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Flood Risk Assessment

Proposed Glasshouse Development at

**Lower Farm, Yapton Lane
Walberton, West Sussex**

On behalf of

John Hall Consulting

November 2020

Document History and Status

Project Number 23375

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28 Aug 2020	1.0	Steve Doughty Director	Stuart Magowan IEng MICE	Stuart Magowan IEng MICE
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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 John Hall Consulting in support of a Planning Application for the construction of 5 hectares of commercial glasshouse and irrigation reservoir together with associated access roads and car parking on existing farmland located to the east of the B2132 Yapton Lane, Walberton, West Sussex.
- 1.2 This Assessment is to be read in conjunction with all planning, architectural and other reports that accompany the Planning Application for the proposed development.
- 1.3 The site is located in Flood Zone 1.
- 1.4 The proposed development will incorporate a sustainable drainage system which will discharge surface water to an onsite irrigation reservoir.
- 1.5 Under normal circumstances 100% of water collected from the site will be reused for irrigation and there will be no discharge of surface water from the site.
- 1.6 Only in the event of a 1:100 year +40% pluvial event occurring while the irrigation water level within the reservoir is already at the peak operational level will a discharge be made at a suitably restricted rate to the existing drainage ditch to the east of the site.
- 1.7 Sufficient additional storage will be provided within the reservoir above the level of the peak operational irrigation water for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 1.8 Foul drainage will be discharged to the existing public foul sewer located beneath the B2132 Yapton Lane to the southwest of the site.
- 1.9 This report concludes that the development will not be at risk of flooding from tidal or fluvial sources, overland flows or groundwater.
- 1.10 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 February 2019.

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 In addition Arun District Council have, in collaboration with Chichester District Council, produced 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:

- a) *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;*
- b) *reduces the risk to homes and places of work from flooding whilst increasing biodiversity;*
- c) *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:

- a) *Sufficient water supplies can be provided prior to occupation to serve the development and;*
- b) *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:

- a) *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:*

- a) The sequential test in accordance with the National Planning Policy Guidance has been met.*
- b) 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.*
- c) The sustainability benefits to the wider community are clearly identified.*
- d) The scheme identifies adaptation and mitigation measures.*
- e) 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:

- a) Contribute positively to the appearance of the area, integrating access to allow maintenance of existing watercourses and the system.*
- b) Effectively manage water (including its quality)*
- c) Accommodate and enhance biodiversity by making connections to existing Green Infrastructure assets and*
- d) Provide amenity for local residents (ensuring a safe environment)*
- e) Retain the existing drainage network of the site and the wider area,*
- f) 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:

- f) 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.*
- g) Undertake up to six months groundwater monitoring within the winter period.*
- h) Undertake winter percolation testing in accordance with BRE365.*
- i) The proposed drainage system must be designed to ensure that there is no flooding on a 1 in 30 year storm event.*
- j) 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:

- a) Location (in relation to flood risk and vulnerability to coastal erosion);*
- b) Water efficiency;*
- c) Shade, cooling, ventilation, solar gain;*
- d) Connectivity to the green infrastructure network;*
- e) Layout and massing;*
- f) Resilience of buildings and building materials to extreme weather events;
and*
- g) 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 farmland which forms part of Lower Farm to the east of the B2132 Yapton Lane, Walberton, West Sussex at Ordnance Survey reference SU 979 049. The nearest postcode is BN18 0DN.



Image 1: Site Location

3.1.2 The site is bounded to the north by agricultural farmland, to the south by agricultural farmland beyond which is the Little Tortington Stream (main river) and the West Coastway railway line, to the west by the B2132 Yapton Lane and to the east by agricultural farmland.

3.1.3 There are field drains to the east of the site and to its south east which ultimately discharge to the Little Tortington Stream to the south of the site.

3.1.4 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 site is approximately 9.3ha in area and currently comprises undeveloped agricultural land.
- 3.2.2 Existing ground levels are highest at the north of the site at approximately 11m AOD. The site falls towards its southern boundary to a level of approximately 9m AOD.
- 3.2.3 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 currently discharges in part to ground and in part overland as a greenfield runoff to the Little Tortington Stream.
- 3.3.3 Pre-developed greenfield runoff rates have been established using the HR Wallingford tool for Greenfield runoff estimation as follows:

Calculated by: Steve Doughty Site name: Lower Farm Site location: Walserton This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance 'Fairfield runoff management for developments', SC030219 (2013), the SuDS Manual (CWA, 2015), and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting constraints for the drainage of surface water runoff from sites.	Site Details Latitude: <input n"="" type="text" value="50°53'30"/> Longitude: <input type="text" value="0°52'51" w"=""/> Reference: 2172792E05 Date: Nov 26 2020 10:58
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Runoff estimation approach: RH124					
Site characteristics: Rivers					
Total site area (ha): 1	(1) Is $Q_{bar} < 2.0 \text{ l/s/ha}$?				
Methodology	When Q_{bar} is $< 2.0 \text{ l/s/ha}$ then limiting discharge rates are set at 2.0 l/s/ha .				
Q_{bar} estimation method: Calculate from SPR and SAAR SPR estimation method: Calculate from SDIL type					
Soil characteristics					
SDIL type: <table border="1" style="display: inline-table;"><tr><th>Default</th><th>Edited</th></tr><tr><td>2</td><td>2</td></tr></table>	Default	Edited	2	2	(2) Are flow rates $< 5.0 \text{ l/s}$?
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HOST class: <table border="1" style="display: inline-table;"><tr><th>Default</th><th>Edited</th></tr><tr><td>N/A</td><td>N/A</td></tr></table>	Default	Edited	N/A	N/A	Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if 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.
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Hydrological characteristics					
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Growth curve factor 200 years: <table border="1" style="display: inline-table;"><tr><th>Default</th><th>Edited</th></tr><tr><td>3.74</td><td>3.74</td></tr></table>	Default	Edited	3.74	3.74	Where groundwater levels are low enough the use of soakways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.
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Greenfield runoff rates					
Q_{bar} (l/s): <table border="1" style="display: inline-table;"><tr><th>Default</th><th>Edited</th></tr><tr><td>1.96</td><td>1.96</td></tr></table>	Default	Edited	1.96	1.96	
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This report was produced using the greenfield runoff tool developed by HR Wellingford and available at www.hr-wellingford.co.uk. The use of this tool is subject to the HR Wellingford terms and conditions and license agreement, which can both be found at www.hr-wellingford.co.uk. The outputs from this tool are estimates of greenfield runoff rates. The use of these results is the responsibility of the user of the tool. No liability will be accepted by HR Wellingford, the Environment Agency, CEA, Hydrological or any other organisation for the use of this data in the design or operational standards for any drainage system.					

Image 2: Greenfield Runoff Calculation

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

- Q_{bar} 2 l/s/ha
- 1:100 year 6.3 l/s/ha

3.3.2 There are 150mm and 175mm diameter public foul sewers located beneath the B2132 Yapton Lane to the southwest of the site.

3.3.3 A copy of the sewer records is located in Appendix 3 at the 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 clays and sandy clays to a depth of approximately 5m below ground level.
- 3.4.2 Groundwater was encountered at a depth of 3m below ground level.
- 3.4.3 The online “Magic Map” available from Defra confirms that the site is located in an area where groundwater is classified as having a low to medium vulnerability.
- 3.4.4 A site specific site investigation will be undertaken to confirm winter groundwater levels. Given the intention to store all rainwater on the site for reuse in irrigation no infiltration testing is proposed or required.
- 3.4.5 A copy of the geological borehole data is 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 map of historic flood incidents identifies a short section of the B2132 Yapton Lane to the southwest of the site which has historically suffered localised flooding but do not identify any historic incidents directly affecting the site.

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 a short section of the B2132 Yapton Lane to the southwest of the site, (as identified by the Environment Agency mapping), which has historically suffered localised flooding. A point location attributed to fluvial flooding is also identified on the B2132 Yapton Lane to the west of the site.
- 4.2.3.2 There are however no records of any flood incidents directly affecting the site.
- 4.2.3.3 Copies of the available flood maps and correspondence 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, located within Flood Zone 1 and is not at risk of tidal flooding.

5.2 Fluvial Flooding

- 5.2.1 The site is located within Flood Zone 1 and is not at risk of fluvial flooding.

5.3 Groundwater Flooding

- 5.3.1 The British Geological Survey borehole log information recorded groundwater at a depth of 3m below ground level. The time of year is not recorded.
- 5.3.2 The mapping contained within Arun District Council's latest Strategic Flood Risk Assessment dated November 2016 identifies the location of the site as being within an area of 1 square kilometre where the geology is such that groundwater might emerge within 50-75% of that area. No indication of likelihood is given.
- 5.3.3 There are however 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 confirm that the site is at very low risk of flooding from overland surface water.
- 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 River Arun via the Little Tortington Stream.

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

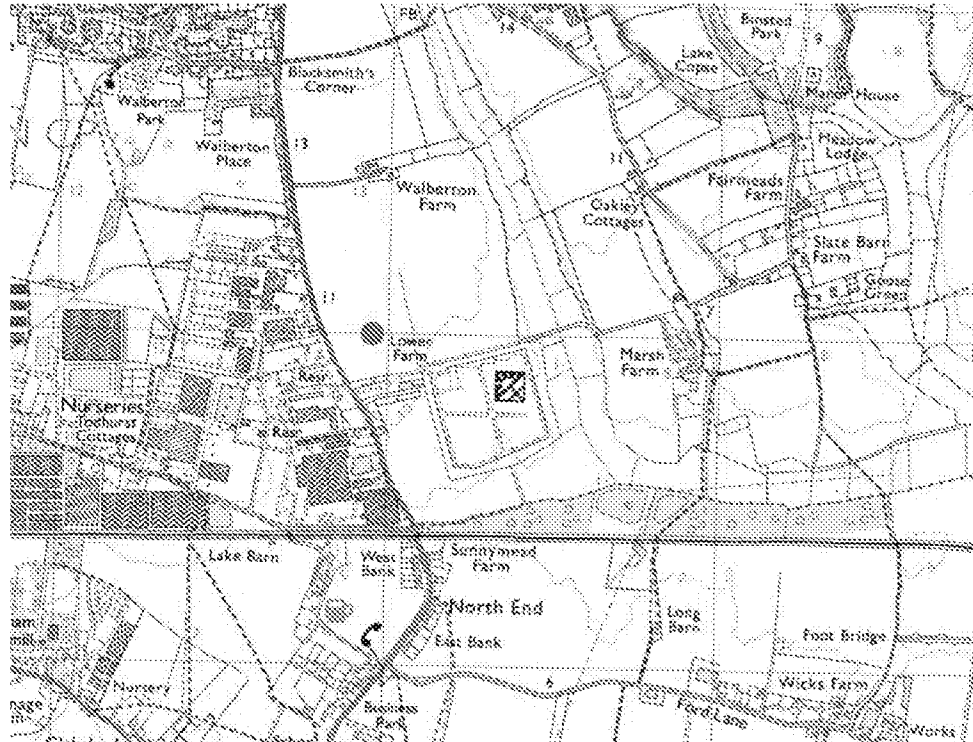


Image 3: Local Topography

6 Development Proposals

6.1 Description

6.1.1 The development proposals are for the construction of a 5ha glasshouse and an irrigation reservoir together with associated access and car parking.

6.1.2 The areas of the various elements of the development are summarised as follows:

- Roof areas 51,375m²
- Access road and parking areas 3,450m²
- Permeable perimeter track 3,400m²

6.1.3 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.

6.2 Surface Water Drainage

6.2.1 Rainwater from the glasshouse roof will be collected and discharged to the irrigation reservoir via a symphonic drainage system and under normal circumstances will provide 100% rainwater recycling for irrigation.

6.2.2 Surface water runoff from the service yard and car parking area will be collected within a voided subbase and filter trench beneath a permeable surface which will provide treatment prior to being discharged by gravity to the reservoir.

6.2.3 The reservoir will be sized with sufficient storage beyond the normal irrigation requirement to accommodate a 1:100 year storm event including an additional 40% to account for the predicted effects of future climate change.

6.2.4 Only in the event that the operational capacity of the reservoir is already full during a significant rainfall event will there be a surface water discharge from the site.

6.2.5 The total impermeable area discharging to the reservoir will be approximately 5.48ha and the equivalent Q_{bar} greenfield runoff at 2l/s/ha is 11/s.

6.2.6 Calculations have been prepared in order to determine the additional storage required beyond the operational irrigation requirement and the additional freeboard required to accommodate a 1:100 year return period storm occurring at a time when the irrigation reservoirs have their maximum operational water already available.

6.2.7 The calculations confirm that with 300mm of freeboard the top 640mm of water will be required to accommodate a 1:100 year +40% storm which will be restricted to 11l/s and discharged to the Little Tortington Stream to the south of the site via a new drainage channel which will be provided from the reservoir outfall to the existing drainage ditch to the southeast of the site.

6.2.8 The various reservoir design levels are summarised as follows:

- Top of reservoir bank (ground level) 9.00m AOD
- Top of 1:100 year + 40% storage 8.70m AOD
- Maximum Irrigation water level 8.06m AOD

6.3 Foul Water Drainage

6.3.1 Foul drainage will be discharged to the existing public foul sewer located beneath the B2132 Yapton Lane to the southwest of the site.

6.3.2 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.

6.3.3 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.

6.4 Water Quality

6.4.1 The proposed development is for commercial use. In accordance with CIRIA report C753 - The SuDS Manual, the pollution hazard level for this type of development ranges between low and medium depending on the use / area of the site.

6.4.2 The surface water scheme will include mitigation to ensure that surface water is suitably treated and any pollution risk adequately managed prior to irrigation reuse or in the event of a restricted discharge to the local watercourses.

6.4.3 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	Hydrocarbons
Commercial / Industrial roofs	Low	0.3	0.2	0.05
Low-traffic roads	Low	0.5	0.4	0.4
Commercial yards and delivery areas	Medium	0.7	0.6	0.7

Table 1: Pollution Hazard Indices

6.4.4 The Pollution Mitigation Indices which are of relevance to the development proposals are as follows:

SuDS Type	Total suspended solids (TSS)	Metals	Hydrocarbons
Filter strip	0.4	0.4	0.5
Filter drain	0.4	0.4	0.4
Swale	0.5	0.6	0.6
Permeable pavement	0.7	0.6	0.7
Detention basin	0.5	0.5	0.6
Pond	0.7	0.7	0.5
Propriety Treatment Systems	These must demonstrate that they can address each of the contaminant types to acceptable levels for inflow concentrations relevant to the contributing drainage area		

Table 2: Pollution Mitigation Indices

- 6.4.5 Where multiple drainage components are used in series the individual mitigation index of secondary and tertiary components is lowered by 50% due to reduced performance associated with primary treatment.
- 6.4.6 The detailed drainage design will be undertaken such that its combined elements meet the target treatment level required for runoff with low to medium risk 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.
- 6.4.7 An outline 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 is located in Flood Zone 1.

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

Land and buildings used for agriculture are classified as less vulnerable.

- Table 3: Flood Risk Vulnerability and Flood Zone Compatibility

Less Vulnerable development is appropriate in Flood Zones 1, 2 and 3.

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 Post development onsite flow routes for exceedance flows, should any ever occur, have been provided so as to maintain routes to the Little Tortington Stream to the south of the site and mimic the path of any existing flow routes.

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

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

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

8 Conclusions

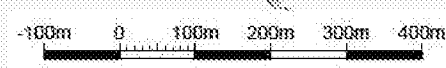
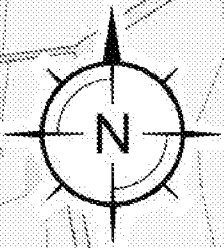
- 8.1 The site is located in Flood Zone 1 and is not at risk from any source of flooding.
- 8.2 There are no historic records of flooding from any source affecting the site.
- 8.3 A suitable SuDS drainage system is proposed which accords with the requirements of national and local policy and will be primarily focused on 100% reused of captured rainwater for irrigation.
- 8.4 Under normal circumstances there will be no discharge of surface water from the site.
- 8.5 Only in the event of a 1:100 year +40% pluvial event occurring while the irrigation water level within the reservoir is already at the peak operational level will a discharge be made at a suitably restricted rate to the Little Tortington Stream.
- 8.6 Preliminary calculations confirm that sufficient additional storage can be provided within the reservoir above the level of the peak operational irrigation water for all storm return periods up to and including the 1:100 year rainfall event with an allowance for climate change.
- 8.7 Water quality improvement will be provided to mitigate against any risk to the receiving watercourses in the event that a restricted overflow is ever required.
- 8.8 Foul drainage will be discharged to the existing public foul sewer located beneath the B2132 Yapton Lane to the southwest of the site.
- 8.9 In terms of flood risk planning the proposed development is safe, will not increase flood risk elsewhere and will provide improvement to immediately adjacent sites by managing surface water from all rainfall events up to the 100 year plus climate change event.
- 8.10 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	Geological Borehole Data
Appendix 5	Flood Maps and Correspondence
Appendix 6	Proposed Site Layout Plan and Impermeable Areas Plan
Appendix 7	Drainage Strategy Plans and Calculations and Exceedance Event Flow Route Plan
Appendix 8	Arun District Council's Surface Water Drainage Proposal Checklist
Appendix 9	Outline Drainage Maintenance Schedule
Table 1	Pollution Hazard Indices
Table 2	Pollution Mitigation Indices
Image 1	Site Location
Image 2	Greenfield Runoff Calculation
Image 3	Local Topography

Appendix 1

Site Location Plan



Appendix 2

Existing Site Layout Plan

Appendix 3

Sewer Records

Appendix 4

Geological Borehole Data



BORE HOLE LOG

Log Ref. 1252

HOLE NO. 11

SU90NE 73 951-058

9778 0426

OD = 12m

COMMERCIAL
IN CONFIDENCE

Ordinance Plot No. _____

Water Struck at 10 ft. 0 ins. Rest Water Level _____ ft. _____ ins. after _____ hours

Description of Material	From	To	Depth of Seam ft. ins.	Total Depth ft. ins.
	ft. ins.	ft. ins.		
Top Soil.	0 - 0	1 - 0	1 - 0	
Brown Clay.	1 - 0	4 - 0	3 - 0	
Clay & Stone.	4 - 0	7 - 0	3 - 0	
Yellow Sandy Clay.	7 - 0	10 - 0	3 - 0	
Yellow Soft Sand.	10 - 0	16 - 0	6 - 0	16 - 0

REMARKS

Sketch Plan

Samples taken at

(1) _____ ft. _____ ins. (2) _____ ft. _____ ins. (3) _____ ft. _____ ins. (4) _____ ft. _____ ins.
(5) _____ ft. _____ ins. (6) _____ ft. _____ ins. (7) _____ ft. _____ ins. (8) _____ ft. _____ ins.

BORE HOLE LOG

HOLE NO. 10

SU90NE 72 987-058

SU90SE/41 9818 0493

Log Ref. 1251

Ordinance Plot No. _____

Water Struck at 10 ft. 0 ins. Rest Water Level _____ ft. _____ ins. after _____ hours**COMMERCIAL
IN CONFIDENCE**

Description of Material	From	To	Depth of Seam ft. ins.	Total Depth ft. ins.
	ft. ins.	ft. ins.		
Top Soil & Stone	0 - 0	1 - 0	1 - 0	
Sub soil.	1 - 0	3 - 0	2 - 0	
(1) Brown Clay.	3 - 0	6 - 0	3 - 0	
Yellow Sandy Clay	6 - 0	10 - 0	4 - 0	
Main Yellow Soft Sand.	10 - 0	26 - 0	10 - 0 + 20 - 0	

REMARKS

Sketch Plan

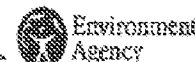
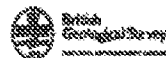
Samples taken at

(1) _____ ft. _____ ins. (2) _____ ft. _____ ins. (3) _____ ft. _____ ins. (4) _____ ft. _____ ins.
 (5) _____ ft. _____ ins. (6) _____ ft. _____ ins. (7) _____ ft. _____ ins. (8) _____ ft. _____ ins.

8H999

WR38: Borehole record form

Borehole record

Nicholls
Boreholes

British Geological Survey

British Geological Survey

British Geological Survey

Water Resources Act 1991 (as amended by the Water Act 2003)

A Site details

Borehole drilled for D Location Lake Barn Maysall Lane, Upton, BN18 0DRNGR (ten digits) SU97741 04359 Please attach site plan

Ground level (if known) _____ metres Above Ordnance Datum

Drilling company N. Challs BoreholesDate drilling commenced 19/2/2020 (DD/MM/YYYY) Completed 21/2/2020 (DD/MM/YYYY)

B Construction details

Borehole datum (if not ground level) _____ metres (m). Please tick if this is above ☐ or below ☐ ground level.
(point from which all measurements of depth are taken, for example, flange, edge of chamber)Borehole drilled diameter 203 mm from 0 to 2.2 m/depth

_____ mm from _____ to _____ m/depth

_____ mm from _____ to _____ m/depth

_____ mm from _____ to _____ m/depth

Casing material Solid uPVC inner diameter 113 mm from 0 to 1.0 m/depth
and type (for example, if plain steel, plastic sleeved). Please record permanent casing details, not temporary casing.Casing material Sleeved uPVC diameter 113 mm from 1.0 to 1.6 m/depthCasing material Solid uPVC diameter 113 mm from 1.6 to 1.9 m/depthCasing material (Sleeved with vertical end cap) diameter _____ mm from _____ to _____ m/depthGrouting details: 53 bags of washed shingle & 3 bags of anhydrite
(see sent to surface)

Water truck at 1. _____ m (depth below datum - mbd) 2. _____ m (mbd)

3. _____ m (mbd) 4. _____ m (mbd)

C Test pumping summary (Please supply full details on form WR39)

Test pumping datum _____ m. Please tick if this is above ☐ or below ☐ ground level.
(if different from borehole datum)

Pump suction depth _____ mbd

Water level (start of test) _____ mbd

Water level (end of test) _____ mbd

Type of test (for example, bailer, step, constant rate)

Pumping rate _____ m³/hour ☐ or litres/second ☐. Please tick as appropriate.

for _____ days, _____ hours, _____ mins

Recovery to _____ mbd in _____ days, _____ hours, _____ mins

(from end of pumping)

Date(s) of measurements Pump started 19/2/2020

Pump stopped _____ (DD/MM/YYYY)

Please supply chemical analysis if available. If you have included this please tick this box ☐

British Geological Survey

WR38 Version 2, February 2011

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page 1 of 3

WRCB: Borehole record form

D Strata log

Geological classification (BGS only)	Description of strata	Thickness m	Depth (to base of strata) m
	• Sandy topsoil • Sand • Clay, chalk and flint • Chalk and flint	1.5 0.5 3 17	1.5 2 5 22
	(continue on separate page if necessary)		
	Other comments (for example, gas encountered, saline water intercepted)		

E Completing this form

How long did it take you to fill in this form?

For Official use only

Date received (DD/MM/YYYY)	File	Consent number	BGS reference number
Accession number	Wellmaster number	SOBI number	NGR
LIC NO	Purpose		E reference number
Copy number	Entered by		

WRCB Version 2, February 2011

page 2 of 3

SU 90 SE 32**9822 0430****North End, Yapton****Block H**

Surface level +6.0 m

Water not stuck

August 1981

Waste**3.3 m****Bedrock****1.2 m+****LOG****Geological classification****Lithology****Thickness****m****Depth****m**

	Soil	0.3	0.3
Brickearth	Clay, brown, silty, with a few subangular flint pebbles. Very sandy near base	2.7	3.0
Raised Beach Deposits (younger)	Sand, mid to dark brown; fine to coarse; quartz with flint; silty and with angular to well rounded flint pebbles	0.3	3.3
Upper Chalk	Chalk, soft, rubbly	1.2+	4.5