

**SUNNY MEAD FARM, NORTH END
ROAD, YAPTON BN18 0DL**

PROPOSED RESIDENTIAL DEVELOPMENT

Drainage Strategy

Prepared on Behalf of

Roy Daniells

D1511/DS/2.0

21 November 2018

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Proposed Residential Development

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1 INTRODUCTION

1.1 Background

- 1.1.1 RGP Design Ltd is instructed by Roy Daniells to prepare a Drainage Strategy to support a planning application for the proposed development at Sunny Mead Farm, Yapton.
- 1.1.2 The proposed development involves the redevelopment of the existing Sunny mead Farm into 7 No. residential properties, with associated hard and soft landscaping.
- 1.1.3 In preparing this report, RGP Design has referred to the following documents and information:
- Environment Agency Flood Maps for Planning
 - Long Term Flood Risk Assessment Surface Water Flood Risk Maps
 - Long Term Flood Risk Assessment Reservoir Flood Risk Maps
 - Local Authorities Strategic Flood Risk Assessment
 - Public Sewer Records
 - Environment Agency Data
 - British Geological Survey Data
- 1.1.4 This strategy has been prepared to demonstrate that the proposed development will not increase flood risk and maximises the use of sustainable drainage techniques.
- 1.1.5 This report has been prepared for the benefit of the parties listed in the Terms of Appointment.

1.2 Site Location and Description

- 1.2.1 The proposed development is bounded to the north by the Ford to Barnham railway line. It is situated in the north east of the North End residential area of Yapton and is also bounded by a horse field to the east, an access track to the field between the neighbouring Apple Tree Cottage to the south and North End Road to the west. The proposed site plan provided by Cover Storey Architects LLP is seen in **Appendix A**.
- 1.2.2 The proposed development is on land currently occupied by the existing Sunny Mead Farm, consisting of the main house as well as the smaller Green House and a swimming pool. Much of the north of the site is overgrown and there are a number of large established trees on site.
- 1.2.3 The River Arun flows southwards 2km east of the site. A tributary to the River Arun becomes a designated Main River at North End Road and passes the site approximately 40m from the north boundary, as seen in the Environment Agency's Flood Map for Planning.

- 1.2.4 The site is approximately 0.27Ha (2,739m²) in size and lies between 3.02m and 5.37m AOD, falling towards the centre of the site, as can be seen in drawing **SK101**.
- 1.2.5 The pre-development impermeable area is 0.02Ha (204m²) as demonstrated on drawing **SK200**, included in this report.

2 EXISTING DRAINAGE

2.1 Surface Water

- 2.1.1 The public sewer records provided by Southern Water do not show any public surface water sewers in the vicinity of the site, as seen in **Appendix B**.
- 2.1.2 It is therefore understood that the site does not currently utilise a connection to a surface water sewer.
- 2.1.3 The Greenfield runoff rate (Qbar) for the site has been calculated using MicroDrainage (ICP SuDS). The Greenfield value for the site is calculated as Qbar (rural) = 1.0l/s (Q1 = 0.8l/s, Q30 = 2.2l/s, Q100 = 3.1l/s).
- 2.1.4 A soil investigation will be required to understand what rate runoff is being infiltrated.
- 2.1.5 MicroDrainage calculations are included within this report.

2.2 Foul Water

- 2.2.1 The public sewer records provided by Southern Water show that an existing public 175mm foul water sewer passes through the centre of the site from south to north, under the rail tracks, to the North End Yapton Waste Pumping Station approximately 25m north of the site. The sewer has an invert of approximately 2.15m AOD under the centre of the site, where existing ground levels are as low as 3.00m AOD.
- 2.2.2 It is unclear if the existing development is connected to the public sewer network.

2.3 Highway Drainage

- 2.3.1 Based upon information supplied by West Sussex County Council (as seen in **Appendix C**), there is a positive drainage system with road gullies and manholes. There are four existing road gullies within the vicinity of Sunny Mead Farm – two on each side of the public highway (North End Road). The council response stated that the existing highway system at this location is piped and outfalls into the watercourse north of the railway line.

2.4 Ground Conditions

- 2.4.1 Southern Testing Laboratories Ltd undertook soakage testing in October 2018 at the site, with a report provided to present the exploratory hole logs and test results, with indicative infiltration rates for the site as a result of the test results – as seen in **Appendix D**.
- 2.4.2 The soils encountered comprised of topsoil over sandy clay, with a layer of gravelly sand over weathered Chalk bedrock below.
- 2.4.3 Testing was carried out in windowless sampler boreholes rather than pits due to access constraints. Three successful soakage tests at pits WLS02, WLS03 and WLS04 recorded infiltration at 4.19×10^{-7} , 8.75×10^{-5} and 1.69×10^{-4} respectively. WLS02 collapsed during testing to 1.34m bgl.
- 2.4.4 Analysis of the BGS website data within the local area confirms underlying strata to be as follows:

Bedrock Geology:

The underlying bedrock is indicated as 'Lewes Nodular Chalk Formation, Seaford Chalk Formation, Newhaven Chalk Formation, Culver Chalk Formation and Portsdown Chalk Formation (undifferentiated) – Chalk'

Beyond the north west corner of the site the bedrock is indicated as 'Lambeth Group - Clay, Silt and Sand'



Figure 6. Bedrock geology by the BGS website

Superficial Deposits:

The superficial deposits indicated to be present at the site are 'Raised Beach Deposits, 1 - Sand and Gravel', as well as 'River Terrace Deposits (undifferentiated) - Sand, Silt And Clay' to the south of the site.

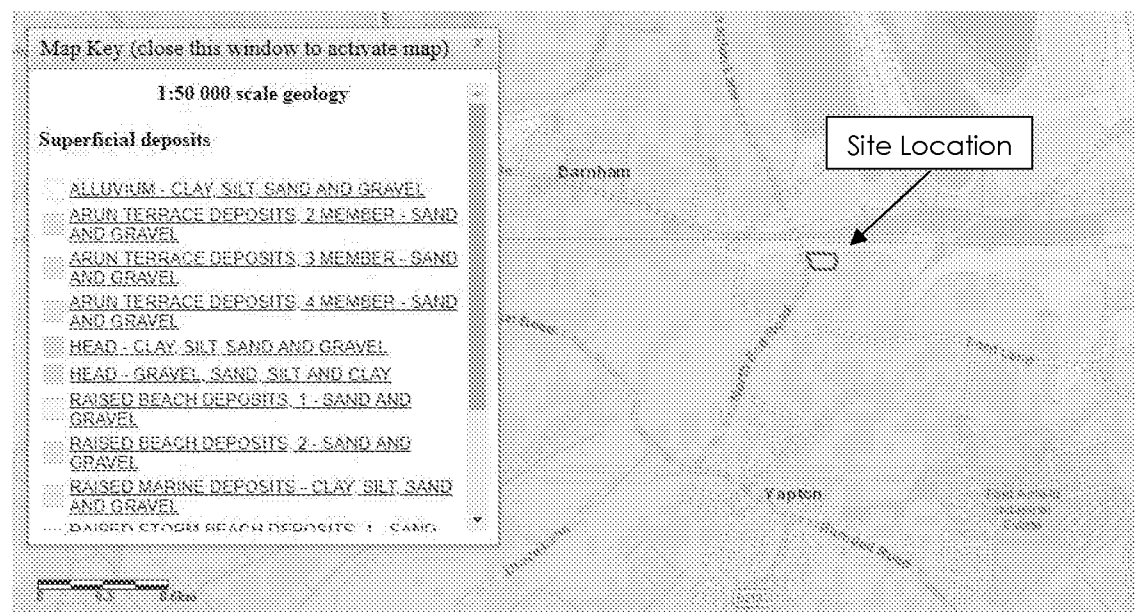


Figure 7. Superficial deposits by the BGS website

2.4.5 Analysis of the Magic Map Application (magic.defra.gov.uk/magicmap.aspx) shows that the site is not located within a groundwater source protection zone.

2.4.6 The site is however within a Principal Aquifer (Bedrock) and a "major aquifer intermediate" vulnerability zone.

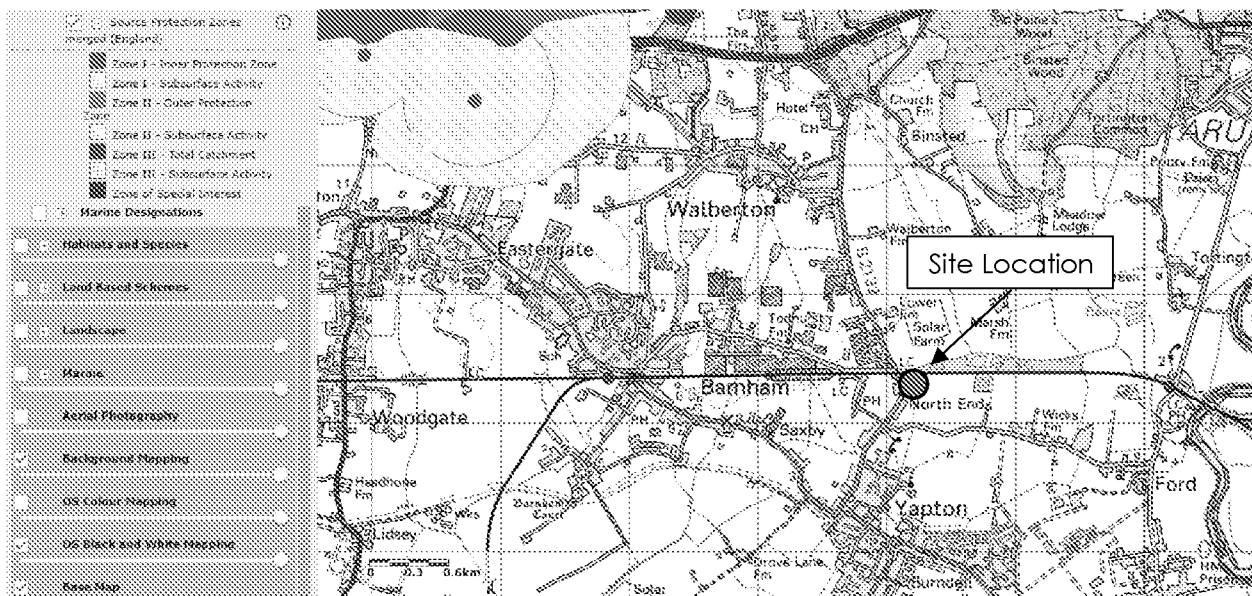


Figure 8. DEFRA Source Protection Zone Mapping

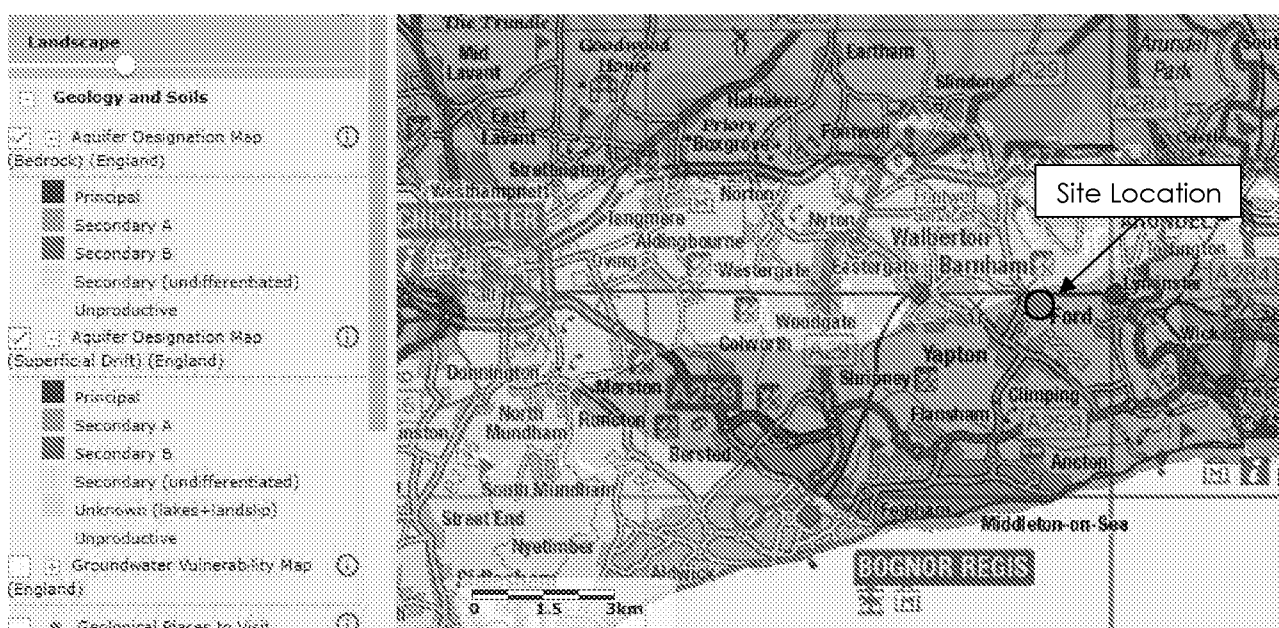


Figure 9. DEFRA Aquifer Designation Mapping

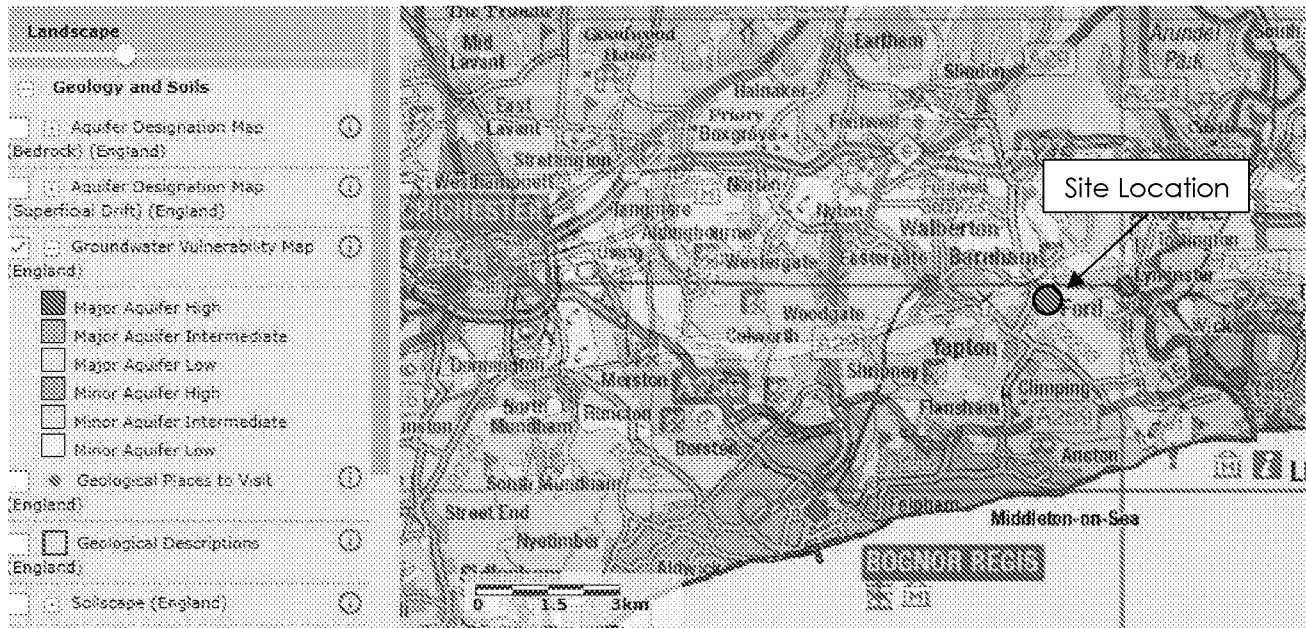


Figure 9. DEFRA Groundwater Vulnerability Zone Mapping

2.5 Groundwater

- 2.5.1 The Soakage Test Report by Southern testing successfully recorded groundwater levels in two of the boreholes. WLS03 and WLS04 groundwater was found to rest at 2.34m and 1.87m bgl respectively.
- 2.5.2 It is likely that groundwater levels vary due to wet and winter weather and will rise above the measured levels seasonally. Any SuDS features utilizing attenuation storage should therefore be kept close to the surface so that there is freeboard between the attenuated surface water and groundwater levels.
- 2.5.3 The Single Onshore Boreholes Index (SOBI) on the BGS website has one borehole record in the vicinity of the site, 75m south east of the site location. This was recorded as 'SU90SE32 — NORTH END YAPTON', which was at a surface level of 6.0m AOD.
- 2.5.4 The borehole log recorded soil to a depth of 0.3m, with silty clay brickearth with flint pebbles to a depth of 3.0m. A layer of raised beach deposits (fine to coarse sand, quartz with flint pebbles) were found to a depth of 3.3m with Upper Chalk bedrock to the bottom of the borehole at 4.5m. Water was not struck during excavation.

3 PROPOSED DEVELOPMENT

3.1 Surface Water

3.1.1 The SUDS manual and Building Regulations set out a hierarchy of drainage methods to ensure that developments maximise the use of sustainable drainage techniques. The hierarchy favours infiltration methods of disposal over other methods such as watercourse and sewers, as detailed below;

- Utilise infiltration techniques
- Attenuate rainwater in ponds or open water features for gradual release
- Attenuate rainwater by storing in tanks or sealed water features for gradual release
- Discharge rainwater direct to a watercourse
- Discharge rainwater to a surface water sewer/drain
- Discharge rainwater to a combined sewer

3.1.2 The proposed development results in an increase in the impermeable area from 204m² (0.02Ha) to 1,523m² (0.15Ha). Surface water flows will be captured by permeable paving in the parking bays and shared driveway. Captured flows will be infiltrated through the permeable paving, as well as two lined soakaways.

3.1.3 Rainfall captured on the roofs of the residential buildings will also be conveyed to the permeable paving.

3.1.4 The strategy outlined will ensure that there is no increase in the amount of run-off leaving the site, therefore no increase in the risk of flooding from this source.

3.1.5 The proposed drainage system has been designed with a combination of SuDS techniques in order to accommodate a 1 in 100-year critical storm and will include an allowance for the effects of climate change (see Section 3.3).

3.1.6 The system will also consider the impacts of urban creep (see Section 3.4).

3.1.7 The proposed surface water drainage strategy is shown on drawing **SK300**, included in this report.

3.1.8 Further to completion of the Southern Testing intrusive investigation, infiltration has proven to be a viable solution. The design rate from WLS03 has been used for the purpose of the calculations.

3.1.9 A permeable paving sub-base thickness of 350mm has been utilised to allow sufficient attenuation of the surface water run-off, with outfall to the soakaways for sufficient infiltration. A diameter of 1200mm has been utilised for both lined soakaways.

3.1.10 The proposed drainage scheme will ensure there is no surface water discharge off the site through the use of infiltration techniques.

- 3.1.11 In designing the drainage system, a safety factor of 3.0 was used for both SuDS features in the MicroDrainage calculations, as seen in **Appendix E**.
- 3.1.12 For an exceedance event, surface water would surcharge the system and pond in the centre of the site, where it would drain through the permeable paving, and the lined soakaways. It is unlikely that this would affect the proposed properties due to the topography of the site, however raised finished floor levels would mitigate this residual risk. The topography of the highway to the west of the site should also be considered, due to the risk of flooding to the site in an exceedance event.

3.2 Foul Water

- 3.2.1 It is proposed to connect the development to the existing public foul sewer located on site. Confirmation of levels will be required for a connection into the 175mm diameter public foul water sewer.
- 3.2.2 Existing foul flow from the site is estimated to be 0.05l/s, and post development there will be an estimated increase in foul water flows to 0.32l/s (based on Sewers for Adoption). The proposed foul drainage layout is shown on drawing **SK300**.
- 3.2.3 The site sits within the Lidsey Treatment Catchment area set out by Arun District Council as seen in **Appendix F**.
- 3.2.4 Recent changes to infrastructure and connection charges (OFWAT Charging Rules) place the onus on the sewerage undertaker to reinforce their network should there no longer be sufficient capacity to serve the new development. Funding for this is provided by revised charging arrangements for infrastructure and connection charges for each dwelling constructed comprising a Network Reinforcement Charge and Site-Specific Charges. The revised charging arrangement (funded by the developer) covers alterations to the Existing Sewer Network and the sewerage undertaker remains responsible for the cost of reinforcing their Strategic Assets. The developer is responsible for connecting the development to the public sewer network.

3.3 Climate Change

- 3.3.1 NPPF sets out percentage increases to be applied to the peak rainfall intensity values used in the design of a surface water drainage system to allow for the effects of climate change.
- 3.3.2 In accordance with NPPF 'climate change allowances' update 3 February 2017, an increase of 20% should be applied for this development and a review should be undertaken to determine the impact of an increase of 40%.
- 3.3.3 A 40% level of climate change has been accounted for within the overall drainage strategy for the site.

3.4 Urban Creep

- 3.4.1 Based upon the assumption that there will be an urban creep on new developments through their lifetime, the impact of an additional 10% impermeable area has been considered. There would be an increase in impermeable area to 1,675m².
- 3.4.2 The proposed system would have sufficient capacity to withstand urban creep without flooding.

3.5 Treatment

- 3.5.1 The use of permeable paving will ensure that the run-off from the private drives and shared parking areas receives a level of treatment that meets the requirement of the SuDS Manual due to naturally occurring microbes digesting Hydrocarbons entering the system and the filtration effects of the aggregates and geotextiles.
- 3.5.2 Impermeable hard stand areas will be drained by trapped road gullies and/or channels with a sump providing a basic level of treatment by collecting silts and oil pollutants. Catchpits will also be provided to collect silts and oil pollutants.
- 3.5.3 The CIRIA SuDS Manual C753 outlines three categories of pollution hazard identification for the various types of land use as follows:
- Total Suspended Solids (TSS).
 - Metals (M).
 - Hydrocarbons (H).
- 3.5.4 In accordance with C753 table 26.2 the proposed land uses at the site are categorised as follows:
- Residential Roofs - very low/TSS-0.2/M-0.2/H-0.05.
 - For other impermeable surfaces - low/TSS-0.5/M-0.4/H-0.4.
- 3.5.5 In accordance with C753 table 26.3 to establish whether a proposed surface water management technique can provide sufficient treatment for runoff, the values are compared. If the treatment score for each pollutant category is higher than the pollution score, then the chosen technique is sufficient. If a single technique is not judged to provide enough treatment, then other techniques can be added to the system.
- 3.5.6 The treatment afforded by the proposed outline surface water management strategy has been assessed based on the following components:
- Permeable pavement – TSS-0.7/M-0.6/H-0.7
 - Infiltration – TSS-0.05/M-0.05/H-0.05
- 3.5.7 Flows will pass through the permeable pavement before infiltration, which provides sufficient treatment for the proposed land uses. In conclusion, the above SuDS methods and techniques can be considered to provide sufficient treatment.

3.6 Maintenance

- 3.6.1 Maintenance plays an important part in the long-term performance of a surface water drainage system and will be required to ensure that it remains fully operational.

3.6.2 Whilst the drainage system has been designed to operate with as little maintenance as possible, there are key operations that must regularly be undertaken to ensure that it remains in optimal condition, most of which are general housekeeping tasks that should be undertaken for any drainage system, but with additional attention to the permeable paving. These operations are summarised below together with recommended frequencies:

- Periodic desilting of any gullies. These should be emptied at least as follows (but with an annual inspection and additional cleansing if required): On completion of drainage works, Year 1, Year 3, then every 5 years. The desilting of these items is required to ensure the system operates as per the design and does not become blocked.
- Periodic jetting or rodding of pipework as required to clear blockages.
- Gratings on any gullies and channel drains to be kept clear of debris.
- Any manufacturer specific requirements for maintenance (i.e. for the soakaways) should be added to the periodic maintenance.

Permeable Paving / Diffuser Units

3.6.3 The areas of permeable paving are designed to allow infiltration of surface water run-off through the joints in the block paving surface course and into the subbase below. The water is then collected and discharged into the positive drainage system.

3.6.4 As part of the permeable paving system, diffuser units are used to discharge surface water run-off from roof areas into the sub-base, as well as forming links between areas of permeable paving. These diffuser units are small heavy-duty cellular units which allow more efficient discharge of surface water into the sub-base base of the permeable paved areas.

3.6.5 The areas of permeable paving will require additional maintenance measures to ensure they operate as designed. Failure in carrying out this maintenance, could increase the risk of flooding. The additional measures are as follow:

- Periodic surface sweeping to reduce silt and debris accumulation. The permeable surfaces should be swept at least every 8 to 12 weeks with additional sweeps in the autumn to clear fallen leaves
- Removal / management of weed growth, as required. Typically, once or twice a year for regularly used areas
- Periodic silt removal from permeable surfaces as described by the manufacturer. If any areas are showing signs of ponding, they shall be dealt with by raking out the joints and redressing. The entire surface shall be monitored and when there are signs of excessive

siltation resulting in poor drainage over the whole area, the blocks shall be taken up and a replacement of bedding layer and geotextile shall be undertaken

- Redressing of joints on the block paving as required
- Catchpits upstream of diffuser units, should be emptied and inspected on the same regime as all catchpits specified previously set out in this document

Lined Soakaways

- 3.6.6 Infiltration systems will require regular maintenance in order to ensure continued full operation of the system. The design should include monitoring points where the water level can be observed, as well as the infiltration surface.
- 3.6.7 The life cycle and operation of the features will depend on the frequency of maintenance and the risk of sediment entering the system.
- 3.6.8 The lined infiltration features will require additional maintenance measures to ensure it operates as designed. The additional measures are as follows:
- Monitoring of silt traps and rate of sediment accumulation, monthly in the first year and then annually.
 - Annual monitoring of soakaway to ensure emptying is occurring.
 - Annual inspection for sediment and debris in pre-treatment components, and inside of concrete manhole rings. Removal of sediment and debris as required.
 - Annual (or as required based on inspections) cleaning of gutters and any filters on downpipes.
 - Remedial works to reconstruct soakaway if performance deteriorates or failure occurs, including replacement of clogged geotextiles.

Remedial/Repair Actions

- 3.6.9 Significant storm events may cause considerable damage to SuDS and their associated components. As such, it may be necessary to inspect and carry out essential recovery works to return the feature to full working order.
- 3.6.10 Resetting of uneven blocks by lifting block area, removing bedding material and relaying to match original design are all actions which may need to be undertaken.

Accidental Spillages

- 3.6.11 It is not envisaged that any materials are to be stored onsite once the development has been completed, which could cause major spills and potential pollution issues within the drainage system. If this situation alters in the future consultation with a specialist will be required in order to confirm if any upgrades to the existing system are necessary.

- 3.6.12 Minor spillages of fuels and oils from motor vehicles will be dealt with by the permeable paving and deep trapped gullies, by bio-degrading and collecting the hydrocarbons respectively.

Future Alterations to the Development

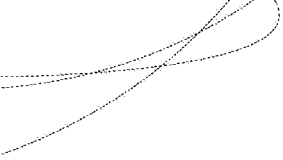
- 3.6.13 Any future alterations to the permeable paving should be confirmed by a specialist. Where possible any future services are to avoid being located through areas of permeable paving or in close proximity to the soakaways. If new services are required to run through areas of permeable paving, services should be installed below the depth of permeable paving with the permeable system reinstalled above.

4 OFFSITE IMPACTS

- 4.1.1 The proposed development will see a decrease in the impermeable area on the site from 204m² (0.02Ha) to 1,523m² (0.15Ha). Surface water run-off will be managed within the bounds of the site as confirmed by the proposed drainage to minimise the risk of flooding both on and offsite.
- 4.1.2 Surface water flows will be captured by permeable paving in the parking bays, as well as drainage channels and gullies. Captured flows will be infiltrated through the permeable paving, as well as three lined soakaways. In addition to this, the system will provide an acceptable level of treatment to improve the quality of surface water run-off.
- 4.1.3 There will be no adverse impact on flood storage volumes or flood flow routes because the proposals will follow the existing topography.
- 4.1.4 The effects of climate change are considered in the design of the proposed surface water drainage system, to ensure there is no off-site impact.

5 SUMMARY

- 5.2.1 The proposed development is on land currently occupied by the existing Sunny Mead Farm and proposed for re-development and extension into 7 No. residential buildings.
- 5.2.2 The site is approximately 2,739m² in size and lies between 3.02m and 5.37m AOD, falling towards the centre of the site.
- 5.2.3 The proposed development results in an increase in the impermeable area on the site to 1,523m².
- 5.2.4 It is proposed that permeable paving is used in the car parking spaces to provide attenuation and infiltration for rainfall flows. Surface water from hardstanding areas and the roof will be captured by drainage channels, gullies and drains to 2 No. concrete ring lined soakaways.
- 5.2.5 The proposed drainage system will be designed to cater for a 1 in 100-year critical storm event and include an allowance of 40% to cater for the effects of climate change. It will ensure that there is no discharge off site from surface water flows.
- 5.2.6 The foul sewer system will be connected to the existing public foul sewer on site.
- 5.2.7 A maintenance regime should be established to ensure the long-term effectiveness of the surface water drainage system.



DRAWINGS

NOTES

1. This drawing is to be read in conjunction with all other RGP drawings, and with all relevant Architect's and Engineer's drawings and specification. Any discrepancies found are to be reported immediately to the Engineer.
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4. Any information given regarding existing underground services is given in good faith after consultation with the relevant authority, however accuracy is not certain.

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Drawing Title
Existing Overland Flow Routes

Scale 1:250	Drawn By DJL	Checked By MJA	Approved MJA
Date 17/10/2018	Drawing No. 2018-D1511-SK101	Rev P	Rev P

-DRAINAGE KEY-

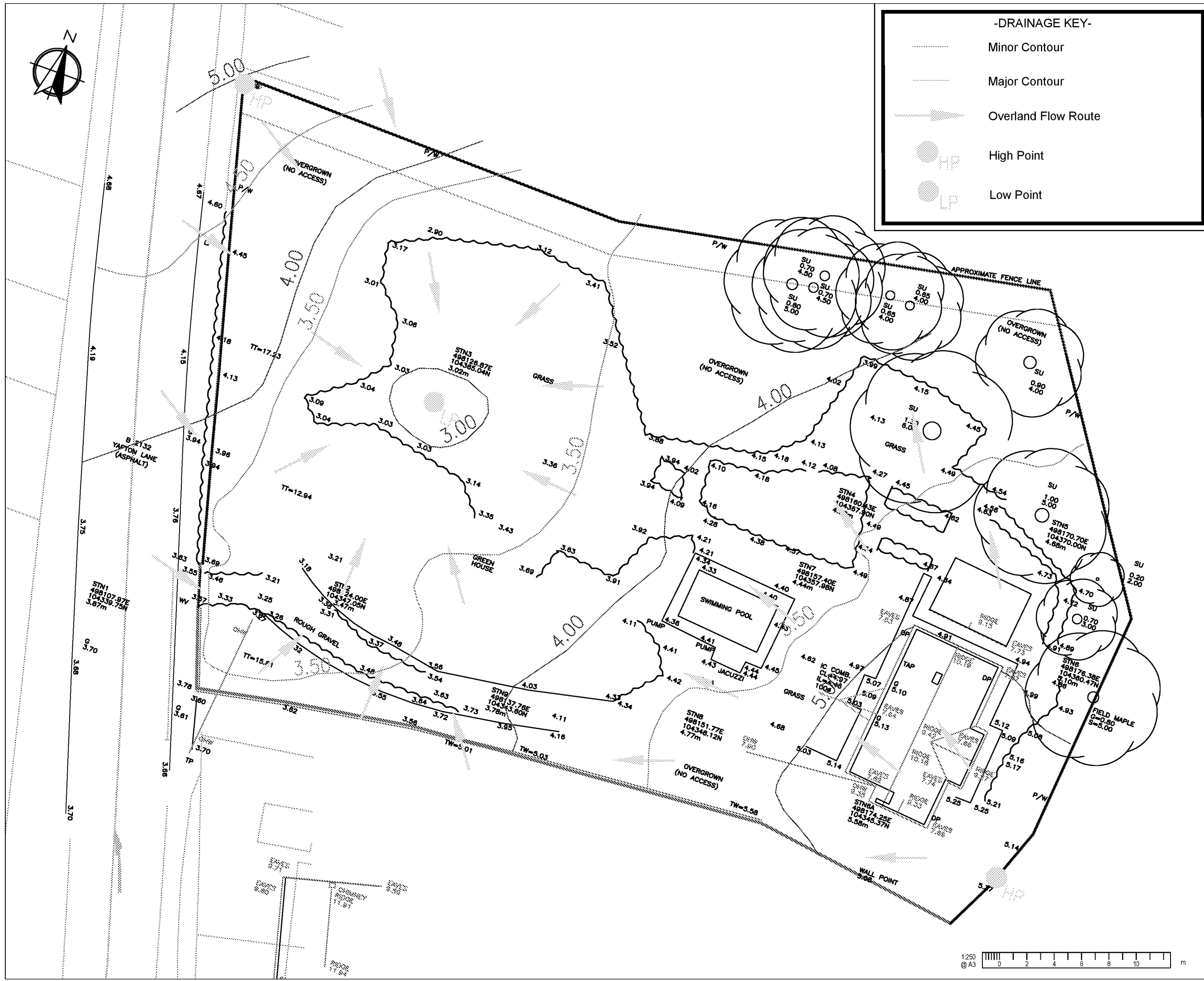
Minor Contour

Major Contour

Overland Flow Route

High Point

Low Point





-KEY-

----- Site Boundary (2,739m² - 0.27Ha)

Existing Impermeable Area (204m² - 0.02Ha)

Proposed Impermeable Area (1,523m² - 0.15Ha)

NOTES

A3

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Drawing Title
Impermeable Areas Comparison

Scale 1:500	Drawn By DJL	Checked By	Approved
Date 08/10/2018	Drawing No. 2018-D1511-SK200	Rev P1	Res ARUN

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P1	18-10-18	Draft
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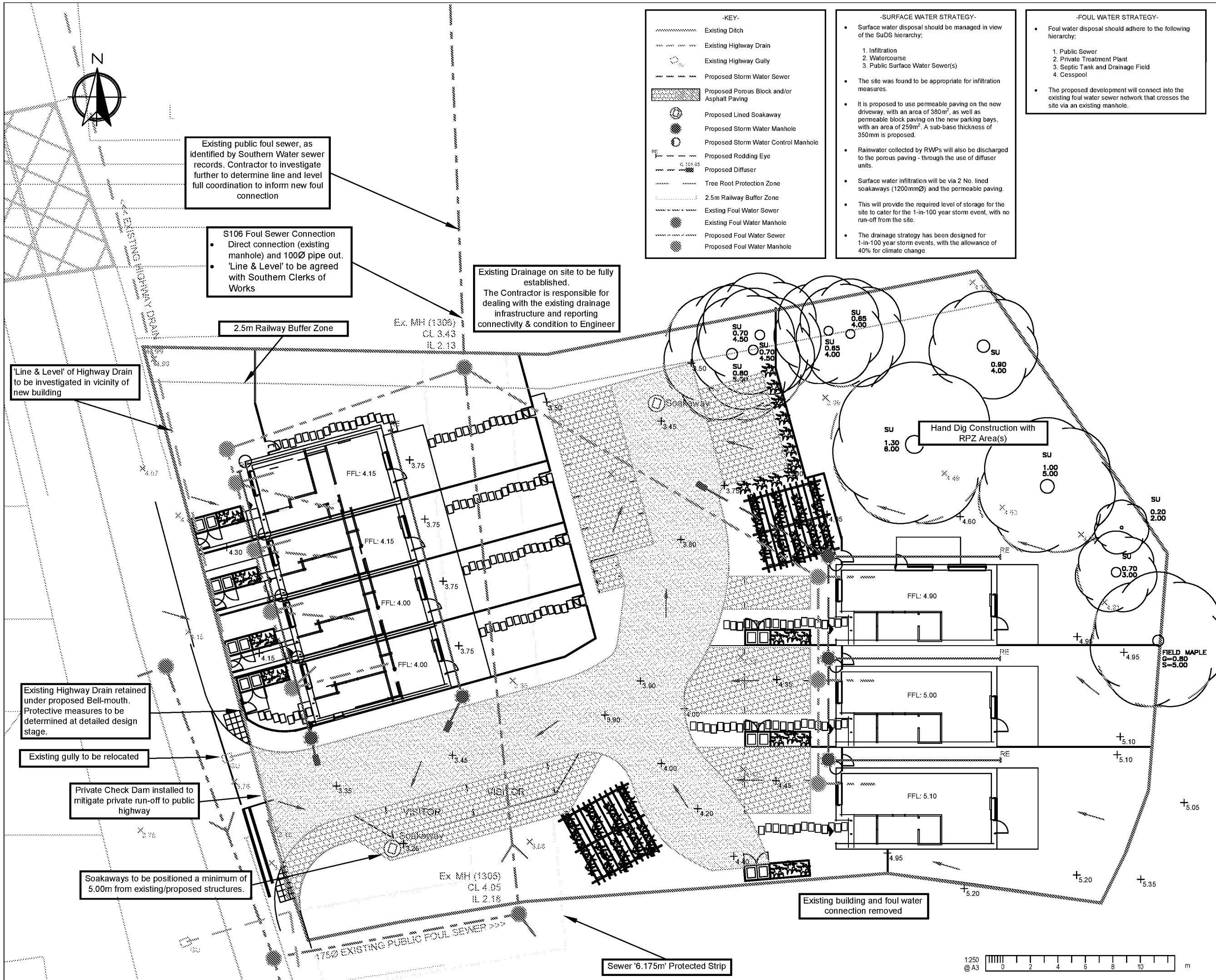
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Client: Neame Sutton

Project: Sunny Mead Farm
North End Road, Yapton BN18 0DL

Drawing Title: Proposed Drainage Strategy

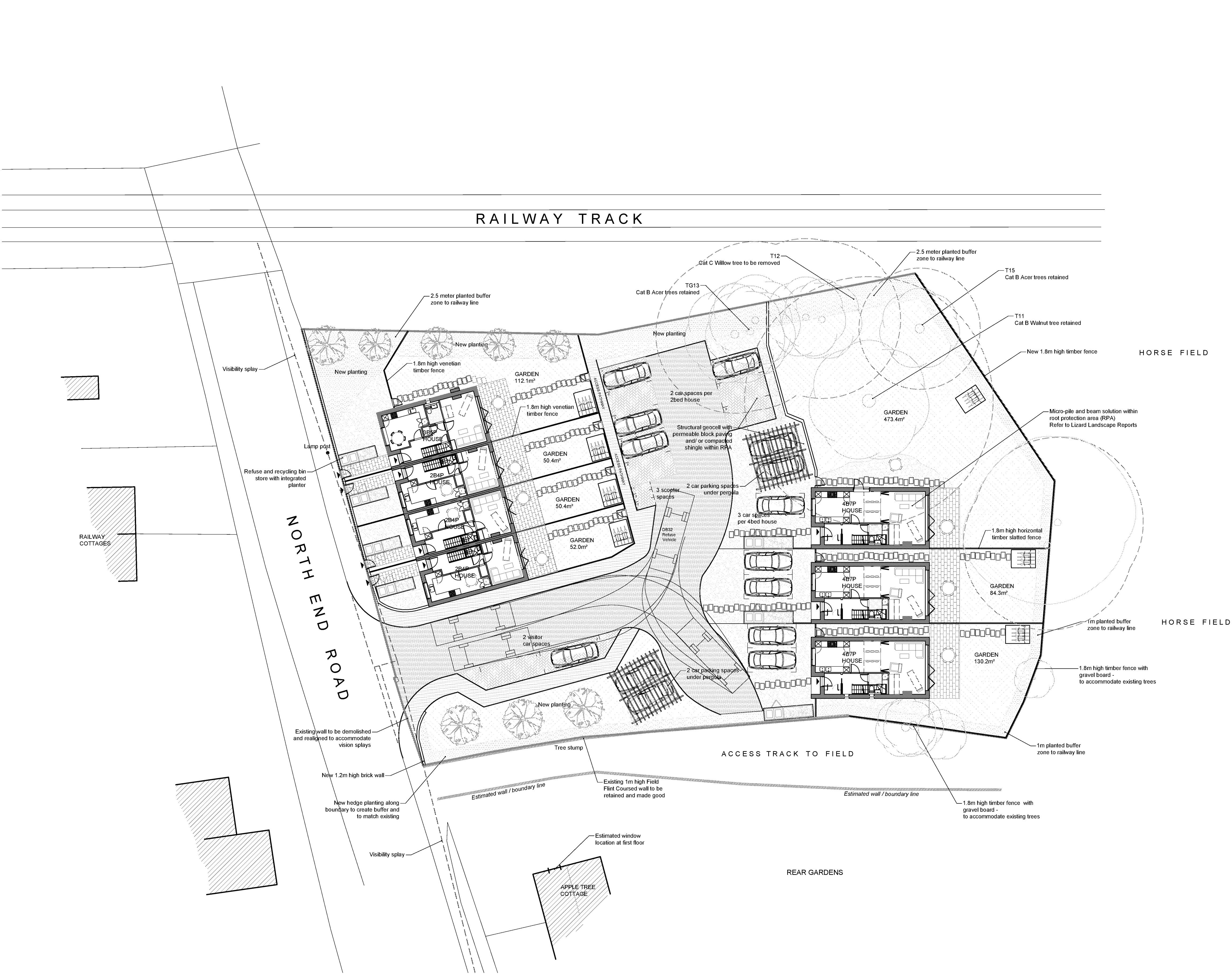
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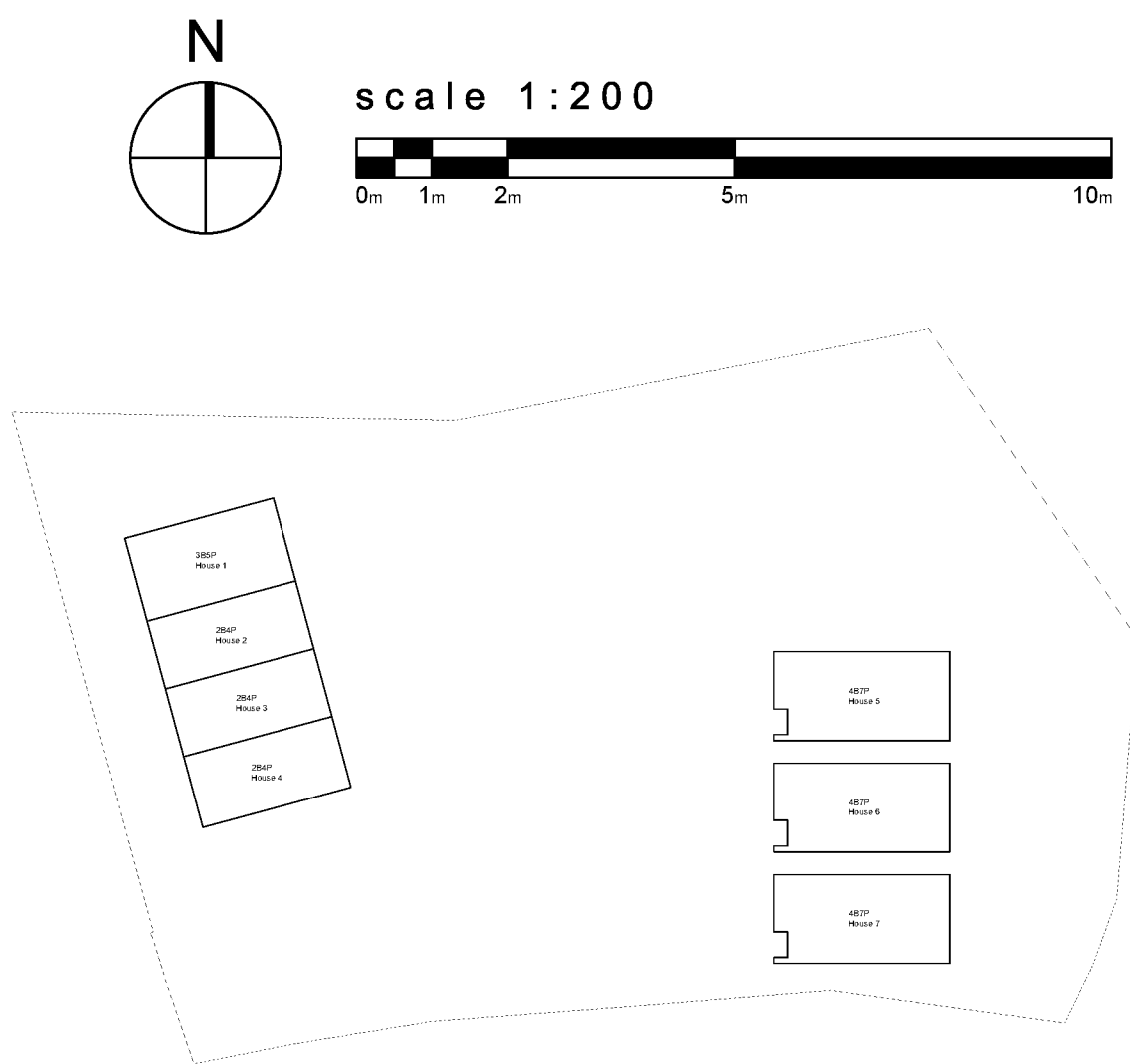
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Appendix A Architects Preliminary Site Layout



proposed site plan 1:200



key plan 1:500

key:

- Grass (laid on turf to front garden and turfed or seeded to rear garden)
- Native shrub planting 'buffer zone'
- Road surface
- Permeable block paving to car park bays and scooter/motorcycle bays
- Shingle / gravel driveways and forecourts
- PCC slab paving to terraces and pathways
- Black bitmac pedestrian surface with corrugated pen north to back edge where retained
- Refer to Lizard Landscape Reports
- Existing trees - various sizes and types retained
- Tree root protection areas (TRPA)
- Existing trees - various sizes and types to be removed
- Proposed new trees / replanted existing trees
- Existing shrubs / small trees to be retained and relocated on the site
- Ornamental shrub / ground cover planting / climbers
- Boundary Treatments**
 - 1.8m high venetian timber fence between dwellings with matching timber gate, hedging holes to be provided
 - 1.1m high timber picket gate
- Garden Features**
 - Normal 1.8 x 2.4m timber shed min. ridge height 2.16m with window on concrete slab base. To meet SED standards.
 - 200 litres min. water butt with rainwater collector and overflow, providing min. average of 30L
- Levels**
 - Existing level
 - Proposed level
- Notes**
 - Show Colgate Land & Building Surveyors Topographic Survey 05016, 10/05, June 2018
 - Topographical, Landscape Design and Ecology, Tree Constraints Plan (L21446-REC-COVC-01) Preliminary Ecological Appraisal LD-1446-ECO-REP-001, Site Habitat Plan (L21446-JAB-COVC-01)
 - rgi Transport Planning and Infrastructure Design, Consultation, Visibility Study and Vehicle Impact Path Analysis, 2018-4287-001
 - RP Environmental, Noise Impact Assessment Technical, RPE-0205-18-01 July 2018

Rev.	Description	by	check	date	

REVISIONS

Cover Storey
Architects

Cover Storey Architects LLP
Tel. 02392 006286

The Studio, 18 St Georges Avenue, Havant
info@coverstorey.co.uk

PO9 2RX
www.coverstorey.co.uk

Project name: Sunnymead Farm, North End Road, Yapton, Arundel BN18 0DL	Project no.: 18010	Drawing no.: P121	Revision: /	Status: PLANNING	This drawing is copyright of Cover Storey Architects LLP All dimensions must be verified on site prior to construction Do not scale this drawing except for planning application purposes
Drawing name: Proposed Site Ground Floor Plan	Scale @ A1 1:200	Drawn by JB	Checked by DJS	Date 07.2018	

Cover Storey
Architects

Cover Storey Architects LLP
Tel. 02392 006266

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PO9 2RX

Appendix B Public Sewer Records

104210



4.984.04

SEWER RECORDS PAGE 2 OF 2

Node	Cover	Invert	Size	Material	Shape
0301X	8.48	4.73	150	VC	CIRC
0401K	4.96	2.6	175	VC	CIRC
1201X	5.75	3.32	175	VC	CIRC
1202Z	5.59	3.13	175	VC	CIRC
1203X	4.98	2.99	175	VC	CIRC
1204K	4.83	2.75	175	VC	CIRC
1301K	3.94	2.48	175	VC	CIRC
1303X	3.67	2.23	175	VC	CIRC
1304K	3.92	2.48	175	VC	CIRC
1305X	4.05	2.18	175	VC	CIRC
1306X	3.43	2.13	175	VC	CIRC
1401K	3.97	2.3	175	VC	CIRC
1403X	3.5	1.9	175	VC	CIRC
1404K	3.46	2.06	175	VC	CIRC
140PX	3.91	3.9	100	CI	CIRC

[illegible]

Drawn by: rohandas

Title: 310572_Sunny Mead Farm, North

Date: 27/09/2018



Appendix C West Sussex County Council Response

Dan Lytton

From: Kevin Macknay <[REDACTED]>
Sent: 02 October 2018 11:48
To: Dan Lytton
Cc: Mark Akmenkalns
Subject: Sunny Mead Farm, North End Road, Yapton, Arundel BN18 0DL
Attachments: Sunny Mead Farm - EA Flood Zones.pdf; Sunny Mead Farm - Existing Road Gullies.pdf; Sunny Mead Farm - Groundwater Flood Risk.pdf; Sunny Mead Farm - Surface water flood mapping_1in30 and 1in100 years.pdf

Follow Up Flag: Follow up
Flag Status: Flagged

Dan,

Further to your recent on-line enquiry. Please see our response below:

Flood Zones

- Please confirm the Flood Zones for this area.
Based on the current EA mapping the site is within Flood Zones 1.
- Please confirm surface water, reservoir flooding, sewer flooding. Please provide plans and depth data from your GIS UFMSW for 30yr, 100yr & 1000yr as applicable (OS Datum).
Based on the current surface water flood maps parts of the site are at risk during both 1 in 30 and 1 in 100 storm events.
- Please confirm mapping and records for any surface water assets owned or maintained.
The adjacent road (North End Road) has a positive drainage system i.e. road gullies and manhole along it.
- Please confirm if there are any future drainage improvements proposed for this area.
None that we are aware of.
- Please confirm details of existing or planned flood alleviation and defences in this area.
None that we are aware of.
- Please confirm if you are aware of any historic flooding within the confines of the site.
None that we are aware of. That is not to say that the site has never flooded, just that it has not been reported to us as LLFA.
- Please confirm if you are aware of any historic flooding in close vicinity and/or on the public highway.
We are aware of local road flooding north of the existing railway crossing i.e. at the junction of Yapton Road / Lake Lane. We are not aware that this flooding affected any areas south of the railway crossing.

Groundwater

- Please confirm details of any groundwater flooding issues in the area, including flood levels, flood extents and any available anecdotal information.
We are not aware of any ground water flooding issues at this site. That is not to say that the site has never flooded due to ground water, just that it has not been reported to us as LLFA. Current JBA ground water mapping shows the area to be at high risk of ground water flooding.

Assets

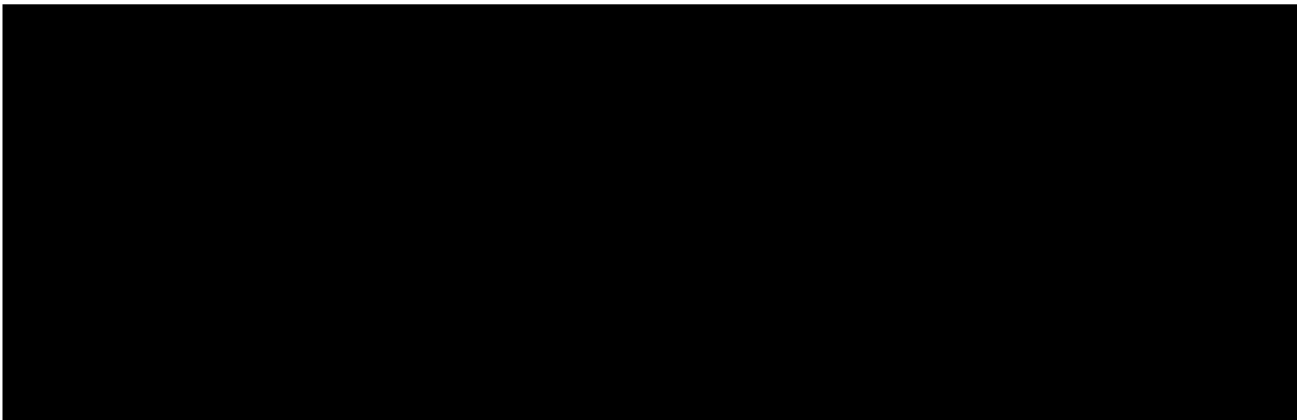
- Please confirm mapping and records for any surface water assets owned or maintained.
The adjacent road (North End Road) does have a positive drainage system along it.
- Please confirm if there are any historic culverted watercourses within or in close vicinity to the site.
Please provide map records where available.
Historic mapping does not appear to show any historic or culverted watercourses within or in close vicinity to the site.
- Please can you provide any map records denoting the highway drainage network. Is this a piped system or soakaways?
See attached plan. The existing highway system at this location is piped and is likely to outfall into the adjacent stream.

Policy/Future

- Please confirm the most recent Strategic Flood Risk Assessment (SFRA).
WSCC SFRA – June 2010
- Please confirm if there are any future drainage improvements proposed for this area.
None that we are aware of.
- Please confirm if any drainage studies and/or SWMP have/are being assess for this area.
None that we are aware of.

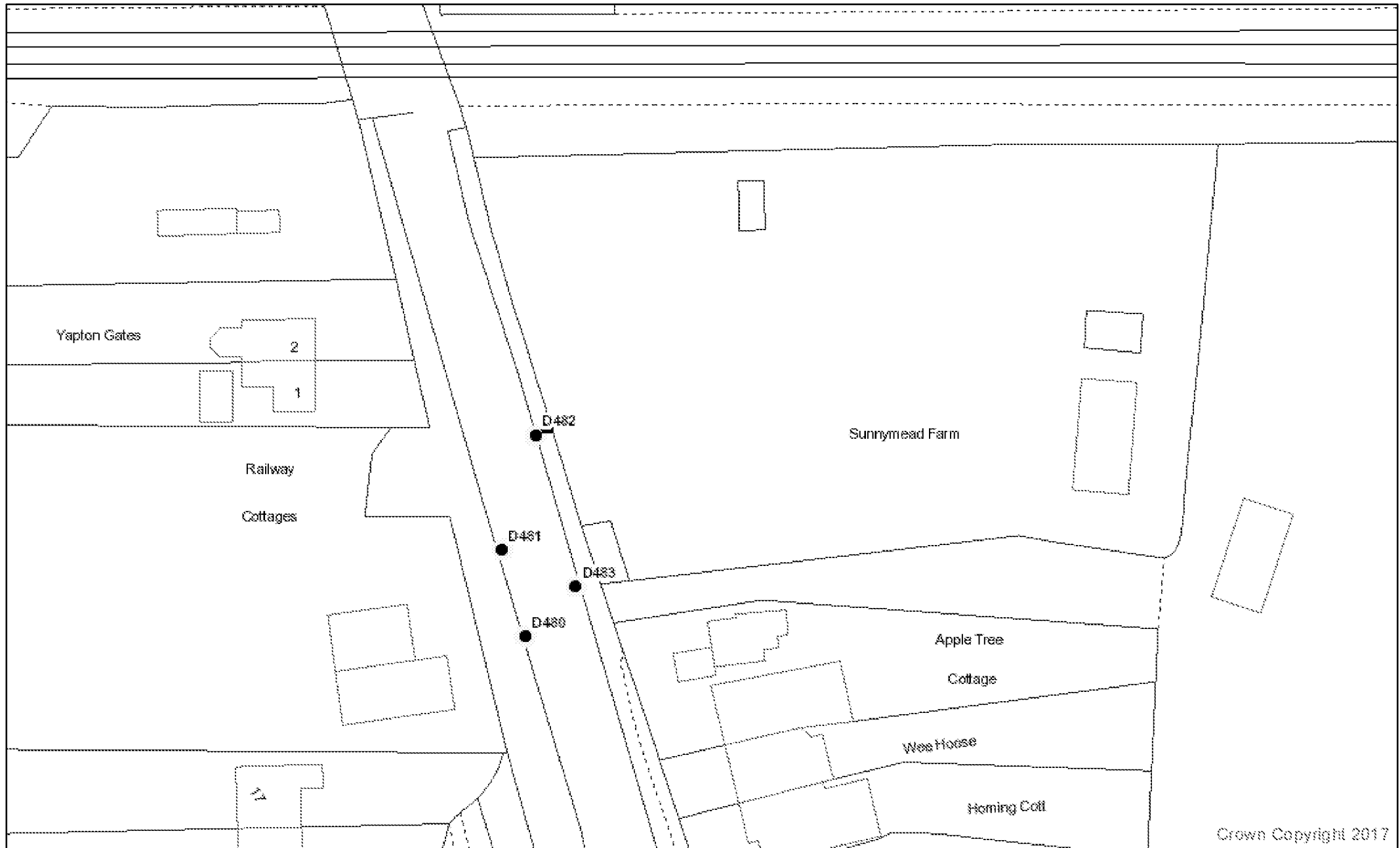
Regards,

Kevin



This email and any attachments are confidential and intended solely for the persons addressed. If it has come to you in error please reply to advise us but you should not read it, copy it, show it to anyone else nor make any other use of its content. West Sussex County Council takes steps to ensure emails and attachments are virus-free but you should carry out your own checks before opening any attachment.

Sunny Mead Farm, North End Road, Yapton, Arundel BN18 0DL - Existing Road Gullies



Date: October 2018

Author: K Macknay

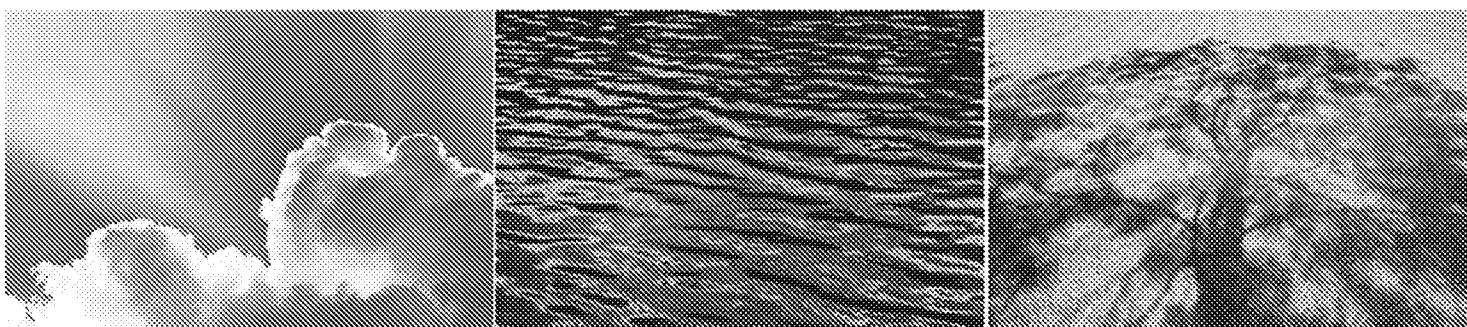
Scale 1:500

Map Notes:

Crown Copyright. All rights reserved.
West Sussex County Council
100023447 (2017)

Appendix D Southern Testing Soakage Test Report

Soakage Test Report



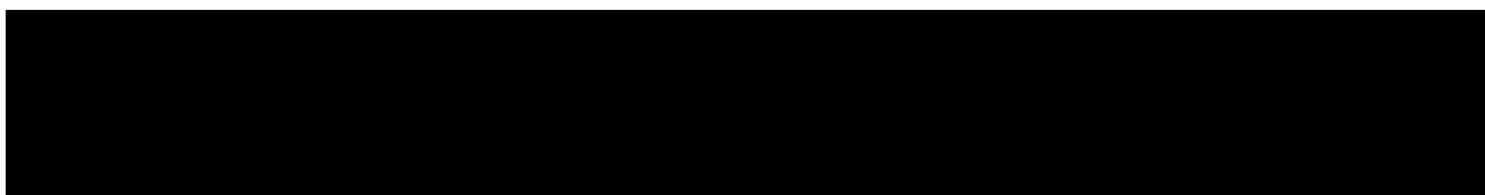
Desk Studies | Risk Assessments | Site Investigations | Geotechnical | Contamination Investigations | Remediation Design and Validation

Site: Sunny Mead Farm, North End Road, Yapton BN18 0DL

Client: Mr Roy Daniells

Report Date: November 2018

Project Reference: J13840



FS 29280

EMS 506775

OHS 506776

A INTRODUCTION

1 Authority

Our authority for carrying out this work is contained in a completed project order form received October the 19th 2018 from Mr. Roy Daniells in relation to Sothern Testing Laboratories Ltd. quotation – Q182029.

2 Location

The site is located on the eastern side of North End Road, Yapton, approximately 2.0 km west of Ford Railway Station and approximately 2.2 km east of Banham Railway Station. The approximate National Grid Reference of the site is SU 98141 04368.

3 Investigation Brief

In accordance with the Client's instructions, and our quotation, the following was included in our brief for this soakage investigation:

3 No. Preliminary soakage tests were carried out across the site using a modified version of the BRE 365 Digest method.

A forth Preliminary soakage test was attempted, however ground conditions encountered on site prevented this.

The fieldwork was carried out on Wednesday 7th November 2018 at which time the weather was generally variable, with scattered short periods of sunshine amongst heavy rain conditions. The rainfall in the South of England for the preceding three months was generally drier than normal, with approximately 30% of the normal.

4 Scope

This report presents our exploratory hole logs and test results only. As with any site there may be differences in soil conditions between exploratory hole positions.

This report is not an engineering design and the figures and calculations contained in the report should be used by the Engineer, taking note that variations will apply, according to variations in design loading, in techniques used, and in site conditions. Our figures therefore should not supersede the Engineer's design.

Contamination issues are not considered in this report.

The site investigation was conducted and this report has been prepared for the sole internal use and reliance of Mr. Roy Daniells and their appointed Engineers. This report shall not be relied upon or transferred to any other parties without the express written authorisation of Southern Testing Laboratories Limited. If an unauthorised third party comes into possession of this report they rely on it at their peril and the authors owe them no duty of care and skill.

S F Pratt MSc CGeol
(Countersigned)

N Harris BEng GMICE
(Signed)

For and on behalf of Southern Testing Laboratories Limited

B FIELDWORK

5 General Site Description

The site is situated on the eastern side of North End Road, Yapton, and forms a roughly rectangular shape and is currently occupied by a single storey structure and outbuilding to the eastern area of the site, with a swimming pool approximately in the central southern area of the site and a temporary greenhouse type structure within the central western area of the site. The site falls gently towards the west at approximately 5 degrees.

A proportion of the site along the boundary is overgrown. A mixed paved driveway is present along the southern boundary leading from North End Road to the current structures on site.

The site contained a wide variety of mixed vegetation and trees including; mature oak, sycamore, ash, eucalyptus, laurel, palm and beach trees, laurel, poplar, privet, spindle, honeysuckle and hornbeam hedging.

The site fall gently towards the west at approximately 5 degrees, with apparent foul waste services crossing the site in an east to west direction and in a north to south direction towards the pumping station.

The site is bound to North End Road to the west, Railway land to the north and residential land to the east and south.

6 Geology

The British Geological Survey Map indicates that the site geology consists of Raised Beach Deposits over River Terrace Deposits over Lewes Nodular Chalk Formation.

Raised Beach Deposits

The beach deposits consist of uniformly graded, often buff, silty sand, which lie beneath a superficial cover of (usually) clayey gravel. They are above 4 m thick and are dated to the second warm interglacial period (the Hoxnian). They rest on a wave-cut platform which falls gently from its maximum elevation of just over 30 m AOD to about 25 m AOD over a distance of 1 to 2 km. Where the base platform is in chalk there is often a thin superficial gravelly layer and the upper 150 mm or so of the chalk is hard and calcreted. At the interface between the chalk and the overlying beach large solution features may be found.

The lower beach deposits, which comprise fine uniform silty sands with some gravel, rest on a platform which falls from about +15 m AOD, to present sea level, over a distance of up to 15 km. They lie beneath a superficial cover of brickearth or Coombe deposits.

As the deposits are up to about 5 m thick, the ground level at the inner margin is about +20 m AOD, and a slight change in slope can sometimes be detected at this point. There is a former cliff at the margin, usually in soft Tertiary clays which have been highly degraded but which may have been up to 10 to 12 m high. Highly variable soil conditions must be anticipated in the region of the ancient cliffs.

The beaches were formed in a complex marine transgression which is traditionally considered to belong to the Ipswichian Interglacial (about 80,000 years ago) and there are also deep local cryoturbation and solution features.

River Terrace Deposits (Brickearth)

Brickearth (loess deposit) is a recent deposit which is so called as it is suited to brick manufacture. It is predominantly an Aeolian deposit; formed during cold, dry climatic conditions. There is evidence that brickearth has been reworked as part of 'sheet flooding' which helped incorporate flint gravels into the deposit. Brickearth consists mainly of ferruginous silty clay, which is often sandy and may contain some finely divided chalk, scattered flints and gravelly seams, or other locally derived material. It is usually poorly consolidated and may contain numerous hollow root tubes and worm burrows.

Lewes Nodular Chalk Formation

The Lewes Nodular Chalk Formation is characterised by bands of orange-stained, hard, medium to very high density chalk interbedded with soft greyer low density chalk. There are some well-developed hardgrounds noted such as the Top Rock and Chalk Rock. A number of persistent marl and flint horizons are included within this formation. Fracturing is variable, although commonly steeply inclined and curvilinear in nature. Horizons of sub-horizontal sheet flints are also present.

7 Soils as Found

The soils encountered are described in detail in the attached exploratory hole logs (Appendix A), but in general comprised a covering of Topsoil over sandy Clay over gravelly Sand over weathered Chalk. A summary is given below.

Depth	Thickness	Soil Type	Description
GL to 0.20/0.25m	0.20m to 0.25m	TOPSOIL	Dark to grey brown sandy clayey TOPSOIL with occasional roots
0.20/0.25m to 1.00/1.60m	0.78m to 1.40m	Sandy CLAY	Firm to stiff, Orange to mid brown desiccated friable, sandy CLAY with occasional roots and flint gravels.
1.00/1.60m to	0.45m to 1.35m	Gravelly SAND	Orange brown gravelly SAND.

Depth	Thickness	Soil Type	Description
1.45m/2.95m			Gravel is flint. (WLS01 WLS02)
0.23m to 1.30m	1.07m	Sandy CLAY	Firm, friable, desiccated, mid brown, sandy CLAY with frequent white chalk speckling (WLS04)
2.95/1.30m to 3.00m+	0.05m+ to 1.7m+	Weathered CHALK	WEATHERED CHALK recovered as cream to light grey, silty clayey GRAVEL

8 Soakage Test Method

Falling Head Tests (After the BRE 365 Method)

The BRE365 paper on soakaway design allows for the design of trench soakaways as well as traditional square and circular soakaways.

The test to measure the soil infiltration rate is normally carried out in pits which are excavated to the full depth of the proposed soakaway. The trial pits are filled and allowed to drain to empty or near empty, three times, on the same day or on consecutive days. In this case, due to access restraints, testing was carried out in windowless sampler boreholes.

The pit or borehole is considered full when the water level is the same as the proposed inlet invert. The time for the water level to fall from $\frac{3}{4}$ full to $\frac{1}{4}$ full is obtained and the soil infiltration rate is obtained from the following formula:

$$f = \frac{V_{p75-25}}{a_{p50} \times t_{p75-25}}$$

Where: f = soil infiltration rate (in this case expressed in l/m²/minute)

V_{p75-25} = the effective storage volume of water in the borehole between 75% and 25% effective depth;

a_{p50} = the internal surface area of the borehole up to 50% effective depth and excluding the base area;

t_{p75-25} = the time for the water level to fall from 75% to 25% effective depth.

The soakage rate in this report is expressed as l/m²/minute, which is a convenient rate to use. The BRE use a unit of m/sec, which is the value in l/m²/minute divided by 60,000.

Because of time and cost constraints testing was restricted to one day.

9 Soakage Test Results & Discussion

A total of three soakage tests were carried out across the site, at the locations shown on the attached site plan (Figure 1). It is noted that the current site usage, layout and overgrowth constrained the positions of potential suitable testing locations. The full results of the soakage tests are appended, however, the soakage rate from each borehole is summarised in the table below.

Results of Preliminary BRE 365 Soakage tests				
Pit	Depth (m)	f l/m ² /min	BRE Units (m/sec)	Comments
WLS02	3	0.025	4.19E-7	Exploratory hole collapsed during testing to 1.34m bgl between the 120 and 180 minute reading. Non-compliant value calculated.
WLS03	3	5.25	8.75E-5	Groundwater rested at 2.34m bgl. Three fillings completed. Non-compliant value calculated.
WLS04	3	10.13	1.69E-4	Groundwater rested at 1.87m bgl. Three fillings completed. Non-compliant value calculated.

The BRE Digest 365 indicates that 3 fillings must be carried out. Where 3 fillings have not been carried out, a reduction factor should be applied.

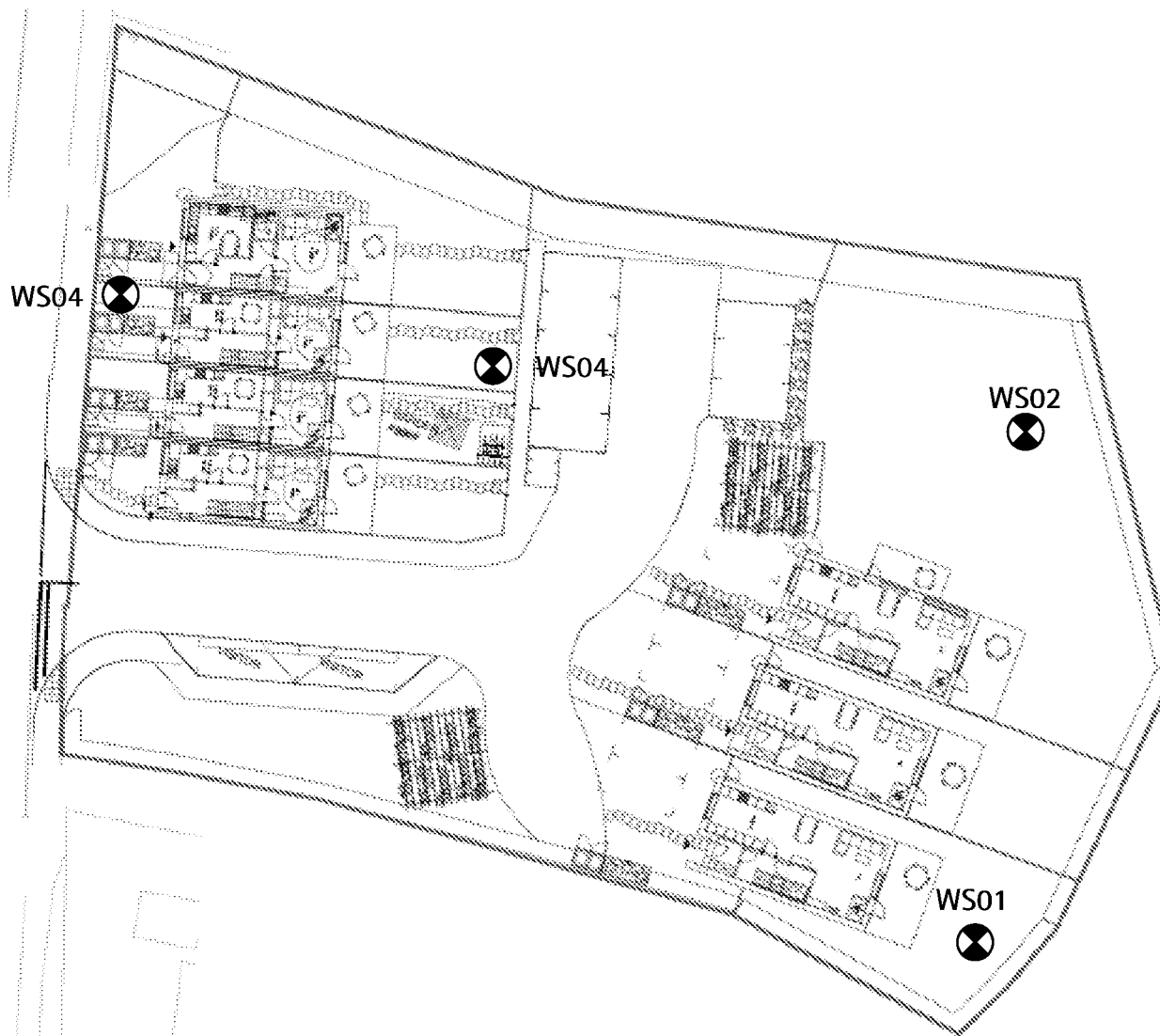
It should be noted that due to a high groundwater level, testing was restricted in some locations to the zone above the groundwater & therefor non-compliant values have been resulted.

It is noted that these values are only preliminary and must be confirmed prior to instalment of any soakaway or drainage scheme. This may be requested when suitable access for a Loaded Land Rover with trailer and a rubber-tyred JCB backhoe excavator into the proposed locations of the soakaway/s.

Any soakaway scheme will require the approval of the Environment Agency, Building Control and, where applicable, the adopting Highways Authority.

Groundwater levels can vary considerably from season to season and year to year, often rising in wet or winter weather, and falling in periods of drought. As such, a high groundwater table may affect the storage capacity of soakaways (where applicable). Water levels at the time of the investigation would likely be close to a seasonal low. In addition, it should be noted that an unsaturated zone may be required between the base of soakaways and the groundwater table, by the Environment Agency.

APPENDIX A – EXPLORATORY HOLE LOGS & SITE PLAN



NB: Positions of Boreholes and/or Trial Pits are only indicative unless dimensioned

Site: Sunny Mead Farm, North End Road, Yapton, Arundel, BN18 0DL

Date: 09 November 2018

STL: J13840

Fig No: 1

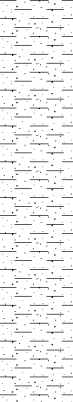
Exploratory Hole Location Plan

 Southern Testing

Southern Testing: Keeble House, Stuart Way, East Grinstead, West Sussex RH19 4QA
ST Consult: Twigden Barns, Brixworth Road, Creton, Northampton NN6 8NN

 ST Consult

 Southern Testing ST Consult				Start - End Date 07/11/2018		Project ID: J13840		Hole Type: WLS		WLS01 Sheet 1 of 1	
Project Name: Sunny Mead Farm				Remarks:		Co-ordinates:		Level:		Logger: NH	
Location: Sunny Mead Farm, North End Road, Yapton, Arundel, BN18 0DL				No groundwater encountered. Preliminary BRE 365 Test performed in exploratory hole. Exploratory hole collapsed during introduction of water during testing. Hole redrilled and cased. Casing partially pulled for testing. Hole collapsed for second time.							
Client: Mr. Roy Daniells											

Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description	
		Depth (m bgl)	Type	Results						
										
		0.50	HP	UCS(kPa)=200.0		(0.25)		0.25	Moss and leaf debris over grey brown fine sandy clayey TOPSOIL with occasional roots and rare clinker. Firm to stiff, friable, desiccated, fine sandy CLAY with occasional roots and rare flint gravel.	
		1.00	HP	UCS(kPa)=260.0		(1.35)			From 1.20m - Becoming less friable with depth. Increase of flint gravels to occasional occurrence.	1
		1.50	HP	UCS(kPa)=600.0		(1.35)		1.60	Orangish brown, slightly clayey gravelly, fine to medium grained SAND. Gravels are fine to medium subangular flint.	2
						(0.05)		2.95 3.00	WEATHERED CHALK recovered as cream silty clayey GRAVEL. Gravel is fine to medium, extremely weak to very weak, subrounded to subangular CHALK. End of Borehole at 3.00m	3
										4
										5

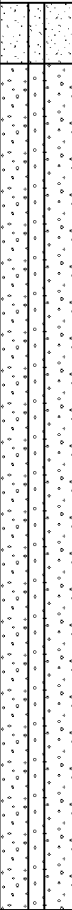
Hole Details		Casing Details		Waterstrike (m bgl)						Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth Strike	Depth Casing	Depth Sealed	Rose to:	Time (mins)	From	To	Time	Remarks
3.00	150												

 Southern Testing ST Consult				Start - End Date 07/11/2018		Project ID: J13840		Hole Type: WLS		WLS02 Sheet 1 of 1	
Project Name: Sunny Mead Farm				Remarks:		Co-ordinates:		Level:		Logger: NH	
Location: Sunny Mead Farm, North End Road, Yapton, Arundel, BN18 0DL				No groundwater encountered. Preliminary BRE 365 Test performed in exploratory hole. Exploratory hole collapsed to 1.34m bgl during testing.							
Client: Mr. Roy Daniells											

Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description		
		Depth (m bgl)	Type	Results							
		0.22				(0.22)		0.22	Leaf debris over dark to grey brown fine sandy clayey TOPSOIL with occasional roots.	1	
									Firm to stiff, friable, desiccated, fine sandy CLAY with occasional roots and rare flint gravel.		
		0.50	HP	UCS(kPa)=600.0		(0.78)					
		1.00	HP	UCS(kPa)=520.0							From 0.90m - Becoming sandier with depth.
						(0.45)		1.00	Orangish brown, gravelly fine to medium grained SAND. Gravels are fine to medium subangular flint.		
								1.45	At 1.20m - Coarse flints encountered.		
		1.50	HP	UCS(kPa)=500.0		(1.55)			WEATHERED CHALK recovered as cream silty clayey GRAVEL. Gravel is fine to medium, extremely weak to very weak, subrounded to subangular CHALK with rare flint.	2	
								3.00	End of Borehole at 3.00m	3	
										4	
										5	

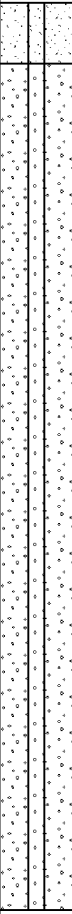
Hole Details		Casing Details		Waterstrike (m bgl)						Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth Strike	Depth Casing	Depth Sealed	Rose to:	Time (mins)	From	To	Time	Remarks
3.00	150												

 Southern Testing ST Consult				Start - End Date 07/11/2018		Project ID: J13840		Hole Type: WLS		WLS03 Sheet 1 of 1	
www.southerntesting.co.uk tel:01342 333100 www.stconsult.co.uk tel:01604 500020											
Project Name: Sunny Mead Farm				Remarks:		Co-ordinates:		Level:		Logger: NH	
Location: Sunny Mead Farm, North End Road, Yapton, Arundel, BN18 0DL				Groundwater encountered. Preliminary BRE 365 Test performed in exploratory hole.							
Client: Mr. Roy Daniells											

Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description	
		Depth (m bgl)	Type	Results						
										
		0.20				(0.20)		0.20	Grass over dark brown fine sandy clayey TOPSOIL with rare roots and brick fragments.	
		1.40				(1.40)		1.60	Firm, friable, desiccated, mid brown, fine sandy CLAY with occasional roots and rare flint gravel.	1
		1.50	HP	UCS(kPa)=30.0				From 1.10m - Becoming less friable with depth		
		1.50	HP	UCS(kPa)=130.0			1.60	WEATHERED CHALK recovered as cream silty clayey GRAVEL. Gravel is fine to medium, extremely weak to very weak, subrounded to subangular CHALK with rare flint.	2	
		2.00	HP	UCS(kPa)=140.0			3.00	End of Borehole at 3.00m	3	
									4	
									5	

Hole Details		Casing Details		Waterstrike (m bgl)						Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth Strike	Depth Casing	Depth Sealed	Rose to:	Time (mins)	From	To	Time	Remarks
3.00	150				2.60			2.34	30				

 Southern Testing ST Consult				Start - End Date 07/11/2018		Project ID: J13840		Hole Type: WLS		WLS04 Sheet 1 of 1	
Project Name: Sunny Mead Farm				Remarks:		Co-ordinates:		Level:		Logger: NH	
Location: Sunny Mead Farm, North End Road, Yapton, Arundel, BN18 0DL				Groundwater encountered. Preliminary BRE 365 Test performed in exploratory hole.							
Client: Mr. Roy Daniells											

Well	Water Strikes	Samples and Insitu Testing			Level (m AOD)	Thickness (m)	Legend	Depth (m bgl)	Stratum Description	
		Depth (m bgl)	Type	Results						
										
		0.50	HP	UCS(kPa)=80.0		(0.23)		0.23	Grass over dark brown fine sandy clayey TOPSOIL with occasional roots	
		1.00	HP	UCS(kPa)=30.0		(1.07)		1.30	Firm, friable, desiccated, mid brown, fine sandy CLAY with frequent white chalk speckling, occasional roots and infrequent flint gravel.	
		1.00	SPT()	N=13 (1,1/3,3,3,4)					From 0.85m - Becoming less friable with depth. Increase in chalk content.	
		1.20	HP	UCS(kPa)=130.0						
	2.00	SPT()	N=10 (3,2/2,2,3,3)		(1.70)			WEATHERED CHALK recovered as cream to light grey, silty clayey GRAVEL. Gravel is fine to medium, extremely weak to very weak, subrounded to subangular CHALK with rare flint.		
	3.00	SPT()	N=12 (2,1/2,2,4,4)				3.00	End of Borehole at 3.00m		

Hole Details		Casing Details		Waterstrike (m bgl)						Standing/Chiselling (m bgl)			
Depth (m bgl)	Dia. (mm)	Depth (m bgl)	Dia. (mm)	Date	Depth Strike	Depth Casing	Depth Sealed	Rose to:	Time (mins)	From	To	Time	Remarks
3.00	150				2.55			1.87	30				

APPENDIX B – SOAKAGE TEST RESULTS

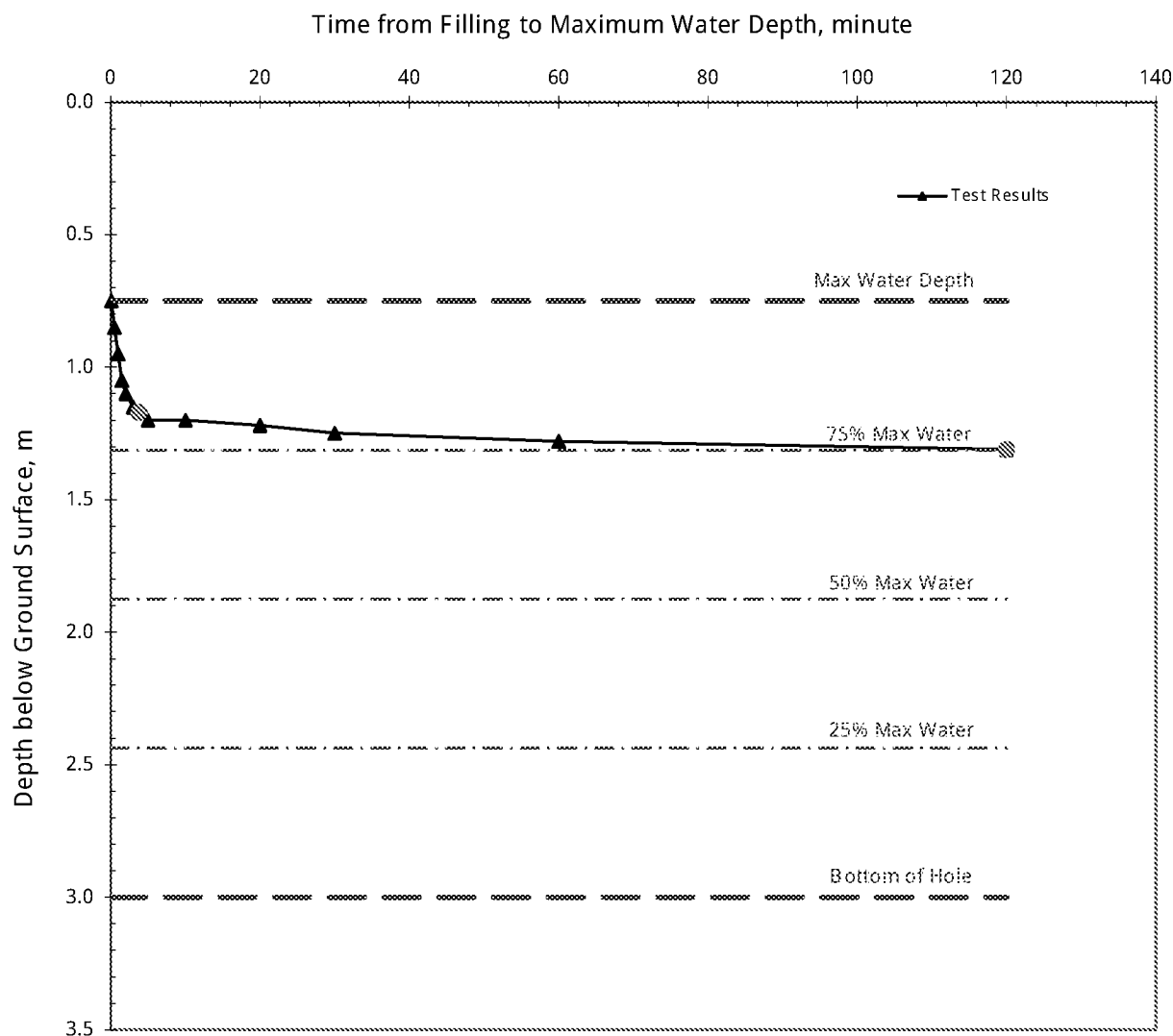
Summary Sheet

Results of Preliminary Falling-Head Soakage Tests

Site : Sunny Mead Farm, North End Road, Yapton, Aru					J ob No : J 13840		
Client : Roy Daniells					O S Reference : SU 98191 04366		
Tested By : AA/RA				Engineer: NH		Test Date : 07/Nov/2018	
Hole No	Test No	Hole Depth m	Soakage Rate for Each Test litre/m ² /min	Soakage Rate for Each Hole litre/m ² /min m/sec		Water Level at Finish of Test	Remarks
WLS02	No 1	3.00	0.025	0.025	4.19E-7	Pit was not emptied; Non compliant value was calculated.	Exploratory hole collapsed during 2 and 3 hour reading.
WLS03	No 1	3.00	6.59	5.25	8.75E-5	Pit was not emptied; Non compliant value was calculated.	Depth to existing ground water level was 2.34m.
WLS03	No 2	3.00	5.89			Pit was not emptied; Non compliant value was calculated.	
WLS03	No 3	3.00	5.25			Pit was not emptied; Non compliant value was calculated.	
WLS04	No 1	3.00	19.82	10.13	1.69E-4	Pit was not emptied; Non compliant value was calculated.	Depth to existing ground water level was 1.87m.
WLS04	No 2	3.00	11.63			Pit was not emptied; Non compliant value was calculated.	
WLS04	No 3	3.00	10.13			Pit was not emptied; Non compliant value was calculated.	
Mean Value of All Calculated Soakage Rates :				5.13 litre/m ² /min	8.56E-5 m/sec		

Preliminary Falling-Head Soakage Test

Test Hole No: WLS02
Test No: Test No 1 (Initial)



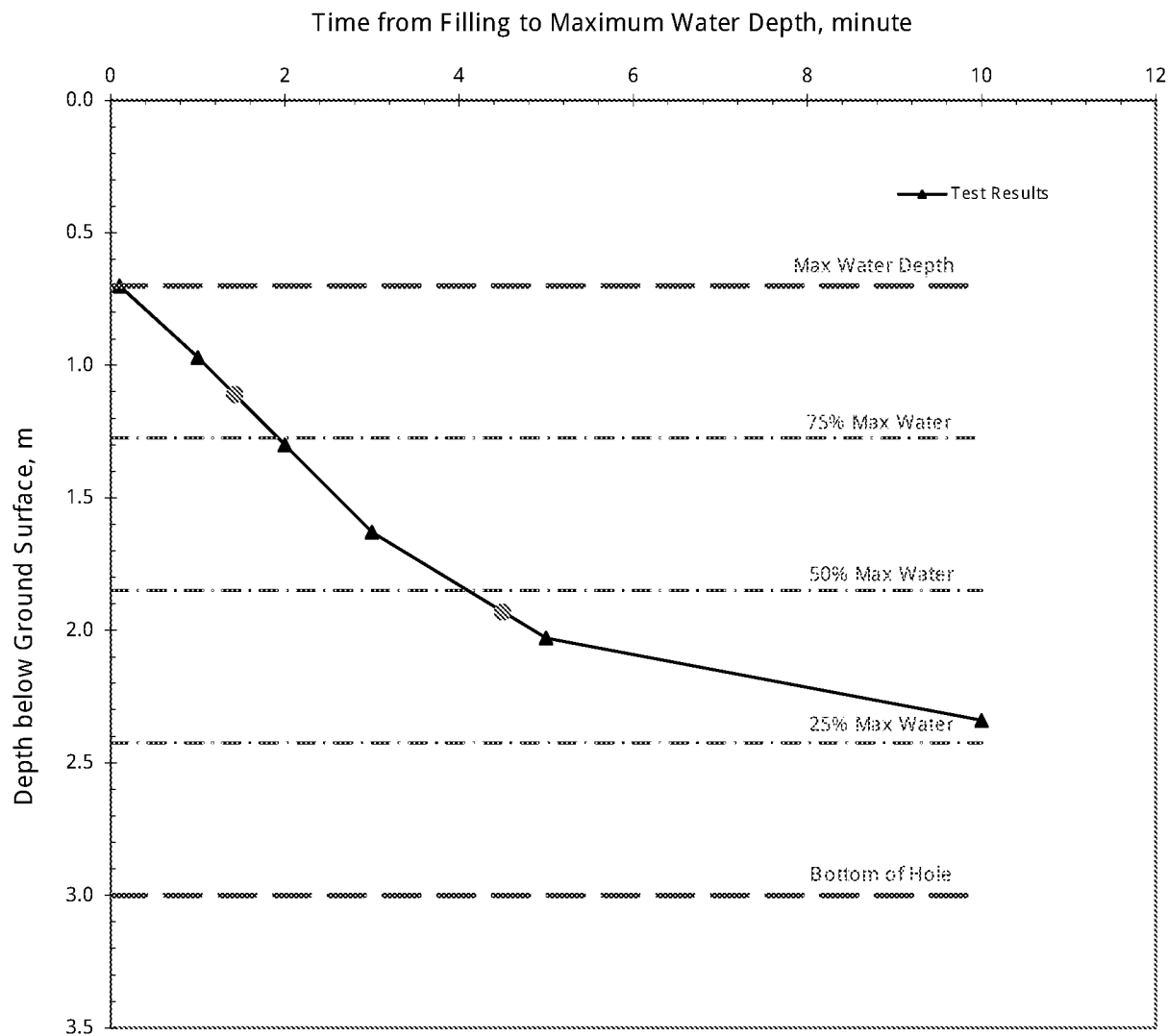
Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.750
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	0.560
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	120.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.847
Depth to Groundwater Surface, m		Discharge Rate, litre/min	0.021
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	0.025
Void Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	4.19E-07

Comments: Exploratory hole collapsed during 2 and 3 hour reading.
Water level did not fall to 75% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yaptor	Tested By: AA/RA	Engineer: NH Fig. S1

Preliminary Falling-Head Soakage Test

Test Hole No: WLS03
Test No: Test No 1 (Initial)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.700
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.640
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	10.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.715
Depth to Groundwater Surface, m	2.340	Discharge Rate, litre/min	4.711
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	6.59
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	1.10E-04

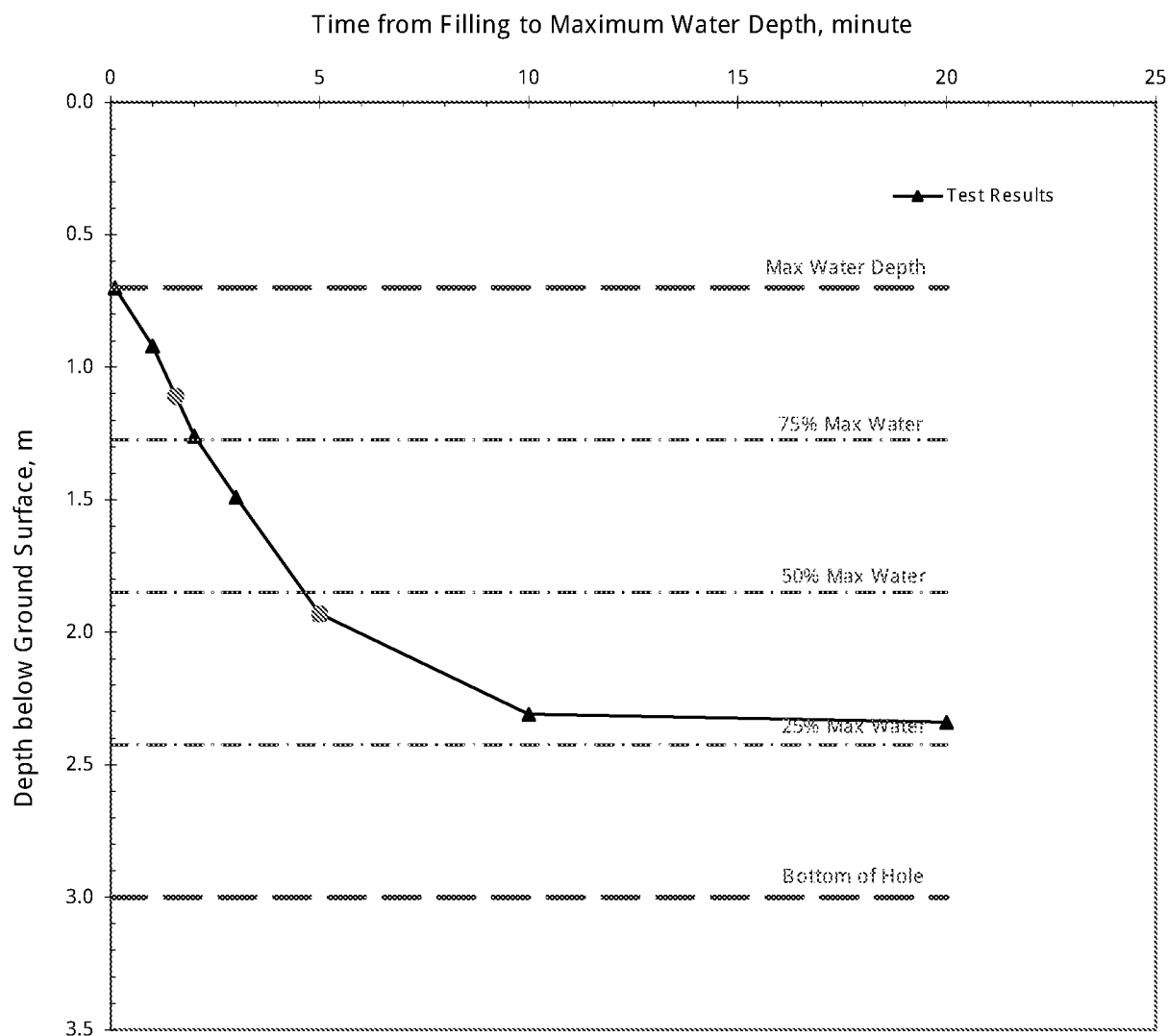
Comments:

Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S2

Preliminary Falling-Head Soakage Test

Test Hole No: WLS03
Test No: Test No 2 (Repeated)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.700
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.640
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	20.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.715
Depth to Groundwater Surface, m	2.340	Discharge Rate, litre/min	4.211
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	5.89
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	9.81E-05

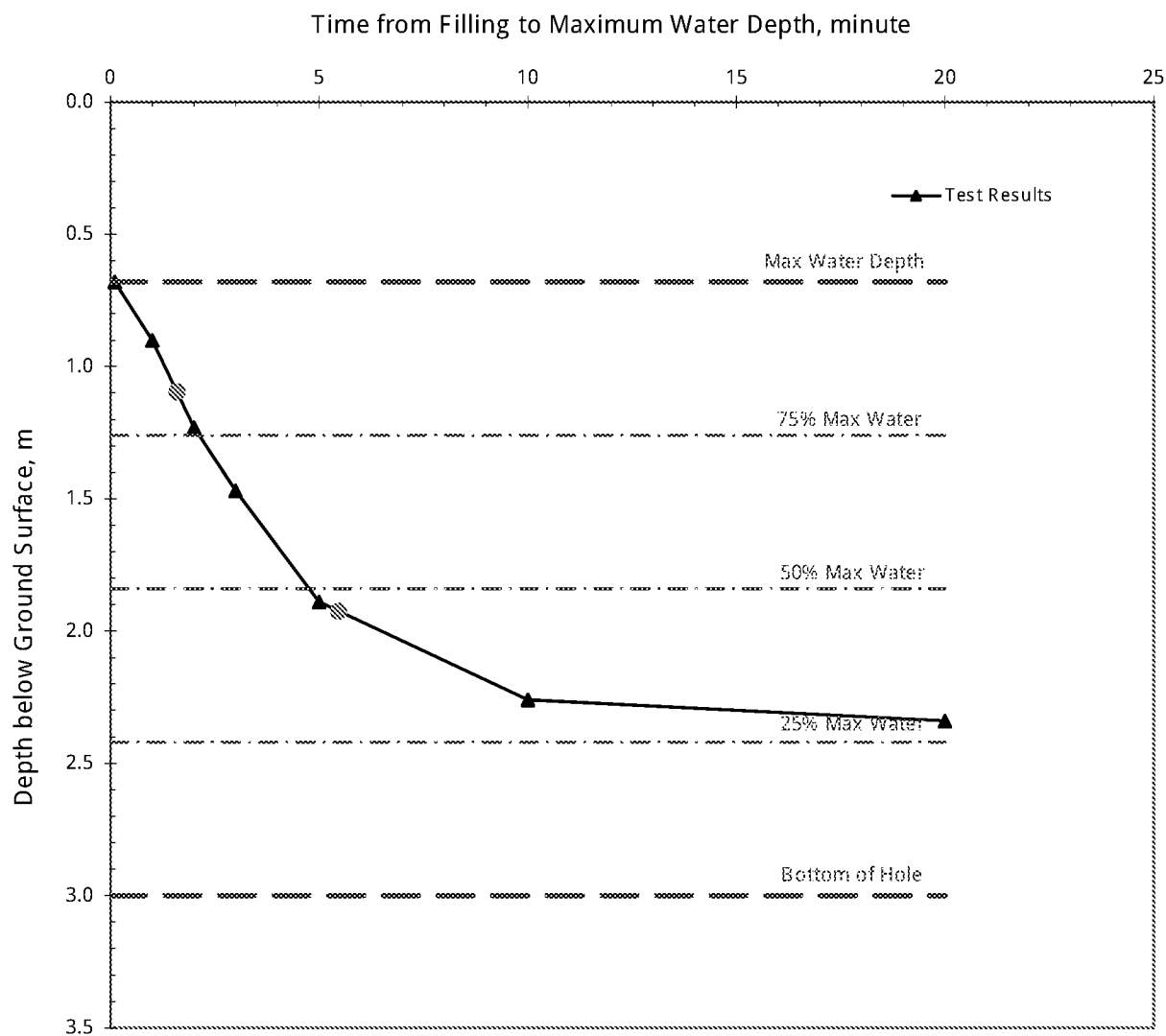
Comments:

Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S3

Preliminary Falling-Head Soakage Test

Test Hole No: WLS03
Test No: Test No 3 (Repeated)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.680
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.660
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	20.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.720
Depth to Groundwater Surface, m	2.340	Discharge Rate, litre/min	3.778
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	5.25
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	8.75E-05

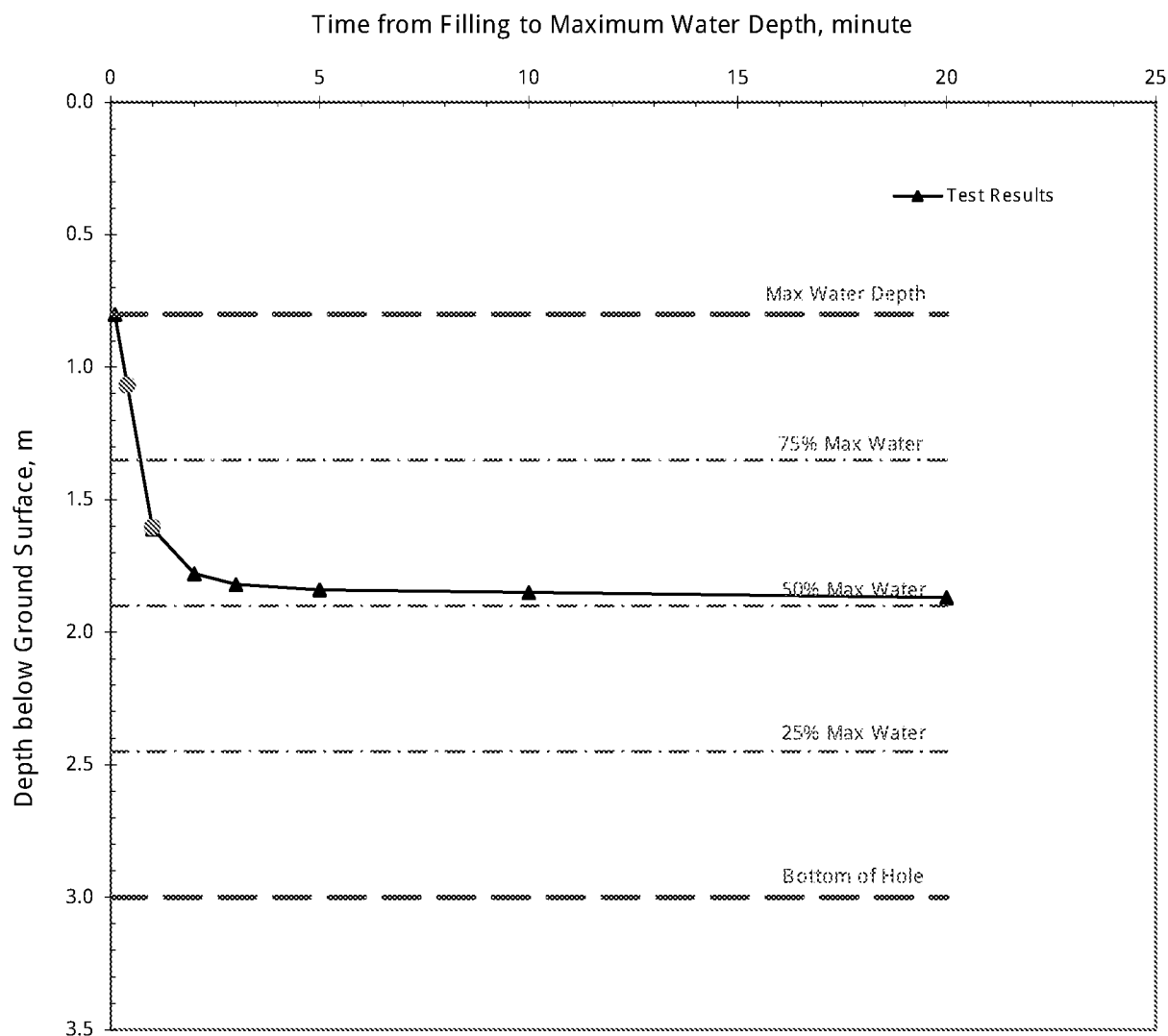
Comments:

Water level fell to 50% -- 25% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S4

Preliminary Falling-Head Soakage Test

Test Hole No: WLS04
Test No: Test No 1 (Initial)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.800
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.070
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	20.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.802
Depth to Groundwater Surface, m	1.870	Discharge Rate, litre/min	15.904
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	19.82
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	3.30E-04

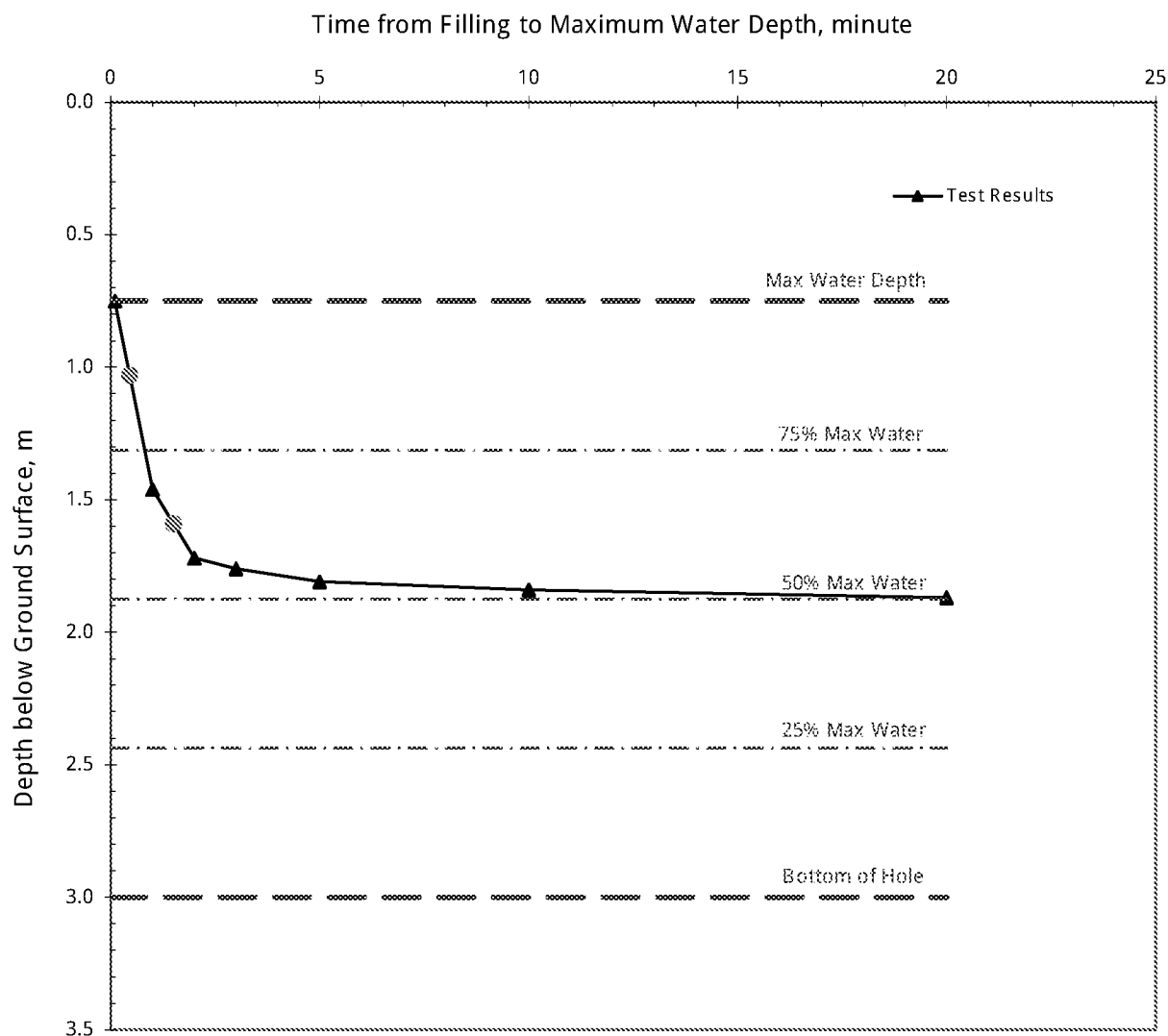
Comments:

Water level fell to 75% -- 50% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S5

Preliminary Falling-Head Soakage Test

Test Hole No: WLS04
Test No: Test No 2 (Repeated)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.750
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.120
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	20.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.814
Depth to Groundwater Surface, m	1.870	Discharge Rate, litre/min	9.469
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	11.63
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	1.94E-04

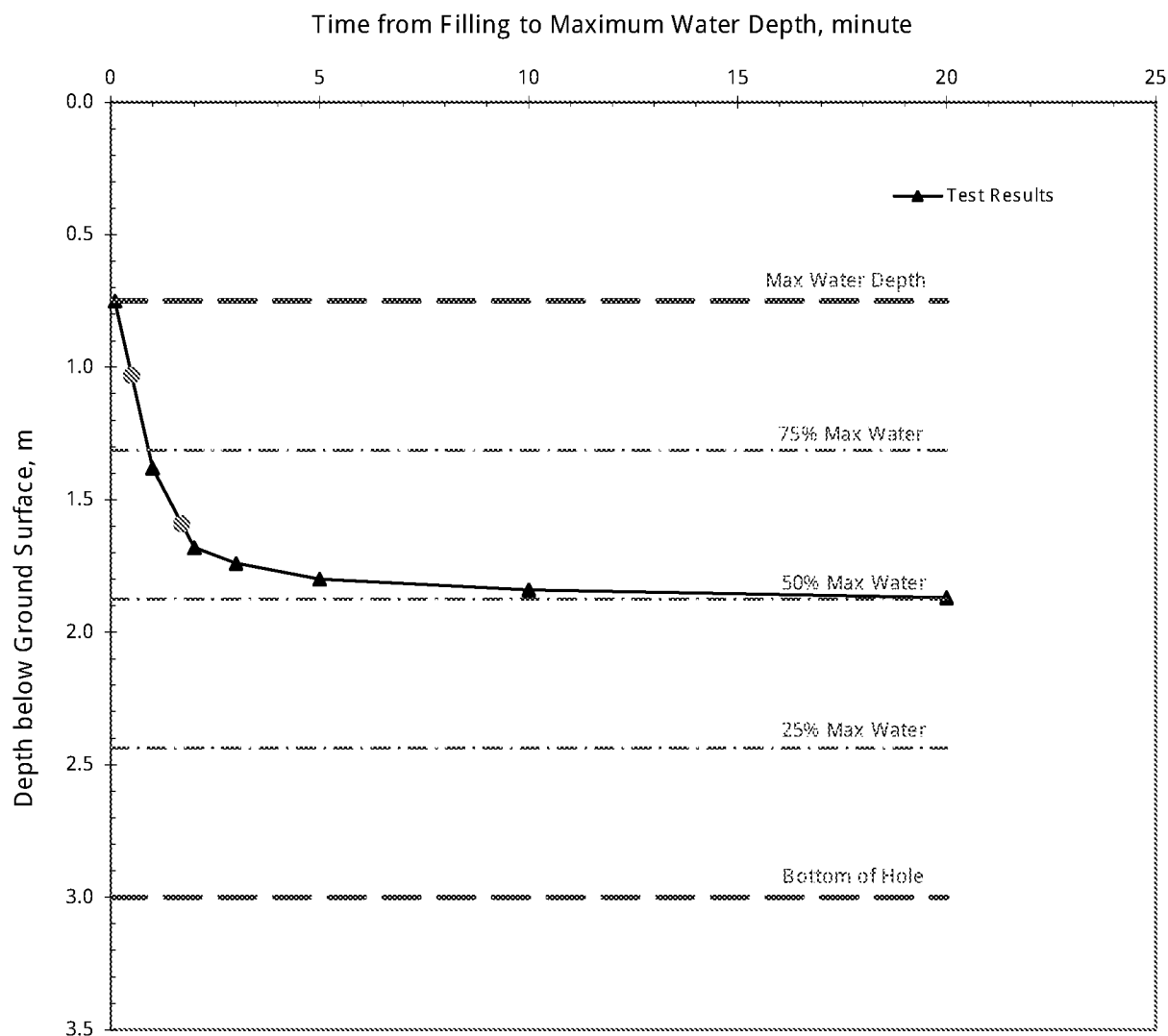
Comments:

Water level fell to 75% -- 50% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S6

Preliminary Falling-Head Soakage Test

Test Hole No: WLS04
Test No: Test No 3 (Repeated)



Diameter of Borehole, m	0.150	Depth to Water at Start of Test, m	0.750
Depth to End of Borehole Casing, m		Max Water Dropdown during Test, m	1.120
Depth to Borehole Base, m	3.000	Total Soakage Test Time, min	20.0
Depth to Top of Permeable Soils, m		Mean Internal Discharge Area, m ²	0.814
Depth to Groundwater Surface, m	1.870	Discharge Rate, litre/min	8.247
Depth to Top of Granular Fill, m		Soakage Rate, litre/m ² /min	10.13
Voids Assumed within Borehole, %	100%	BRE Soil Infiltration Rate, m/sec	1.69E-04

Comments:

Water level fell to 75% -- 50% max water depth, calculations were based on actual fall of water level achieved.
Result not compliant with BRE365 requirement since water did not fall to 25% max water depth.

Client: Roy Daniells	Job No: J 13840	Test Date: 07/Nov/2018
Site: Sunny Mead Farm, North End Road, Yapton	Tested By: AA/RA	Engineer: NH Fig. S7

Appendix E MicroDrainage Calculations

RGP Design Limited		Page 1
2 West Barn Norton Lane Chichester PO20 3AF	Greenfield Runoff Rate Sunny Mead Farm Yapton BN18 0DL	
Date 08/10/2018 File	Designed by D Lytton Checked by	
Innovyze	Source Control 2017.1	

ICP SUDS Mean Annual Flood

Input

Return Period (years)	100	Soil	0.400
Area (ha)	0.270	Urban	0.000
SAAR (mm)	726	Region Number	Region 7

Results 1/s

QBAR Rural	1.0
QBAR Urban	1.0
Q100 years	3.1
Q1 year	0.8
Q30 years	2.2
Q100 years	3.1

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RGP Design Limited		Page 1
2 West Barn Norton Lane Chichester PO20 3AF	Greenfield Runoff Volume Sunny Mead Farm Yapton BN18 0DL	
Date 08/10/2018 File	Designed by D Lytton Checked by	
Innovyze Source Control 2017.1		

Greenfield Runoff Volume

FSR Data

Return Period (years)	100
Storm Duration (mins)	360
Region	England and Wales
M5-60 (mm)	19.000
Ratio R	0.350
Areal Reduction Factor	1.00
Area (ha)	0.270
SAAR (mm)	731
CWI	109.000
Urban	0.000
SPR	37.000

Results

Percentage Runoff (%)	37.04
Greenfield Runoff Volume (m³)	63.039

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RGP Design Limited				Page 1																																																																																																																																																																																																																			
2 West Barn Norton Lane Chichester PO20 3AF		Drainage Strategy Calculations Sunny Mead Farm Yapton																																																																																																																																																																																																																					
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<u>Summary of Results for 100 year Return Period (+40%)</u> Half Drain Time : 14 minutes. <table><tr><th>Storm Event</th><th>Max Level (m)</th><th>Max Depth (m)</th><th>Max Infiltration (l/s)</th><th>Max Volume (m³)</th><th>Status</th></tr><tr><td>15 min Summer</td><td>3.232</td><td>1.732</td><td>19.6</td><td>18.3</td><td>Flood Risk</td></tr><tr><td>30 min Summer</td><td>3.267</td><td>1.767</td><td>19.6</td><td>24.1</td><td>Flood Risk</td></tr><tr><td>60 min Summer</td><td>3.277</td><td>1.777</td><td>19.6</td><td>25.9</td><td>Flood Risk</td></tr><tr><td>120 min Summer</td><td>3.255</td><td>1.755</td><td>19.6</td><td>22.2</td><td>Flood Risk</td></tr><tr><td>180 min Summer</td><td>3.226</td><td>1.726</td><td>19.6</td><td>17.4</td><td>Flood Risk</td></tr><tr><td>240 min Summer</td><td>3.205</td><td>1.705</td><td>19.6</td><td>13.9</td><td>Flood Risk</td></tr><tr><td>360 min Summer</td><td>3.192</td><td>1.692</td><td>16.5</td><td>11.6</td><td>O K</td></tr><tr><td>480 min Summer</td><td>3.184</td><td>1.684</td><td>13.7</td><td>10.4</td><td>O K</td></tr><tr><td>600 min Summer</td><td>3.179</td><td>1.679</td><td>11.8</td><td>9.6</td><td>O K</td></tr><tr><td>720 min Summer</td><td>3.176</td><td>1.676</td><td>10.4</td><td>8.9</td><td>O K</td></tr><tr><td>960 min Summer</td><td>3.171</td><td>1.671</td><td>8.5</td><td>8.1</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>3.165</td><td>1.665</td><td>6.2</td><td>7.1</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>3.160</td><td>1.660</td><td>4.5</td><td>6.4</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>3.158</td><td>1.658</td><td>3.8</td><td>6.0</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>3.156</td><td>1.656</td><td>2.8</td><td>5.6</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>3.154</td><td>1.654</td><td>2.3</td><td>5.3</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>3.153</td><td>1.653</td><td>1.9</td><td>5.2</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>3.153</td><td>1.653</td><td>1.7</td><td>5.1</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>3.152</td><td>1.652</td><td>1.5</td><td>5.0</td><td>O K</td></tr><tr><td>15 min Winter</td><td>3.250</td><td>1.750</td><td>19.6</td><td>21.4</td><td>Flood Risk</td></tr></table> <table><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr><tr><td>15 min Summer</td><td>124.633</td><td>0.0</td><td>23</td></tr><tr><td>30 min Summer</td><td>83.789</td><td>0.0</td><td>32</td></tr><tr><td>60 min Summer</td><td>53.779</td><td>0.0</td><td>48</td></tr><tr><td>120 min Summer</td><td>33.337</td><td>0.0</td><td>80</td></tr><tr><td>180 min Summer</td><td>24.832</td><td>0.0</td><td>108</td></tr><tr><td>240 min Summer</td><td>20.006</td><td>0.0</td><td>136</td></tr><tr><td>360 min Summer</td><td>14.706</td><td>0.0</td><td>194</td></tr><tr><td>480 min Summer</td><td>11.818</td><td>0.0</td><td>254</td></tr><tr><td>600 min Summer</td><td>9.966</td><td>0.0</td><td>314</td></tr><tr><td>720 min Summer</td><td>8.665</td><td>0.0</td><td>374</td></tr><tr><td>960 min Summer</td><td>6.943</td><td>0.0</td><td>492</td></tr><tr><td>1440 min Summer</td><td>5.071</td><td>0.0</td><td>736</td></tr><tr><td>2160 min Summer</td><td>3.696</td><td>0.0</td><td>1104</td></tr><tr><td>2880 min Summer</td><td>2.949</td><td>0.0</td><td>1448</td></tr><tr><td>4320 min Summer</td><td>2.142</td><td>0.0</td><td>2180</td></tr><tr><td>5760 min Summer</td><td>1.705</td><td>0.0</td><td>2864</td></tr><tr><td>7200 min Summer</td><td>1.427</td><td>0.0</td><td>3584</td></tr><tr><td>8640 min Summer</td><td>1.235</td><td>0.0</td><td>4376</td></tr><tr><td>10080 min Summer</td><td>1.093</td><td>0.0</td><td>5000</td></tr><tr><td>15 min Winter</td><td>124.633</td><td>0.0</td><td>24</td></tr></table>						Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	3.232	1.732	19.6	18.3	Flood Risk	30 min Summer	3.267	1.767	19.6	24.1	Flood Risk	60 min Summer	3.277	1.777	19.6	25.9	Flood Risk	120 min Summer	3.255	1.755	19.6	22.2	Flood Risk	180 min Summer	3.226	1.726	19.6	17.4	Flood Risk	240 min Summer	3.205	1.705	19.6	13.9	Flood Risk	360 min Summer	3.192	1.692	16.5	11.6	O K	480 min Summer	3.184	1.684	13.7	10.4	O K	600 min Summer	3.179	1.679	11.8	9.6	O K	720 min Summer	3.176	1.676	10.4	8.9	O K	960 min Summer	3.171	1.671	8.5	8.1	O K	1440 min Summer	3.165	1.665	6.2	7.1	O K	2160 min Summer	3.160	1.660	4.5	6.4	O K	2880 min Summer	3.158	1.658	3.8	6.0	O K	4320 min Summer	3.156	1.656	2.8	5.6	O K	5760 min Summer	3.154	1.654	2.3	5.3	O K	7200 min Summer	3.153	1.653	1.9	5.2	O K	8640 min Summer	3.153	1.653	1.7	5.1	O K	10080 min Summer	3.152	1.652	1.5	5.0	O K	15 min Winter	3.250	1.750	19.6	21.4	Flood Risk	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	124.633	0.0	23	30 min Summer	83.789	0.0	32	60 min Summer	53.779	0.0	48	120 min Summer	33.337	0.0	80	180 min Summer	24.832	0.0	108	240 min Summer	20.006	0.0	136	360 min Summer	14.706	0.0	194	480 min Summer	11.818	0.0	254	600 min Summer	9.966	0.0	314	720 min Summer	8.665	0.0	374	960 min Summer	6.943	0.0	492	1440 min Summer	5.071	0.0	736	2160 min Summer	3.696	0.0	1104	2880 min Summer	2.949	0.0	1448	4320 min Summer	2.142	0.0	2180	5760 min Summer	1.705	0.0	2864	7200 min Summer	1.427	0.0	3584	8640 min Summer	1.235	0.0	4376	10080 min Summer	1.093	0.0	5000	15 min Winter	124.633	0.0	24
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480 min Summer	11.818	0.0	254																																																																																																																																																																																																																				
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720 min Summer	8.665	0.0	374																																																																																																																																																																																																																				
960 min Summer	6.943	0.0	492																																																																																																																																																																																																																				
1440 min Summer	5.071	0.0	736																																																																																																																																																																																																																				
2160 min Summer	3.696	0.0	1104																																																																																																																																																																																																																				
2880 min Summer	2.949	0.0	1448																																																																																																																																																																																																																				
4320 min Summer	2.142	0.0	2180																																																																																																																																																																																																																				
5760 min Summer	1.705	0.0	2864																																																																																																																																																																																																																				
7200 min Summer	1.427	0.0	3584																																																																																																																																																																																																																				
8640 min Summer	1.235	0.0	4376																																																																																																																																																																																																																				
10080 min Summer	1.093	0.0	5000																																																																																																																																																																																																																				
15 min Winter	124.633	0.0	24																																																																																																																																																																																																																				
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2 West Barn Norton Lane Chichester PO20 3AF		Drainage Strategy Calculations Sunny Mead Farm Yapton			
Date 09/10/2018 File D1511 DRAINAGE STRATEGY...		Designed by D Lytton Checked by			
Innovyze		Source Control 2017.1			
<u>Summary of Results for 100 year Return Period (+40%)</u>					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	3.290	1.790	19.6	27.9	Flood Risk
60 min Winter	3.293	1.793	19.6	28.5	Flood Risk
120 min Winter	3.248	1.748	19.6	20.9	Flood Risk
180 min Winter	3.206	1.706	19.6	14.0	Flood Risk
240 min Winter	3.194	1.694	17.3	11.9	O K
360 min Winter	3.182	1.682	12.9	10.0	O K
480 min Winter	3.176	1.676	10.4	9.0	O K
600 min Winter	3.172	1.672	8.9	8.2	O K
720 min Winter	3.169	1.669	7.8	7.7	O K
960 min Winter	3.165	1.665	6.2	7.1	O K
1440 min Winter	3.160	1.660	4.5	6.4	O K
2160 min Winter	3.157	1.657	3.4	5.8	O K
2880 min Winter	3.155	1.655	2.6	5.5	O K
4320 min Winter	3.154	1.654	2.1	5.3	O K
5760 min Winter	3.153	1.653	1.7	5.1	O K
7200 min Winter	3.152	1.652	1.3	5.0	O K
8640 min Winter	3.151	1.651	1.1	4.9	O K
10080 min Winter	3.151	1.651	1.1	4.8	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	83.789	0.0	33		
60 min Winter	53.779	0.0	50		
120 min Winter	33.337	0.0	82		
180 min Winter	24.832	0.0	108		
240 min Winter	20.006	0.0	134		
360 min Winter	14.706	0.0	196		
480 min Winter	11.818	0.0	256		
600 min Winter	9.966	0.0	314		
720 min Winter	8.665	0.0	374		
960 min Winter	6.943	0.0	502		
1440 min Winter	5.071	0.0	742		
2160 min Winter	3.696	0.0	1084		
2880 min Winter	2.949	0.0	1472		
4320 min Winter	2.142	0.0	2196		
5760 min Winter	1.705	0.0	2856		
7200 min Winter	1.427	0.0	3608		
8640 min Winter	1.235	0.0	4352		
10080 min Winter	1.093	0.0	4904		
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2 West Barn Norton Lane Chichester PO20 3AF	Drainage Strategy Calculations Sunny Mead Farm Yapton	
Date 09/10/2018 File D1511 DRAINAGE STRATEGY...	Designed by D Lytton Checked by	
Innovyze	Source Control 2017.1	

Model Details

Storage is Online Cover Level (m) 3.500

Complex Structure

Lined Soakaway

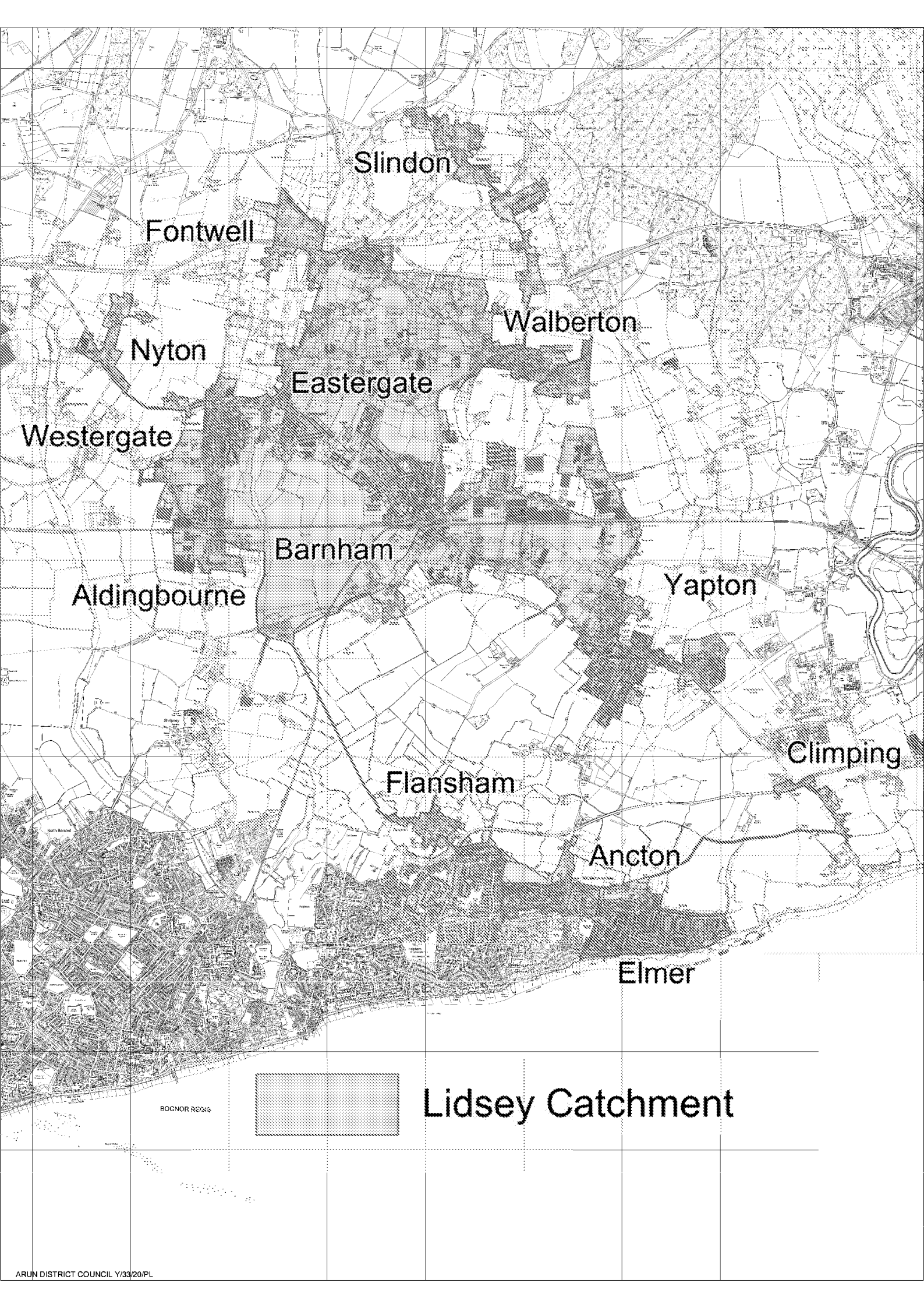
Infiltration Coefficient Base (m/hr)	0.40000	Ring Diameter (m)	1.20
Infiltration Coefficient Side (m/hr)	0.40000	Pit Multiplier	1.0
Safety Factor	3.0	Number Required	2
Porosity	1.00	Cap Volume Depth (m)	2.000
Invert Level (m)	1.500	Cap Infiltration Depth (m)	1.500

Porous Car Park

Infiltration Coefficient Base (m/hr)	0.40000	Width (m)	10.0
Membrane Percolation (mm/hr)	1000	Length (m)	51.3
Max Percolation (l/s)	142.5	Slope (1:X)	0.0
Safety Factor	3.0	Depression Storage (mm)	5
Porosity	0.32	Evaporation (mm/day)	3
Invert Level (m)	3.150	Membrane Depth (m)	0

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Appendix F Lidsey Treatment Catchment Area Plan



Slindon

Fontwell

Walberton

Nyton

Eastergate

Westergate

Barnham

Aldingbourne

Yapton

Flansham

Climping

Ancton

Elmer

BOGNOR R2/043

Lidsey Catchment