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Flood Risk Assessment

Proposed Residential Development at

Land at Bonhams Field, Yapton

On behalf of

Seaward Properties Ltd.

30 November 2021

Document History and Status

Project Number 23572

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1 Non Technical Summary

- 1.1 This Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of Seaward Properties Ltd. in support of a Full Planning Application. This application is for the construction of the northern part of the site referred to as Phase 2, consisting of 18 residential dwellings, taking the total number of dwellings on site to 72. The site is also associated with access roads, car parking and landscaping on the land at Bonhams Field, B2233 Main Road, Yapton, West Sussex.
- 1.2 This proposal is to undertake the construction of the 18 dwellings in the northern part of the site already accounted for in the previous drainage strategy scheme.
- 1.3 A Flood Risk Assessment has been undertaken in accordance with the National Planning Policy Framework on behalf of Seaward Properties Limited in support of a Full Planning Application for the construction of 56 residential dwellings with associated access roads, car parking and landscaping on the land at Bonhams Field, B2233 Main Road, Yapton, West Sussex.
- 1.4 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Full Planning Application for the proposed development.
- 1.5 The site is located in Flood Zone 1.
- 1.6 The proposed development will incorporate a sustainable drainage system which will discharge surface water by infiltration to ground via an infiltration blanket and provide sufficient onsite storage for all storm return periods up to and including the 1:100 year rainfall event with a 40% allowance for climate change.
- 1.7 Foul drainage will be discharged by gravity to the existing public foul sewer located beneath the B2233 Main Road to the southwest of the site.
- 1.8 A suitable maintenance plan will be implemented by the Developer to ensure that maintenance of the foul and surface water drainage systems in shared ownership is passed on to a suitably qualified Management Company appointed by the Developer on behalf of the Residents.
- 1.9 The development will not increase flood risk elsewhere and the proposed development is suitable at this location.

2 Planning Policy Context

2.1 National Planning Policy Framework

2.1.1 The National Planning Policy Framework was updated in July 2021.

2.1.2 With regard to planning and flood risk the policy framework states that *‘when determining any planning applications, local planning authorities should ensure that flood risk is not increased elsewhere. Where appropriate, applications should be supported by a site-specific flood-risk assessment.*

Development should only be allowed in areas at risk of flooding where, in the light of this assessment (and the sequential and exception tests, as applicable) it can be demonstrated that:

- a) within the site, the most vulnerable development is located in areas of lowest flood risk, unless there are overriding reasons to prefer a different location;*
- b) the development is appropriately flood resistant and resilient;*
- c) it incorporates sustainable drainage systems, unless there is clear evidence that this would be inappropriate;*
- d) any residual risk can be safely managed; and*
- e) safe access and escape routes are included where appropriate, as part of an agreed emergency plan.’*

2.1.3 With regard to major developments the NPPF states that *‘major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:*

- a) take account of advice from the lead local flood authority;*
- b) have appropriate proposed minimum operational standards;*
- c) have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and*
- d) where possible, provide multifunctional benefits’*

2.1.4 Major development is defined as follows:

‘For housing, development where 10 or more homes will be provided, or the site has an area of 0.5 hectares or more. For non-residential development it means additional floorspace of 1,000m² or more, or a site of 1 hectare or more, or as otherwise provided in the Town and Country Planning (Development Management Procedure) (England) Order 2015.’

2.2 Lead Local Flood Authority

2.2.1 West Sussex County Council became a Lead Local Flood Authority under the Flood and Water Management Act 2010 and was given a series of new responsibilities to coordinate the management of local flood risk.

2.2.2 As part of its role West Sussex County Council has commissioned and produced the following documents:

- Strategic Flood Risk Assessment - January 2010
- Preliminary Flood Risk Assessment - May 2011
- Local Flood Risk Management Strategy - May 2014

2.2.3 In addition to the above documents the West Sussex County Council Policy for the Management of Surface Water was updated in November 2018.

2.2.4 The above documents have been reviewed in the preparation of this report.

2.3 Arun District Council

2.3.1 Arun District Council has commissioned and produced the following documents:

- Strategic Flood Risk Assessment - February 2008
- Arun Strategic Surface Water Management Study - October 2016
- Combined Level 1 and Level 2 Strategic Flood Risk Assessment - November 2016

2.3.2 Arun District Council have collaborated with Chichester District Council to produce a Surface Water Drainage Proposal Checklist dated November 2019 which outlines both councils' expectations and requirements for Surface Water Drainage proposals.

2.3.3 The above documents have been reviewed in the preparation of this report.

2.4 Local Planning Policy

2.4.1 The Arun Local Plan 2011 - 2031 was adopted in July 2018.

2.4.2 **Policy W SP1 – Water** states that '*Arun District Council will encourage water efficiency measures in order to protect the District's water resources and enhance the quality of the water environment which supports a range of habitats and ecosystems. Development will be encouraged to make active use of surface water as a design feature and permitted where it identifies measures to improve and enhance waterbodies, coastal habitats or provides additional flood relief.*

The Council will also support development that:

- *is appropriately located, taking account of flood risk and promotes the incorporation of appropriate mitigation measures into new development, particularly Sustainable Drainage Systems that reduces the creation and flow of surface water and improves water quality;*
- *reduces the risk to homes and places of work from flooding whilst increasing biodiversity;*
- *delivers a range of community benefits including enhancing the quality of life and providing greater resistance to the impact of climate change.'*

2.4.3 Policy W DM1 – Water Supply and Quality states:

'1. Water supply

Development will be permitted where:

- 1 Sufficient water supplies can be provided prior to occupation to serve the development and;*
- 2 Provision of a water supply is not considered detrimental to existing abstractions, river flows, water quality, fisheries, amenity or nature conservation.*

To ensure that all new development of two dwellings or more are water efficient and reduce pressure on water abstraction sites, it must include measures that meet the optional standards of 110 l/person/day.

2. Water quality

To ensure good water quality in the District, all major developments must:

- 1 Illustrate, where necessary, how they have contributed to the protection and enhancement of waterbodies identified by the South East River Basin Management Plan objectives; and*

Demonstrate, where it will materially increase foul and/or surface water discharges, adequate drainage capacity exists or can be provided as part of the development. Where adequate capacity does not exist, there will be a requirement that facilities are adequately upgraded prior to the completion and occupation of development. In sewered areas, there will be a general presumption against the use of non mains foul water drainage.'

2.4.4 Policy W DM2 – Flood Risk states that 'development in areas at risk from flooding, identified on the latest Environment Agency flood risk maps and the Council's Strategic Flood Risk Assessment (SFRA) will only be permitted where all of the following criteria have been satisfied:

- *The sequential test in accordance with the National Planning Policy Guidance has been met.*
- *A site specific Flood Risk Assessment demonstrates that the development will be safe, including access and egress, without increasing flood risk elsewhere and reduce flood risk overall.*
- *The sustainability benefits to the wider community are clearly identified.*
- *The scheme identifies adaptation and mitigation measures.*
- *Appropriate flood warning and evacuation plans are in place; and*

New site drainage systems are designed to take account of events which exceed the normal design standard i.e. consideration of flood flow routing and utilising temporary storage areas.

The reports prepared as part of the criteria above must take into account contingency allowances, taking climate change into account as set out in Flood Risk Assessments: climate change allowances section of the NPPG.

In locations where strategic flood defence or resilient and resistant construction measures are necessary within the site itself, proposals will be required to demonstrate how measures have been incorporated as an intrinsic part of the scheme in a manner which is compatible with the latest Strategic Flood Risk Assessment.

All development proposals must take account of relevant Surface Water Management Plans, Catchment Flood Management Plans and related Flood Defence Plans and strategies such as the Lower Tidal River Arun Strategy. The council may require financial contributions from development on sites where measures to address flood risk or to improve the environmental quality of watercourses have been identified by these Plans and Strategies.'

- 2.4.5 Policy W DM3 – Sustainable Urban Drainage Systems** states that *'to increase the levels of water capture and storage and improve water quality, all development must identify opportunities to incorporate a range of Sustainable Urban Drainage Systems (SUDS), appropriate to the size of development, at an early stage of the design process.*

Proposals for both major and minor development proposals must incorporate SUDS within the private areas of the development in order to provide source control features to the overall SUDS design. These features include:

- *Green roofs*

- *Permeable driveways and parking*
- *Soakaways*
- *Water harvesting and storage features including water butts.*

Proposals for major development must also integrate SUDS within public open spaces and roads, reflecting discussion with the appropriate bodies. SUDS must therefore be integrated into the overall design of a development and must:

- *Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- *Effectively manage water (including its quality)*
- *Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- *Provide amenity for local residents (ensuring a safe environment)*
- *Retain the existing drainage network of the site and the wider area,*
- *Be maintained in perpetuity, supported through a Maintenance and Management Plan/Regime, including its financing, agreed with the Local Planning Authority.*

In order to ensure that SUDS discharge water from the development at the same or lesser rate, as prior to construction, developers must:

- *Follow the hierarchy of preference for different types of surface water drainage disposal systems as set out in Approved Document H of the Building Regulations and the SUDS manual produced by CIRIA.*
- *Undertake up to six months groundwater monitoring within the winter period.*
- *Undertake winter percolation testing in accordance with BRE365.*
- *The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- *The design must also take account of the 1 in 100 year storm event plus 30% allowance for climate change, on stored volumes, to ensure that there is no flooding of properties or the public highway or inundation of the foul sewerage system. Any excess flows must be contained within the site boundary, and within designated storage areas.'*

2.4.6 Policy ECC SP1 – Adapting to climate change states that *'the Council will support development which is located and appropriately designed to adapt to impacts arising from climate change such as the increased probability of tidal and*

fluvial flooding; water stress; health impacts as a result of extreme temperatures and a decline in the quality of habitats and richness of biodiversity.

In order to achieve this, development must be designed to take account of the following issues:

- *Location (in relation to flood risk and vulnerability to coastal erosion);*
- *Water efficiency;*
- *Shade, cooling, ventilation, solar gain;*
- *Connectivity to the green infrastructure network;*
- *Layout and massing;*
- *Resilience of buildings and building materials to extreme weather events; and*
- *Capacity of drainage systems and incorporation of Sustainable urban Drainage Systems (SuDS)'*

3 Existing Site

3.1 Site Location

- 3.1.1 The development site is located on the northeast side of the B2233 Main Road, Yapton, West Sussex at Ordnance Survey reference SU 975 034. The nearest postcode is BN18 0DX.



Image 1: Site Location

- 3.1.2 The site is bounded to the north by agricultural farmland, the east and southwest by existing residential dwellings and the southern boundary by the B2233 Main Road.
- 3.1.3 A copy of the site location plan is located in Appendix 1 at the rear of this report.
- #### 3.2 Site Description
- 3.2.1 The entire site is approximately 3.2ha in area and currently comprises undeveloped agricultural land.
- 3.2.2 Phase 2 located on the northern part of the site is approximately 0.95ha in area.
- 3.2.3 Existing ground levels generally ranging between 6.5m and 6m AOD falling at the southwest site boundary to approximately 4.5m AOD at its boundary with the B2233 Main Road.
- 3.2.4 There are no public sewers crossing the site and Southern Water's sewer records do not identify any surface water sewers in the immediate vicinity.
- 3.2.5 A copy of the existing site layout plan is located in Appendix 2 at the rear of this report.

3.3 Existing Drainage

- 3.3.1 The site currently has no positive surface water or foul water drainage infrastructure.
- 3.3.2 Rainfall on the site currently discharges in part to ground and in part overland as greenfield runoff.
- 3.3.3 There are no watercourses adjoining the site boundaries.
- 3.3.4 The existing greenfield runoff rate has been established using the HR Wallingford tool for Greenfield runoff estimation.



HR Wallingford

Greenfield runoff rate estimation for sites

www.uksoils.com | Greenfield runoff tool

Calculated by: Martin Kempinski

Site name: Bonham Field

Site location: Yagton

This is an estimation of the greenfield runoff rates that occurred to meet normal best practice criteria in the UK Environment Agency guidance "Rainfall runoff management for developments", SC000019 (2013), the SuDS Manual (753) (Eas, 2015) and the use of advisory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be used for existing elements for the drainage of particular developments.

Site Details

Latitude: 51° 52' 30" N

Longitude: 0° 51' 55" W

Reference: 1214527547

Date: Sep 08 2020 12:31

Runoff estimation approach: HR24

Site characteristics

Total site area (ha): 1

Methodology

Q_{RAE} estimation method: Calculate from SPR and SAAR

SPR estimation method: Calculate from SCL type

Soil characteristics

	Default	Edited
SCL type:	2	2
HOST class:	N/A	N/A
SPR/SPRHOST:	0.3	0.3

Hydrological characteristics

	Default	Edited
SAAR (mm):	743	743
Hydrological region:	7	7
Growth curve factor 1 year:	0.85	0.85
Growth curve factor 30 years:	2.3	2.3
Growth curve factor 100 years:	3.19	3.19
Growth curve factor 200 years:	3.74	3.74

Notes

(1) Is Q_{RAE} < 2.0 l/s/ha?

When Q_{RAE} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 6.0 l/s?

Where flow rates are less than 6.0 l/s, comment for discharge is usually set at 6.0 l/s (blockage from vegetation and other materials is possible). Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

(3) Is SPR/SPRHOST ≤ 0.3?

Where groundwater levels are low enough the use of soakaways to avoid discharge of water would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates

	Default	Edited
Q _{RAE} (l/s):	1.85	1.85
1 in 1 year (l/s):	1.68	1.68
1 in 30 years (l/s):	4.48	4.48
1 in 100 years (l/s):	5.21	5.21
1 in 200 years (l/s):	7.29	7.29

The software produces runoff rates based on the best practice guidance in the UK Environment Agency guidance "Rainfall runoff management for developments", SC000019 (2013), the SuDS Manual (753) (Eas, 2015) and the use of advisory standards for SuDS (Defra, 2015). The software is not a substitute for professional advice and should not be used for legal or regulatory purposes. The software is not a substitute for professional advice and should not be used for legal or regulatory purposes. The software is not a substitute for professional advice and should not be used for legal or regulatory purposes.

Image 2: Greenfield Runoff Calculation

3.3.5 The pre-developed greenfield runoff rates are as follows:

- Q_{bar} 1.95 l/s/ha
- 1:100 year 6.21 l/s/ha

3.3.6 There are no public surface water sewers located within the vicinity of the site.

3.3.7 There are public foul water sewers located beneath the B2233 Main Road to the southwest of the site

3.3.8 A copy of the sewer records is located in Appendix 3 at rear of this report.

3.4 Geology and Groundwater

3.4.1 British Geological Survey maps and borehole information confirm that the site is within an area underlain by Superficial River Terrace Deposits beneath made ground overlying Lewes Nodular Chalk.

3.4.2 Superficial River Terrace Deposits predominantly comprise slightly gravelly slightly sandy silty clay to a depth of approximately 3.5mbgl.

3.4.3 A site specific Site Investigation was undertaken by Tweedie Evans Consulting in September 2016 with additional investigations in October 2019.

3.4.4 Soakage testing in September 2016 was undertaken to BRE365 and generally recorded favourable soakage rates in the order of 3×10^{-5} m/s.

3.4.5 The worst case infiltration rate recorded in the Site Investigation in September 2016 was 9.16×10^{-6} m/s and identified a localised infiltration rate equivalent to 3.65×10^{-6} m/s.

3.4.6 Further site wide testing was completed in October 2019 which confirmed infiltration test results of between 1.1×10^{-6} m/s and 9.31×10^{-6} m/s at a depth of between 1.7mbgl and 3.5mbgl.

3.4.7 Groundwater was encountered at a depth of 3m below ground level during the October 2019 testing. Subsequent monitoring undertaken between October 2019 and March 2020 confirmed groundwater at a maximum level of 0.95m below ground level in the southeast corner of the site.

3.4.8 The online “Magic Map” available from Defra confirms that the site is located above a major aquifer classified as having an intermediate vulnerability.

3.4.9 Extracts from the site investigation reports are located in Appendix 4 at the rear of this report.

4 Flood Zone and Flood History

4.1 Flood Zone

- 4.1.1 The Environment Agency's online mapping confirms that the site is located in Flood Zone 1 and is not at risk of flooding from rivers or the sea from anything less extreme than a 1:1,000 year flood event.

4.2 Flood History

4.2.1 Environment Agency

- 4.2.1.1 The Environment Agency maps of historic flood incidents identify a short section of the B2233 Main Road 125m west of the site which has historically suffered localised flooding, but they do not identify any historic incidents directly affecting the site or adjacent highway.

4.2.2 West Sussex County Council

- 4.2.2.1 Neither the Strategic Flood Risk Assessment dated January 2010, the Preliminary Flood Risk Assessment dated May 2011, nor the Local Flood Risk Management Strategy dated May 2014 identify any specific flood incidents in the immediate vicinity of the site.

4.2.3 Arun District Council

- 4.2.3.1 The Strategic Flood Risk Assessment dated November 2016 identifies no historic flooding on the site or adjacent section of highway to the south of the site. A short section of the B2233 Main Road 125m west of the site, (as identified by the Environment Agency mapping) has historically suffered localised flooding. Two points attributed to surface water flooding are also identified on the B2132 North End Road, approximately 50m from the sites eastern boundary.
- 4.2.3.2 There are no records of any flood incidents directly affecting the site.
- 4.2.3.3 Copies of the available flood maps are located in Appendix 5 at the rear of this report.

5 Flooding Potential

5.1 Tidal Flooding

- 5.1.1 The site is located 2km from the tidal estuary of the River Arun and is defended against tidal flooding.

5.2 Fluvial Flooding

- 5.2.1 The area of the proposed site is within Flood Zone 1 and is not at risk of fluvial flooding from anything less extreme than a 1:1,000 year flood event.

5.3 Groundwater Flooding

- 5.3.1 Groundwater monitoring undertaken between October 2019 and March 2020 confirmed groundwater at a maximum level of 0.95m below ground level in the southeast corner of the site.
- 5.3.2 The flood mapping contained within Arun District Council's latest Strategic Flood Risk Assessment dated November 2016 identifies the site as being within an area of 1 square kilometre where the geology is such that ground water might emerge within 25-50% of that area. No indication of likelihood is given.
- 5.3.3 There are no records identified within West Sussex County Council's Strategic Flood Risk Assessment, Preliminary Flood Risk Assessment or Local Flood Risk Management Strategy nor in Arun District Council's Strategic Flood Risk Assessments (2006 and 2016 update) or Strategic Surface Water Management Study of groundwater flooding affecting the site.

5.4 Overland Flow

- 5.4.1 The Environment Agency maps identify the southeast boundary of the site to be at low risk of flooding from overland surface water with the remainder of the site at very low risk.
- 5.4.2 The flood mapping contained within the various flood documents produced by West Sussex County Council and Arun District Council do not identify any associated history of flooding and the risk is identified as low.

5.5 Flood Routing

5.5.1 The natural route for flood waters to dissipate, should any event occur on the site, is towards the B2233 Main Road to the southern boundary heading southwest away from the site.

5.5.2 There is no associated flood risk to the downstream catchment area.

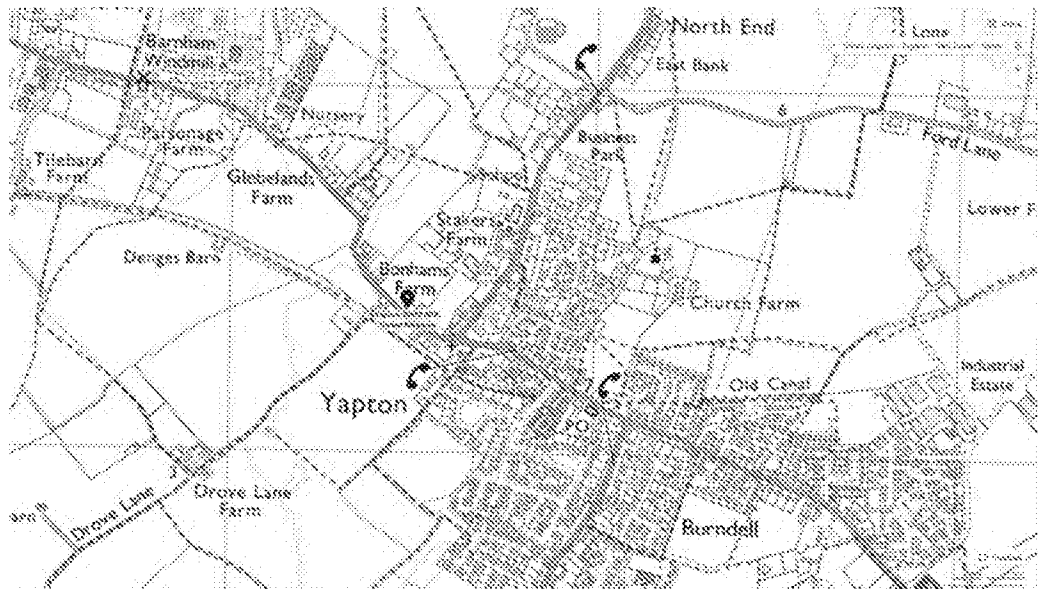


Image 3: Local Topography

6 Development Proposals

6.1 Description

6.1.1 The development proposals are for the construction of the northern part of the site (Phase 2) comprising 18 residential dwellings with associated access roads, car parking and landscaping.

6.2 Impermeable areas

6.2.1 The impermeable areas of the development are summarised as follows:

- Roof areas 2,350m²
- Access Road and Parking Areas 2,060m²

6.2.2 A copy of the proposed site layout plan together with an impermeable areas plan is located in Appendix 6 at the rear of this report.

6.3 Surface Water Drainage

6.3.1 CIRIA report C753 The SuDS Manual-v6 provides guidance on surface water drainage. The aim for surface water runoff is to match greenfield runoff rates and volumes where reasonably achievable.

6.3.2 For surface water discharge, the drainage hierarchy notes the following list of drainage options in order of preference:

- 1 Infiltration to ground
- 2 Discharge to a watercourse
- 3 Discharge to a surface water sewer
- 4 Discharge to a foul water sewer

6.3.3 The proposed surface water drainage strategy will be based on infiltration to ground with sufficient storage provided to accommodate a 1:100 year storm event with an additional 40% to account for the predicted effects of future climate change.

6.3.4 All surface water runoff from the roofs, private access roads, driveways and parking areas will be discharged via rainwater diffusers units into voided subbase infiltration blankets located beneath the onsite roads and driveways.

6.3.5 Calculations have been prepared for the entire site of 72 dwellings using existing infiltration test data to demonstrate that surface water drainage can be adequately accommodated within the site without any increased flood risk elsewhere.

6.3.6 The drainage has initially been separated into eight catchments. The lowest recorded site infiltration rate of $1.1 \times 10^{-6} \text{m/s}$ has been used in the design. Location specific testing will be used in the final detailed design.

6.3.7 Surface water storage requirements for each catchment for the whole site is as follows:

Catchment	Total Impermeable Area	Total Area of Permeable Highway	Subbase Thickness Required for Storage of 1:100 Plus 40% Climate Change Storm Event	Storage Required for 1:100 Plus 40% Climate Change Storm Event	Storage provide with minimum 450mm of voided subbase
A	102m ²	102m ²	235mm	7.2m ³	13.8m ³
B	303m ²	166m ²	422mm	21.5m ³	22.4m ³
C	510m ²	319m ²	370mm	36.5m ³	43.1m ³
D	4,730m ²	2,773m ²	405mm	337.0m ³	375.0m ³
E	2,310m ²	1,854m ²	307mm	171.0m ³	250.3m ³
F	2,328m ²	1,200m ²	470mm	169.0m ³	162m ³
G	1,485m ²	869m ²	250mm	58.4m ³	117.3m ³
H	1,936m ²	1,008m ²	395mm	117.2m ³	136.1m ³

Table 1: Surface Water Storage Requirements

6.3.8 Phase 2 of the site has an updated layout and impermeable area and only affects catchments D and F. Surface water storage requirements for each affected catchment for Phase 2 is as follows:

Catchment	Total Impermeable Area	Total Area of Permeable Highway	Subbase Thickness Required for Storage of 1:100 Plus 40% Climate Change Storm Event	Storage Required for 1:100 Plus 40% Climate Change Storm Event	Storage provide with minimum 450mm of voided subbase
D	2,660m ²	**2,773m ²	405mm	337.0m ³	375.0m ³
F	2,328m ²	**1,200m ²	470mm	169.0m ³	162m ³

Table 1a: Surface Water Storage Requirements (Phase 2)

***Total area of permeable highway is not included as part of Phase 2 of the development site but will be drained into the previous schemes required storage as the total impermeable areas are less with the revised layout.*

6.3.9 Assumed CBR values of 2%-5% require a minimum voided subbase thickness of 450mm is to be provided beneath all parking areas, access roads and driveways accept where additional depth is required for surface water storage. Catchment F will have a deeper voided subbase to ensure sufficient surface water attenuation is achieved.

- 6.3.10 The initial design identifies a maximum depth of construction of the formation level for the permeable paving as 800mm below existing ground levels. The winter groundwater monitoring confirms that an unsaturated zone can be maintained between the voided subbase and the maximum recorded groundwater level.
- 6.3.11 The drainage proposals will be confirmed prior to the final detailed design with further site investigations planned during Winter 2020/21.
- 6.3.12 Should the discharging of surface water using infiltration to ground become unviable then an alternative means of discharge is proposed in accordance with the drainage hierarchy.
- 6.3.13 All surface water from the site will be discharged to the public foul sewer located beneath B2233 Main Road as there are no ordinary watercourses adjacent to the site and no or surface water sewers within the vicinity of the site.
- 6.3.14 Surface water storage will be provided using a lined voided subbase beneath highways, driveways and footways.
- 6.3.15 Initial calculations indicate that a discharge rate of 3.6l/s would be capable of achieving half drain time of less than 24 hours for a 1:30 year event.
- 6.3.16 To accommodate a 1:100 year storm event with an additional 40% to account for the predicted effects of future climate change at a restricted rate of 3.6l/s an average minimum subbase thickness of 460mm providing 1,148m³ of storage is required.

6.4 Foul Water Drainage

- 6.4.1 The anticipated peak foul water discharge from the site is 3.45l/s in accordance with Sewers for Adoption requirements.
- 6.4.2 Foul drainage will be discharged to the existing public foul sewer located beneath the B2233 Main Road to the south of the site.
- 6.4.3 A copy of the drainage strategy plans together with copies of the calculations and a plan showing exceedance event flow routes is located in Appendix 7 at the rear of this report.
- 6.4.4 A completed copy of Arun District Council's Surface Water Drainage Proposal Checklist together with supporting calculations is located in Appendix 8 at the rear of this report.

6.5 Water Quality

- 6.5.1 The proposed development is for residential use. In accordance with CIRIA SuDS Manual 2015 (Report C753), the pollution hazard level for this type of development is between very low and low.
- 6.5.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to discharge.
- 6.5.3 Table 26.2 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Pollution Hazard Indices for varying land types. Those of relevance to the development proposals are as follows:

Land Use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydro-carbons
Residential roofs	Very Low	0.2	0.2	0.05
Individual property driveways, residential car park, low-traffic roads (<300 movements a day)	Low	0.5	0.4	0.4
All roads except low traffic roads, trunk roads and motorways	Medium	0.7	0.6	0.7

Table 2: Pollution Hazard Indices

- 6.5.4 Table 26.3 in Chapter 26 of CIRIA report C753 The SuDS Manual provides Mitigation Indices for various types of SuDS components. Those of relevance to the development proposals are as follows:

SuDS Type	Total suspended solids (TSS)	Metals	Hydro-carbons
Permeable pavement	0.7	0.6	0.7

Table 3: Pollution Mitigation Indices

- 6.5.5 The proposed use of permeable paving will meet the target treatment level required for runoff with very low to medium level of pollution hazard thus demonstrating that the surface water drainage system for the site can be designed to adequately mitigate against the risk of pollution.
- 6.5.6 A drainage maintenance schedule is located in Appendix 9 at the rear of this report.

7 Safe Development

7.1 Flood Zone Compatibility

7.1.1 The site and its wider area are in Flood Zone 1 and will remain so for the foreseeable future.

7.1.2 With reference to the Government Guidance on Flood Risk and Coastal Change at <https://www.gov.uk/guidance/flood-risk-and-coastal-change>:

- Table 2: Flood Risk Vulnerability Classification

The type of commercial element of the development proposed is classified as less vulnerable and the residential element as More Vulnerable

- Table 3: Flood Risk Vulnerability and Flood Zone Compatibility

More Vulnerable development is appropriate in Flood Zones 1

7.2 Risk to Others

7.2.1 The proposed surface water drainage system will be designed to current standards incorporating SuDS elements providing treatment, attenuation and storage which will minimise runoff leaving the site during times of heavy rain.

7.2.2 Allowance has been made for a 40% increase in rainfall intensities which accords with the latest figures published by the Environment Agency and in accordance with the requirements under the National Planning Policy Framework.

7.2.3 The proposed drainage system will incorporate sufficient treatment prior to final discharge thus mitigating the risk of pollution from the site.

7.2.4 The risk of surface water flooding to others due to the development proposals is reduced and the resultant risk is negligible.

7.2.5 Sewerage undertakers have an obligation to upgrade the existing networks if a connection to an equivalent or larger sized public sewer is technically achievable.

7.2.6 The residual risk of sewer flooding from this development for the foreseeable future is therefore negligible.

8 Conclusions

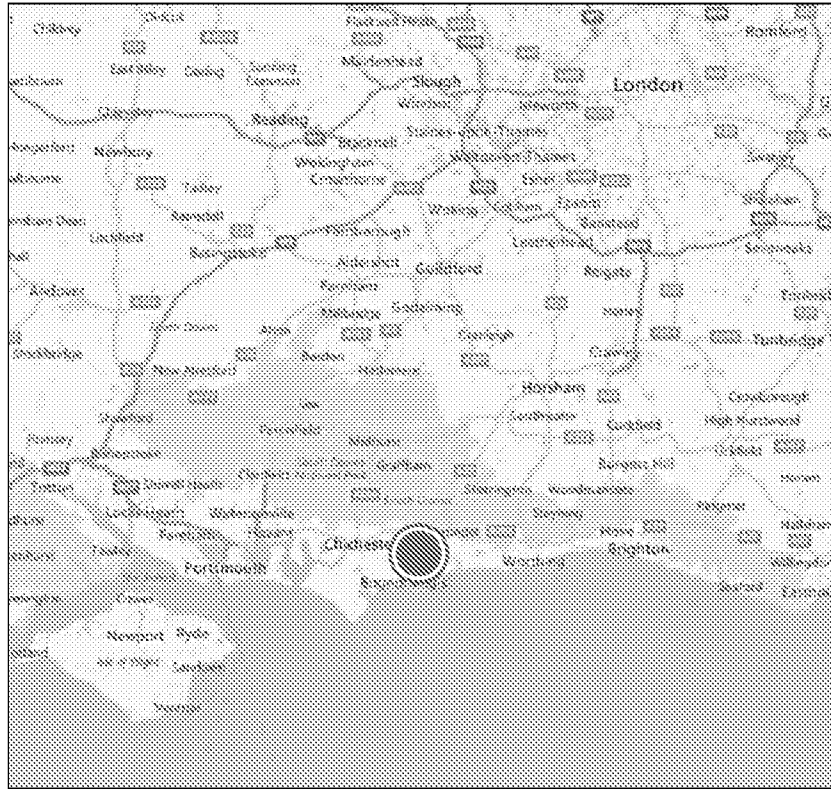
- 8.1 The site is located within Flood Zone 1 and is not at risk from any source of flooding.
- 8.2 There are no historic records of flooding from any source affecting the site or its immediate area.
- 8.3 The geology of the area is currently demonstrated as being suitable to provide an infiltration drainage system. Should infiltration prove unviable an alternative design option is achievable.
- 8.4 Calculations confirm that surface water runoff generated by the proposed development can be discharged to ground via a voided subbase infiltration blanket located beneath the roads and driveways sized with sufficient depth to accommodate a 1:100 year storm event with an additional 40% to account for the predicted effects of future climate change.
- 8.5 Water quality improvement will be provided to mitigate against any risk to any receiving waterbody.
- 8.6 Foul drainage will be discharged by gravity to the existing public foul sewer located beneath the B2233 Yapton Road to the southwest of the site.
- 8.7 The development proposals are suitable at this location.

9 List of Appendices, Images and Tables

Appendix 1	Site Location Plan
Appendix 2	Existing Site Layout Plan
Appendix 3	Sewer Records
Appendix 4	Site Investigation and Winter groundwater Monitoring Extracts
Appendix 5	Flood Maps
Appendix 6	Proposed Site Layout Plan and Impermeable Areas Plan
Appendix 7	Drainage Strategy Plans, Calculations and Exceedance Event Flow Route Plan
Appendix 8	Arun District Council's Surface Water Drainage Proposal Checklist
Appendix 9	Drainage Maintenance Schedule
Table 1	Surface Water Storage Requirements
Table 1a	Surface Water Storage Requirements (Phase 2)
Table 2	Pollution Hazard Indices
Table 3	Pollution Mitigation Indices
Image 1	Site Location
Image 2	Greenfield Runoff Calculation
Image 3	Local Topography

Appendix 1

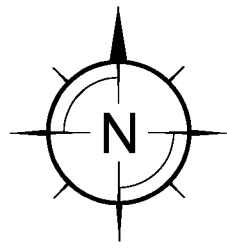
Site Location Plan



TITLE Site Location Plan, Bonhams Field, Yapton BN10 0DX. OS Reference: SU 094034			
SCALE 1:10000 @ A3		PROJECT No. 23572	
REPORT TYPE FRA		DRG. No. 01	

Appendix 2

Existing Site Layout Plan



TITLE Existing Site Layout Plan	
SCALE 1:1000 @ A3	PROJECT No. 23572
REPORT TYPE FRA	DRG. No. 02

Appendix 3

Sewer Records



Node	Cover	Invert	Size	Material	Shape		Node	Cover	Invert	Size	Material	Shape
0001X	8.32	6.31	150	VC	CIRC	*	9101X	6.61	3.01	350	PF	CIRC
0001X	5.9	4.02	175	VC	CIRC	*	9102X	3.22	-0.06	350	PF	CIRC
0001X	6.06	3.61	225	VC	CIRC	*	9301X	5.53	4.18	175	VC	CIRC
0002X	5.83	3.49	225	VC	CIRC	*	9302X	5.56	4.18	175	VC	CIRC
0002X	6.96	4.79	150	VC	CIRC	*	9303X	5.54	4.08	175	VC	CIRC
0002X	5.93	3.76	175	VC	CIRC	*	9402X	6.999	5.79	150	VC	CIRC
0003X			150	VC	CIRC		9502X	6.938	5.057	150	VC	CIRC
0004X			150	VC	CIRC		9505X	7.037		150	VC	CIRC
0101X	6.13	2.98	350	PF	CIRC		9601X	6.25	3.98	175	VC	CIRC
0301X	5.67	4.49	175	VC	CIRC		9603X	6.298		175	VC	CIRC
0401X	5.92	4.58	150	VC	CIRC		9801X	6.27	4.77	175	VC	CIRC
0402X	5.8	5.03	150	VC	CIRC		9901X	6.27	4.85	175	VC	CIRC
0403X	6.32	5.24	150	VC	CIRC		9902X	6.13	4.56	175	VC	CIRC
0404X	6.46	5.42	150	VC	CIRC							
0405X	6.55	5.38	150	VC	CIRC							
0406X	6.72	5.55	150	VC	CIRC							
0407X	7.03	5.69	150	VC	CIRC							
0408X	6.82	5.6	150	VC	CIRC							
0501X	5.89	4.78	175	VC	CIRC							
0502X	5.86	4.41	175	VC	CIRC							
0503X	5.99		175	VC	CIRC							
0504X	6.05	4.53	175	VC	CIRC							
0801X	5.38	3.93	175	VC	CIRC	*						
0801X	6.25	4.12	225	VC	CIRC	*						
0802X	7.44	4.75	175	VC	CIRC	*						
0802X	4.67	3.24	175	VC	CIRC	*						
0803X	7.4	4.64	175	VC	CIRC							
0804X	7.47	4.43	175	VC	CIRC							
0901X	6.53	3.91	225	VC	CIRC	*						
0901X	5.39	3.49	150	VC	CIRC	*						
0902X	6.5	3.9	225	VC	CIRC							
0903X	6.23	3.79	225	VC	CIRC							
1001X	5.78	4.38	150	VC	CIRC	*						
1001X	5.73	3.46	350	PF	CIRC	*						
1002X	6.88	3.85	150	VC	CIRC							
1003X	6.53	3.87	175	VC	CIRC							
1004X	7.13	6.1	150	VC	CIRC							
1005X	6.414	3.974	150	VC	CIRC							
1008X	6.06	4.145	150	VC	CIRC							
1007X	6.96	4.445	150	VC	CIRC							
1101X	6.908	4.753	150	VC	CIRC	*						
1101X	5.91	3.61	175	VC	CIRC	*						
1102X			150	VC	CIRC							
1103X	6.887	4.987	150	VC	CIRC							
1104X			150	VC	CIRC							
1105X			150	VC	CIRC							
1201X			150	VC	CIRC							
1401X	6.39	5.24	175	VC	CIRC							
1501X	6.45	4.65	175	VC	CIRC							
1502X	6.39	4.58	175	VC	CIRC							
1701X	5.34	2.61	175	VC	CIRC							
1801X	4.84	3	175	VC	CIRC							
1802X	7.14	5	175	VC	CIRC							
180DX			175	VC	CIRC							
1901X	7.23	6.16	150	VC	CIRC							
1902X	7.12	5.95	150	VC	CIRC							
1903X	7.31	5.78	150	VC	CIRC							
1904X	7.11	5.92	150	VC	CIRC							
2001X	6.59	4.81	175	VC	CIRC							
2002X	6.82	4.02	175	VC	CIRC							
2003X	6.78		175	VC	CIRC							
2101X	6.5	5.36	175	VC	CIRC							
2102X	6.092	4.332	150	VC	CIRC							
2103X		4.551	150	VC	CIRC							
2104X	6.684	4.669	150	VC	CIRC							
2105X			150	VC	CIRC							
2106X			150	VC	CIRC							
2402X			150	VC	CIRC							
2405X	6.453	5.647	UNK	UNK	CIRC							
2601X	4.42	2.1	175	VC	CIRC							
2701X	4.91	2.31	175	VC	CIRC							
2801X	7.02	5.74	150	VC	CIRC							
2802X	6.67	5.54	175	VC	CIRC							
2803X	7.06	5.33	175	VC	CIRC							
2901X	6.91	6.02	150	VC	CIRC							
2902X	6.99	5.66	150	VC	CIRC							
3001X	7.06	4.28	175	VC	CIRC							
3002X	6.98	4.99	150	VC	CIRC							
3003X	6.92	5.15	150	VC	CIRC							
3005X	7.02		150	VC	CIRC							
3006X			UNK	UNK	CIRC							
3007X			UNK	UNK	CIRC							
3008X			UNK	UNK	CIRC							
3401X	3.95	1.25	350	PF	CIRC							
3501X	3.02	1.08	350	PF	CIRC							
3502X	2.58	0.9	350	PF	CIRC							
3601X	3.96	2.11	175	VC	CIRC							
3602X	3.14	0.74	350	PF	CIRC							
3604X	3.19	0.86	150	VC	CIRC							
3605Y	3.15		225	VC	CIRC	*						
3605X	3.15		225	VC	CIRC	*						
3606X	3.42		150	VC	CIRC							
360PX	3.42	3.41	300	BAC	CIRC							
3701X	5	3.44	150	VC	CIRC							
3901X	7.06	4.38	175	VC	CIRC							
4301X	4.78	1.72	350	PF	CIRC							
4401X	4.49	1.27	350	PF	CIRC							
4601X	4.46	2.99	150	VC	CIRC							
4901X	6.58	4.6	175	VC	CIRC							
5101X	6.35	2.81	150	VC	CIRC							
5102X	6.42	3.06	150	VC	CIRC							
5301X	4.63	2.12	350	PF	CIRC							
5302X	4.86	2.04	350	PF	CIRC							
5303X	5.39	1.81	350	PF	CIRC							
5304X	5.33	1.81	350	PF	CIRC							
5305X	5.32	1.96	350	PF	CIRC							

Appendix 4

Site Investigation and Winter Groundwater Monitoring Extracts

materials, CBR values of <2.5% would be recommended for preliminary design purposes where road formation is proven to be within made ground.

- 10.5.5 It should be noted that all road formations should be proof rolled and soft spots removed and replaced with selected granular fill and, where adoptable, a pavement of sufficient thickness to prevent the penetration of frost should be employed.

10.6 Excavations

- 10.6.1 Excavation of the materials immediately beneath the site should be achievable using conventional excavation plant.
- 10.6.2 Based on observations made during intrusive site investigations, groundwater ingress unlikely to pose an issue within excavations on site. Therefore, dewatering works are considered unlikely during the excavation works.
- 10.6.3 Where excavations extend beyond 1.2m depth and are within soils, it is recommended that appropriate shoring/temporary works is used i.e. in accordance with current Health and Safety requirements where access for personnel is required.

10.7 Protection of Buried Concrete

- 10.7.1 The results of the water soluble sulphate and pH testing carried out for the made ground and natural ground materials indicate that in accordance with BRE Special Digest 1 (2005), the natural ground materials encountered on site generally yield an Aggressive Chemical Environment for Concrete (ACEC) of AC-1 requiring a Design Sulphate Class of DS-1.

10.8 Drainage

- 10.8.1 Soakage testing was undertaken in two locations on site (TP1/SA1 and TP2/SA2), in general accordance with BRE 365, within the natural ground materials comprising gravelly sandy clay and sandy gravelly clay respectively. The full data sheet is provided in Appendix I.
- 10.8.2 TP1 (SA1) failed to drain during the test period (i.e. to 75% effective water depth). Notwithstanding this, extrapolation of the data suggests indicative infiltration rate of 3.65×10^{-6} within this location.
- 10.8.3 TP2 (SA2) drained fully (i.e. to >75% effective water depth) during the 3No. tests undertaken within this location. As a result, an infiltration rate has been calculated based on the methodology described in BRE365, with indicative infiltration rates of between 3.02×10^{-5} and 6.75×10^{-5} m/s calculated for this location.
- 10.8.4 A summary of the calculated infiltration rates for all soakage tests carried out at the site is presented in Table 10.3.

Table 10.3: Summary of Soakage Test Data

Location	Test 1	Test 2	Test 3
TP01/SA1	9.16×10^{-6}	-	-
TP02/SA2	3.08×10^{-5}	2.92×10^{-5}	2.97×10^{-5}

- 10.8.5 Based on the soakage test data collated to date, it is considered that the more granular underlying ground materials encountered may provide a suitable drainage medium, should suitable and sufficient attenuation be available. It is recommended that an

Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2007) Soakaway Design

Site	Bonhams Field, Yapton
Test Pit Reference	TP2/SA2
Site Reference	1008913/001
Client	Seaward Properties Ltd
Operator	TEC
Test Date	8th September 2016

Test 1

Time (min)	Depth (mm bgl)
0	1500
10	1500
20	1500
30	1500
40	1500
50	1500
60	1500
70	1500
80	1500
90	1500
100	1500
110	1500
120	1500
130	1500
140	1500
150	1500
160	1500
170	1500
180	1500
190	1500
200	1500
210	1500
220	1500
230	1500
240	1500
250	1500
260	1500
270	1500
280	1500
290	1500
300	1500
310	1500
320	1500
330	1500
340	1500
350	1500
360	1500
370	1500
380	1500
390	1500
400	1500
410	1500
420	1500
430	1500
440	1500
450	1500
460	1500
470	1500
480	1500
490	1500
500	1500
510	1500
520	1500
530	1500
540	1500
550	1500
560	1500
570	1500
580	1500
590	1500
600	1500
610	1500
620	1500
630	1500
640	1500
650	1500
660	1500
670	1500
680	1500
690	1500
700	1500
710	1500
720	1500
730	1500
740	1500
750	1500
760	1500
770	1500
780	1500
790	1500
800	1500
810	1500
820	1500
830	1500
840	1500
850	1500
860	1500
870	1500
880	1500
890	1500
900	1500
910	1500
920	1500
930	1500
940	1500
950	1500
960	1500
970	1500
980	1500
990	1500
1000	1500

Test 2

Time (min)	Depth (mm bgl)
0	1500
10	1500
20	1500
30	1500
40	1500
50	1500
60	1500
70	1500
80	1500
90	1500
100	1500
110	1500
120	1500
130	1500
140	1500
150	1500
160	1500
170	1500
180	1500
190	1500
200	1500
210	1500
220	1500
230	1500
240	1500
250	1500
260	1500
270	1500
280	1500
290	1500
300	1500
310	1500
320	1500
330	1500
340	1500
350	1500
360	1500
370	1500
380	1500
390	1500
400	1500
410	1500
420	1500
430	1500
440	1500
450	1500
460	1500
470	1500
480	1500
490	1500
500	1500
510	1500
520	1500
530	1500
540	1500
550	1500
560	1500
570	1500
580	1500
590	1500
600	1500
610	1500
620	1500
630	1500
640	1500
650	1500
660	1500
670	1500
680	1500
690	1500
700	1500
710	1500
720	1500
730	1500
740	1500
750	1500
760	1500
770	1500
780	1500
790	1500
800	1500
810	1500
820	1500
830	1500
840	1500
850	1500
860	1500
870	1500
880	1500
890	1500
900	1500
910	1500
920	1500
930	1500
940	1500
950	1500
960	1500
970	1500
980	1500
990	1500
1000	1500

Test 3

Time (min)	Depth (mm bgl)
0	1500
10	1500
20	1500
30	1500
40	1500
50	1500
60	1500
70	1500
80	1500
90	1500
100	1500
110	1500
120	1500
130	1500
140	1500
150	1500
160	1500
170	1500
180	1500
190	1500
200	1500
210	1500
220	1500
230	1500
240	1500
250	1500
260	1500
270	1500
280	1500
290	1500
300	1500
310	1500
320	1500
330	1500
340	1500
350	1500
360	1500
370	1500
380	1500
390	1500
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410	1500
420	1500
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760	1500
770	1500
780	1500
790	1500
800	1500
810	1500
820	1500
830	1500
840	1500
850	1500
860	1500
870	1500
880	1500
890	1500
900	1500
910	1500
920	1500
930	1500
940	1500
950	1500
960	1500
970	1500
980	1500
990	1500
1000	1500

Ground Conditions / Comments

100% Fines, silty sand, sandy silt, and gravel (1-2mm)

Test Results

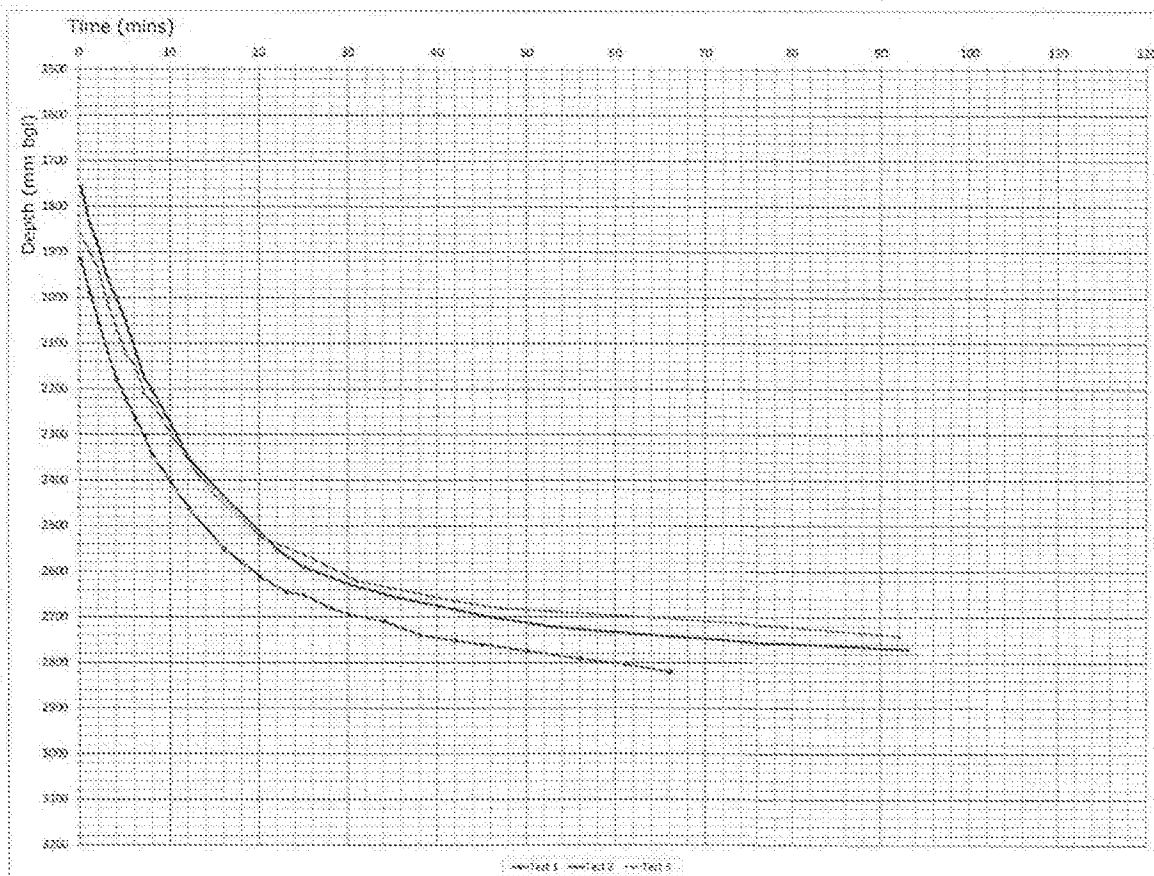
Test	Soil Infiltration Rate (m/sec)	Soil Infiltration Rate (mm/hr)
Test 1	6.75E-05	2.43E+02
Test 2	6.17E-05	2.22E+02
Test 3	3.02E-05	1.09E+02

Soil Infiltration Rate (m/sec)	Test 1	Test 2	Test 3
Soil Infiltration Rate (mm/hr)	2.43E+02	2.22E+02	1.09E+02

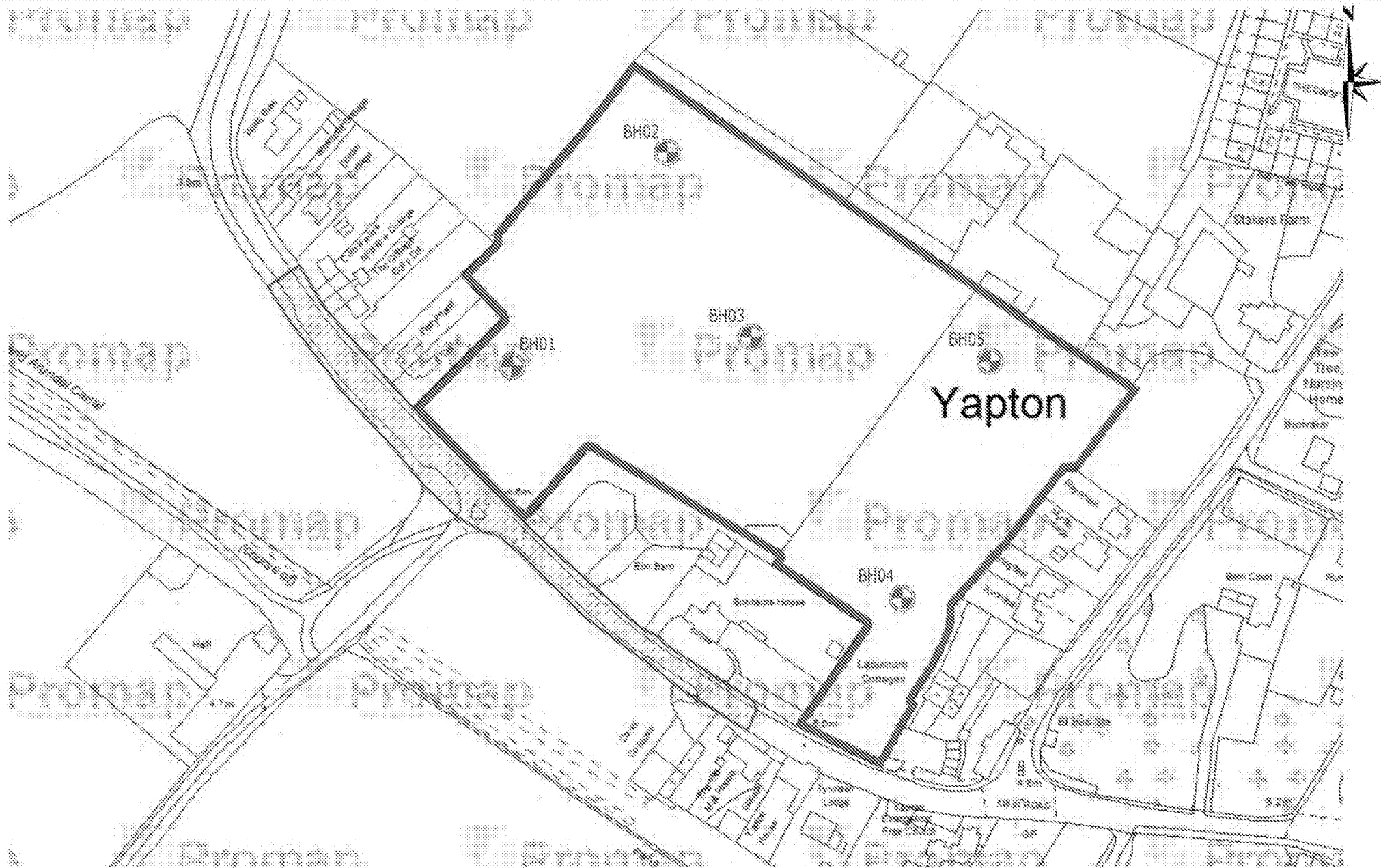
Soil Infiltration Rate (m/sec)	Test 1	Test 2	Test 3
Soil Infiltration Rate (mm/hr)	2.43E+02	2.22E+02	1.09E+02

Soil Infiltration Rate (m/sec)	Test 1	Test 2	Test 3
Soil Infiltration Rate (mm/hr)	2.43E+02	2.22E+02	1.09E+02

Soil Infiltration Rate (m/sec)	6.75E-05	6.17E-05	3.02E-05
Soil Infiltration Rate (mm/hr)	2.43E+02	2.22E+02	1.09E+02



Infiltration calculated to method in BRE Digest 365 (2007) Soakaway Design

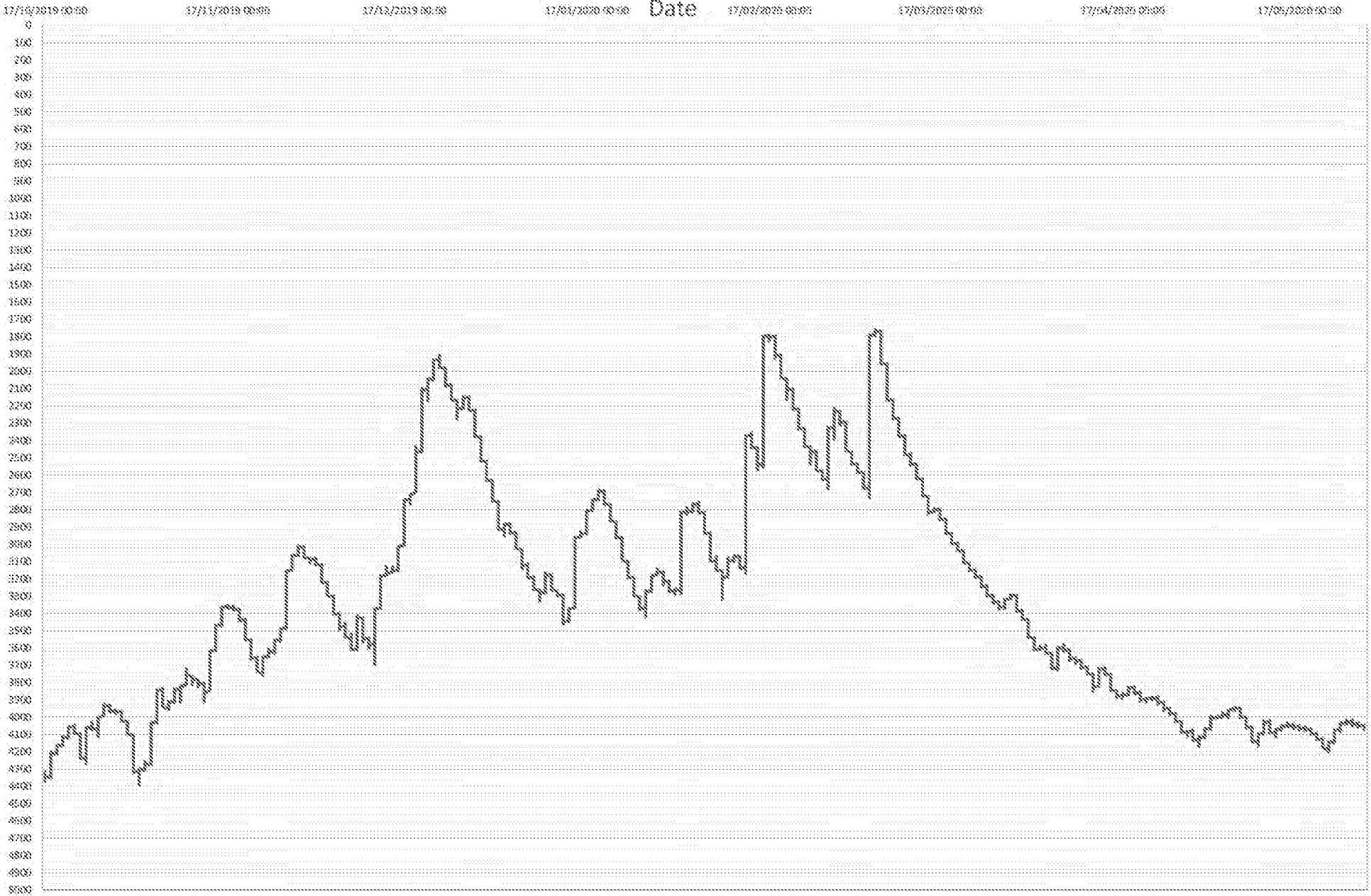


TEC Exploratory Hole with Installation Location: 

BH01

Date

Water Depth below GL (mm)



BH02

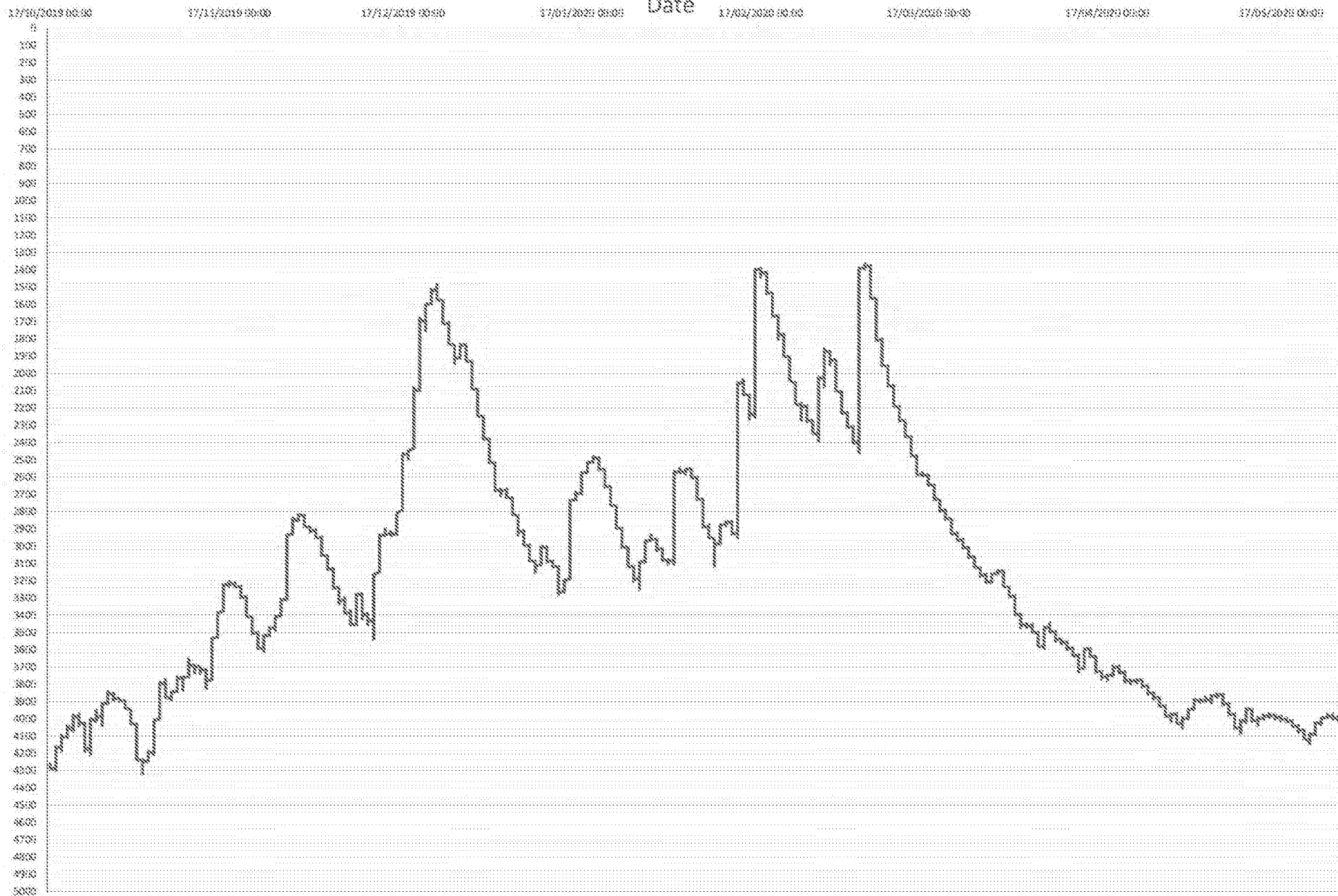
Date

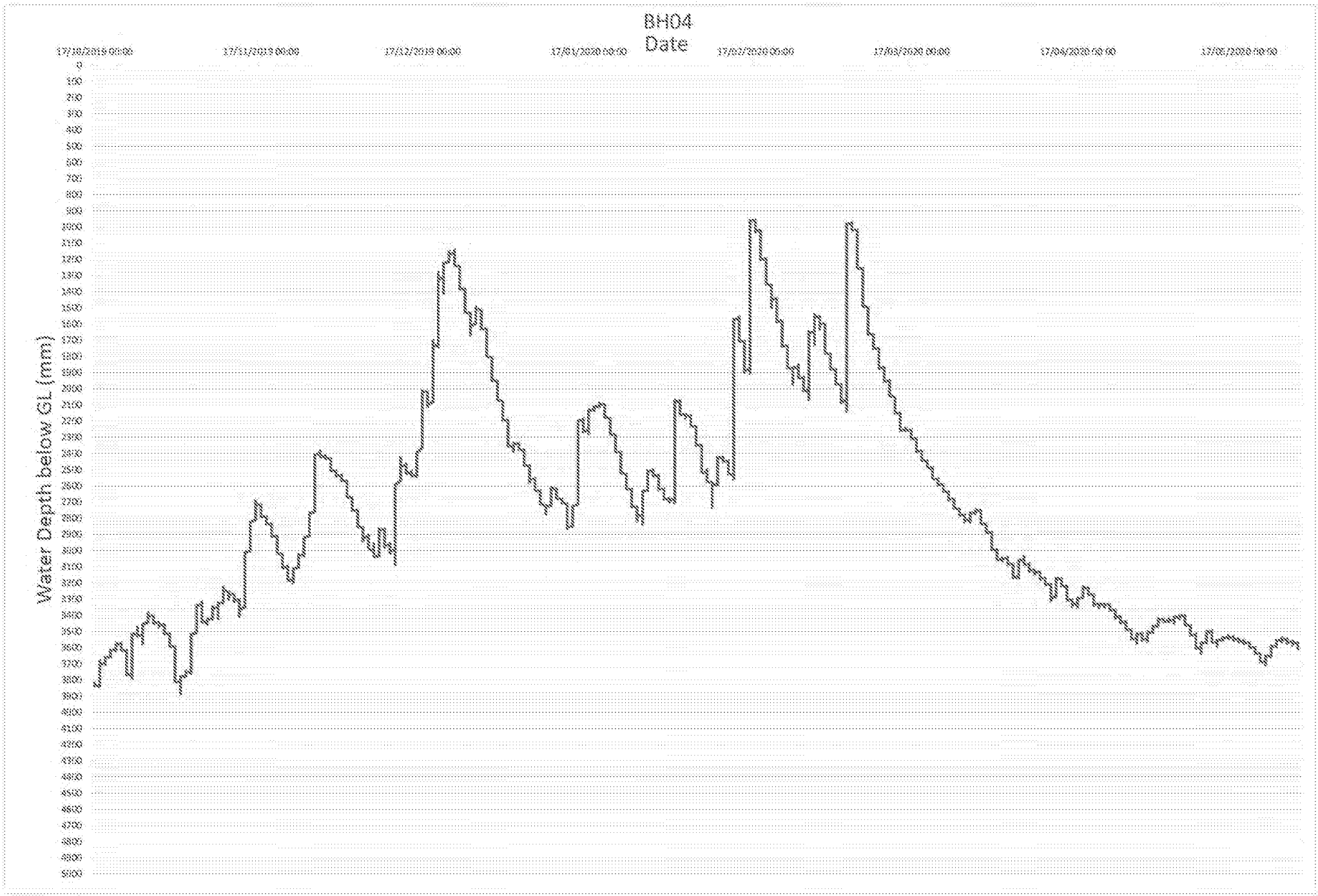


BH03

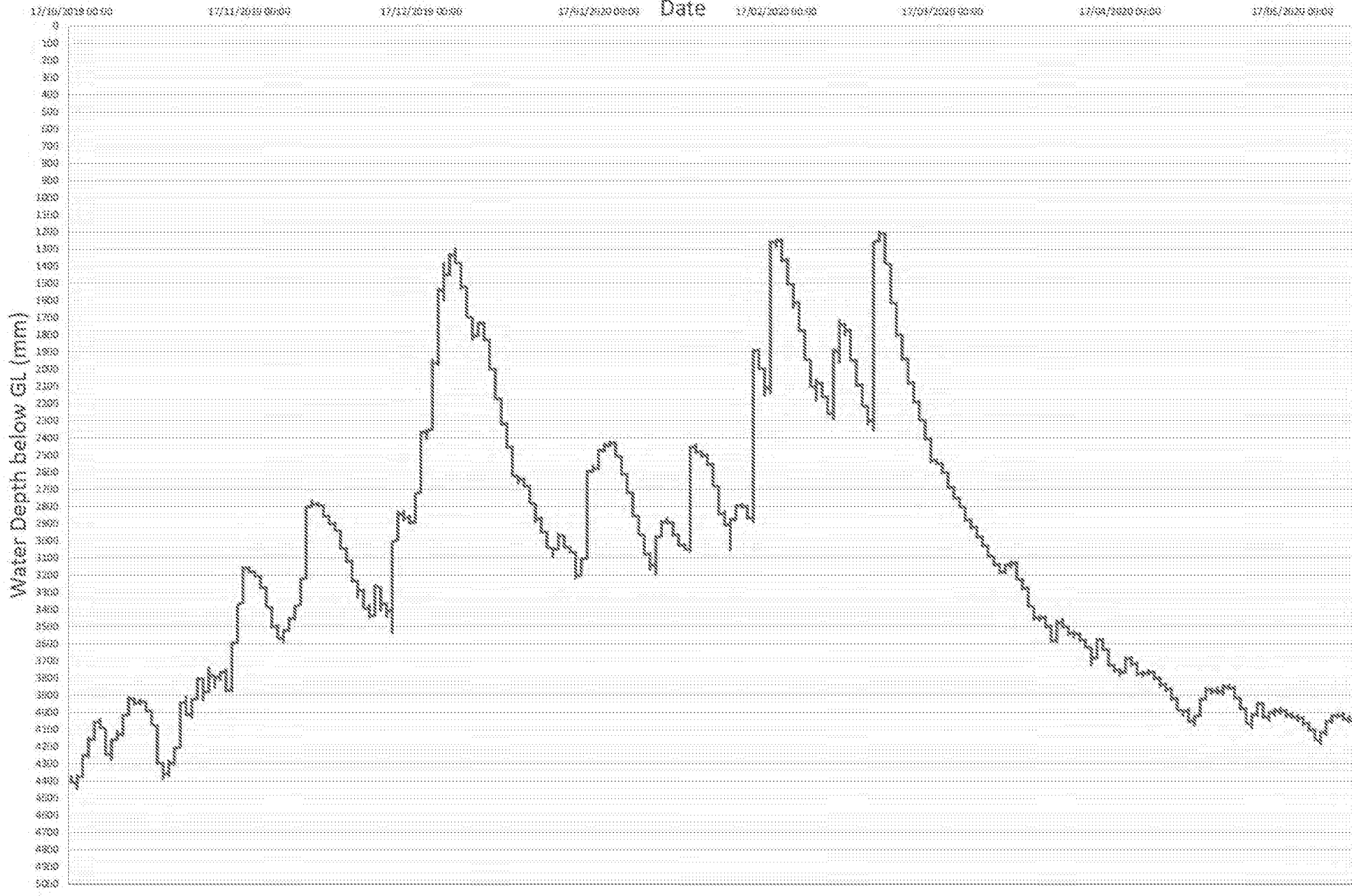
Date

Water Depth below GL (mm)





BH05
Date



Intrusive investigation.

Soakage Test Results

The results of the soakage tests generally indicate a very slight drop in water level at all locations and all test locations failed to drain during the test (i.e. to 75% effective water depth) and, therefore, insufficient time was available to complete the testing in accordance with BRE365 and determination of infiltration rates at the site in strict accordance with BRE365 has not been possible.

Soakage Test Results

Soakage Test	Depth (mbgl)	Comments
TP01	2.6	Drop in water level: 7.5m in 5hr
TP02	2.9	Drop in water level: 6.5cm in 4hr 22min
TP03	3.5	Drop in water level: 3.0cm in 4hr
TP04	2.9	No drop in water level in 5hr and 32min
TP05	3.0	Drop in water level: 9cm in 5hr 6min
TP06	1.8	Drop in water level: 16cm in 4hr 49min
TP07	3.1	Drop in water level: 5.0cm in 5hr 1min
TP08	3.2	Drop in water level: 2.0cm in 5hr 4min
TP09	1.7	Drop in water level: 21cm in 4hr 12min

The results indicate that the ground materials tend to be of very limited permeability.

It should also be noted that CIRIA Report 156 – Infiltration Drainage – Manual of Good Practice, recommends that any infiltration systems constructed should normally be built at least 5m away from the nearest foundation. In addition, it is noted that where draining to the underlying chalk, CIRIA Report C574 recommends that soakaways should be located at least 5m from foundations for the medium density chalk recorded at the site.

In addition, the requirements of the Environment Agency would need to be incorporated into any design which drains into an aquifer, such as on this site.

Recommendations

Based on the results, it is considered unlikely that the encountered ground materials would provide a suitable drainage medium for the site.

Closure

We hope you find the above to your satisfaction, but should you have queries please do not hesitate to contact us.

Yours sincerely

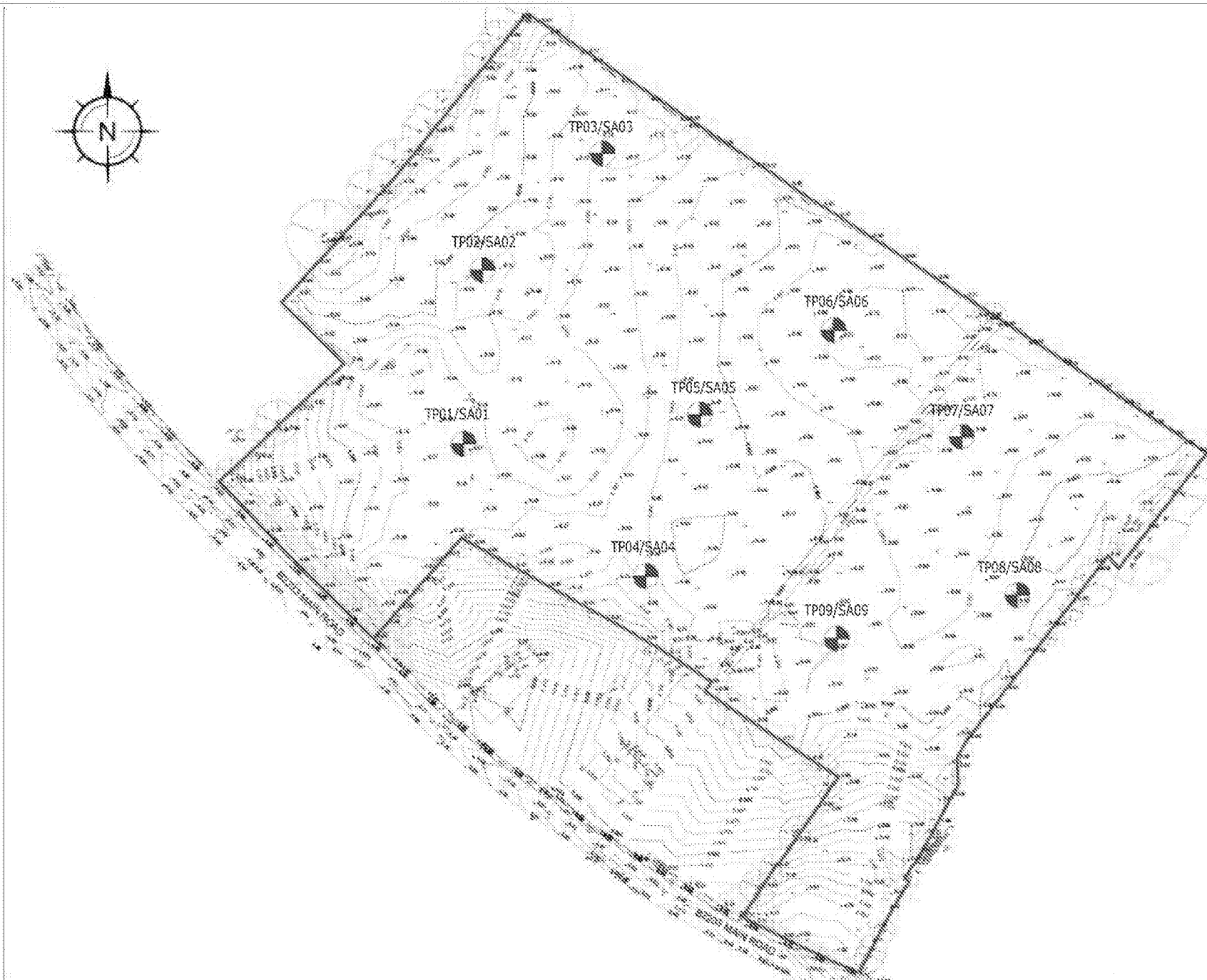
Marl Langreiter
For and on behalf of

TWEEDIE EVANS CONSULTING LIMITED

Enclosed:

- Figure 1 - Exploratory Hole Location Plan
- Exploratory Hole Logs
- Soakage Test Results

Richard Evans

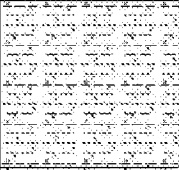
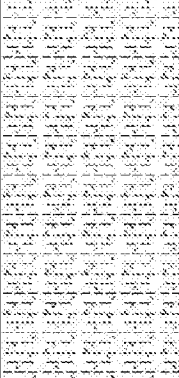
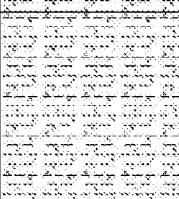


TEC Soakage Test Location:

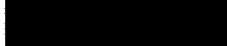


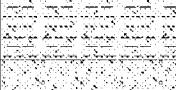
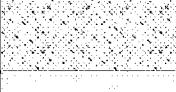
Engineering Logs

TRIAL PIT RECORD:		 TWEEDIE EVANS CONSULTING
Project Title: Bonhams Field, Yapton	Trial Pit: TP01	
Project No: 1909008.002	Dates: 22nd October 2019	
Client: The Civil Engineering Practice		

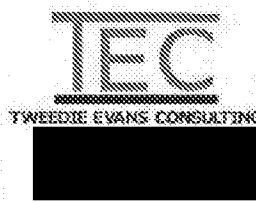
Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.30	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.				
0.80	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
2.00	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.		1.00		HSV at 1.0mbgl - 60-70 kPa
2.60	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.		2.00		HSV at 1.5mbgl - 60 kPa
	Trial Pit Terminated		2.60		HSV at 2.0mbgl - 35-40kPa
			3.00		HSV at 2.5mbgl - 35kPa

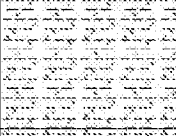
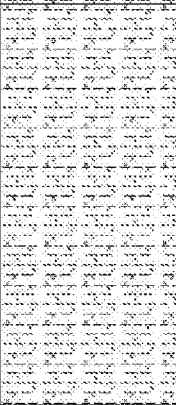
Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 22nd October 2019	B: 0.5m	Water observations: No groundwater encountered.	
Date backfilled: 22nd October 2019	A: 3.2m		
Plant: JCB 3CX		Logged by: DH	Checked by: RE
Shoring: None		Approved by: ET	
Stability: Good			

TRIAL PIT RECORD:		 TWEEDIE EVANS CONSULTING 
Project Title: Bonhams Field, Yapton	Trial Pit: TP02	
Project No: 1909008.002	Dates: 22nd October 2019	
Client: The Civil Engineering Practice		

Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.25	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.				
0.60	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.		1.00		HSV at 1.0mbgl - 65-70 kPa
					
					
			2.00		HSV at 1.5mbgl - 55-60 kPa
					
					
2.40					
2.60	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.				HSV at 2.0mbgl - 50-55kPa
2.90	RIVER TERRACE DEPOSITS [Loose] yellow-brown clayey/silty gravelly SAND with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.				HSV at 2.5mbgl - 40 kPa
	Trial Pit Terminated		3.00		

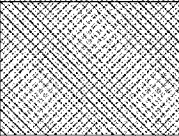
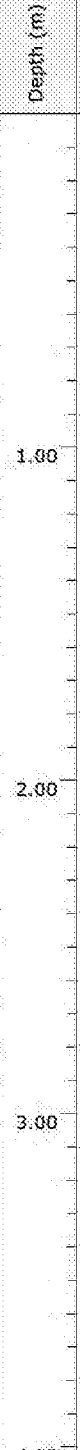
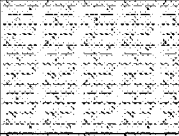
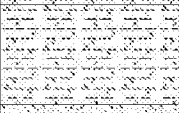
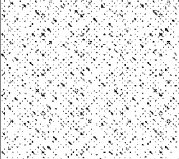
Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 22nd October 2019	B: 0.5m	Water observations: No groundwater encountered.	
Date backfilled: 22nd October 2019	A: 3.2m		
Plant: JCB 3CX		Logged by: DH	Checked by: RE
Shoring: None		Approved by: ET	
Stability: Good			

TRIAL PIT RECORD:		
Project Title: Bonhams Field, Yapton	Trial Pit: TP03	
Project No: 1909008.002	Dates: 22nd October 2019	
Client: The Civil Engineering Practice		

Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.25	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.				
0.65	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.		1.00		HSV at 1.0mbgl - 65-70 kPa
					HSV at 1.5mbgl - 60-65 kPa
			2.00		HSV at 2.0mbgl - 45-50 kPa
2.30					
	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.		3.00		HSV at 2.5mbgl - 35 kPa
					HSV at 3.0mbgl - 35-40 kPa
3.50					
	Trial Pit Terminated				

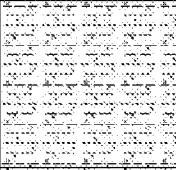
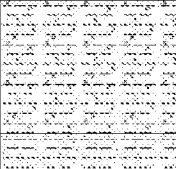
Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 22nd October 2019	B: 0.5m	Water observations: No groundwater encountered.	
Date backfilled: 22nd October 2019	A: 3.1m		
Plant: JCB 3CX		Logged by: DH	Checked by: RE
Shoring: None		Approved by: ET	
Stability: Good			

TRIAL PIT RECORD:		
Project Title: Bonhams Field, Yapton	Trial Pit: TP04	
Project No: 1909008.002	Dates: 23rd October 2019	
Client: The Civil Engineering Practice		

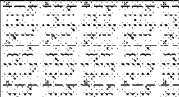
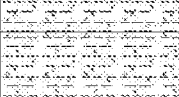
Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.40	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.				HSV at 1.0mbgl - 70-75kPa HSV at 1.5mbgl - 60-65kPa HSV at 2.0mbgl - 55 -60 kPa
0.80	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
2.10	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
2.40	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.				
2.90	RIVER TERRACE DEPOSITS [Loose] yellow-brown clayey/silty gravelly SAND with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.				
Trial Pit Terminated					

Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 23rd October 2019	B: 0.5m	Water observations: No groundwater encountered.	
Date backfilled: 23rd October 2019	A: 3.0m		
Plant: JCB 3CX		Logged by: DH	Checked by: RE
Shoring: None		Approved by: ET	
Stability: Good			

TRIAL PIT RECORD:		 TWEEDIE EVANS CONSULTING
Project Title: Bonhams Field, Yapton	Trial Pit: TP05	
Project No: 1909008.002	Dates: 23rd October 2019	
Client: The Civil Engineering Practice		

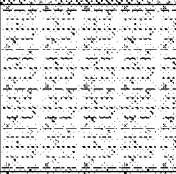
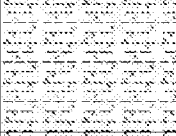
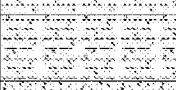
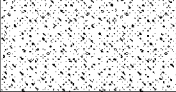
Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks	
0.30	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.		1.00		HSV at 1.0mbgl - 65-70 kPa HSV at 1.5mbgl - 55-60 kPa HSV at 2.0mbgl - 45-50 kPa HSV at 2.5mbgl - 35-40 kPa HSV at 3.0mbgl - 30-35 kPa	
0.80	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.					
2.30	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.			2.00		
2.70	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.			3.00		
3.00	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange gravelly very sandy silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint. Trial Pit Terminated		3.00			
Excavation Details:		Dimensions:	Notes and Remarks:			
Date excavated: 23rd October 2019 Date backfilled: 23rd October 2019 Plant: JCB 3CX Shoring: None Stability: Good		B: 0.5m  A: 3.2m	Water observations: No groundwater encountered. Logged by: DH Checked by: RE Approved by: ET			

TRIAL PIT RECORD:		 YWEEDIE EVANS CONSULTING W IN
Project Title: Bonhams Field, Yapton	Trial Pit: TP06	
Project No: 1909008.002	Dates: 23rd October 2019	
Client: The Civil Engineering Practice		

Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.30	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets throughout.		1.00		HSV at 1.0mbgl - 65-70 kPa HSV at 1.5mbgl - 60 kPa
0.70	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
1.80	RIVER TERRACE DEPOSITS Firm medium strength dark orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
	Trial Pit Terminated		2.00		
			3.00		

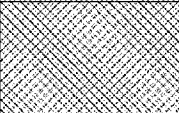
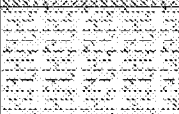
Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 23rd October 2019 Date backfilled: 23rd October 2019 Plant: JCB 3CX Shoring: None Stability: Good	B: 0.5m A: 2.9m 	Water observations:	
		Logged by: DH	Checked by: RE Approved by: ET

TRIAL PIT RECORD:		 TWE [REDACTED]
Project Title: Bonhams Field, Yapton	Trial Pit: TP07	
Project No: 1909008.002	Dates: 24th October 2019	
Client: The Civil Engineering Practice		

Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.30	MADE GROUND Grass over brown slightly gravelly sandy organic silt/clay. Gravel is flint. Fine fibrous rootlets and roots up to 10mm diameter throughout.		1.00		HSV at 1.0mbgl - 75-80 kPa
0.80	RIVER TERRACE DEPOSITS Firm to stiff orange-brown slightly gravelly slightly sandy SILT/CLAY with low cobble content. Gravel and cobbles are strong angular to subrounded flint.				
1.20	RIVER TERRACE DEPOSITS Stiff high strength orange-brown slightly gravelly slightly sandy silty CLAY. Gravel is strong fine to medium angular to subrounded flint.				
	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY. Gravel is strong fine to medium angular to subrounded flint.				
2.60			2.00		HSV at 1.5mbgl - 65-70 kPa
2.80	RIVER TERRACE DEPOSITS Soft low strength grey, buff and orange slightly sandy gravelly silty CLAY with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.		3.00		HSV at 2.0mbgl - 45-50 kPa
3.10	RIVER TERRACE DEPOSITS [Loose] yellow-brown slightly clayey/silty gravelly to very gravelly SAND with low cobble content. Gravel is strong angular to subrounded flint and very weak subrounded to rounded fine to medium chalk. Cobbles are strong angular to subangular flint.				
Trial Pit Terminated					

Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 24th October 2019 Date backfilled: 24th October 2019 Plant: JCB 3CX Shoring: None Stability: Good	B: 0.5m  A: 3.0m	Water observations: No groundwater encountered.	
		Logged by: DH	Checked by: RE Approved by: ET

TRIAL PIT RECORD:		 TWEEDALE EVANS CONSULTING
Project Title: Bonhams Field, Yapton	Trial Pit: TP09	
Project No: 1909008.002	Dates: 25th October 2019	
Client: The Civil Engineering Practice		

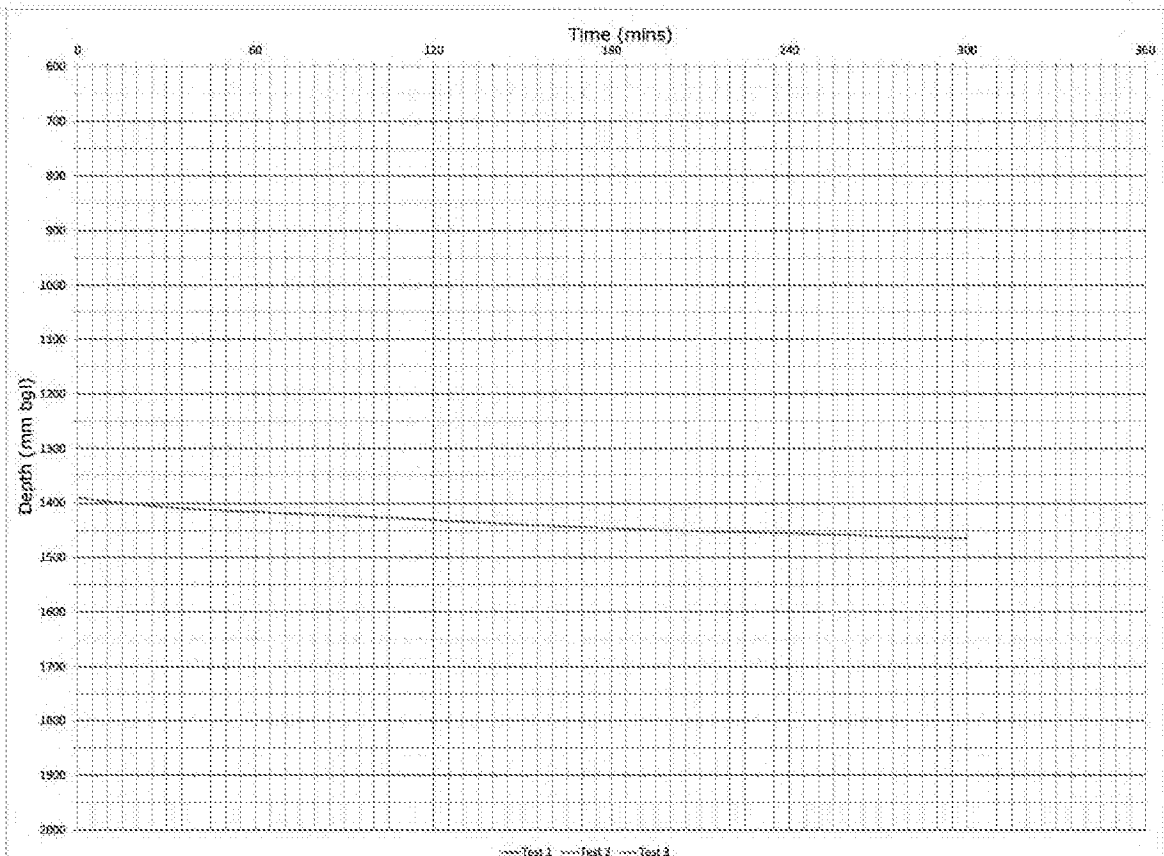
Depth (m)	Description	Legend	Depth (m)	Sample Details	Remarks
0.35	MADE GROUND Grass over brown sandy organic silt/clay. Fine fibrous rootlets throughout.		1.00		HSV at 1.0mbgl - 70-75 kPa
0.70	RIVER TERRACE DEPOSITS Stiff orange-brown slightly gravelly slightly sandy SILT/CLAY. Gravel is strong angular to subrounded flint.				
1.50	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly gravelly slightly sandy silty CLAY with low cobble content. Gravel is strong fine to medium angular to subrounded flint. Cobbles are strong angular to subangular flint.				
1.70	RIVER TERRACE DEPOSITS Firm medium strength orange-brown slightly sandy gravelly silty CLAY with moderate cobble content. Gravel and cobbles are strong angular to subrounded flint.				
	Trial Pit Terminated		2.00		HSV at 1.5mbgl - 60-70 kPa
			3.00		

Excavation Details:	Dimensions:	Notes and Remarks:	
Date excavated: 25th October 2019	B: 0.5m	Water observations: No groundwater encountered.	
Date backfilled: 25th October 2019	A: 2.9m		
Plant: JCB 3CX		Logged by: DH	Checked by: RE
Shoring: None		Approved by: ET	
Stability: Good			

BRE365 Soakage Test Data

TEC
TWEEDIE EVANS CONSULTING

THRODDE SWANE CLARK ET AL.

[illegible]

Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2018) Soakaway Design

Address	Bonhams Fields, Yapton
Access Number	1909008.001
Access Point Reference	T902
Access Point	Seaward Homes
Access Point	On
Access Point	22/10/2019

Time (m)	Depth (mm bg)
0.0	1.745
1.0	1.745
2.0	1.745
3.0	1.745
4.0	1.745
5.0	1.745
6.0	1.745
7.0	1.745
8.0	1.745
9.0	1.745
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239.0	1.745
240.0	1.745
241.0	1.745
242.0	1.745
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268.0	1.745
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272.0	1.745
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287.0	1.745
288.0	1.745
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303.0	1.745
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324.0	1.745
325.0	1.745
326.0	1.745
327.0	1.745
328.0	1.745
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330.0	1.745
331.0	1.745
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333.0	1.745
334.0	1.745
335.0	1.745
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337.0	1.745
338.0	1.745
339.0	1.745
340.0	1.745
341.0	1.745
342.0	1.745
343.0	1.745
344.0	1.745
345.0	1.745
346.0	1.745
347.0	1.745
348.0	1.745
349.0	1.745
350.0	1.745
351.0	1.745
352.0	1.745
353.0	1.745
354.0	1.745
355.0	1.745
356.0	1.745
357.0	1.745
358.0	1.745
359.0	1.745
360.0	1.745

Test 2	
Time (m)	Depth (mm bg)

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Project:	Bonhams Fields, Yapton
Project Number:	1909008.001
Est. No. References:	TP05
Client:	Seaward Homes
Manager:	DH
Issue Date:	22/10/2019

Test 1		
Time (min)	Depth (mm)	Score
0.0	1.420	
5	1.480	
10	1.535	
15	1.600	
20	1.615	
25	1.625	
30	1.530	
35	1.545	
40	1.570	
45	1.585	
50	1.575	

[illegible][illegible][illegible]

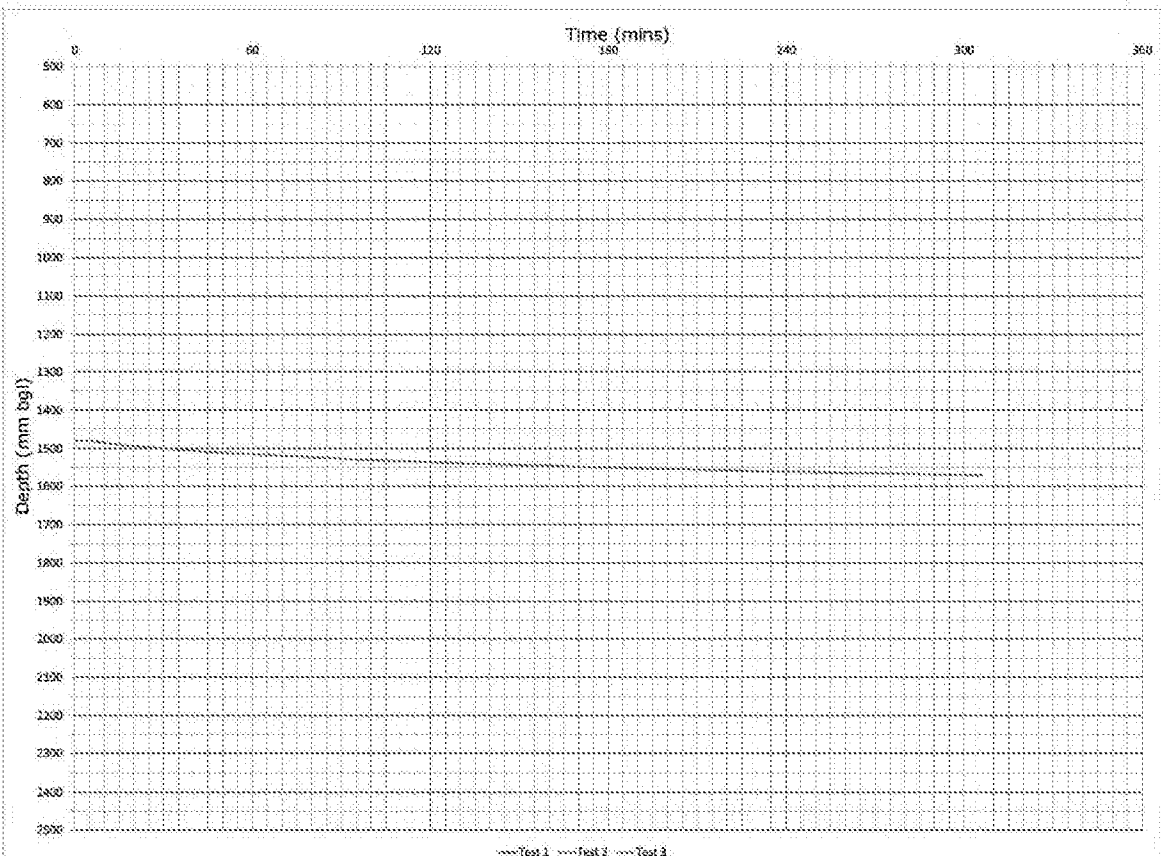
Parameter	Value
Pit depth (m)	3.00
Pit width (m)	1.59
Pit length (m)	3.26
Depth to grouting water (m)	
Gravel Pit used to surround the pit	N

	Test 1	Test 2	Test 3
Student's average score (avg)	1809		
Standard deviation (std dev)	3466		
Maximum score (max)	1871		
Score percentile (score / max)	1809		
Score standard score (z-score)	2746		
Score standard error (std err)	2524		
Sample size (n)			
Population size (N)			

	1.22		
	7.22		
	0		

Note: Where granular fill used to stabilize the base pit, concrete should be 30% free volume.

Soil Infiltration Rate (m/sec)			
Soil Infiltration Rate (mm/hr)			
Extrapolated Data?			



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Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2018) Soakaway Design

Address	Bonhams Fields, Yapton
Project Number	1909008.001
Client Reference	TPO
Site Name	Seaward Homes
Location	On
Date	24/10/2019

Time (m)	Depth (mm bg)
0.0	2035
1	2035
2	2035
3	2035
4	2035
5	2035
6	2035
7	2035
8	2035
9	2035
10	2035
11	2035
12	2035
13	2035
14	2035
15	2035
16	2035
17	2035
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345	2035
346	2035
347	2035
348	2035
349	2035
350	2035

Test 2	
Time (m)	Depth (mm bg)

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Trial Pit Soakage Test Summary Sheet

BRE Digest 365 (2018) Soakaway Design

Address	Bonhams Fields, Yapton
Access Number	1909008.001
Access Point Reference	TPO
Property	Seaward Homes
On	On
Date	25/10/2019

Test 1	
Time (m)	Depth (mm bg)
0.0	500
1.0	500
2.0	500
3.0	500
4.0	500
5.0	500
6.0	500
7.0	500
8.0	500
9.0	500
10.0	500
11.0	500
12.0	500
13.0	500
14.0	500
15.0	500
16.0	500
17.0	500
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31.0	500
32.0	500
33.0	500
34.0	500
35.0	500
36.0	500
37.0	500
38.0	500
39.0	500
40.0	500
41.0	500
42.0	500
43.0	500
44.0	500
45.0	500
46.0	500
47.0	500
48.0	500
49.0	500
50.0	500
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84.0	500
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293.0	500
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295.0	500
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297.0	500
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299.0	500
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359.0	500
360.0	500

Test 2	
Time (m)	Depth (mm bg)
0.0	500
1.0	500
2.0	500
3.0	500
4.0	500
5.0	500
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10.0	500
11.0	500
12.0	500
13.0	500
14.0	500
15.0	500
16.0	500
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153.0	500
154.0	500
155.0	500
156.0	500
157.0	500
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160.0	500
161.0	500
162.0	500

TP1 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	3.2 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.6 m ²	
Start Depth	1.21 m	
End Depth	1.135 m	
Volume of water lost from pit		0.12 m ³
Average effective drainage area including base		1.8775 m ²
Test Duration	18000 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	3.55E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	3.55E-06 m/s

TP2 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	3.2 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.6 m ²	
Start Depth	1.16 m	
End Depth	1.095 m	
Volume of water lost from pit		0.104 m ³
Average effective drainage area including base		1.8405 m ²
Test Duration	15720 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	3.59E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	3.59E-06 m/s

TP3 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	3.1 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.55 m ²	
Start Depth	1.47 m	
End Depth	1.44 m	
Volume of water lost from pit		0.0465 m ³
Average effective drainage area including base		1.658 m ²
Test Duration	14400 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	1.95E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	1.95E-06 m/s

TP5 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	3.2 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.6 m ²	
Start Depth	1.52 m	
End Depth	1.43 m	
Volume of water lost from pit		0.144 m ³
Average effective drainage area including base		1.933 m ²
Test Duration	18360 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	4.06E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	4.06E-06 m/s

Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	2.9 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.45 m ²	
Start Depth	1.23 m	
End Depth	1.07 m	
Volume of water lost from pit		0.232 m ³
Average effective drainage area including base		1.994 m ²
Test Duration	17340 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	6.71E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	6.71E-06 m/s

TP7 Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	3 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.5 m ²	
Start Depth	0.97 m	
End Depth	0.92 m	
Volume of water lost from pit		0.075 m ³
Average effective drainage area including base		1.675 m ²
Test Duration	18060 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	2.48E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	2.48E-06 m/s

TP8 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	2.8 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.4 m ²	
Start Depth	0.94 m	
End Depth	0.92 m	
Volume of water lost from pit		0.028 m ³
Average effective drainage area including base		1.466 m ²
Test Duration	18240 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	1.05E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	1.05E-06 m/s

TP9 - Alternate Method based on actual volume discharged over observed time period

Width of Trial Pit	0.5 m	
Length of Trial Pit	2.9 m	
or		
Diameter of Borehole	0 m	
Surface area of pit	1.45 m ²	
Start Depth	1.01 m	
End Depth	0.8 m	
Volume of water lost from pit		0.3045 m ³
Average effective drainage area including base		2.164 m ²
Test Duration	15120 s	

Infiltration rate = Volume discharged / (effective drainage area x test duration)

Infiltration rate =	9.31E-06 m/s
Factor of Safety	1
Design Infiltration Rate =	9.31E-06 m/s

Appendix 5

Flood Maps

Flood map for planning

Your reference
Bonhams Field

Location (easting/northing)
497486/103397

Created
9 Sep 2020 15:44

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

This means:

- you don't need to do a flood risk assessment if your development is smaller than 1 hectare and not affected by other sources of flooding
- you may need to do a flood risk assessment if your development is larger than 1 hectare or affected by other sources of flooding or in an area with critical drainage problems

Notes

The flood map for planning shows river and sea flooding data only. It doesn't include other sources of flooding. It is for use in development planning and flood risk assessments.

This information relates to the selected location and is not specific to any property within it. The map is updated regularly and is correct at the time of printing.

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<https://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/>



Flood map for planning

Your reference

Bonhams Field

Location (easting/northing)

497486/103397

Scale

1:2500

Created

9 Sep 2020 15:44

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

0 20 40 60m



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map A1-F - Actual and Residual Risk of Flooding from Rivers



CAPITA SYMONDS

Legend

- Arun District Boundary
- Actual Defended Fluvial Flood Risk (1% AEP, 2006)
- Residual Defended Fluvial Flood Risk (0.1% AEP, 2006)

0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-F.wor



Notes:

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map A1-T - Actual and Residual Flooding from the Sea



CAPITA SYMONDS

Legend

-  Arun District Boundary
-  Actual Defended Tidal Flood Risk (0.5% AEP, 2006)
-  Residual Defended Tidal Flood Risk (0.1% AEP, 2006)
-  Coastal Risk Area

0 2 4
Kilometres

Scale at A3: 1:80,000

Date: 31/01/2008

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Map_A1-T.wor



Notes

The Arun SFRA is a strategic assessment of flooding. Users of the SFRA should be aware of this when interpreting the information presented. The user is directed to the SFRA reports which outline the uncertainties associated with the studies. Particular attention is drawn to the following:

- Flood extent boundaries are not considered definitive. Land adjacent to these areas may also be at risk.
- Some flooding mechanisms have not been included in the assessment. The 'coastal risk area' is based on advice from LA Engineers and requires further assessment.

Arun District Council SFRA

Map B - Residual Risk from Breach



CAPITA SYMONDS

Legend

- Arun District Boundary
- Main River
- Modelled Fluvial Breach Extents - Residual Risk
- Modelled Tidal Breach Extents - Residual Risk
- Proposed Breach Locations

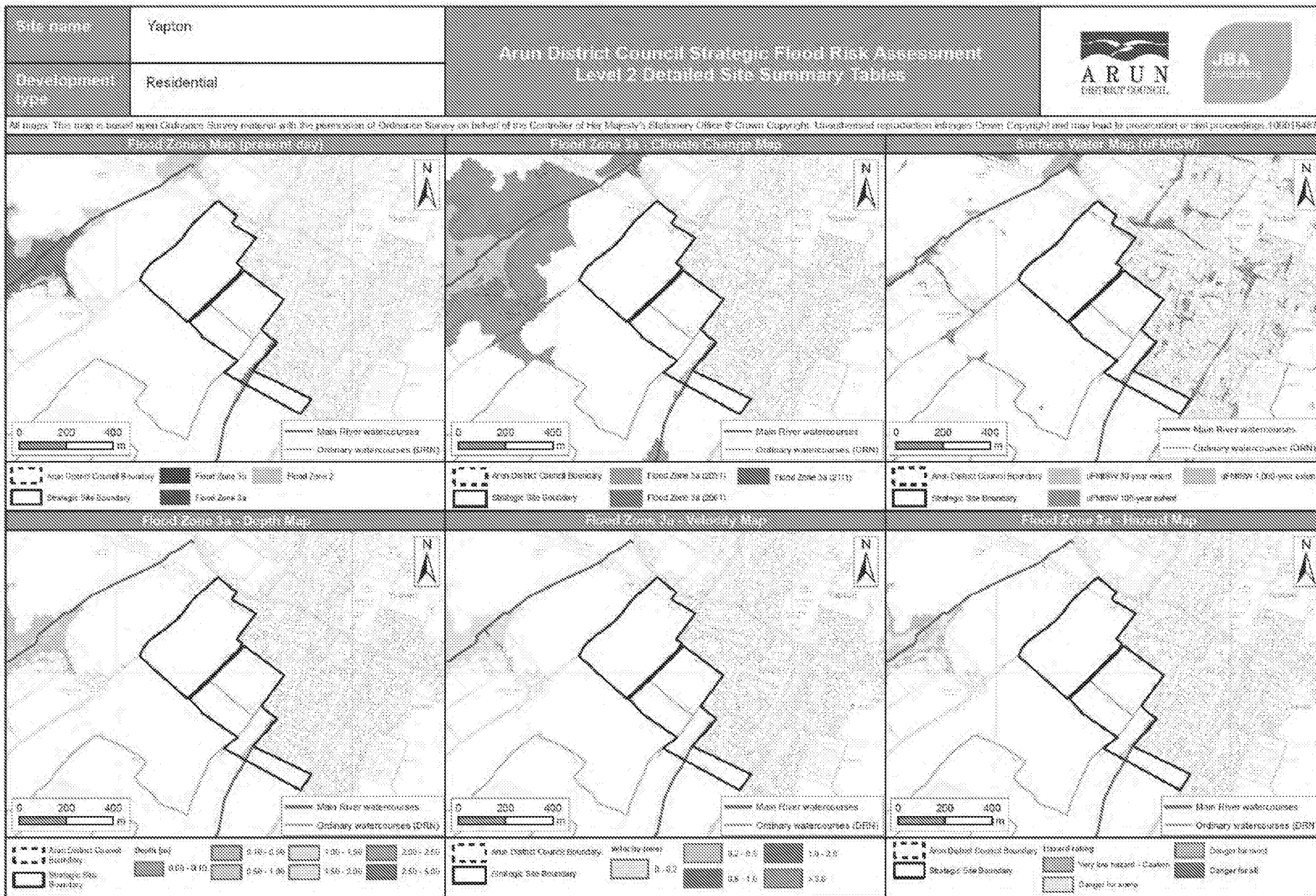
0 2 4
Kilometres

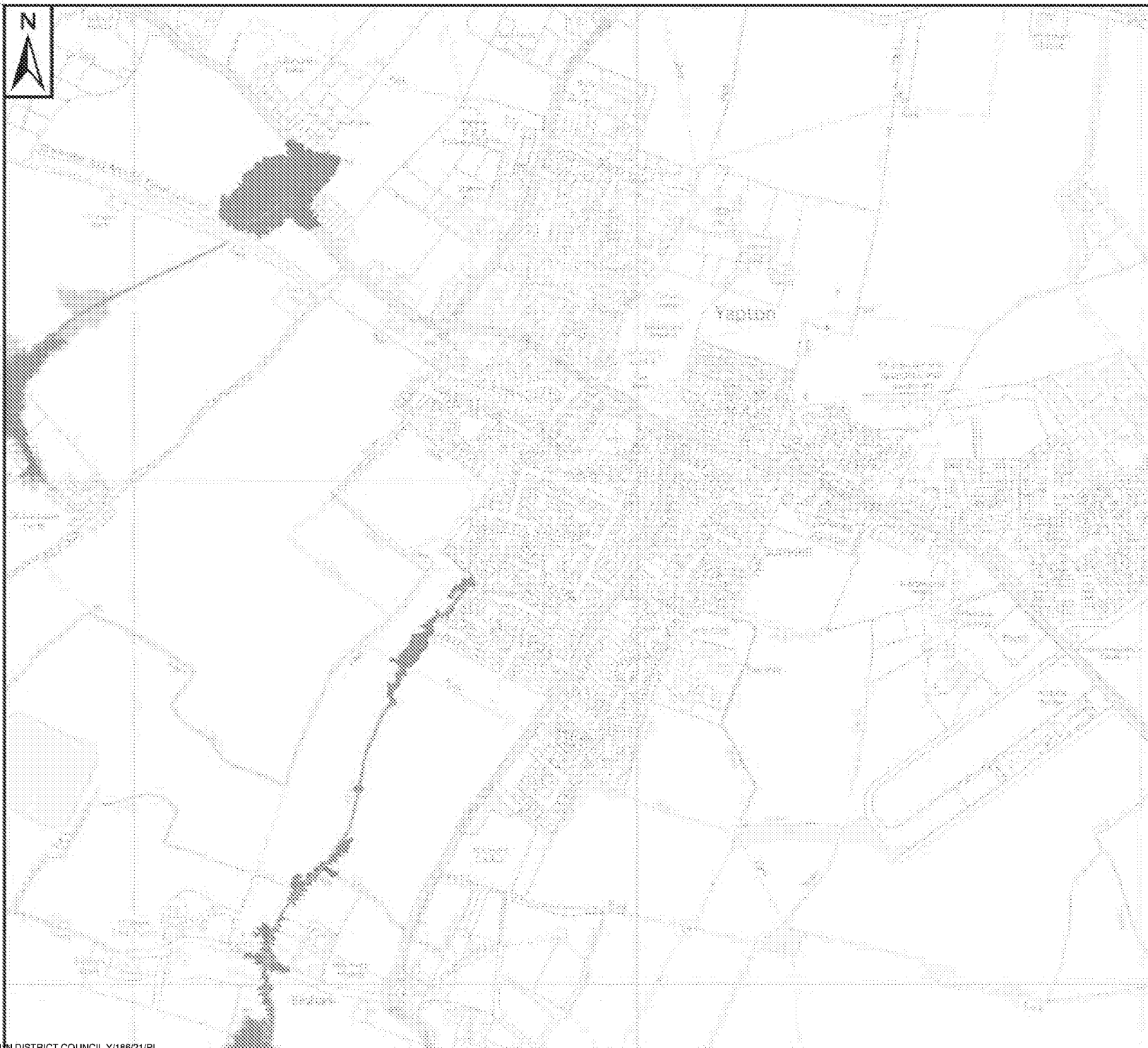
Scale at A3: 1:80,000

Date: 31/01/2008

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Map_B.wor





Notes

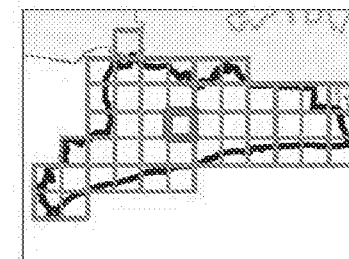
Zone 1: Composed of land having a less than 1 in 1,000 annual probability of river or sea flooding in any year.

Zone 2: Composed of land having between a 1 in 100 and 1 in 1,000 annual probability of river flooding or 1 in 200 and 1 in 1,000 annual probability of sea flooding in any year.

Zone 3a: This zone comprises land assessed as having a greater than 1 in 100 annual probability of river flooding or a greater than 1 in 200 annual probability of flooding from sea in any year.

Zone 3b: This zone comprises land where water has to flow to be stored at times of flood (the functional floodplain). The SFRA identified this Flood Zone as land which would flood with an annual probability of 1 in 20 years, where detailed modelling exists. In the absence of detailed hydraulic model information, a precautionary approach has been adopted with the assumption that the extent of Flood Zone 3b would be equal to Flood Zone 3a. If development is shown to be in Flood Zone 3a, further work should be undertaken as part of a detailed site specific

Key Plan



Legend

- Arun District SFRA boundary
- Flood Zone 3b
- Flood Zone 3a
- Flood Zone 2

0 0.125 0.25 0.5
kilometres

REF	Date	Comments
A	June 2015	
B		
C		

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ARUN DISTRICT COUNCIL

LEVEL 1 SFRA/APPENDIX C FLOOD ZONES

Sheet No: 01 of 10 Index Number: A00_01

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100 Best Fishing Spots in Vermont	
Lake Umbagog	Lake Umbagog
Lake Umbagog	Lake Umbagog
Lake Umbagog	Lake Umbagog
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Lake Umbagog	Lake Umbagog
Lake Umbagog	Lake Umbagog



REF	Date	Comments
A	June 2015	
B		
C		

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LEVEL 1 SFPA: APPENDIX B
WATERCOURSES

Abstract

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The updated Flood Map for Surface Water (FLOODS) shows the flooding that takes place from the surface runoff generated by rainwater (including snow and other precipitation) when it is on the surface of the ground (whether or not it is moving), and

(b) has not yet entered a constructed drainage system or public sewer.

The USGS will pick out natural drainage channels, rivers, low water in the floodplain and flow paths between lowlands, but it will only indicate flooding caused by local rainfall.

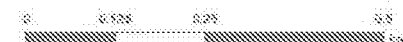
Notes: The *df*MSSE shows predictions of flooded areas but does not show whether individual properties will be affected by surface water flooding or have been affected in the past. The *df*MSSE should not be used to predict if individual properties will flood.

Asian District SFRA boundary

of 30000 30-year extent

of 30000 100-year extent

of 30000 1,000-year extent



REF	Date	Comments
a	June 2016	
b		
c		

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ARLUN DISTRICT COUNCIL

LEVEL 1 SFRA: APPENDIX E
SURFACE WATER FLOOD RISK

[illegible]

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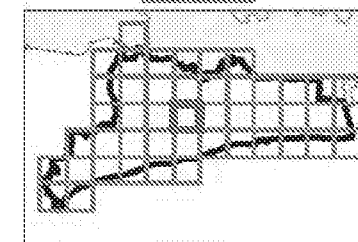
Notes

The *Areas Susceptible to Groundwater Flooding (ASGWF)* is a strategic scale map showing groundwater flood areas on a 1km square grid. The data was produced to assist the *Initial Flood Risk Areas for Preliminary Flood Risk Assessment (PFRA)* studies and allow the *Lead Local Flood Authority (LLFA)* to determine whether there may be a risk of flooding from groundwater.

This data shows the proportion of each 1km grid square where geological and hydrogeological conditions show that groundwater might emerge. It does not show the likelihood of groundwater flooding occurring. It does not take account of the chance of flooding from groundwater recharge. This dataset covers a large area of land, and only isolated locations within the overall catchment area are actually likely to suffer the consequences of groundwater flooding.

The ASGWF data should be used only in combination with other information, for example local data or historic data. It should not be used as sole evidence for any specific flood risk management, land use planning or other decisions at any scale. However, the data can help to identify areas for assessment of a local scale where first resolution datasets exist.

Key Plan



Legend



Arun District SFRA boundary



< 25%



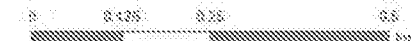
25% - 49%



50% - 74%



> 75%



REF	Date	Comments
1	June 2015	-
2		
3		

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ARUN DISTRICT COUNCIL LEVEL 1 SFRA APPENDIX F AREAS SUSCEPTIBLE TO GROUNDWATER

Sheet No: 01 of 15 Index Number: A00_01

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ARUN
DISTRICT COUNCIL



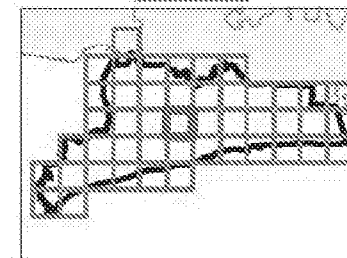
Notes

The Historic Flooding Map shows the recorded incidents and flood extents provided by Arun District Council, West Sussex County Council, Southern Water and Environment Agency. Historical flood extent was obtained from the Environment Agency.

Flooding incidents provided have been categorised based upon the details provided in the records. Unknown flood extents could not be determined from the information provided, and therefore could be from a number of sources.

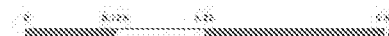
Please note that not all historical records may be shown on this map, and that it is therefore advised you contact Arun District Council for updated information post 2015.

Key Plan



Legend

- | | |
|---|---|
|  Arun District SFRA boundary |  Total |
|  Historic flood outline |  Surface Water |
| Source of Flooding | |
|  Partial |  Feature |
|  Channel |  Unknown |



REF	Date	Comments
1	June 2016	
2		
3		

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ARUN DISTRICT COUNCIL LEVEL 1 SFRA APPENDIX H HISTORIC FLOODING RECORDS

Sheet No: 21 of 25 Index Number: AOC_21

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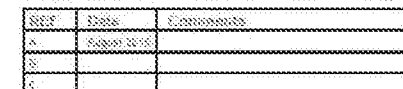


Hydraulic modelling has been undertaken as part of this EFRA to provide updated climate change flood mapping in the Arun District for Flood Zone 3a. This modelling followed the latest guidance for climate change in EFRA/EFRA released by the Environment Agency in February 2016 (and updated in April 2017). Climate change for flood events has been based on the Higher Central estimates for the years 2031, 2061 and 2111. Present day flood risk information is available for comparison. Arun District is within the South East River Basin District and therefore allowances are:

- 2031 = +15% flows
- 2061 = +30% flows
- 2111 = +45% flows

For catchment models, unattended case still water level and defending case still water level with wave overtopping simulations have been completed to inform future flood risk within the Arun District. Again, climate change allowance reductions are for the years 2031, 2061 and 2111, with present day values for comparison.

	Actual Observed Diff: 8 secondary		Pattern Flood Zone: 8 (2000)
	Pattern Flood Zone: 8		Pattern Flood Zone: 8 (2011)
	Pattern Flood Zone: 8 (2011)		



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LEVEL 1 SEPA: APPENDIX C
CLIMATE CHANGE MAPPING[illegible]

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Appendix 6

Proposed Site Layout Plan and Impermeable Areas Plan