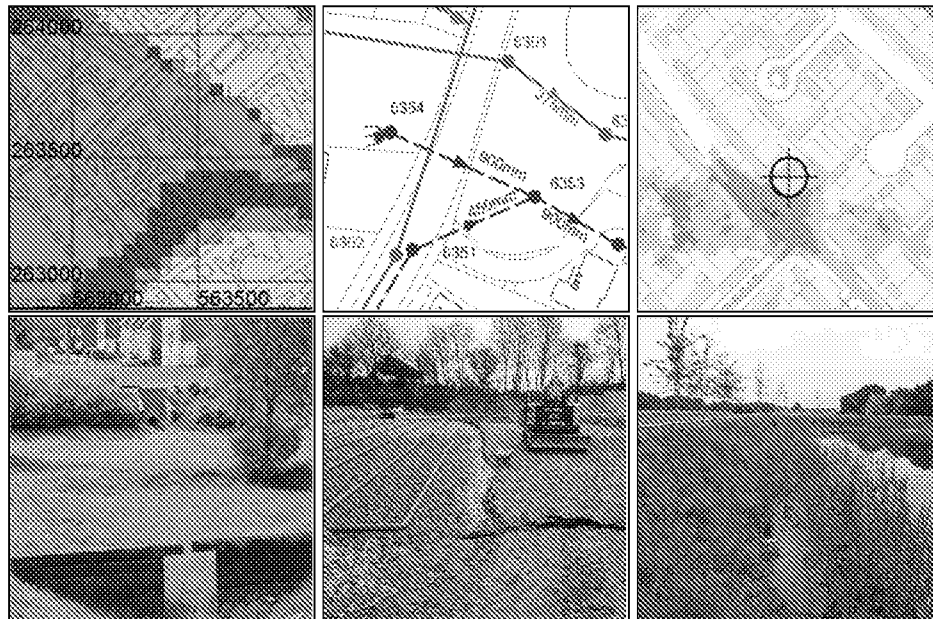




Flood Risk Assessment and Drainage Strategy

Tars Farm Barnham, West Sussex

Reference: 1841

Issue: Date:

1 8/3/2019

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Appendices

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

1. Introduction

- 1.1 Instructions were received from Mr Paul Voller to undertake a Flood Risk Assessment (FRA) and set out a Drainage Strategy (DS) for a planning application for the development of 4 residential dwellings at Tars Farm, Church Lane, Barnham, West Sussex, PO22 0DB.
- 1.2 This assessment has been undertaken by A P Traves BSc CEng MIStructE 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 comprises approximately 0.43 Ha of land at Tars Farm, Church Lane, Barham (grid ref 495915 104135). The site extents are indicated on the annotated aerial photograph in Appendix A. The existing topography is shown on J Brotherton Surveys drawing 17118-A contained in Appendix A of this report.
- 2.2 The site comprises a gravel access track to grasslands connected to Tars Farm.
- 2.3 It is proposed to develop the site for 4 residential dwellings. The proposed layout is identified on Crossley Design Architecture drawing number 1816-2.20 rev - contained in Appendix A of this report.

3. Local Development Documents & Strategic Flood Risk Assessment

- 3.1 The Strategic Flood Risk Assessment-2016 (SFRA) for Arun DC has been reviewed and this indicates the following:
- 3.2 SFRA map tile B-32 indicates the site is located south of Barnham Rife.
- 3.3 SFRA map tile C-32 indicates the site is located in FZ1.
- 3.4 SFRA map tile D-32 indicates the site lies outside FZ3a 2111_{AD} for climate change.
- 3.5 SFRA map tile E-32 indicates the site lies in an area of very low surface water flood risk (<0.1%AEP).
- 3.6 SFRA map tile F-32 shows the coarse division of the Arun DC into 1km² grid squares and indicates the 1,000,000m² grid square for the site, in common with most of the district has susceptibility to groundwater flooding. This should not be mistaken for groundwater flood risk which is different. Paragraph 5.7 of the SFA confirms *"This data shows the proportion of each 1km grid square, where geological and hydrogeological conditions indicate that groundwater might emerge."* It also advises that *"It does not show the likelihood of groundwater flooding occurring. This dataset covers a large area of land, and only isolated locations within the overall susceptible area are actually likely to suffer the consequences of groundwater flooding."* It also advises *"It should be noted that although an area may be designated as susceptible to groundwater flooding, this does not mean that groundwater flooding will definitely be a problem within these areas, rather it provides an indication of potential risk."* The SFRA however later continues to identify that in 2012 and 2013/2014 significant events of groundwater flooding were reported in the Westergate/Barnham area. The SFRA-2008 map G1 indicated groundwater flood risk and groundwater emergence zones. The site is not indicated to be in a groundwater emergence zone on this older mapping.
- 3.7 SFA map tile H-32 indicates the site does not contain any incidents of historic flooding from fluvial, coastal, tidal, surface water, failure, or unknown sources. Barnham Rife, outside of and north of the site has an indicated historic flood outline.

- 3.8 Flood mapping data has been reviewed from the Environment Agency (EA) website. (refer to Appendix B). This indicates the following:
- 3.9 The EA mapping indicates the existing site is located in Flood Zone 1.
- 3.10 The EA mapping indicates the site is at very low (<0.1% AEP) surface water flood risk
- 3.11 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 lies beyond the policy unit mappings for South Downs Shoreline Management Plan 2 (SMP2).
- 4.2 The Arun and Western Streams Catchment Flood Management plan summary – December 2009 (CFMP) indicates the site falls within sub-area 6 Coastal Plains and East Wittering The CFMP states that policy 4 is the preferred policy approach:

“Areas of low, moderate or high flood risk where we are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change”

- 4.3 Overall the SMP and CFMP do 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 Desktop literature reviews are typically based on 1:50,000 digital geological maps and not site-specific data. Desktop reports are not an alternative for an on-site investigation or soakaway test which might reach different conclusions about groundwater and permeability. With particular reference to paragraph 3.6 and commentary within the SFRA-2016 noting recent recorded groundwater flooding reports in the Westergate/Barnham area in 2012 and 2013/2014 a site specific soils investigation was undertaken.
- 5.2 The site investigation was undertaken by Soils Ltd in November 2018 and included five window sample boreholes and four trial pits and subsequent Winter groundwater level monitoring. Given the small scale of the proposed development for 4 dwellings and in relation to ADC Supplementary Planning Requirements for Surface Water Drainage Proposals the extent of groundwater monitoring was discussed with ADC Engineers before the investigation. The preinvestigation discussion concluded that:
- Due to the close proximity of Barnham Rife to the rear there is potential for superficial alluvial gravels of unknown depth, so pending actual exploration there is a chance there may be permeable soils. GWLs are generally high around Barnham and Westergate and there are historic reports in 2012-2014 of this. Even if confined to an underlying silt or sand strata by overlying cohesive strata on site it is possible GWL may already be too high to consider infiltration, in which case monitoring would be pointless.
 - If however there is permeable soil and GWL is sufficiently low at present then monitoring would be requested as the Winter recharge period is just commencing and GWLs could rise above any initial low level further into the Winter. In this case a shorter monitoring period of Dec-Mar would be accepted as the site is only for 4 dwellings.
- 5.3 Reference should be made to Soils Ltd report 17324/PIR January 2019 for full details by salient aspects are summarised in the following paragraphs:

- 5.4 Seven window sample bores were advanced to depths between 2 and 5m below ground level. Five dynamic probes were advanced to depths between 5 and 7m below ground level. Four shallow trial pits were excavated at depths up to 1.5m below ground level.
- 5.5 The ground conditions and soil profile are discussed in sections 2.2 and 2.3 of the GI report. These are summarised in Table 2.2 as typically 0.4m of topsoil/made ground over London Clay formation to end of each hole the deepest of which was 7m. the topsoil/made ground cover typical description is slightly sandy slightly gravelly Silt and the London Clay Formation typical description is of slightly sandy silty Clay.
- 5.6 Three of the window sample bores were fitted with monitoring wells and groundwater level monitoring has been undertaken on Winter. The current results have been obtained from Soils Ltd and are shown below:

	23/11/2018	03/12/2018	12/12/2018	02/01/2019	06/02/2019
WS01	1.21m bgl	1.18m bgl	1.20m bgl	0.95m bgl	0.70m bgl
WS02	0.98m bgl	0.47m bgl	0.49m bgl	0.12m bgl	0.34m bgl
WS03	1.52m bgl	0.80m bgl	0.85m bgl	0.75m bgl	1.58m bgl

To date this shows a maximum 0.34 and 0.70mbgl at the lower edge of the site and around 0.75m at the upper edge of the site. The single 0.12m reading for WS02 on 2/1/19 is very high and has been treated as a data outlier. The results were discussed with ADC Drainage Engineer on 4 March 2019 and groundwater monitoring will continue until the end of March 2019 but is not expected to rise above previous levels.

The groundwater seasonal high level is located within the shallow silty topsoil/made ground overlying the London Clay and the profile tracks down the slope towards Barnham Rife. It is evident that groundwater in the topsoil and made ground permeates downslope over the top of the London Clay as the low resistance flow path rather than into the low permeability London Clay.

- 5.7 Three shallow trial pits were tested for Winter permeability. Paragraph 3.3 of the Gi report notes that none of the tests were able to comply with BRE365 due to the slow rates of infiltration and that results therefore had to be calculated by extrapolation. The results are shown on table 3.1 of the GI report. The pits were of identical geometry. Pit TPSA2 exhibited no fall in level over the test period and is indicating nil permeability. Based on the monitoring timelines for the other pits it is deduced that the head of water in TPSA1a fell 0.13m under monitoring and was extrapolated from this point to determine a permeability value of 3×10^{-6} m/sec. An extrapolation was not made for TPSA3 for which the head depth fell 0.10m during the monitoring. Given the identical pit geometries this would imply an extrapolated permeability of some 2×10^{-6} given the lesser volume infiltrated for the same time elapsed.
- 5.8 Review the groundwater level monitoring results (5.6 refers) suggests that normalised groundwater level was probably just below the base of the pits at the time of permeability testing. It is also apparent from the subsequent monitoring results that the seasonal high groundwater level is around 0.5m below ground level. It is concluded that the high seasonal GWL renders an infiltration strategy for surface water discharge non-viable.

6. Sewage Authority Data

- 6.1 The existing farmhouse is served by a high level existing 175mm DN gravity foul sewer to the front. There is also a 350mm DN and 375mm DN lower level gravity foul water sewers to the rear of the site. A copy of the local sewer plan is contained in Appendix B.
- 6.2 The proposed redevelopment will discharge foul water (FW) to one of the rear public FW sewers. The additional load for 4 dwellings will be *de minimis*, but notwithstanding this the standing wastewater Infrastructure Charge (IC), which came into force from 1st April 2018,

will be paid. Should any downstream reinforcement be required Southern Water will deliver this from the development ICs they will collect.

7. Site Particulars

- 7.1 The site comprises a gravel access track to grasslands connected to Tars Farm. The access is being retained and will be upgraded.
- 7.2 The grasslands fall from towards Barnham Rife which lies some 20-25m beyond the site.
- 7.3 There are existing residential dwellings to the front and either side. The land on the far side of the rife is in agricultural use.

8. Source-Pathway-Receptor Assessments

- 8.1 The site is in FZ1 and has a low fluvial and tidal flood risk of <0.1%AEP.
- 8.2 The EA mapping indicates the site is at very low risk <0.1%AEP of surface water flooding.
- 8.3 The EA mapping indicates the site is not in an area of reservoir flood risk.
- 8.4 The SFRA indicates the site is not in a groundwater emergence zone. The site soils investigation encountered high groundwater levels, however the site is on a moderate gradient and the land to the north of the site falls contiguously to Barnham Rife. The site morphology does not facilitate the accrual of groundwater at the surface.
- 8.5 The SFRA indicates no incidents of sewer flooding at the site. The site is therefore not considered to be at risk from sewer flooding.
- 8.6 The critical flood source is pluvial and surface water runoff within the site. The site surface water system will accord with the principles of CIRIA C753.
- 8.7 The flood receptors of the development would be:
- Residential dwellings
 - Users of the residential dwellings
- 8.8 The proposed development and existing site classifications to Table 2 (Paragraph 066 Reference ID: 7-066-20140306) are as follows:
- | | |
|-----------------------------|-----------------|
| • Land used for agriculture | Less vulnerable |
| • Proposed residential | More vulnerable |

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: 7-065-20140306) 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 (>5% 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 in Flood Zone 1 (low risk).

10. Climate Change

10.1 The new climate change allowances for flood risk assessment GOV.UK 3 February 2017 update have been used. Climate change values for the site are:

- Peak river flow: Table 1, South East, third epoch, central range +35%
- Peak rainfall intensity: Table 2, third epoch, upper end +40%

10.2 SFRA map tile D-32 indicates the site lies outside FZ3a 2111_{AD} for climate change.

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 Surface water drainage must accord with a receptor hierarchy in which Tier 1 (infiltration) must be considered first. As set out in Section 3 the site geology comprises silty topsoil/made ground over London Clay with a high Winter GWL in the topsoil/made ground of around 0.5m below ground level. An infiltration strategy is not viable at this site.

11.2 The site lies adjacent to Barnham Rife. The existing run-off falls north into the rife and it is apparent from the GI report that groundwater in the topsoil/made ground will also track down slope to the rife. The current Tier 2 (discharge to watercourse) will be maintained. Given the high Winter GWL there would be a risk of buoyancy issues if a buried tank were to be used, and a tank would not on its own provide any water quality treatment. It is therefore proposed to form a part cut, part embanked shallow attenuation basin onto the sloping ground surface at the northern (lower) edge of the site just beyond the flood plain. This will provide both habitat environmental benefits and a water quality treatment function. The discharge from the basin will outfall to the rife.

11.3 The existing and proposed site characteristics comprise:

	<u>Existing</u>	<u>Proposed</u>
Roof	65 m ²	655 m ²
Traditional pavement	nil	690 m ²
Soft landscape and gravel track	4,235 m ²	2,955 m ²

11.4 Calculations for the existing and post development premitigation flows are contained in Appendix C and comprise:

		<u>Existing</u>	<u>Premitigation</u>
Q ₁	peak flow rate l/sec	2.0	14.7
Q ₁₀₀	peak flow rate l/sec	7.0	45.8
M _{100-6hr}	runoff volume m ³	102.7	135.5

11.5 The proposed discharge rate from the basin to the rife needs to take account of the blockage risk from vegetation. The accepted minimum rate is 5.0 l/sec where there is a risk of blockage from vegetation. It is desirable when setting a flat discharge rate for small sites to seek to set this at Q_{BAR} rate but not less than 2.0 l/sec due to practicable constraint. Calculations are contained in Appendix C for the basin shown on the proposed layout in Appendix A. the basin is capable of provision of storage to 1% AEP +40%CC and attenuation to 2 l/sec. The final discharge rate is to be agreed with Arun DC Drainage Engineers but for values between the 2 l/sec absolute minimum and the 5 l/sec recommended to mitigate blockage risk, storage requirement would be lower and would therefore still be met. A second calculation for 5 l/sec is also shown.

- 11.6 The surface water drainage system will be designed to accommodate a 1 in 100 year +40% combined climate change and urban creep rainfall event. With respect to the Non-statutory Technical Standards for Sustainable Drainage Systems (NTS SuDS) the design accords with requirements S3, S5/6 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 basin storage as outlined in paragraph 11.5
 - Provision of water butts as outlined in paragraph 11.7
- 11.9 The surface water strategy mimics the existing run-off regime at Q_1 and delivers reduced discharge rates for greater magnitude events above Q_1 . There will therefore be no adverse impact on flood flow rates outside the site.
- 11.10 The use comprises generally low and very low pollution hazard levels (C753 Table 26.2) and does not require groundwater risk screening.
- 11.11 Simple index approach calculations are contained in Appendix C. These demonstrate that the proposed SuDS infrastructure can provide the mitigation necessary.
- 11.12 The site morphology will maintain a contiguous fall to the so there will be no impact on local flood flow pathways.
- 11.13 A schedule of O&M maintenance requirements for the SuDS infrastructure is also contained in Appendix C. The maintenance of the basin and communal assets will be undertaken by the estate management. The maintenance of individual plot assets will be undertaken by the individual owners.

12. Sequential & Exceptions Tests

- 12.1 The site is located in FZ1 and inherently meet the Sequential Test.
- 12.2 Application of 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 that on site surface run-off is the governing flood source. The management of the storage and conveyance of these volumes and flows is provided for by the surface water strategy set out in Chapter 11. The strategy accords with CIRIA C753 SuDS Manual.

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 surface water strategy for the development provides for flood events up to 1:100 year 2019_{AD} + CC rainfall. The residual flood risk is therefore fluvial events in excess of 1:100 year 2019_{AD} + CC rainfall.

Appendix A



Site location



Tree List

Ref No	Name	Trunk	Spread	North	East	South	West	Height
No.1	ELD	200	2.5	2.5	2.5	2.5	3	
No.2	UNK	200	2.5	2.5	2.5	2.5	3	
No.3	HWTH	300	2.5	2.5	2.5	2.5	4	
No.4	HWTH	300	2.5	2.5	2.5	2.5	4	
No.5	APP	300	3.5	1.5	1.5	3.5	4	
No.6	APP	200	2	2	2	2	3	
No.7	APP	150	2	2	2	2	3	
No.8	APP	250	3	3	3	3	3	
No.9	UNK	100	1	1	1	1	1	
No.10	OAK	850	5	7	8	8	10	
No.11	HCN	600	4	6	6	4	10	
No.12	UNK	650	3.5	3.5	3.5	3.5	8	

Abbreviations

wf	brick wall	re	rodding eye
tol	board	mp	road name plate
tw	bus stop	rep	rainwater pipe
st	lat inspection chamber	rs	road sign
ctr	cable tv cover	▲ Stn	survey station
dr	drainage channel	sc	stop cock
dk	dropped kerb	st	stop
d	diameter	sv	stop valve
ep	electricity pole	s	traffic sign
er	earth rod	tp	telegraph pole
fb	flower bed	vp	vent pipe
fh	fire hydrant	wm	water meter
fb	footpath	wsc	water stop cock
g	gully	wsv	water stop valve
gsc	gas stop cock		
gv	gas stop valve		
h	hydrant		
ic	inspection chamber		
jbx	junction box		
kb	kerb		
lbb	letter box		
lp	lamp post		
m	manhole		
mk	marker		
h	height		
p	post		
pb	post box		
lp	lamp post		

Line types

-----	Fences
-----	Kerb
-----	Walls
-----	Stairs
-----	Change of Surface
-----	Footpath
-----	Bank Top
-----	Bank Bottom
-----	Building
-----	Building Overhead
-----	Roof heights
-----	Flower Bed
-----	Overhead Cable
-----	Road Edge
-----	Hedge Row
-----	Canopy
-----	Edge of vegetation
-----	Multi directional tree canopy

Notes

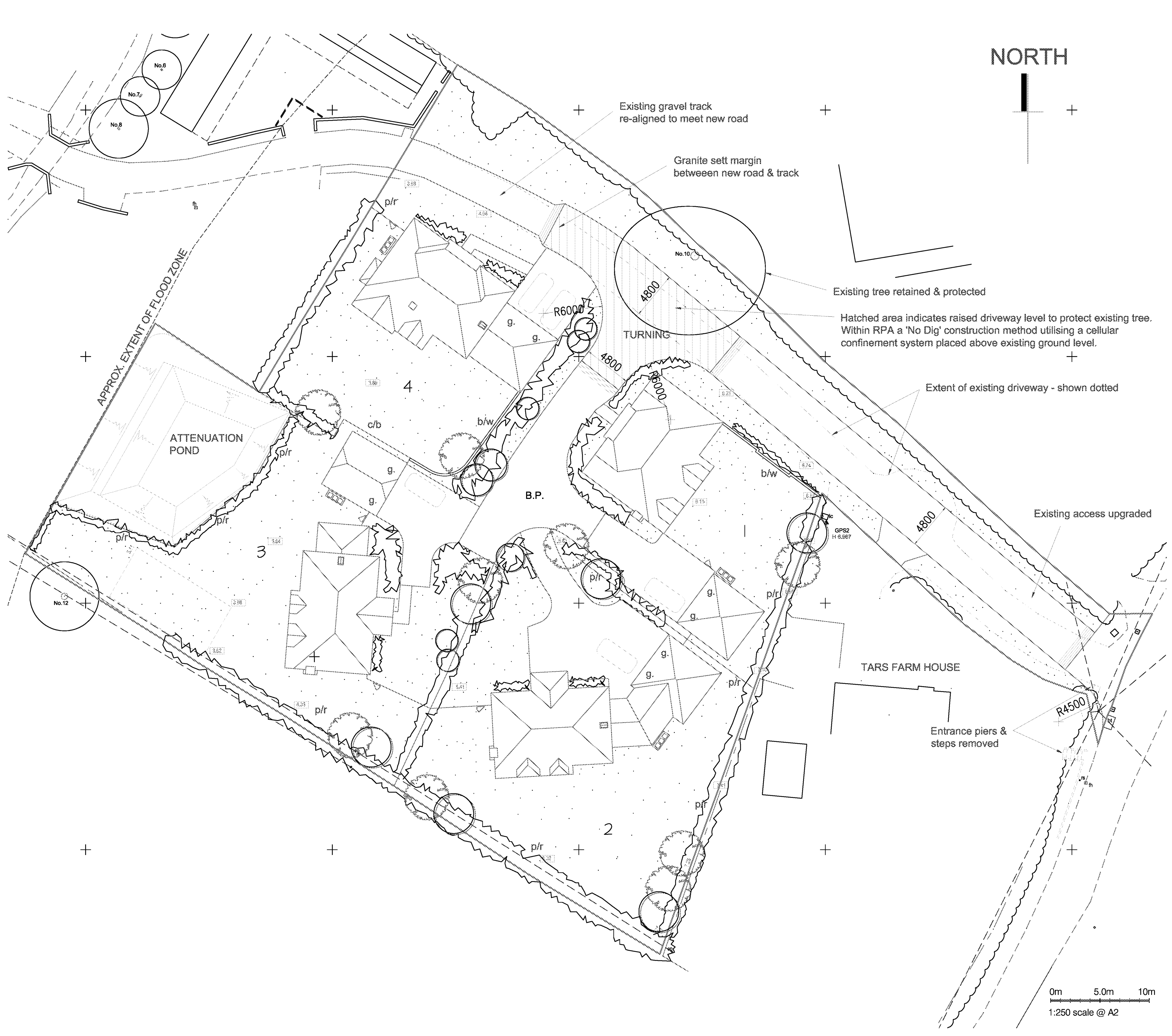
Tree species should be confirmed by a arboricultural consultant if critical.
Trunk sizes are measured at 1.5m above ground level.

Eaves heights (where shown) are taken at the end of the tile / top of guttering.
Ridge heights are taken at the top of the ridge tile.
Service covers indicated where visible at time of survey.

113 Frognore Lane
Wottonville, Hampshire PO22 0DB

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Client		Wilson Designer Homes	
Drawing Title		Topographic Land Survey	
Location		Tass Farm, Church Lane, Barmham, Bognor Regis, PO22 0DB	
The grid and datum for this survey is based on the Ordnance Survey grid OSG36, site centered on control station GPS1 with a scale factor of 1.00		Rev A: Survey of church lane extended 19-10-17	
LEVELS BASED ON	OSGB36	Surveyor	SB
GRID BASED ON	OSGB36	Drawn By	SB
Checked by		JC	
Checked by		JB	
Drawing & CAD file		REVISIONS	
17118		A	
SCALE (when printed) 1:500 @ A1		Date 6th March 2017	
Removal of this block also removes all warranties This drawing has been created for use at a scale of 1:500 All critical dimensions, positions and levels to be checked on site			



NORTH

SCHEDULE OF UNITS - 4 Total

LEGEND :

..... DIGITAL / ORDNANCE SURVEY APPLICATION SITE BOUNDARY

[Symbol] INDICATES INDIVIDUAL BIN STORE FOR 3 BINS IN EACH PRIVATE GARDEN.

NOTE : ALL GARAGES TO MEASURE A MINIMUM OF 6x3m INTERNALLY. CYCLE STORAGE TO REAR OF EACH GARAGE.

c/b INDICATES 1.0m HIGH CLOSEBOARDED FENCE

p/r INDICATES 900mm HIGH POST & TWIN RAIL FENCE

b/w INDICATES 1.0m HIGH FACING BRICK GARDEN WALL

g. INDICATES GARAGE

[Symbol] INDICATES GATE ACCESS TO REAR GARDEN

B.P. INDICATES BLOCK PAVED ROAD FINISH

[Symbol] GRANITE SETTS RUMBLE STRIP

[Symbol] EXISTING GROUND SPOT LEVELS

CROSSLEY DESIGN
ARCHITECTURE

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client
MR P VOLLER

project
RESIDENTIAL DEVELOPMENT
LAND AT TARS FARM
CHURCH LANE, BARNHAM
WEST SUSSEX, PO22 0DB

drawing

SITE PLAN

scale	date	job no.	dwg no.	rev.
1:250 @A2	NOV. 18	1816	2.20	1

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ARUN DISTRICT COUNCIL BN26 2PL

Appendix B

Flood map for planning

Your reference
1841

Location (easting/northing)
495930/104134

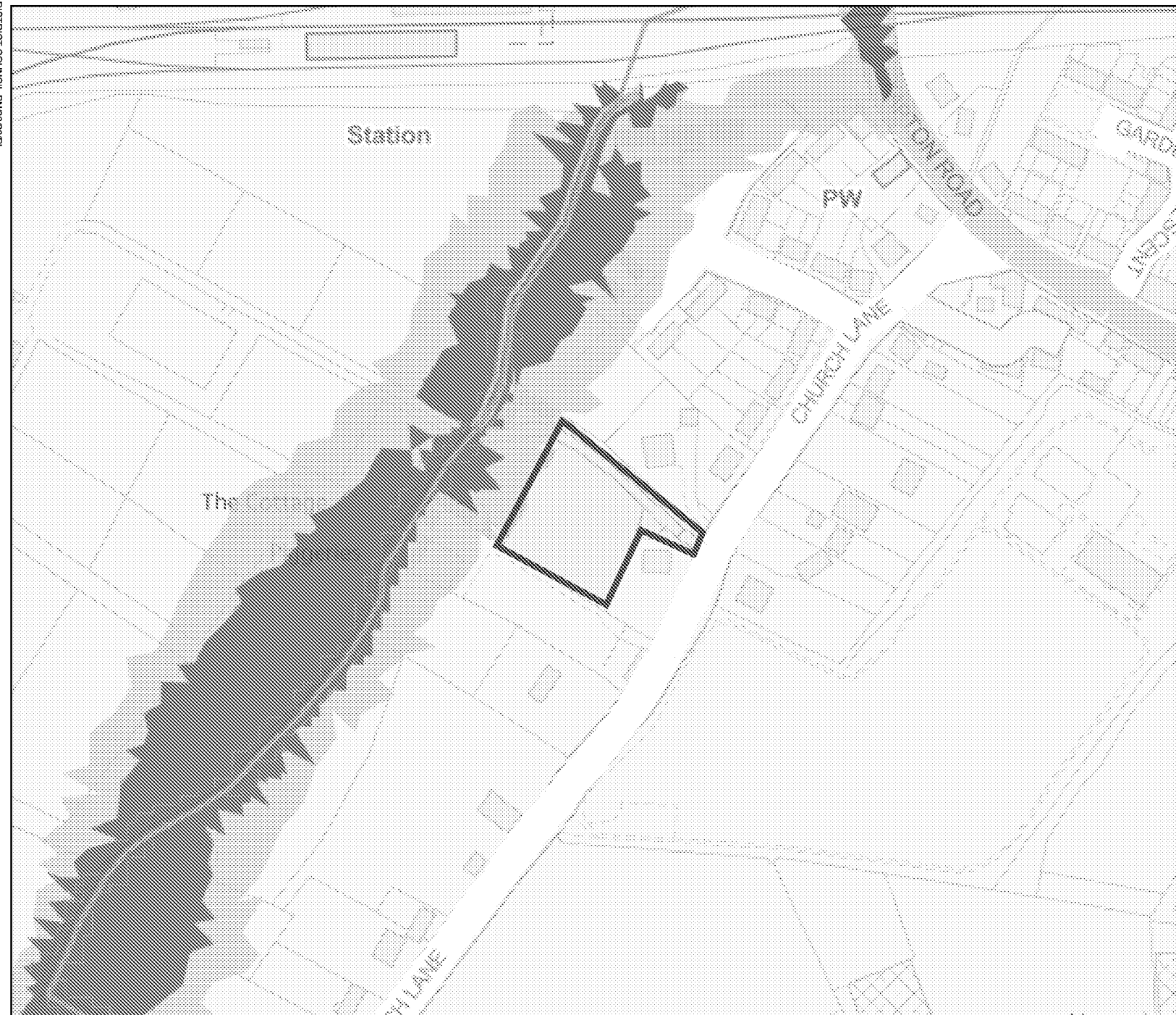
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1:2500

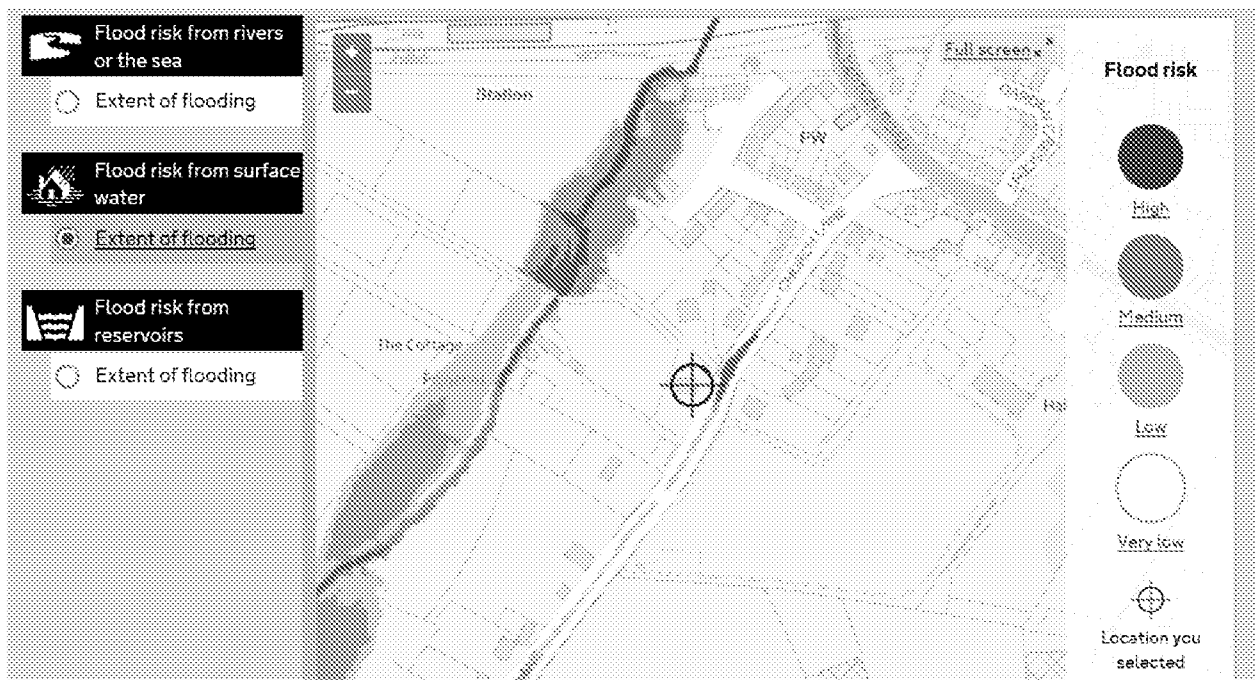
Created
22 Feb 2019 3:01

-  Selected area
-  Flood zone 3
-  Flood zone 3: areas benefitting from flood defences
-  Flood zone 2
-  Flood zone 1
-  Flood defence
-  Main river
-  Flood storage area

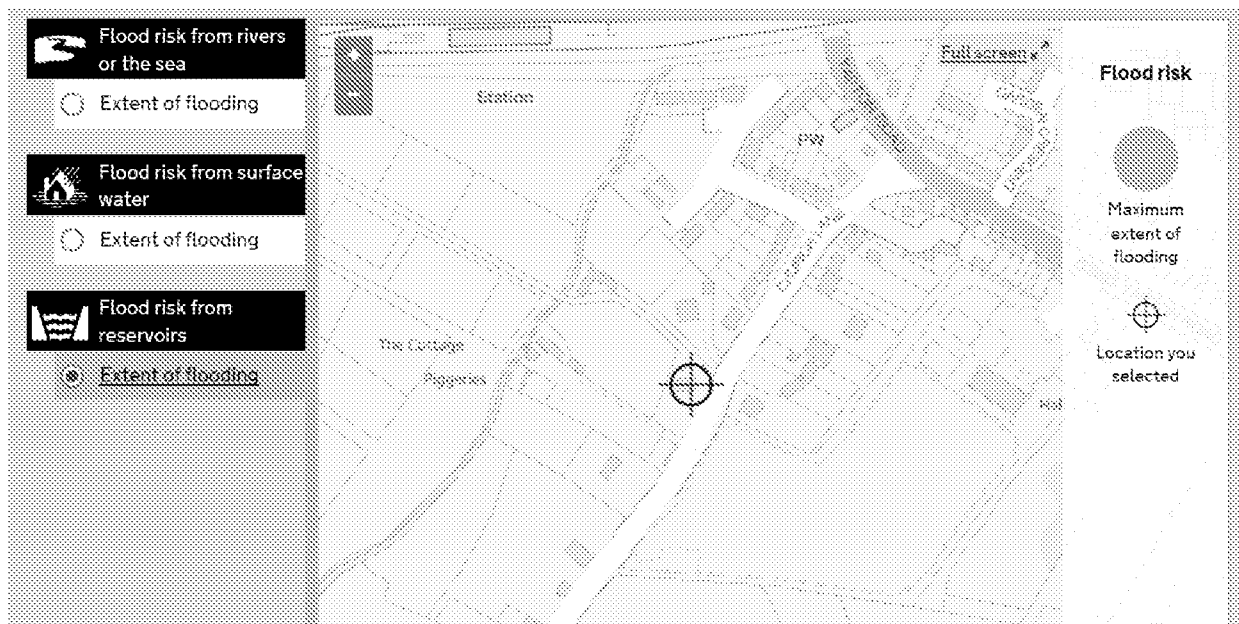
0 20 40 60m

Page 2 of 2





Surface water flood risk



Reservoir flood risk



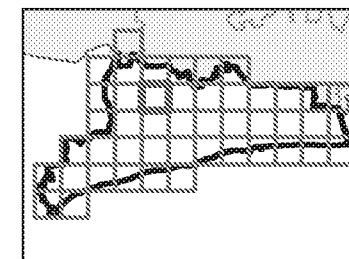
Notes

Hydraulic modeling has been undertaken as part of the SFRA to provide updated climate change flood mapping in the Arun District for Flood Zone 3a. This modeling followed the latest guidance for climate change in FRA/SFRAs released by the Environment Agency in February 2019 (and updated in April 2016). Climate change for flood events has been based on the Higher Central estimate for the years 2021, 2031, and 2111. Present day flood risk information is available for comparison. Arun District is within the South East River Basin District and therefore follows the

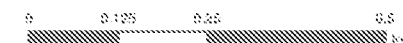
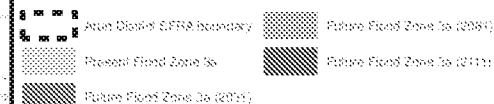
- 2531 = +15% flows
- 2081 = +30% flows
- 2111 = +45% flows

For teleoperator models, undefended case still water level and defended case still water level with wave overtopping simulations have been completed to inform future flood risk within the Arun District. Again, climate change allowance procedures are for the years 2031, 2061 and 2111, with present day outputs for comparison.

~~Not Done~~



Legend



INIF	Date	Comments
A	August 2016	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA- APPENDIX D
CLIMATE CHANGE MAPPING

Sheet No. 7 of 46

Index Number: A00_18

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SEWER RECORDS PAGE 1 OF 2

104258



103970

O.S. REF. SU9504SE	Drawn by: gujskew	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. WARNING: BAC pipes are constructed of Bonded Asbestos Cement WARNING: Unknown (UNK) materials may include Bonded Asbestos Cement	 N	
	Scale: 1:1250			
Title: 287584_Tars Farm Church Lane	Date: 04/04/2018	Based upon Ordnance Survey Digital Data with the permission of the controller of H.M.S.O. Crown Copyright Reserved Licence No. WU 298530.		

496196

Appendix C

Site Ref

Tars Farm

Catchment

Existing

CIRIA C753 Initial stormwater generation assessment**Rainfall Parameters**

SAAR	750	mm	CWI	121	
2DM5 rain	50	mm	DPRCWI	-1.1	%
r	36	%	UCWI _{winter}	133	
M560 rain	18	mm	Hydrometric area	7(SE)	

Soil Parameters

WRAP soil class	3	
SOIL	0.40	
SPR	37	%

Surface Parameters

Soft landscape	3975	m ²	Roof Standard (impermeable)	65	m ²
Permeable pavement	260	m ²	Pavement 1 (impermeable)	0	m ²
Green roof ₍₁₎	0	m ^c	Pavement 2 (50% permeable)	0	m ^c
A_p	4235	m ²	A	65	m ²

(1) includes standard roof directed into permeable pavement A_i 65 m²

PIMP 100%

PR 83 %

 $t = 5 \text{ mins } (t_{\text{entry}}) + t_{\text{concentration}} = 5 \text{ mins}$ **Flows**

QBAR _{rural}	1.6	l/sec	TOTALS		
Q ₁ rural	1.3	l/sec	Q ₁ 2.0	Q ₁ urban	0.7 l/sec
Q ₃₀ rural	3.5	l/sec	Q ₃₀ 5.2	Q ₃₀ urban	1.7 l/sec
Q ₁₀₀ rural	5.0	l/sec	Q ₁₀₀ 7.0	Q ₁₀₀ urban	2.0 l/sec

Volumes

V _{100 6hr} rural	99.5	m ³	TOTAL		
			V _{100 6hr} 102.7	V _{100 6hr} urban	3.2 m ³

Site Ref

Tars Farm

Catchment

Post development premitigation

CIRIA C753 Initial stormwater generation assessment**Rainfall Parameters**

SAAR	750	mm	CWI	121	
2DM5 rain	50	mm	DPRCWI	-1.1	%
r	36	%	UCWI _{winter}	133	
M560 rain	18	mm	Hydrometric area	7(SE)	

Soil Parameters

WRAP soil class	3	
SOIL	0.40	
SPR	37	%

Surface Parameters

Soft landscape	2910	m ²	Roof Standard (impermeable)	655	m ²
Permeable pavement	45	m ²	Pavement 1 (impermeable)	690	m ²
Green roof ₍₁₎	0	m ^c	Pavement 2 (50% permeable)	0	m ^c
A_p	2955	m ²	A	1345	m ²

(1) includes standard roof directed into permeable pavement

A_i	1345	m ²
PIMP	100%	
PR	83	%

$$t = 5 \text{ mins } (t_{\text{entry}}) + t_{\text{concentration}} = 5 \text{ mins}$$

Flows

QBAR _{rural}	1.1	l/sec	TOTALS		
Q ₁ rural	0.9	l/sec	Q ₁ 14.7	Q ₁ urban	13.8 l/sec
Q ₃₀ rural	2.5	l/sec	Q ₃₀ 36.7	Q ₃₀ urban	34.2 l/sec
Q ₁₀₀ rural	3.5	l/sec	Q ₁₀₀ 45.8	Q ₁₀₀ urban	42.3 l/sec

Volumes

V _{100 6hr} rural	69.4	m ³	TOTAL		
			V _{100 6hr} 135.5	V _{100 6hr} urban	66.1 m ³

Project No : 1841
Project Title : Tars Farm

Detention Basin

Site Location: Barnham
 $r = 0.36$ (range 0.12 to 0.45)
 Drained Area = 1345 m²
 Design storm 1 in = 100 year
 Design-operational = 20 % for climate change
 Sensitivity case at rim = 40 % for climate change
 Urban Creep allowance = 0 % uplift to Drained Area

Catchment ID: gross $C_v=1.0$
 Width of base = 8.0 m
 Length of base = 9.0 m
 Base Area = 72.27 m²
 Side slopes 1 in = 3

Site Considerations

Where determined, what is the depth to highest seasonal groundwater level (GWL) from surface 0.70 m

Technical Assessment

Design Desicharge Rate = 2.00 l/s
 Operational depth from base = 0.61 m
 O/A depth rim-base = 0.71 m

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
OPERATIONAL LOAD										
With CC & UC uplift (mm)	15.9	23.4	29.0	37.9	48.7	58.9	70.1	77.9	86.9	105.9
RUNOFF (m ³)	21.41	31.50	38.99	50.91	65.53	79.25	94.27	104.73	116.90	142.39
Discharge capacity (m ³)	0.60	1.20	1.80	3.60	7.20	14.40	28.80	43.20	72.00	172.80
DISCHARGED (m ³)	0.60	1.20	1.80	3.60	7.20	14.40	28.80	43.20	72.00	142.39
Req'd STORAGE (m ³)	20.81	30.30	37.19	47.31	58.33	64.85	65.47	61.53	44.90	0.00
	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass

TOTAL STORAGE AVAILABLE 65.82 m³ Width at Operation depth = 11.69 m
 Time to drain full to half full = 4.5 hours Length at oprational depth = 12.66 m

SENSITIVITY CASE										
RUNOFF (m ³)	24.98	36.75	45.49	59.40	76.45	92.46	109.98	122.19	136.38	166.12
Discharge capacity (m ³)	0.60	1.20	1.80	3.60	7.20	14.40	28.80	43.20	72.00	172.80
DISCHARGED (m ³)	0.60	1.20	1.80	3.60	7.20	14.40	28.80	43.20	72.00	166.12
Req'd STORAGE (m ³)	24.38	35.55	43.69	55.80	69.25	78.06	81.18	78.99	64.38	0.00

TOTAL STORAGE AVAILABLE 81.36 m³ Width at rim = 12.29 m
 Time to drain full to half full = 5.6 hours Length at rim = 13.26 m

Overall Assessment

Base elevation above seasonal high GWL -0.01 m
 Will the basin drain from full to half full in 24 hours or less? (sensitivity case) Yes pass
 Does the basin provide sufficient storage? Yes pass

Project No : 1841
Project Title : Tars Farm

Detention Basin

Site Location: Barnham
 $r = 0.36$ (range 0.12 to 0.45)
 Drained Area = 1345 m²
 Design storm 1 in = 100 year
 Design-operational = 20 % for climate change
 Sensitivity case at rim = 40 % for climate change
 Urban Creep allowance = 0 % uplift to Drained Area

Catchment ID: gross $C_v=1.0$
 Width of base = 8.0 m
 Length of base = 9.0 m
 Base Area = 72.27 m²
 Side slopes 1 in = 3

Site Considerations

Where determined, what is the depth to highest seasonal groundwater level (GWL) from surface 0.70 m

Technical Assessment

Design Desicharge Rate = 5.00 l/s
 Operational depth from base = 0.61 m
 O/A depth rim-base = 0.71 m

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
OPERATIONAL LOAD										
With CC & UC uplift (mm)	15.9	23.4	29.0	37.9	48.7	58.9	70.1	77.9	86.9	105.9
RUNOFF (m ³)	21.41	31.50	38.99	50.91	65.53	79.25	94.27	104.73	116.90	142.39
Discharge capacity (m ³)	1.50	3.00	4.50	9.00	18.00	36.00	72.00	108.00	180.00	432.00
DISCHARGED (m ³)	1.50	3.00	4.50	9.00	18.00	36.00	72.00	104.73	116.90	142.39
Req'd STORAGE (m ³)	19.91	28.50	34.49	41.91	47.53	43.25	22.27	0.00	0.00	0.00
	pass	pass	pass	pass	pass	pass	pass	pass	pass	pass

TOTAL STORAGE AVAILABLE 65.82 m³ Width at Operation depth = 11.69 m
 Time to drain full to half full = 1.3 hours Length at oprational depth = 12.66 m

SENSITIVITY CASE										
RUNOFF (m ³)	24.98	36.75	45.49	59.40	76.45	92.46	109.98	122.19	136.38	166.12
Discharge capacity (m ³)	1.50	3.00	4.50	9.00	18.00	36.00	72.00	108.00	180.00	432.00
DISCHARGED (m ³)	1.50	3.00	4.50	9.00	18.00	36.00	72.00	108.00	136.38	166.12
Req'd STORAGE (m ³)	23.48	33.75	40.99	50.40	58.45	56.46	37.98	14.19	0.00	0.00

TOTAL STORAGE AVAILABLE 81.36 m³ Width at rim = 12.29 m
 Time to drain full to half full = 1.6 hours Length at rim = 13.26 m

Overall Assessment

Base elevation above seasonal high GWL -0.01 m
 Will the basin drain from full to half full in 24 hours or less? (sensitivity case) Yes pass
 Does the basin provide sufficient storage? Yes pass

Date: 08/03/2019

Site Ref

Tars Farm

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

driveways

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? ☐ N

Land Use

driveways (individual)

Hazard

low

TSS index	Metals index	HydroCar index
0.5	0.4	0.4

Treatments

To surface water discharge ☐ Y

Component

1 Detention basin

2 N/A

3 N/A

mitigation index

basic OK

X1 N/A

Enhanced mitigation index

n/a

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	0.50
0.5	0.5	0.6	
0	0	0	

Land Use

driveways (individual)

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: 08/03/2019

Site Ref

Tars Farm

SuDS Water Quality Management CIRIA C753 Ch26

Simple Index Approach

Catchment

roofs

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?

N

Land Use

roofs-residential

Hazard

very low

TSS index	Metals index	HydroCar index
0.2	0.2	0.05

*2 residential roofs remove gross solids and sediments

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

basic OK

n/a

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	0.50
0.5	0.5	0.6	
0	0	0	

Land Use

roofs-residential

Hazard

very low

TSS index	Metals index	HydroCar index
0	0	0

residual

*2 residential roofs remove gross solids and sediments

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).

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

ENGINEER'S INSPECTION CONDITIONS AND LIMITATIONS



1. The report is a record of a visual inspection carried out by, or under the direction of a Chartered Structural Engineer and must not be misinterpreted as a Structural Survey such as would be carried out by a Chartered Surveyor. The report is not a Valuation Survey.
2. The inspection is strictly limited to the items requested and these will be detailed in the report. No consideration will be given to any other aspects or parts of the building.
3. The report is confidential to the Client(s) and has been prepared to their instructions for their own purposes only and it is not permitted to disclose this report to any other parties (except the Clients own Solicitors, Surveyors, Building Societies or Estate Agents) without the prior consent of Aqua Callidus Consulting Ltd.
4. The copyright of this report remains the property of Aqua Callidus Consulting Ltd.
5. No liability for the contents of this report is accepted to any parties other than the Client(s). No parties other than the client should rely upon this report.
6. Unless specifically stated otherwise:-
 - a) Trial holes will not be excavated prior to the preparation of the report and the depth and construction of the foundations and type of sub-soil will not be inspected.
 - b) All external observations will be carried out by eye from the ground level only. Internal inspection is made within the limits of ready accessibility and it is not normal practice to lift floor coverings or floor boards, remove fixtures, panels or plaster, or move heavy items of furniture or bulky goods or materials.
 - c) No inspection will be made of any roof voids, floor joists, wall cavities, drainage pipework or any other hidden or inaccessible parts.
 - d) No timbers will be checked for damp, rot, infestation by wood-boring insects or other defects.
 - e) It should not be construed that any parts of the construction comply with the requirements of the Building Regulations Act or standard practice either current or as current at the time of original construction. No enquiries to any Authorities will be made.
 - f) No testing or enquiries into the presence of or susceptibility to pollution, contamination, radiation, methane, radon or other gases or hazardous substances has been carried out.
7. Unless specifically stated otherwise in the report, any recommendations for works given in the report are outline only and are to be confirmed or modified as appropriate at detailed design stage.
8. Where trial holes are specifically included in our instructions the condition of the footing and the founding soil relates only to the point of excavation and does not necessarily confirm a continuation of the same conditions throughout the non-inspected areas of the structure. Whilst such trial pits will usually provide a reasonable indication as to the general state of the foundations and ground conditions, these can not be determined with complete certainty.
9. Under the Construction (Design & Management) Regulations latest edition, the Client has obligations for ensuring Health and Safety arising from any construction work. If it is proposed to proceed with construction work based upon information or recommendations contained in this report, these regulations apply. Further details of any issues arising from our report or the Clients obligations generally are available on request.
10. Unless dealt with more specifically above the Association of Consulting Engineers Conditions of Engagement Short Form Agreement 2002 apply.