability of fluvial flooding (0.1-1% AEP)
Zone 3a	High probability of tidal flooding (>0.5% AEP)

	High probability of fluvial flooding (>1% AEP)
Zone 3b	Functional floodplain (>3.3% AEP probability of flooding)

The flood map does not differentiate between zones 3a and 3b.
Zone 3b is only considered appropriate for water-compatible development.
Zone 3a is additionally considered appropriate for less vulnerable uses.

- 9.2 The site is located within Flood Zone 1 (FZ1) low risk <0.1%AEP and the risk of flooding from other sources is low. (see 8.3)

10. Climate Change

- 10.1 The new climate change allowances for flood risk assessment GOV.UK 27 May 2022 update have been used. Non residential is 'commercial' uses are considered to have a lifetime of 75 years. Climate change values for the site are:

- Peak rainfall Test catchment 2124, 1%AEP +45%

- 10.2 SFRA Fig 12-4 indicates the site lies FZ3 flow + climate change flood extents.

- 10.3 Surface water drainage strategy is discussed in Chapter 11. The volumes and flows for this strategy have been derived in accordance with CIRIA C753 and include for climate change effects.

11. Detailed Development Proposals & Surface Water Strategy

- 11.1 Although the development parcel is some 1.2 Ha the vast majority of this is a change of use in name only as this will remain grass paddocks which will have no impact on flood risk.
- 11.2 It is proposed that the 400m² of hard stand around the stables will comprise unbound granular material and as such will be permeable and pass runoff into the underlying natural soils at the natural rate.
- 11.3 It is proposed to drain the stable roof (90m²) to shallow attenuation storage with a discharge ultimately being received into the front ditch. Discharge will be limited to 2 l/sec. The calculation contained in Appendix C confirms this will require an attenuation storage capacity of 1.7m³. There are a number of ways in which this could be provided:
- Above ground rainwater tank set up to maintain 1,700L of free space with overflow regulated to 2.0 l/sec.
 - Shallow buried geocellular storage eg 'Permavoid' units with 1.7m³ storage and flow control set to 2.0 l/sec
 - Form shallow surface basin 12m² x 150mm deep with permeable 'outlet' at the surface to shallow swale. This could be located north of the stable building and just upslope of the 20 x 20m surface water flood area.

The calculations serve to demonstrate a need for 1.7m³ of attenuation storage and that there are a number of ways in which this could be easily delivered.

- 11.4 The proposed residential use retains generally low and very low pollution hazard levels (C753 Table 26.2) and does not require groundwater risk screening.
- 11.5 Simple index approach calculations are contained in Appendix C. These demonstrate that the proposed SUDS will provide the required level of mitigation index.
- 11.6 The surface water drainage system will be designed to accommodate a 1 in 100 year +45% climate change and +10% urban creep rainfall event. With respect to the Non-statutory

Technical Standards for Sustainable Drainage Systems (NTS SuDS) the design accords with requirements S3, S5 and S7-9. Design and construction details will accord with Building Regulations and Sewers for Adoption, as appropriate, so according with S10-11 and S13-14. The design does not include pumping so S12 is not applicable.

- 11.7 Water butts should be installed to intercept roof water run-off. These will reduce the annual volume of surface water discharge but will not make a material contribution to regulation of critical run-off as these tend to be full during Winter months as there is minimal demand for irrigation in these months.
- 11.8 In summary source control will be provided by:
 - Attenuation storage outlined in paragraph 11.3.
- 11.9 The existing exceedance flow path above the site is east to west. The existing exceedance pathways are maintained by the proposed development.
- 11.10 The surface water strategy better the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.
- 11.11 A schedule of O&M maintenance requirements for the SuDS infrastructure is also contained in Appendix C. The maintenance of plot specific drainage will be undertaken by the owners.

12. Sequential & Exceptions Tests

- 12.1 Section 8 concludes the site is at low risk of flooding. The proposed development to outdoor sports/recreation facilities and is of water compatible classification. The proposed development is therefore considered to meet the Sequential test.
- 12.2 The Exceptions Test is not required.

13. Flood Risk Management Measures

- 13.1 The source pathway receptor assessment is contained in Chapter 8.
- 13.2 Paragraph 8.6 identifies surface water flooding and run-off within the site is the governing flood source.
- 13.3 The built fabric of the development avoids the 20 x 20m surface water flood risk area north of the site access

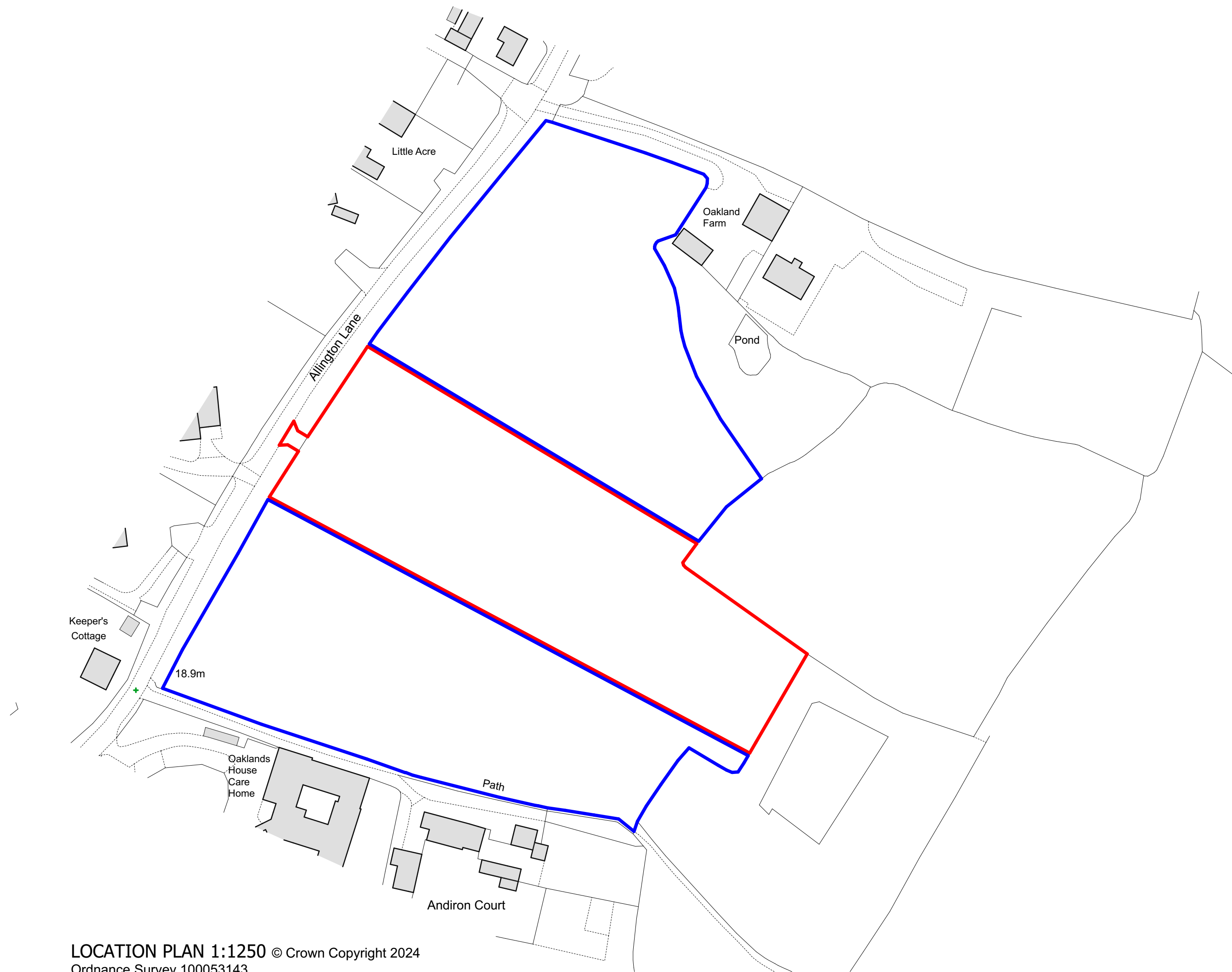
14. Off Site Impacts

- 14.1 The surface water strategy mimics the existing run-off regime. There will therefore be no adverse impact on flood flow rates outside the site.

15. Residual Risks

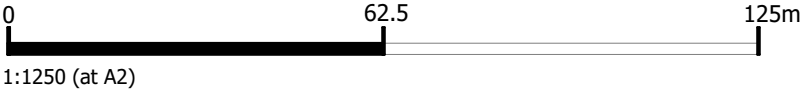
- 15.1 The proposed development provides for flood events up to 1:100 year 2024_{AD} + CC. The residual flood risk is therefore events in excess of 1:100 year 2024_{AD} + CC.

Appendix A



LOCATION PLAN 1:1250 © Crown Copyright 2024
Ordnance Survey 100053143

REV	DESCRIPTION	DATE	AUTHOR	CHK'D	NOTES



DATE
JANUARY 2024
SCALE @ A2
1:1250

AUTHOR
CW
CHECKED BY

PROJECT
Proposed Stable Block & Feed Store at the Rear on Land
to the rear of Huston, Moneyrow Green, Holyport

CLIENT
Mr T Peters

STATUS

For Planning

DRAWING

LOCATION PLAN

PROJECT NO.
592

DRAWING NO.
100

REV.



BLOCK PLAN 1:1000

REV DESCRIPTION

DATE

AUTHOR CHK'D

NOTES

DATE
JANUARY 2024
SCALE @ A1
1:1000

AUTHOR
CW
CHECKED BY

PROJECT
Proposed Change of Use, Widening of Existing Access &
Stable Block on Land at Allington Lane, Fair Oak, Eastleigh

CLIENT
Mr T Peters

STATUS
FOR PLANNING

DRAWING
BLOCK PLAN

PROJECT NO.
592

DRAWING NO.
101

REV.

All dimensions are subject to site survey and site verification. Do not scale from this drawing.



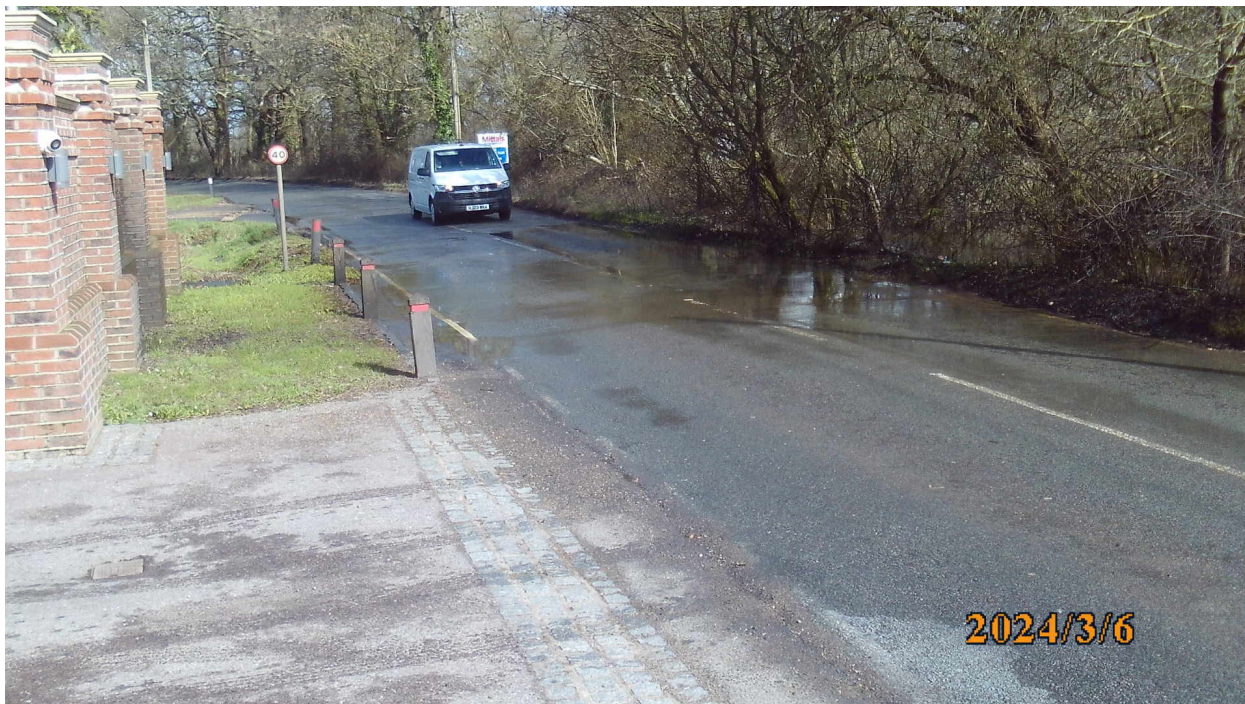
REV	DESCRIPTION	DATE	AUTHOR	CHK'D	NOTES	DATE JANUARY 2024 SCALE @ A1 1:500	PROJECT Proposed Change of Use, Widening of Existing Access & Stable Block on Land at Allington Lane, Fair Oak, Eastleigh CLIENT Mr T Peters STATUS FOR PLANNING DRAWING PROPOSED SITE LAYOUT	PROJECT NO. 592	DRAWING NO. 102	REV.

All dimensions are subject to site survey and site verification. Do not scale from this drawing.

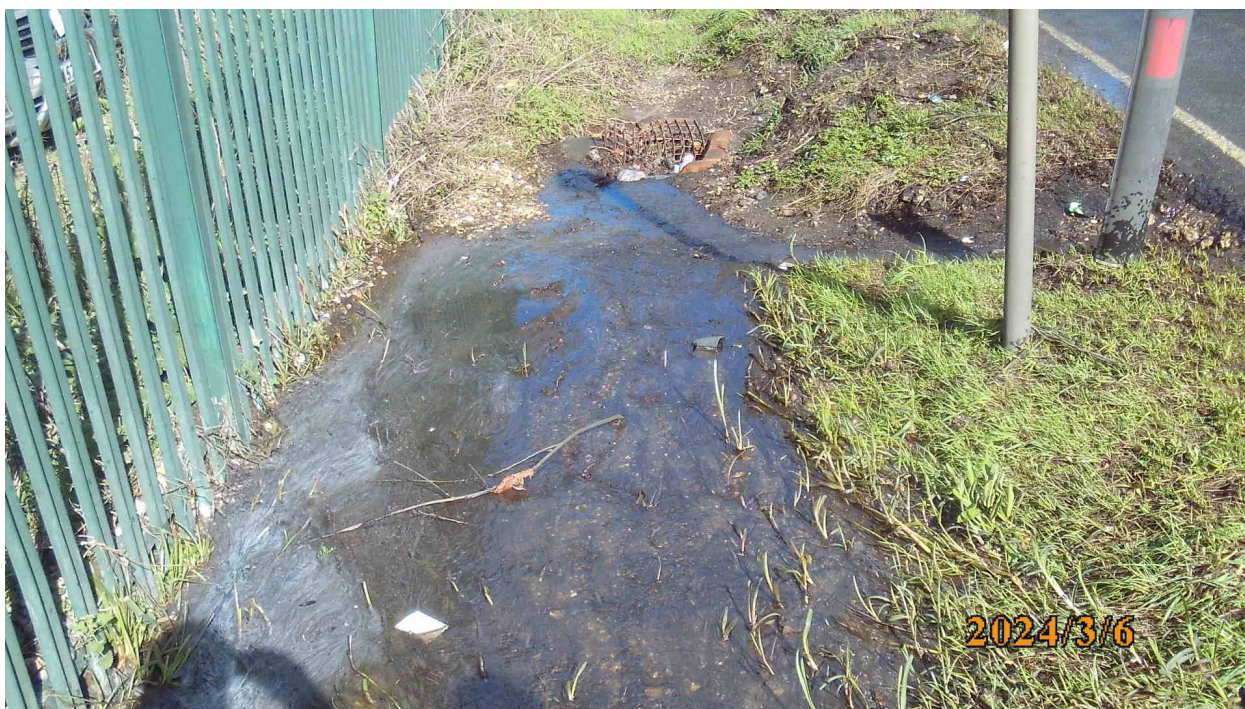
0 25 50m
1:500 (at A1)



Site location



Low point on Allington Lane 100m north of site awaiting HCC maintenance to culvert



Inspection chamber with grating in western ditch line 100m north of site (outfall pipe runs west under compound to LHS)

Appendix B

Flood map for planning

Your reference
<Unspecified>

Location (easting/northing)
447440/116150

Created
13 Mar 2024 12:14

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 than 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)

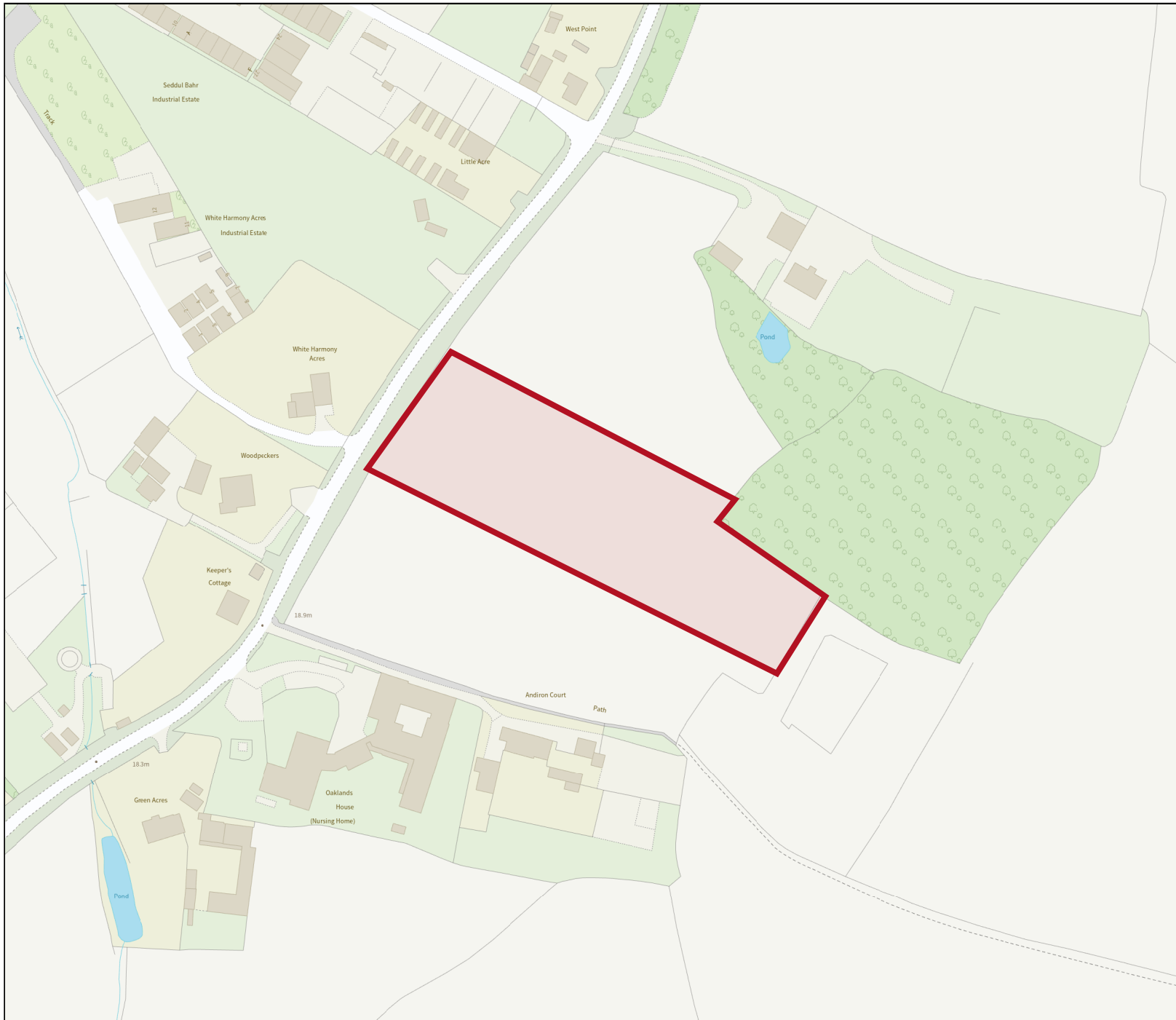
Notes

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 2022 OS 100024198. <https://flood-map-for-planning.service.gov.uk/os-terms>



Flood map for planning

Your reference
<Unspecified>

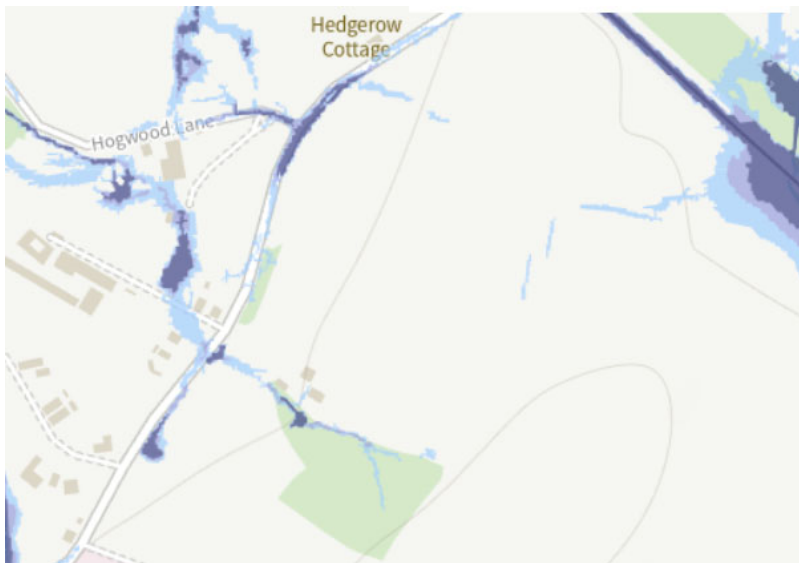
Location (easting/northing)
447440/116150

Scale
1:2500

Created
13 Mar 2024 12:14

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


0 20 40 60m



Surface water

-  Extent
-  High risk
More than 3.3% chance each year
-  Medium risk
Between 1% and 3.3% chance each year
-  Low risk
Between 0.1% and 1% chance each year

Surface water flood risk



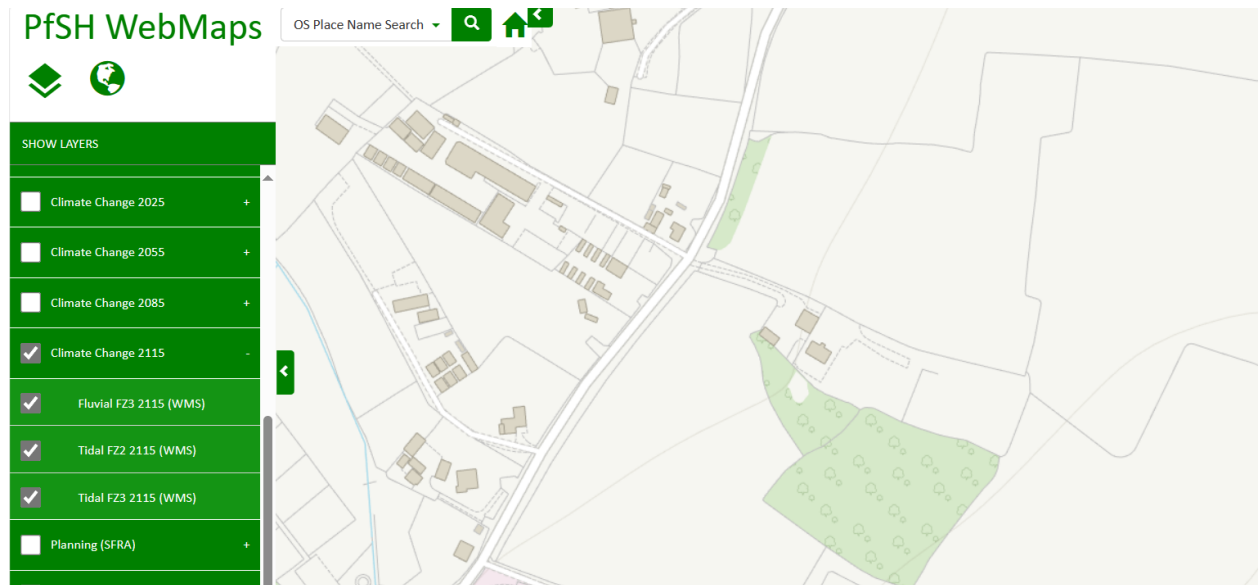
Reservoirs

-  Extent
-  When river levels are normal
-  When there is also flooding from rivers

Map details

- ☒ Show flooding

Reservoir flood risk



SFRA climate change flood zone mapping 2115

Appendix C

Project No.: 24025
Project Title: Land at Allington Lane

Detention Assessment to CIRIA C753

No infiltration

Site Location: West End
r = 0.36 (range 0.12 to 0.45)
Drained Area = 90 m²
Design storm 1 in = 100 year
Runoff volume uplift = 45 % for climate change
10 % for urban creep

Catchment ID: stables

C_v = 1.00

Technical Assessment

Base axis Length L_x = 6.00 m
Base axis Length L_y = 2.00 m
Discharge rate = 2.0 l/s
Storage depth = 0.15 m
storage porosity = 95 %

Base area = 12.0 m²

storage volume = 1.7 m³

Design volume = 1.7 m³

M5-60 Rainfall = 20 mm

Storm Duration	5 min	10 min	15 min	30 min	1 hr	2 hr	4 hr	6 hr	10 hr	24 hr
(secs)	300	600	900	1800	3600	7200	14400	21600	36000	86400
r= 0.36 Value Z1	0.36	0.51	0.62	0.79	1.00	1.22	1.48	1.67	1.90	2.42
Rainfall M5 (mm)	7.2	10.2	12.4	15.8	20.0	24.4	29.6	33.4	38.0	48.4
M100/M5 gf Value Z2	1.84	1.91	1.95	2.00	2.03	2.01	1.97	1.94	1.91	1.82
Rainfall M100 (mm)	13.3	19.5	24.2	31.5	40.6	49.1	58.4	64.9	72.4	88.2
With climate uplift (mm)	19.2	28.3	35.0	45.7	58.9	71.2	84.7	94.1	105.0	127.9
With urban creep (mm)	21.2	31.1	38.5	50.3	64.8	78.3	93.2	103.5	115.5	140.7
RUNOFF (m³)	1.9	2.8	3.5	4.5	5.8	7.0	8.4	9.3	10.4	12.7
inflow rate (l/s)	6.3	4.7	3.9	2.5	1.6	1.0	0.6	0.4	0.3	0.1
storage rate (l/s)	4.3	2.7	1.9	0.5	0.0	0.0	0.0	0.0	0.0	0.0
Discharge (m³)	0.6	1.2	1.8	3.6	5.8	7.0	8.4	9.3	10.4	12.7
Req'd STORAGE (m³)	1.3	1.6	1.7	0.9	0.0	0.0	0.0	0.0	0.0	0.0
Residual drain time (h)	0.2	0.2	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0

Date: 13/03/2024

Site Ref

land at Allington Lane

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

driveway

Is discharge to: SPZ1? ☐ N Drinking Water Protection Area ?

☐ N

Is site in close proximity to an area with sensitive environmental designation?

☐ N

if so how close?

m

Is an additional treatment component required due to sensitivity?

☐ Y

Land Use

car parks-residential

Hazard

low

TSS index	Metals index	HydroCar index
0.5	0.4	0.4

Treatments

To surface water discharge ☐ Y

Component

1 Permeable pavement

2 N/A

3 N/A

mitigation index

X1 N/A

Enhanced mitigation index

Residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0.7	0.6	0.7	1.00
0	0	0	0.50
0	0	0	0.50
0.7	0.6	0.7	
0	0	0	1.00
0.7	0.6	0.7	
0	0	0	

Land Use

car parks-residential

Hazard

low

TSS index	Metals index	HydroCar index	residual
0	0	0	

Treatments

To groundwater discharge ☐ N

Infiltration surface

1 N/A

2 N/A

Final residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0	0	0	1.00
0	0	0	0.50
0	0	0	

Is a groundwater risk screening required?

☐ N

Notes:

Date: 13/03/2024

Site Ref

land at Allington Lane

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

roof

Is discharge to: SPZ1? **N** Drinking Water Protection Area ?

N

Is site in close proximity to an area with sensitive environmental designation?

N

if so how close?

m

Is an additional treatment component required due to sensitivity?

Y

Land Use

roofs-non-residential

Hazard

low

TSS index	Metals index	HydroCar index
0.3	0.2	0.05

Treatments

To surface water discharge **Y**

Component

1 Detention basin

2 N/A

3 N/A

mitigation index

X1 N/A

Enhanced mitigation index

Residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0.5	0.5	0.6	1.00
0	0	0	0.50
0	0	0	0.50
0.5	0.5	0.6	
0	0	0	1.00
0.5	0.5	0.6	
0	0	0	

Land Use

roofs-non-residential

Hazard

low

TSS index	Metals index	HydroCar index	residual
0	0	0	

Treatments

To groundwater discharge **N**

Infiltration surface

1 N/A

2 N/A

Final residual pollution index

TSS MIndex	Metals MIndex	HydroCa MIndex	factor
0	0	0	1.00
0	0	0	0.50
0	0	0	

Is a groundwater risk screening required?

N

Notes:

SUDS operation and maintenance - general

There are three categories on maintenance activities:

Regular maintenance consists of basic tasks done on a frequent and predictable schedule, including vegetation management, litter and debris removal, and inspections.

Occasional maintenance comprises tasks that are likely to be required periodically, but on a much less frequent and predictable basis than the routine tasks (sediment removal is an example). The table below summarises the likely maintenance activities required for each SUDS component and specific maintenance activities is given in the following sections.

Remedial maintenance comprises intermittent tasks that may be required to rectify faults associated with the system. 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. Remedial maintenance items can comprise items such as:

- inlet/outlet repairs
- erosion repairs
- reinstatement or realignment of edgings, barriers, rip-rap or other erosion control
- infiltration surface rehabilitation
- replacement of blocked filter fabrics
- construction stage sediment removal (although this activity should have been undertaken before the maintenance contract)
- system rehabilitation immediately following a pollution event.

O&M activity	SUDS component												
	Pond	Wetland	Detention basin	Infiltration basin	Soakaway	Infiltration trench	Filter trench	Modular storage	Pervious pavements	Swale/bioretention/greenroofs	Filter strip	Sand filter	Pre-treatment systems
Regular maintenance													
Inspection	■	■	■	■	■	■	■	■	■	■	■	■	■
Litter/debris removal	■	■	■	■	□	■	■	□	■	■	■	■	■
Grass cutting	■	■	■	■	□	■	■	□	□	■	■	□	□
Wee/invasive plant control	□	□	□	□		□	□		□	□	□	□	□
Shrub management	□	□	□	□					□	□	□		□
Shoreline vegetation management	■	■	□										□
Aquatic vegetation management	■	■	□										□
Occasional maintenance													
Sediment management *	■	■	■	■	■	■	■	■	■	■	■	■	■
Vegetation/plant replacement	□	□	□	□						□	□		□
Vacuum sweeping and brushing									■				
Remedial maintenance													
Structure rehabilitation/repair	□	□	□	□	□	□	□	□	□	□	□	□	□
Infiltration surface reconditioning				□	□	□	□		□	□	□	□	

■ will be required

□ may be required

* sediment to be collected upstream of the main device

GENERAL MAINTENANCE

Litter/debris removal

This is an integral part of SUDS maintenance and reduces the risks of inlet and outlet blockages, retains amenity value and minimises pollution risks. High litter removal frequencies may be required at high profile commercial/retail parks where aesthetics are a major driver.

Grass cutting

It is recommended that grass cutting be minimised around SUDS facilities, apart from swales and filter strips and structural embankments where a height of 100–150 mm is recommended to prevent the plants falling over, or “lodging”, when water flows across the surface. In general, allowing grass to grow tends to enhance water quality performance. Short grass around a wet system such as pond or wetland provides an ideal habitat for nuisance species such as geese; allowing the grass to grow is an effective means of discouraging them. Grass around wet pond or wetland systems should not be cut to the edge of the permanent water. Grass cutting is an activity undertaken primarily to enhance the perceived aesthetics of the facility. The frequency of cutting will tend to depend on surrounding land uses, and public requirements. Therefore, grass cutting should be done as infrequently as possible, recognising the aesthetic concerns of local residents. However, grass around inlet and outlet infrastructure should be trimmed closely to reduce risks to system performance. If a manicured, parkland effect is required, then cutting will need to be undertaken more regularly than for meadow type grass areas, which aim to maximise habitat and biodiversity potential.

Weed/invasive plant control

Weeds are generally defined as vegetation types that are unwanted in a particular area. For SUDS, weeds are often alien or invasive species, which do not enhance the technical performance or aesthetic value of the system, or non-native species and the spread of which is undesirable. In some places, weeding has to be done by hand to prevent the destruction of surrounding vegetation (hand weeding should generally be required only during the first year, ie during plant establishment). However, over grassed surfaces, mowing can be an effective management measure. The use of herbicides and pesticides should be prohibited since they cause water quality deterioration. The use of fertilisers should also be limited or prohibited to minimise nutrient loadings which are damaging to water bodies.

Shrub management

Shrubs tend to be densely planted and are likely to require weeding at the base, especially during the first year to ensure that they get enough water. Shrubs should be selected so they can grow to their maximum natural height without pruning.

Aquatic/shoreline vegetation management

Aquatic plant aftercare in the first 1–3 years may be required to ensure establishment of planted vegetation and control nuisance weeds/invasive plants. Once established, the build-up of dead vegetation from previous seasons should be removed at convenient intervals to reduce organic silt accumulation (eg every three years and at the end of landscape contract periods).

Emergent vegetation may need to be harvested every 5–10 years to maintain flood attenuation volumes, optimise water quality treatment potential and ensure fresh growth, although this is often not required. Care should be taken to avoid nesting birds during the breeding season and to avoid great crested newt and water vole habitats. The typical window for this activity is towards the end of the growing season (September and October). As vegetation matures, plant height may also become a safety issue in residential areas.

Where emergent vegetation is managed, up to 25 per cent can be removed by cutting at 100 mm above soil level using shearing action machinery. Up to 25 per cent of submerged vegetation can be cut and raked out at any one time, using approved rakes, grabs or other techniques, depending on whether clay or waterproof membranes are present. Aquatic vegetation arisings should be stacked close to the water's edge for 48 hours to de-water and allow wildlife to return to the SUDS feature. They should then be removed to wildlife piles, compost heaps or off site before decomposition, rotting or damage to existing vegetation can occur.

Algae removal may be undertaken for aesthetic purposes during the first 3–5 years of a pond/wetland's life. The growth of algae, which is considered by some to be visually intrusive, is encouraged by nutrients introduced into the water body. This situation should settle down once upstream construction activities are complete.

Management of green waste

Appropriate methods should be implemented to dispose of green waste, including

- The development of wildlife piles
- On- or off-site composting
- Disposal to landfill

REMEDIAL MAINTENANCE

Structure rehabilitation/repair

There will come a time with most SUDS techniques when a major overhaul of the system is required to remove clogged filters, geotextiles, gravel etc. This will typically be between 10 and 25 years, depending on the technique and factors such as the type of catchment and sediment load. For example the use of geotextiles close to the surface in pervious surfaces traps the majority of sediment in a relatively easily accessible location. Reconstruction of the surface layer and bedding layer is all that is required, rather than reconstruction of the whole pavement depth.

Major overhaul is most likely to be required on techniques that rely on filtration through soils or aggregates, such as sand filters and infiltration devices. Other SUDS techniques are unlikely to need major overhaul if routine maintenance is undertaken as required (for example ponds and wetlands).

Rehabilitation activities for each SUDS component are described on the following tables.

Infiltration surface rehabilitation

In the event that grassed surface permeability has reduced, there are a number of landscape techniques that can be used to open the surface to encourage infiltration. Such activities are not commonplace and are likely to be required only in circumstances where silt has not been effectively managed upstream.

1. Scarifying to remove “thatch”. Thatch is a tightly intermingled organic layer of dead and living shoots, stems and roots, developing between the zone of green vegetation and the soil surface. Scarifying with tractor-drawn or self-propelled equipment to a depth of at least 50 mm breaks up silt deposits, removes dead grass and other organic matter and relieves compaction of the soil surface.
2. Spiking or tining the soil, using aerating equipment to encourage water percolation. This is particularly effective if followed by top dressing with a medium to fine sand, and is best undertaken when the soil is moist. Spiking or tining with tractor drawn or self-propelled equipment penetrates and perforates soil layers to a depth of at least 100 mm (at 100 mm centres) and allows the entry of air, water, nutrients and top dressing materials.
3. As a last resort, it may be necessary to remove and replace the grass and topsoil by:
 - removing accumulated silt and (subject to a toxicity test) applying to land or dispose of to landfill
 - removing damaged turf which should be composted
 - cultivating remaining topsoil to required levels
 - re turfing (using turf of a quality and appearance to match existing) or reseeded (to BS 7370: Part 3, Clause 12.6 (BSI, 1991) using seed to match existing turf) area to required levels. It may be necessary to supply and fix fully biodegradable coir blanket to protect seeded soil. Turf and seeded areas should be top dressed with fine sieved topsoil to BS 3882 (BSI, 1994) to achieve final design levels. Watering will be required to promote successful germination and/or establishment.

Water butts operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Cleaning of tank, inlets, outlets, gutters, withdrawal devices and roof drain filters of silts and other debris..	Annually (or following poor performance).
Occasional maintenance	Replacement of any filters.	As required
Remedial actions	Repair of erosion damage, or damage to tank.	As required
Monitoring	Inspection of the tank for debris and sediment build up.	Annually (or following poor performance).
	Inspection of inlets, outlets and withdrawal devices.	Annually (or following poor performance).
	Inspection of areas receiving overflow, for evidence of erosion.	After extreme storms.
	Inspection of roof drain filters	Annually (or following poor performance).

Swales operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter and debris removal.	Monthly (or as required).
	Grass cutting – to retain grass height within specified design range.	Monthly (during growing season), or as required.
	Manage other vegetation and remove nuisance plants.	Monthly (at start then as required).
Occasional maintenance	Check for poor vegetation growth due to lack of sunlight or dropping of leaf litter, and cut back adjacent vegetation where possible.	Annually.
	Re-seed areas of poor vegetation growth. Alter plant types to better suit conditions, if required.	Annually, or if bare soil is exposed over 10% or more of the swale treatment area.
Remedial actions	Repair erosion or other damage by re-turfing or reseeded.	As required
	Re-level uneven surfaces and reinstate design levels.	As required
	Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface.	As required
	Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip.	As required
	Remove and dispose of oils or petrol residues using safe standard practices.	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly.
	Inspect infiltration surfaces for ponding, compaction, silt accumulation. Record areas where water is ponding for > 48 hours.	Monthly, or when required.
	Inspect inlets and facility surface for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.

Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on-site if there is an appropriate safe and acceptable location to do so.

Pervious pavement operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Brushing and vacuuming.	Three times/year at end of winter, mid-summer, after autumn leaf fall, or as required based on site-specific observations of clogging or manufacturers' recommendations.
Occasional maintenance	Stabilise and mow contributing and adjacent areas.	As required
	Removal of weed.	As required
Remedial actions	Remediate any landscaping which, through vegetation maintenance or soil slip, has been raised to within 50 mm of the level of the paving.	As required
	Remedial work to any depressions, rutting and cracked or broken blocks considered detrimental to the structural performance or a hazard to users.	As required
	Rehabilitation of surface and upper sub-structure.	As required (if infiltration performance is reduced as a result of significant clogging).
Monitoring	Initial inspection.	Monthly for 3 months after installation.
	Inspect for evidence of poor operation and/or weed growth. If required take remedial action.	3-monthly, 48 h after large storms.
	Inspect silt accumulation rates and establish appropriate brushing frequencies.	Annually
	Monitor inspection chambers.	Annually

Modular systems operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Inspect and identify any areas that are not operating correctly. If required, take remedial action.	Monthly for 3 months, then six monthly
	Debris removal from catchment surface (where may cause risks to performance)	Monthly
	Where rainfall infiltrates into blocks from above, check surface of filter for blockage by silt, algae or other matter. Remove and replace surface infiltration medium as necessary.	Monthly (and after large storms)
	Remove sediment from pre-treatment structures	Annually, or as required
Occasional maintenance	-	-
Remedial actions	Repair/rehabilitation of 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 and after large storms

Infiltration basin operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter, debris and trash removal.	Monthly
	Grass cutting – for landscaped areas and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
Occasional maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	As required
	Remove sediment from pre-treatment system when 50% full.	As required
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required
	Realignment of rip-rap.	As required
	Repair/rehabilitation of inlets, outlets and overflows.	As required
	Rehabilitate infiltration surface using scarifying and spiking techniques if performance deteriorates.	As required
	Re-level uneven surfaces and reinstate design levels.	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly
	Inspect banksides, structures, pipework, etc for evidence of physical damage.	Monthly
	Inspect inlets and pre-treatment systems for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Inspect infiltration surfaces for compaction and ponding.	Monthly

Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on-site if there is an appropriate safe and acceptable location to do so.

Detention basin operation and maintenance

Maintenance schedule	Required action	Frequency
Regular maintenance	Litter, debris and trash removal.	Monthly
	Grass cutting – for landscaped areas and access routes.	Monthly (during growing season), or as required.
	Grass cutting – meadow grass in and around basin.	Half yearly (spring – before nesting season, and autumn).
	Manage other vegetation and remove nuisance plants.	Monthly (at start, then as required).
	Tidy all dead growth before start of growing season.	Annually
	Remove sediment from inlets, outlet and forebay.	Annually (or as required)
	Manage wetland plants in outlet pool – where provided.	Annually
Occasional maintenance	Re-seed areas of poor vegetation growth.	Annually, or as required.
	Prune and trim trees and remove cuttings.	As required
	Remove sediment from pre-treatment system when 50% full.	As required
Remedial actions	Repair of erosion or other damage by re-seeding or re-turfing.	As required
	Realignment of rip-rap.	As required
	Repair/rehabilitation of inlets, outlets and overflows.	As required
	Re-level uneven surfaces and reinstate design levels.	As required
Monitoring	Inspect inlets, outlets and overflows for blockages, and clear if required.	Monthly/ after large storms
	Inspect banksides, structures, pipework, etc for evidence of physical damage.	Monthly/ after large storms
	Inspect inlets and pre-treatment systems for silt accumulation. Establish appropriate silt removal frequencies.	Half yearly.
	Check penstocks and other mechanical devices.	Monthly

Sediment testing may be required before sediment excavation to determine its classification and appropriate disposal methods. For industrial site runoff sediment testing will be essential. In the majority of cases, it will be acceptable to distribute the sediment on-site if there is an appropriate safe and acceptable location to do so.

Appendix D

CONDITIONS AND LIMITATIONS OF FLOOD RISK ASSESSMENT & DRAINAGE STRATEGIES

October 2020

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