



Technical Drainage Note: Foul and Surface Water

**Proposed Development at Bird in Eye Hill,
Uckfield, East Sussex**

May 2015

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1 Objectives and Site Description

1.1 Overview

The objective of this technical drainage note is to outline the potential drainage mechanisms with regard to the disposal of surface water run-off and foul sewerage from the proposed development at:

Bird in Eye Hill, Uckfield, East Sussex, TN22 5HA.

In order for the potential development at Bird in Eye Hill to be considered as part of the Strategic Housing Land Availability Assessment (SHLAA), Herrington Consulting Limited has been commissioned to investigate the potential solutions for discharging both foul and surface water from the site. The following assessment has been undertaken in accordance with the National Planning Policy Framework (March 2012), has therefore been produced to ensure a suitable and sustainable method is available for draining the site.

This document is primarily aimed at addressing the requirements for both surface water and foul drainage, however, it is not intended to comprise a full utilities assessment nor does it constitute a detailed drainage design.

1.2 Site Location

The site is located at OS coordinates 548310 120683, off of the B2102 in Uckfield. In total the site covers an area of approximately 11.6 hectares and currently comprises a series of fields and some small wooded areas. The location of the site in relation to the surrounding area is shown in Figure 1.1.

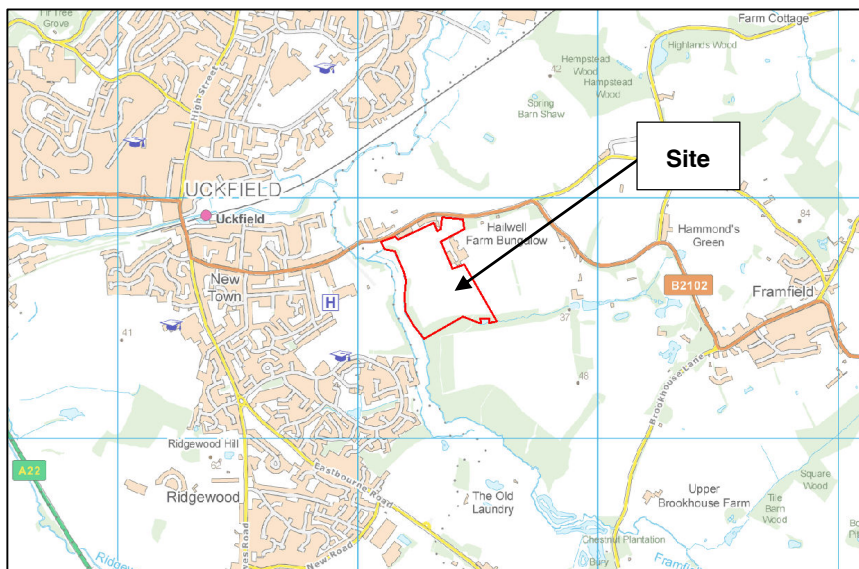


Figure 1.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2015)

1.3 The Development

The proposals for development will comprise the construction of approximately 175 residential dwellings, as well as associated roads and hardstanding. The current proposals also include the potential to build a community centre within the site boundary. An indicative master plan layout has been produced and is included in appendix A.3.

1.4 Site Specific Information

Site specific topographic surveys – A site-specific topographic survey has not been undertaken at this stage, however, inspection of OS mapping and LiDAR aerial height data records show that the land levels at the site vary between 19m and 51m Above Ordnance Datum Newlyn (AODN).

The general topography of the site shows land levels fall towards a natural valley to the west of the site, where the site boundary lies adjacent to the Framfield Stream. The southern edge of the site is flanked by a second small valley containing an unnamed tributary of the Framfield Stream, however, the majority of the site is elevated significantly above the height of these two watercourses.

Figure 1.2 (below) shows 1m terrain LiDAR, which provides an indication of land levels across the site (red = high, blue = low).

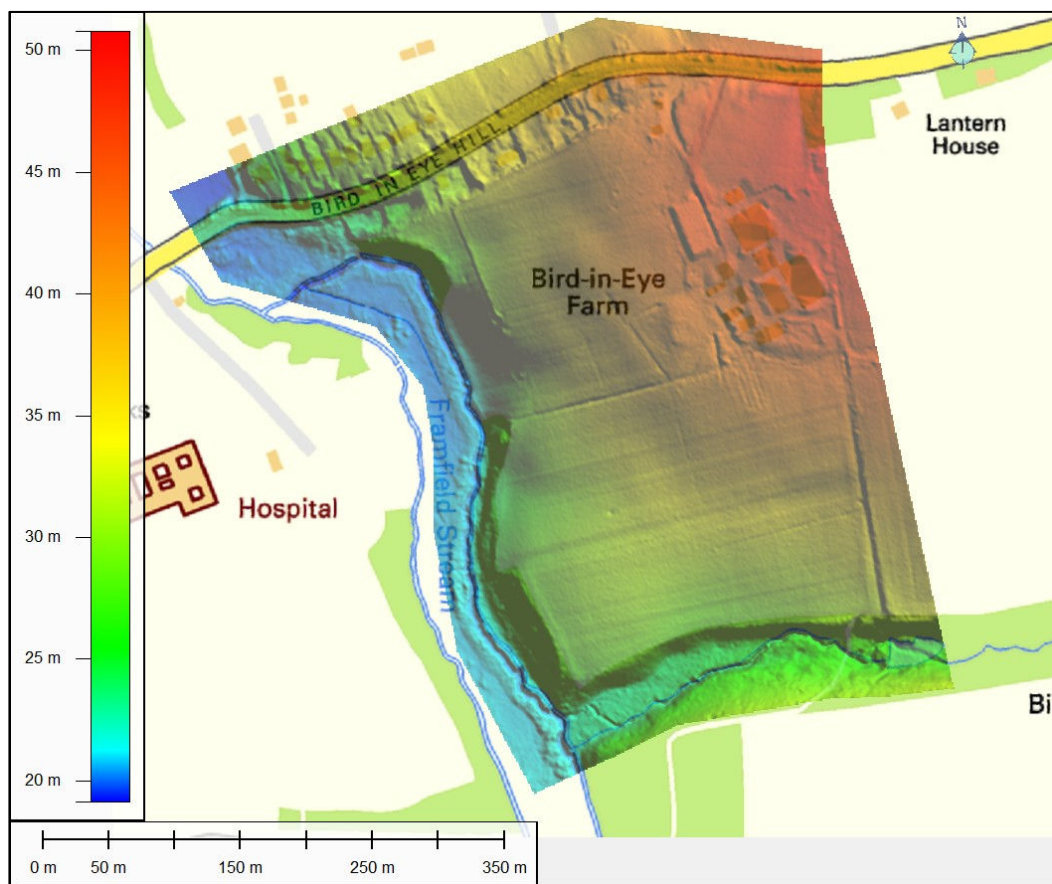


Figure 1.2 - 1m terrain LiDAR mapping for development site (red = high, blue = low)

Geology – Reference to the Geological Survey map (Figure 1.3) shows that the underlying solid geology in the location of the subject site is Lower Tunbridge Wells Sand (Sandstone, Siltstone and Mudstone). There is a small area of superficial Alluvium (Clay, Silt, Sand and Gravel) which follows the Framfield Stream running along the western boundary of the site. It is likely this Alluvium is derived from fluvial processes related to the formation of the river valley and is limited in its topology to the valley bottom.

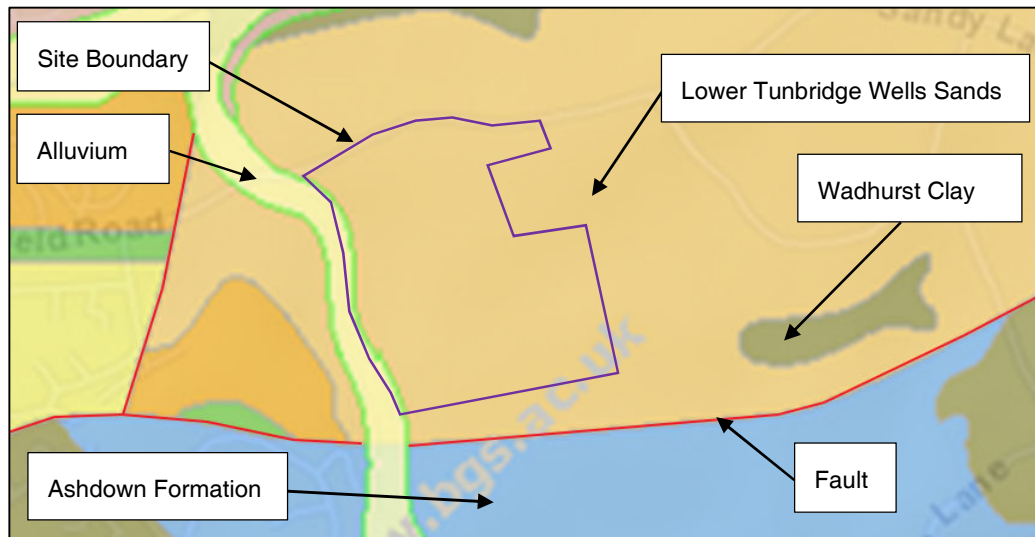


Figure 1.3 – BGS Geological Mapping showing bedrock and superficial deposits (© British Geological Survey)

Further details derived from the BGS's classification of the Lower Tunbridge Wells Sands shows the sequence is commonly composed of fine grained sandstones with interbedded siltstone and clay. In some locations pebbles / pebble beds can also be common.

Soils – Soil type provides a generic description of the drainage characteristics of soils. This will dictate, for example, the susceptibility of soils to water logging or the capacity of a soil to freely drain to allow infiltration to groundwater. Soil type may only be fully determined after suitable ground investigations, although the mapped soil types (soil association) found beneath the study area may be used as an indicator of permeability and infiltration potential. Reference to the National Soil Resources Institute mapping shows that the general soil type in this location is “*slightly acid loamy and clayey soils*”. Further analysis of the drainage characteristics for the site states that the soils at the site are likely to have “*slightly impeded drainage*”.

Information provided by Southern Water – Southern Water has provided the results of an asset location search for the site (Figure 1.4). The results of this search show there are no surface water sewers in close proximity to the site, however, an existing 150mm foul sewer is present within Bird in Eye Hill located approximately 40m to the north west of the site (circled). This foul sewer is believed to connect a small number of properties located east of the Framfield Stream, with a foul water pumping station located on the western bank across a bridge, approximately 170m from the site. There are no other known sewers located within the site boundary.

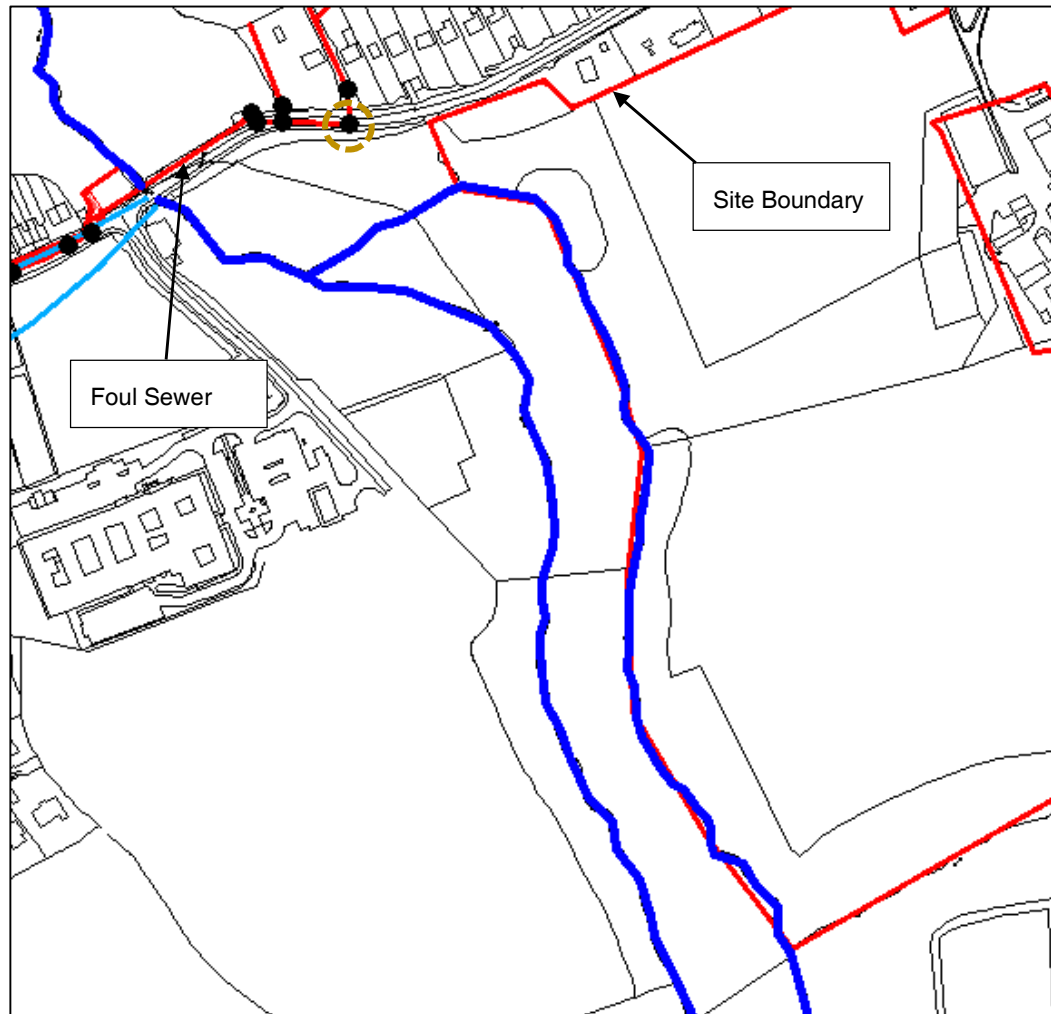


Figure 1.4 –Southern Water sewer locations for the area around Bird in Eye Hill. The brown circle delineates the nearest connection to the existing foul sewer.

1.5 Existing Drainage & Watercourses

Given the undeveloped nature of the site, it is assumed that there is no formal drainage mechanism and surface water run-off currently drains from the site via a combination of infiltration and overland flow - directly into the streams and rivers to the south and west of the site.

The Framfield Stream (main river) is located adjacent to the western boundary of the site and is the principle watercourse in this area. This river flows along the site boundary before passing under Bird in Eye Hill Road (B2102). Site investigations (undertaken by others) have revealed the size and condition of the Framfield Stream along the site boundary (Figure 1.5).



Figure 1.5 – Photograph from Phase 1 Desk Study and Site Reconnaissance Report showing condition of the Framfield stream adjacent to the site.

The Chalybeate Arm of the Framfield Stream is not located directly adjacent to the site, however, it does run parallel to the Framfield Stream at a distance of approximately 50m between the two watercourses. Between the Framfield Stream and the Chalybeate Arm is an area of grass and scrubland flood plain, although this land does not encompass part of the site. This second stream originates from a spring located around 430m south of the site and intersects another spring 80m from the southern site boundary. The conflux of the Chalybeate Arm and the Framfield Stream is located just north of the site, after which point both watercourses pass under Bird in Eye Hill Road.

There is an unnamed tributary of the Framfield Stream which runs adjacent to the site's southern boundary through Bird in Eye Shaw. This tributary originates approximately 1km from the site boundary and passes through a number of managed ponds and sluice gates before meeting the Framfield Stream adjacent to the south west corner of the site.

The location and relationships between these three watercourses can be seen in Figure 1.6 below.

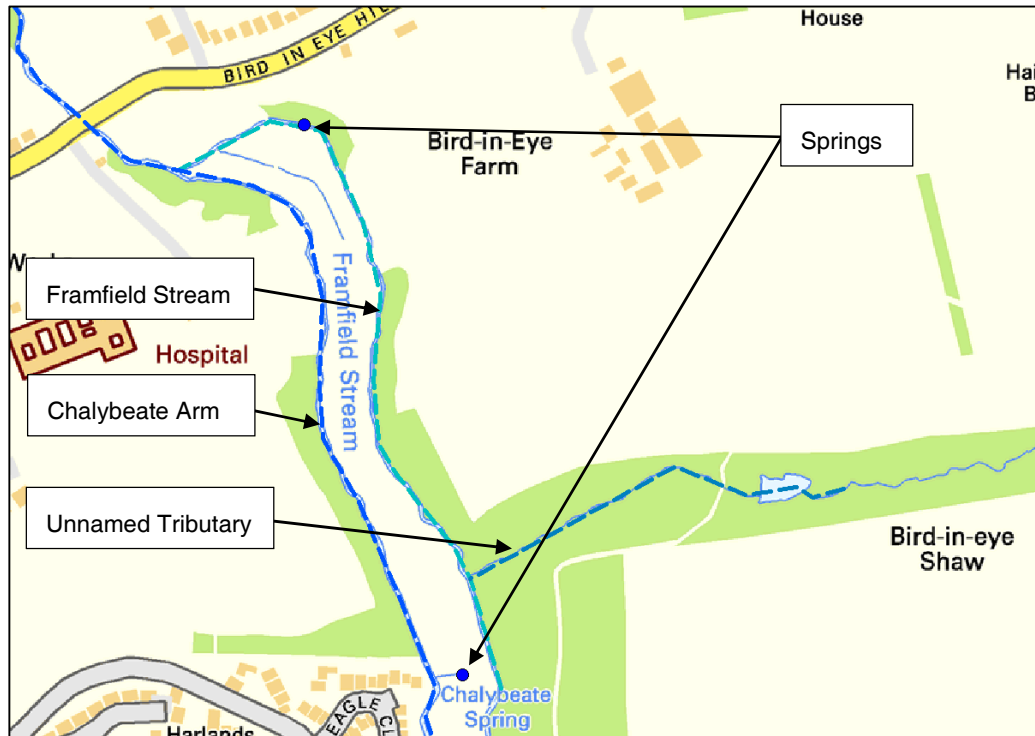


Figure 1.6 – Watercourses and Springs around Bird in Eye Farm

There are two springs located in close proximity to the site, these can be seen marked in blue in Figure 1.6 above. The Chalybeate Spring to the south of the site is believed to be related to groundwater migration along a large fault within the geological bedrock. The second spring located in the north east corner of the site is believed to be representative of the ground water table within the Lower Tunbridge Wells Sands beneath Bird in Eye Hill.

There are no existing buildings located within the site boundary and therefore it is assumed there are no existing provisions for foul or surface water drainage onsite. Nonetheless, Southern Water has provided the results of an asset location search (Figure 1.4) which delineates the location of the existing foul sewers in close proximity to the site. However, as there are no sewers located within the site boundary, the farm house and existing buildings to the east of the site are believed to discharge foul waste via individual package treatment systems.

Further investigation may be required at the detailed design stage to confirm the exact layout of any existing underground drainage networks or package treatment systems used by the existing buildings and farmhouse located east of the site. Further to this, the potential to utilise any pre-existing or new connections to the streams and rivers adjacent to the site should also be investigated.

1.6

Flooding

A brief assessment of flooding has been carried out in order to ensure any existing flooding issues are considered and to ensure that any proposed drainage system specified for the site will not have an adverse impact with regard to increasing flood risk (both on and off site). Whilst this does not constitute a site specific flood risk assessment, it does outline some of the potential flooding issues which could affect the site.

Fluvial Flooding

The site is almost entirely located within Flood Zone 1 (lowest flood risk zone). The southern and western edges of the site, located immediately adjacent to the existing rivers and streams, are shown to be partially located within Flood Zone 2 (refer to Figure 1.7 below).

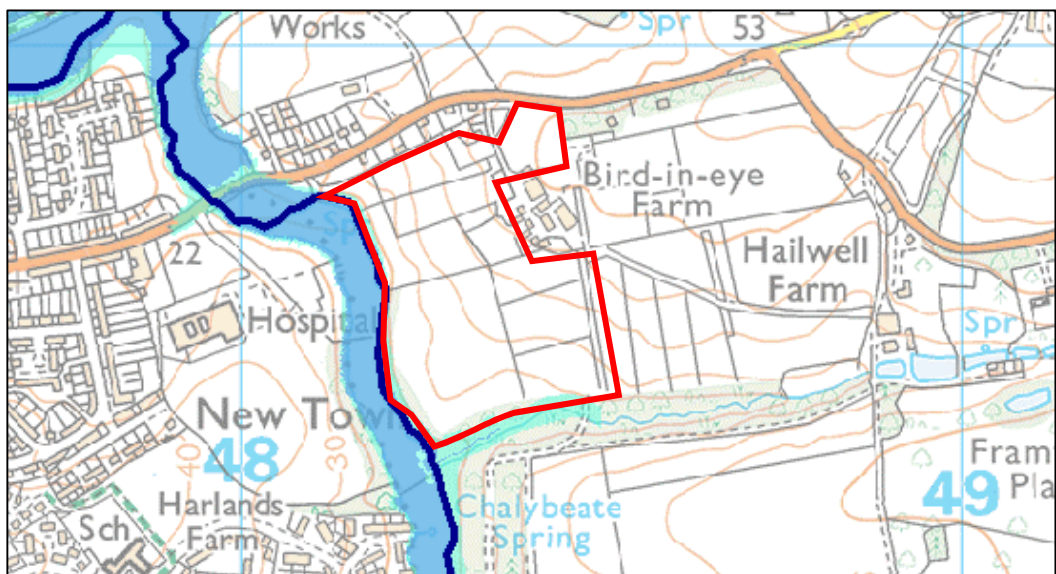


Figure 1.7 – Extract from Environment Agency Flood Zone Mapping (site outlined in red) (© Environment Agency)

The areas located within Flood Zone 2 are related to the low lying land adjacent to the watercourses (located to the west and south of the proposed development site). Given the watercourse shown by the EA flood zone map is classified as a 'Main River' (marked as a blue line on Figure 1.7) an 8m buffer zone will be required to ensure access is available for maintenance purposes. Consequently, it is unlikely that any part of the developed site (including highways and buildings) will be located within Flood Zone 2.

Groundwater

There are two groundwater springs in close proximity to the site. Based on the nature of these two springs, and the analysis of the desk study and site reconnaissance report (undertaken by others), it is unlikely the groundwater level will be significantly elevated across the parts of the site which are not directly adjacent to the existing watercourses. Consequently, providing a sufficient buffer between these watercourses and the development is maintained, it is unlikely any proposed SuDS features, such as soakaways or storage ponds, will intercept the natural groundwater table.

2 Surface Water Drainage Potential

2.1 Background Information & Policy

As part of the Government's continuing commitment to protect people and property from flood risk, the Department for Environment, Food and Rural Affairs (DEFRA) consulted on a proposal to make better use of the planning system to secure sustainable drainage systems (2014).

These changes came into effect from 6 April 2015, and relate to The Floods and Water Management Act 2010 National Standards (Schedule 3 – paragraph 5) for design, construction, maintenance and operation of Sustainable Drainage Systems (SuDS). These (non-statutory) Technical Standards for SuDS specify criteria to ensure sustainable drainage is included within developments of 10 dwellings or more; or equivalent non-residential, or mixed development (as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2010).

These technical standards (S1 -14) provide additional detail and requirements not initially covered by the NPPF. However, it is recognised that the sustainable drainage system should be designed to ensure that the maintenance and operation requirements are economically proportionate.

Notwithstanding this, the current requirement of national policy is that all new developments in areas at risk of flooding should give priority to the use of sustainable drainage systems. Within this section of the report reference is therefore made to the new SuDS criteria, ensuring the proposed scheme is compliant with the current planning standards for the lifetime of the development.

2.2 Surface Water Management Overview

The requirements for managing rainfall run-off from developments depends on the pre-developed nature of the site. If an undeveloped greenfield site, then the impact of the development will require mitigation to ensure that the run-off from the site replicates the natural drainage characteristics of the pre-developed site.

In the case of brownfield sites, drainage proposals will be measured against the existing performance of the site, although it is preferable for solutions (where practical) to provide run-off characteristics that are similar to greenfield behaviour.

In addition, the Wealden District Council Strategic Flood Risk Assessment (SFRA) sets out clear objectives for new development in Zone 1. These are to demonstrate that there will be no increase in:

- the peak rate of stormwater run-off leaving the site;
- the volume of run-off leaving the site;
- the pollution load to receiving waters from stormwater run-off (by following the SuDS 'management train')

The main characteristics of the site and the proposed development that affect the surface water drainage strategy are summarised in Table 2.1 below.

Site Characteristic	Value
Total area of site	11.6 ha
Current site condition	Greenfield Site
Proposed number of Units	181
Proposed Impermeable Area	Estimated at 4.4 ha (based on the current master plan layout)
Greenfield run-off rate	5.1 l/sec/ha (based on IoH Report 124 methodology)
Infiltration coefficient	0.1-0.001 (assumed based on underlying geology and typical soil conditions)
Standard Percentage Run-off (SPR)	31.4%
Current surface water discharge method	Combination of overland flow and infiltration
Is there a watercourse within close proximity to site?	Yes
Is site within groundwater Source Protection Zone?	No

Table 2.1 – Site characteristics affecting surface water run-off

From Table 2.1 (above) it can be seen that the proposed development will increase the percentage of impermeable area within the boundaries of the site and consequently this will increase the volume of surface water runoff from the site. Therefore, it will be necessary to include mitigation measures within the scheme design to reduce this impact.

The following calculations have been undertaken to ensure a solution for discharging surface water runoff from the proposed site will be achievable, based on the current master plan layout.

2.3 Opportunities for Managing Surface Water Run-Off

For any given development, the National Standards in relation to SuDS state that the preferred option for discharging surface water run-off from the site is to **infiltrate** water into the ground as this deals with the water at source, and serves to replenish groundwater. If this is not viable (due to a high water table, local impermeable soils, contamination issues including source protection zones etc.), then the next option of preference is for the run-off to be discharged into a **watercourse**. Only if neither of these options is possible should the water be conducted into the **public sewer** system.

Infiltration – When designing soakaways, or other infiltration systems, it is necessary to take a number of other factors into consideration. These are listed below:

- Soakaways shall not be constructed through contaminated material.
- The depth of any soakaway should normally not exceed 2.0 metres and under no circumstances shall be permitted to intersect the water table.
- Any soakaway should not normally be located within 5.0 metres of any existing, or proposed (adjacent) buildings.
- A minimum of a 1.0 metre unsaturated zone shall be maintained between the base of any soakaway and the maximum seasonal water table for that site.
- Soakaways within an Inner Source Protection Zone for a Public Water Supply shall only be permitted for the sole use of clean roof water drainage.
- Soakaways intended to drain highway or parking areas will usually require additional safeguards such as seal-trapped gullies or a suitably sized oil/grit separator.
- Soakaways designed to receive clean roof water should be kept separate from those receiving surface water run-off from highway or parking areas.
- The use of borehole soakaways will only be acceptable subject to written agreement from the Environment Agency.

If soakaways are used to discharge surface water from the site it will be necessary to demonstrate that the design rainfall event (100 year plus climate change) can be managed on site. It may not, however, be practical to design the soakaways to accommodate the design event. In which case an alternative method of managing surface water run-off will be required.

In addition, any adopted system will need to ensure that if the capacity of the infiltration system is exceeded, then the impact of any overland flow is considered appropriately. Ideally, these flows should be contained within the site at designated temporary storage locations. If this is not possible, it will be necessary to demonstrate that flooding within the site or any floodwater leaving the site can be shown to have no material impact in terms of nuisance or damage, or increase river flows during periods of river flooding.

Whilst site-specific ground investigations have not been carried out at this stage in the development process, the Standard Percentage Run-off (SPR) value has been established for this site from the Flood Estimation Handbook (FEH) database. This parameter is used to indicate the percentage of rainfall which becomes direct response run-off to a watercourse. A higher run-off percentage means that less rainfall is infiltrated into the soil, indicating lower permeability soil.

The SPR for this site is 44.6%, suggesting that the soils have relatively moderate to poor permeability. Although this statement is not supported by the geology and soil characteristics for the site (which is located on the Lower Tunbridge Wells Sands), it is supported for the catchment as a whole - due to the large outcroppings of Wadhurst Clay Formation (Mudstone) located south of the site.

It is therefore considered that whilst the percolation rate of the soils and bedrock south of the site is likely to be poor, the soils and Tunbridge Wells Sands within the site boundaries are likely to be sufficient for traditional infiltration techniques to be utilised effectively. This will, however, be required to be confirmed at the detailed design stage by undertaking site-specific soakage tests.

Consequently, infiltration is likely to be a suitable mechanism for discharging surface water run-off from the proposed development.

Discharge to Watercourses – Given the proximity of the site to the Framfield River (located adjacent to the site), it is likely that a direct connection to this watercourse will also be an appropriate method of discharging surface water from the site. Alternatively, a connection to the unnamed watercourse (located south of the site) may present a viable discharge point for run-off from the site.

If run-off is discharged to either existing watercourse it will be necessary to restrict the discharge from the site to the greenfield rate. In order to achieve this it will be necessary to incorporate some form of storage into the proposed scheme. Based on the topography of the site both water courses are potentially viable targets for discharging run-off from the site.

Consequently, a connection to the Framfield River is likely to be a suitable mechanism for discharging surface water run-off from the proposed development, providing flows discharged from the site are restricted to the greenfield rate.

Discharge to Public Surface Water Sewer & Existing Connections – Whilst utilising a connection into the surface water sewer is often the most convenient option for discharging surface water, it is the least preferential in the hierarchy of discharge options with reference to CIRIA guidance and the National Standards.

From the assessment undertaken thus far, it is likely that both a connection to the adjacent watercourse and infiltration will be appropriate to enable surface water to be discharged without the requirement to utilise the public sewer network. Nonetheless, utilising a connection to the public sewer may also provide an available method of managing surface water at this site if infiltration rates are found to be low and a connection to the Framfield River is deemed unviable.

Southern Water has provided the results of an asset location search for the site (Figure 1.4) which has identified a public sewer to the north of the site. Given the topography of the site and surrounding area it may be possible to provide a direct connection into the public sewer system.

Notwithstanding this, as this sewer is currently designated for foul water only this option is not preferable and it will be necessary to restrict the rate of discharge from the site in accordance with any requirements Southern Water stipulate.

Nonetheless, at this stage in the development process the option to discharge surface water run-off to the public sewer is available, albeit the least preferable in the hierarchy of discharge options.

2.4 Constraints and Further Considerations

In order to determine whether or not infiltration will be appropriate at the site, infiltration testing may be required at the detailed design stage. It may also be necessary to confirm the depth below the ground level of the groundwater table. At this 'strategic' stage the surface water management strategy has been based upon an assumed infiltration rate of 0.1m/hr into the Lower Tunbridge Wells Sands.

This location is not shown by the Environment Agency's groundwater Source Protection Zone maps to be an area where infiltration is restricted. Consequently, it is unlikely that the use of infiltration for run-off from all parts of the site will be restricted on this basis.

The Kent County Council soakaway design guide recommends questioning the use of soakaways within the Lower Tunbridge Wells Sands, due to the easily erodible nature of the derived soils which could be prone to surface collapse. Consequently, it is recommended that adequate ground investigations are carried out before the use of soakaways to ensure the stability of the underlying soils and bedrock.

If either of the existing watercourses are used for the discharge of surface water run-off from the site, it may be necessary to formally obtain discharge consent from the Environment Agency. Flow control devices and attenuation SuDS features will be required to store run-off onsite before discharging it to the watercourse at the pre-existing greenfield rate.

Inspection of a site photograph (Figure 1.5), shows the Framfield River to be moderately well maintained. Nonetheless, a maintenance and habitat buffer zone will be required around both watercourses, which Environment Agency bylaws state must be 8m wide.

2.5 Opportunities for Sustainable Drainage Systems (SuDS)

Appropriately designed SuDS can be utilised such that they not only attenuate flows but also provide a level of improvement to the quality of the water passed on to watercourses or into the groundwater table. This is known as source control and is a fundamental part of the SuDS philosophy which is addressed in NS12 of the National Standards.

A range of typical SuDS components that can be used to improve the environmental impact of a development is listed in Table 2.2 below along with the relative benefits of each feature and the appropriateness for the subject site.

SuDS Feature	Environmental benefits	Water quality improvement	Suitability for low permeability soils (k<10-6)	Ground-water recharge	Suitable for small/confined sites?	Site-specific restrictions	Appropriate for subject site?
Wetlands	✓	✓	✓	X	X	Possibly Insufficient space	Unlikely
Retention ponds	✓	✓	✓	X	X	None	Yes
Detention basins	✓	✓	✓	X	X	None	Yes
Infiltration basins	✓	✓	X	✓	X	None	Yes
Soakaways	X	✓	X	✓	✓	None	Yes
Underground storage	X	X	✓	X	✓	None	Yes
Swales	✓	✓	✓	✓	X	None	Yes
Filter strips	✓	✓	✓	✓	X	None	Yes
Rainwater harvesting	X	✓	✓	✓	✓	None	Yes
Permeable paving	X	✓	✓	✓	✓	None	Yes
Water butts	✓	X	✓	X	✓	None	Yes
Green roofs	✓	✓	✓	X	✓	Dependant on proposed roof construction	Unknown at this stage

Table 2.2 – Suitability of SuDS

From Table 2.2 it can be seen that there are a number of SuDS elements that are potentially suitable for this site. The following section of this report outlines the potential options for discharging run-off from the site and delineates how SuDS could be incorporated into the proposed scheme.

2.6 Potential Surface Water Drainage Strategy

At this stage a detailed surface water drainage design has not been undertaken, however, it is necessary to ensure that surface water from the proposed development can be discharged safely and sustainably.

The volume of runoff discharged from the site has been calculated, based on the total existing and proposed impermeable area, taking into account a 30% increase in runoff as a result of climate change in accordance with current national standards.

Site condition	Total volume discharged
Existing site	Greenfield
Proposed development (before mitigation)	3725m ³

Table 2.3 – Total volume discharged from the 100 yr+30%cc 6 hour event

As a result, this volume of runoff must be discharged to either the ground via infiltration, or to the Framfield Stream, or to the public sewer at an attenuated rate. As the infiltration rate across the site has not yet been determined, two potential options have been outlined. These assume both good and poor infiltration rates into the underlying soils and bedrock geology, in order to ensure a viable solution is available.

For each option, the different elements of the scheme are set out below, along with the calculations that have been undertaken to demonstrate how the overall objectives have been achieved. This, however, does not represent a detailed surface water drainage design, it is simply an assessment to demonstrate that a scheme for managing surface water runoff onsite is available.

Option 1: Good Infiltration across the site (assumed 0.1m/hr), discharging runoff directly to the ground.

Highways, car parking and hardstanding

For the highways, car parking and hardstanding areas, it is possible to incorporate permeable paving. Provided that this is laid onto a minimum of a 0.2m thick open-graded sub-base, this will provide sufficient storage for the runoff before discharging via infiltration such that the 100 year (plus climate change) event can be fully discharged. This is based upon an assumed infiltration rate of 0.1 m/hr. A summary of the Micro Drainage analysis for permeable paving are shown in Table 2.4 below.

Parameter	Value
Area draining to permeable paving	3.31 ha
Critical storm duration	60 minutes
Maximum filtration	450 l/sec
Half drain time	17 minutes
Required sub-base depth	0.2m

Table 2.4 – Summary of Micro Drainage analysis for the permeable paving (100 yr+30%cc)

An alternative solution for the areas of adoptable highway could be to utilise ring soakaways or gully pots. However, this is only if infiltration rates are deemed sufficient to ensure soakaways can be located at even intervals (greater than 5m), along the length of the proposed roads.

Roof Drainage

The surface water runoff from the roofs of the buildings can be discharged by crate soakaways, this is based upon an assumed infiltration rate of 0.1m/hr.

Parameter	Value
Area draining to Soakaways	1.05 ha
Type of Soakaway	Crate Soakaways
Number of soakaways	70
Total Area Discharging to Each Soakaway	150 ha
Assumed Infiltration Rate	0.1m/hr
Maximum Filtration	0.3 l/sec
Critical storm duration	240 minutes
Half drain time	290 minutes
Required Volume	7m ² x 1.2m (deep)

Table 2.5 – Summary of Micro Drainage analysis for the roof area (100 yr+30%cc)

Option 2: *Poor infiltration (assumed negligible), discharging runoff to the Framfield Stream or public sewer at an attenuated rate.*

It is recognised that, if the infiltration rates determined through site specific infiltration testing are confirmed to be lower than expected, it may still be possible to incorporate permeable paving into the scheme by increase in the depth of the sub-base accordingly; to account for the additional time required to discharge run-off into the ground.

However, if infiltration is found to be negligible, the sub-base could simply be used as additional storage which would be connected to the overall surface water drainage system. The surface water from this storage would subsequently be discharged into the surface water sewer at a restricted rate. For the purpose of this assessment, the additional attenuation provided by runoff filtering through permeable paving has not been taken into account, this provides a worst case scenario giving the maximum required crate size for runoff from all roofs and hardstanding surfaces.

Ideally, flows discharged from the site to either the public sewer or a watercourse should be restricted to the greenfield run-off rate of 22.4l/s. Consequently, a flow control device and adequate storage would be required.

Hardstanding and Roof Drainage

The surface water runoff from all hardstanding areas and roofs of the buildings can be discharged via a cellular storage system, or alternatively a series of storage basins. This is based upon an assumed negligible infiltration rate.

Parameter	Value
Area draining to attenuation system	4.4 ha
Assumed infiltration	None
Flow control device	Hydro-Brake
Maximum allowable rate of discharge	22.4 l/sec
Peak discharge for 100yr+cc	22.3 l/sec
Critical storm duration	960 minutes
Half drain time	1144 minutes
Required storage	2800m ² x 1.2m (deep)

Table 2.6 – Summary of Micro Drainage analysis for all hardstanding and roof areas (100 yr+30%cc)

Figure 2.1 (below) outlines an indicative strategy for incorporating cellular storage crates into the scheme proposals. The above table suggests approximately 2360m³ of storage would potentially be required to be accommodated on site, assuming a total crate depth of 1.2m. The proposed system has been designed to discharge via a Hydro-Brake to the sewer system, limiting to the discharge to the greenfield run-off rate of 22.4l/s.

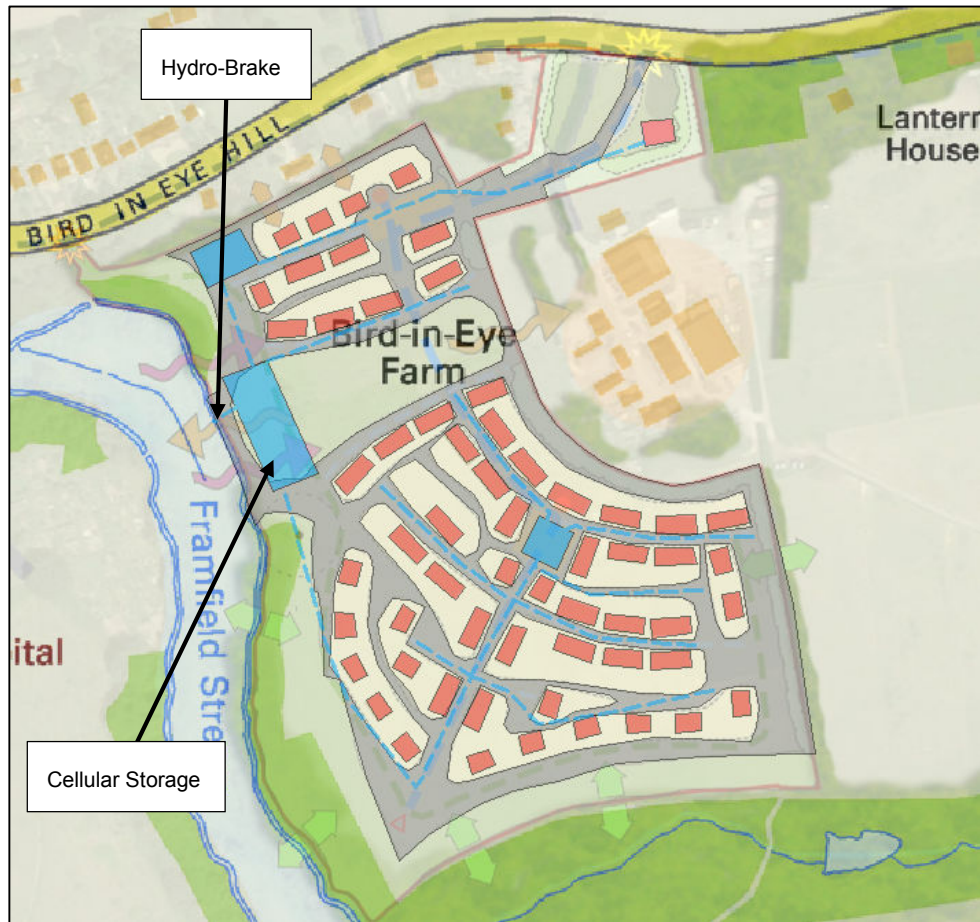


Figure 2.1 – Indicative surface water drainage strategy with potential locations for both the Hydro-Brake and Cellular Storage

Alternatively, cellular storage crates could be located within the gardens of each individual dwelling, as this would reduce the need for crates to be located underneath areas of highway and/or parking spaces.

However, it should be recognised that this configuration could result in a potentially onerous requirement for maintenance, as each individual crate system may require inspection.

2.7 Surface Water Drainage Plan Conclusions

At this stage in the planning process a detailed surface water drainage plan has not been developed, however, there is still a requirement to demonstrate that a solution for managing surface water at the site is available. The potential options outlined above suggest that the most appropriate method for discharging run-off from the site could be through the use of soakaways and other infiltration features, allowing run-off to be discharged into the underlying Lower Tunbridge Wells Sands. Nonetheless, if following site specific investigations the use of soakaways is found to be inappropriate due to a low infiltration rate, high groundwater level or instability within the soils or bedrock then an alternative option utilising cellular storage is available.

If infiltration is deemed unsuitable, the preferred alternative method for discharging run-off from the site would be to provide a direct connection to the existing Framfield River. Run-off would need to be attenuated within SuDS features such holding ponds, swales or underground cellular storage crates before being discharged at the greenfield run-off rate to the watercourse. Inspection of the site and the proposed number of residential units suggest that there is more than sufficient space available on site to locate such SuDS features.

The least preferred method for discharging run-off from the site would be to connect the surface water drainage to the public foul sewer. In this case Southern Water would have to be consulted, however, given the likelihood of high infiltration rates within the site and the potential for a direct connection to the existing watercourse, it is unlikely discharging via this method would be required.

3 Foul Water Drainage

The above information outlines the management of surface water onsite and its potential impact on the existing sewer network. This section of the report is therefore specifically focussed on addressing how the foul water from the site will be managed.

3.1 Background Information

Existing Sewers

An asset location search for the area has identified an existing foul sewer located in Bird in Eye hill. It is envisaged that the proposed development will utilise this potential connection to the foul sewer for the discharge of foul waste from the proposed dwellings.

Figure 3.1 (below) outlines the potential connection routes for foul drainage across the site. This has been formulated in conjunction with the proposed surface water management strategy in order to ensure foul drainage can be adequately incorporated into the scheme alongside the required space for surface water drainage features.

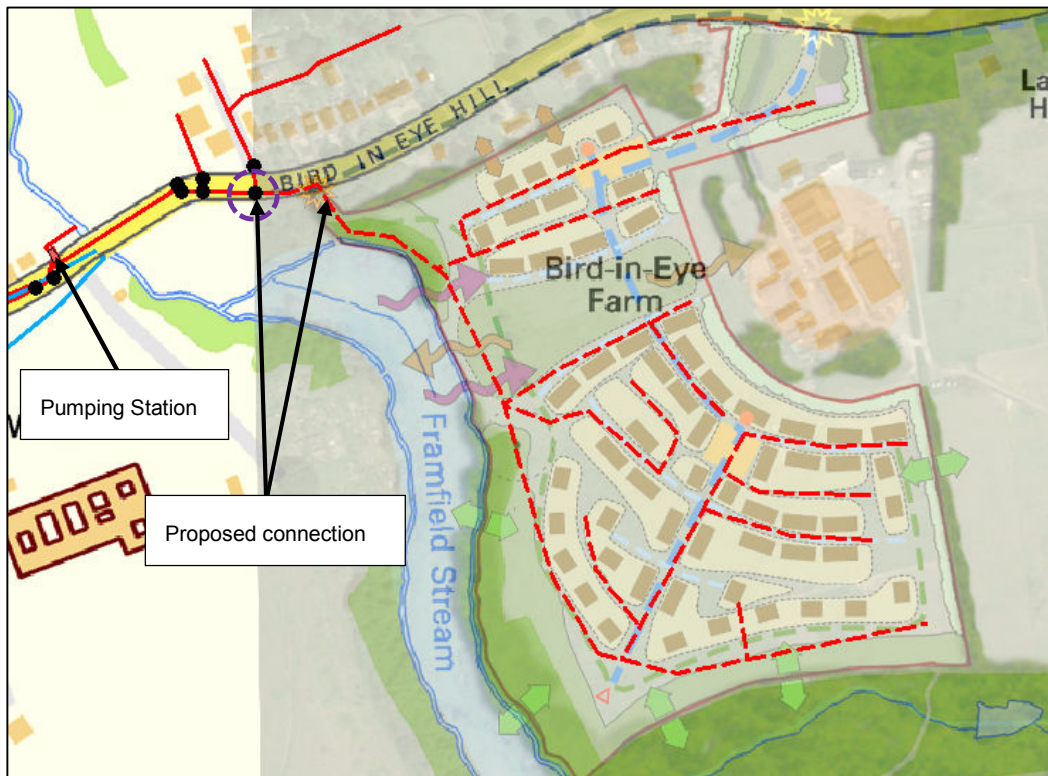


Figure 3.1 – Extract from Southern Water asset location plan showing Indicative foul connection from the proposed site to the existing foul sewer.

Southern Water Checks

A Southern Water asset location search has been undertaken to determine the location of the existing sewer network. However, a capacity check has not been undertaken at present. Notwithstanding this, it is envisaged that a new connection to the public foul sewer will be the most appropriate and potentially the only suitable option for discharging foul water from the site.

Section 106 of the Water Industry Act (1991) states the Undertaker (Southern Water) cannot refuse a connection to the existing sewer network based on inadequate capacity. Nonetheless, it will be necessary to undertake a formal capacity check as part of the detailed drainage design to confirm if adequate capacity is available.

If the capacity check confirms that there is insufficient capacity available in the existing sewer system, it may be necessary to contribute towards an upgrade in order to accommodate any additional foul water discharged from the development. At this stage in the development process, it has been assumed (in either instance) that a solution will be available.

Whilst Figure 3.1 does confirm that a potential option for discharging foul water from the site is available, this does not constitute a detailed Foul Water Drainage design. Notwithstanding this, at this stage in the planning process it does demonstrate that a solution is available for managing the foul water discharged by the proposed development.

Additional Site Investigations

Further site investigations will be required at the detailed design stage to ascertain the route and condition of the existing public sewer. In order to achieve this, it is possible that a CCTV survey of the existing site drainage network could be required.

The Water Industry Act 1991

The Water Industry Act 1991 (WIA) (HMSO, 1991) was introduced to consolidate previous water supply and wastewater services enactments in the UK. Section 94 sets out the principal duties and standards of performance to sewerage undertakers which include the duty ‘...to provide, improve and extend such a system of public sewers (whether inside its area or elsewhere) and so to cleanse and maintain those sewers as to ensure that that area is and continues to be effectually drained’.

Relevant to new development, Section 104 and Section 106 of the WIA provides the framework for the adoption of private sewers at a later date, subject to an agreement with the sewerage undertaker (Southern Water). Section 98 of the WIA provides the legal mechanism through which the appropriate infrastructure can be requested (by the developer) and provided to drain to a specific location.

Section 106 allows the sewerage undertaker a 21 day notice period prior to the works being undertaken. During this time the application may be refused if the undertaker considers that the connection mode or condition of the connecting sewer does not satisfy the required standards. The

undertaker cannot, however, refuse the connection based on inadequate capacity alone (as detailed above)

Proposed Foul Water Discharge

Based on the number of dwellings (175), the estimated maximum foul water discharge from the development has been calculated using best practice guidance from Sewers for Adoption 7th Edition, which states design flow rates for dwellings should be 4000l/day. Therefore the discharge rate for the proposed development of 175 units equates to a foul discharge rate of approximately 8.3l/s.

Historical Flooding

No incidents of historical flooding are known to have affected the site.

Pollution Prevention Guidance

For sewers not connected to a public adopted system, the Environment Agency's Pollution Prevention Guidance 4 (PPG4) 'Treatment and Disposal of Sewage where no foul sewer is available' should be considered. However, this guidance states that "...discharge to a foul sewer is the preferred option as the sewage is conveyed to a purpose built and closely monitored sewage treatment plant, so development proposals in sewered areas should connect to public sewers."

3.2 Potential Foul Water Drainage Plan Conclusions

It is acknowledged that whilst there is not a requirement at this stage in the planning process to develop a detailed drainage design, there is still a requirement to demonstrate that there is a solution for managing foul water at the site. In particular it should be demonstrated that there are no major physical constraints, such the levels across the site, which could prevent connection from being achieved.

Reference to site levels and the outline design clearly show that a connection to the existing foul sewer is achievable and this is delineated in Figure 3.1 (above). In this circumstance, it is likely a new connection would be required as the proposed greenfield site does not appear to have any existing connections to the foul sewer (which is currently located approximately 30m from the site boundary).

4

Conclusions

The primary objective of this technical drainage note is to ensure a viable and sustainable solution for discharging both surface water and foul water flows from the site is available.

The NPPF and National SuDS Standards require that opportunities to reduce flood risk are sought wherever possible and this can be achieved by providing a robust strategy for managing the water discharged from the development. In this instance, a number of strategies have been recommended with varying degrees of flexibility; these are dependent on the specific site constraints that are to be determined at the detailed design stage.

The scheme proposals will result in an increase in the total impermeable area on site and therefore it will be necessary to incorporate appropriate SuDS features within the design of the surface water drainage system to ensure there is not an increased risk of flooding in the surrounding area.

With regard to the specific surface water drainage requirements, the key aims have been addressed in detail and the analysis contained within this report clearly identifies three potential options are available. The first option aims to utilise infiltration to discharge the surface water in a controlled and sustainable manner and is the preferred option with respect to current SuDS guidance. Notwithstanding this, it is acknowledged that this option does rely on good infiltration being available, which has not currently been confirmed by site specific ground tests.

Consequently, a second option for managing the surface water run-off from the site has also been appraised and this option assumes that infiltration is restricted, e.g. as a result of poor infiltration rates, high groundwater, or instability issues. This alternative SuDS solution utilises attenuation SuDS features and a flow control device to restrict the peak discharge rate from the site to the greenfield rate, before discharging the surface water run-off to the existing watercourse.

Similarly and of equal importance, is the necessity to identify how the foul water discharged from the proposed development will be managed.

The analysis has shown that a new connection to the existing public sewer is likely to be available and although adequate capacity has not been confirmed at this stage, it is likely that a connection to this system is will be acceptable to Southern Water.

It can therefore be concluded that both the additional foul and surface water flows from the proposed development can be discharged in a safe and sustainable manner and that this discharge will not increase the risk of flooding elsewhere. Consequently, the requirements of this Drainage Assessment are met and on this basis, the site is considered to be suitable for allocation within the SHLAA.

A Appendices

A.1 Appendix A.1 – Southern Water Asset Location Data

A.2 Appendix A.2 – Surface Water Management Calculations

A.3 Appendix A.3 – Master Plan Layout

Appendix A.1 – Southern Water Asset Location Data



Appendix A.2 – Surface Water Management Calculations

Herrington Consulting Ltd		Page 1
Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ		
Date 07/05/2015 17:43 File SOURCE_CONTROLE.SRCX	Designed by shayward Checked by	
Micro Drainage Source Control 2014.1.1		

ICP SUDS Mean Annual Flood

Input

Return Period (years)	1	Soil	0.450
Area (ha)	1.000	Urban	0.000
SAAR (mm)	800	Region Number	Region 7

Results 1/s

QBAR Rural	5.1
QBAR Urban	5.1
Q1 year	4.4
Q1 year	4.4
Q30 years	11.6
Q100 years	16.4

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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ		Bird In Eye Farm Discharge From The Site			
Date 19/05/2015 File Source Control.srcx		Designed by SAH Checked by SMB			
Micro Drainage		Source Control 2014.1.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
15 min Summer	9.097	1.097	2575.4	7.5	O K
30 min Summer	9.041	1.041	2289.9	6.8	O K
60 min Summer	8.920	0.920	1687.5	5.6	O K
120 min Summer	8.725	0.725	1113.4	3.7	O K
180 min Summer	8.636	0.636	850.7	2.8	O K
240 min Summer	8.571	0.571	690.7	2.3	O K
360 min Summer	8.484	0.484	507.6	1.7	O K
480 min Summer	8.436	0.436	407.7	1.3	O K
600 min Summer	8.399	0.399	343.6	1.1	O K
720 min Summer	8.369	0.369	299.0	1.0	O K
960 min Summer	8.330	0.330	239.9	0.8	O K
1440 min Summer	8.278	0.278	175.3	0.6	O K
2160 min Summer	8.226	0.226	127.4	0.4	O K
2880 min Summer	8.197	0.197	101.4	0.4	O K
4320 min Summer	8.167	0.167	74.1	0.3	O K
5760 min Summer	8.151	0.151	59.0	0.3	O K
7200 min Summer	8.141	0.141	50.4	0.2	O K
8640 min Summer	8.133	0.133	43.1	0.2	O K
10080 min Summer	8.128	0.128	38.5	0.2	O K
15 min Winter	9.097	1.097	2572.9	7.4	O K
30 min Winter	8.979	0.979	1979.2	6.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
15 min Summer	122.433	0.0	998.8	9	
30 min Summer	82.239	0.0	1341.9	17	
60 min Summer	52.662	0.0	1718.6	32	
120 min Summer	32.503	0.0	2121.3	62	
180 min Summer	24.118	0.0	2361.1	92	
240 min Summer	19.386	0.0	2530.5	122	
360 min Summer	14.268	0.0	2793.6	180	
480 min Summer	11.460	0.0	2991.7	244	
600 min Summer	9.659	0.0	3152.1	298	
720 min Summer	8.396	0.0	3287.8	358	
960 min Summer	6.724	0.0	3510.5	478	
1440 min Summer	4.907	0.0	3842.8	726	
2160 min Summer	3.573	0.0	4197.3	1080	
2880 min Summer	2.849	0.0	4462.7	1440	
4320 min Summer	2.067	0.0	4856.5	2164	
5760 min Summer	1.644	0.0	5150.3	2848	
7200 min Summer	1.377	0.0	5394.0	3688	
8640 min Summer	1.193	0.0	5603.9	4392	
10080 min Summer	1.056	0.0	5788.0	5024	
15 min Winter	122.433	0.0	1118.8	10	
30 min Winter	82.239	0.0	1502.9	17	
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ		Bird In Eye Farm Discharge From The Site			
Date 19/05/2015 File Source Control.srcx		Designed by SAH Checked by SMB			
Micro Drainage		Source Control 2014.1.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Control (l/s)	Max Volume (m³)	Status
60 min Winter	8.798	0.798	1327.4	4.4	O K
120 min Winter	8.629	0.629	830.1	2.8	O K
180 min Winter	8.537	0.537	620.2	2.1	O K
240 min Winter	8.479	0.479	497.1	1.6	O K
360 min Winter	8.415	0.415	367.9	1.2	O K
480 min Winter	8.367	0.367	295.9	1.0	O K
600 min Winter	8.336	0.336	249.0	0.8	O K
720 min Winter	8.314	0.314	215.7	0.7	O K
960 min Winter	8.276	0.276	173.5	0.6	O K
1440 min Winter	8.225	0.225	126.5	0.4	O K
2160 min Winter	8.188	0.188	92.8	0.3	O K
2880 min Winter	8.168	0.168	75.0	0.3	O K
4320 min Winter	8.145	0.145	53.6	0.2	O K
5760 min Winter	8.135	0.135	44.4	0.2	O K
7200 min Winter	8.127	0.127	37.6	0.2	O K
8640 min Winter	8.120	0.120	30.9	0.2	O K
10080 min Winter	8.110	0.110	27.3	0.2	O K
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)	
60 min Winter	52.662	0.0	1924.8	32	
120 min Winter	32.503	0.0	2375.9	64	
180 min Winter	24.118	0.0	2644.4	92	
240 min Winter	19.386	0.0	2834.1	124	
360 min Winter	14.268	0.0	3128.8	186	
480 min Winter	11.460	0.0	3350.6	242	
600 min Winter	9.659	0.0	3530.4	304	
720 min Winter	8.396	0.0	3682.3	366	
960 min Winter	6.724	0.0	3931.7	480	
1440 min Winter	4.907	0.0	4303.9	742	
2160 min Winter	3.573	0.0	4701.0	1080	
2880 min Winter	2.849	0.0	4998.5	1456	
4320 min Winter	2.067	0.0	5439.3	2096	
5760 min Winter	1.644	0.0	5768.8	2904	
7200 min Winter	1.377	0.0	6042.0	3432	
8640 min Winter	1.193	0.0	6277.1	4400	
10080 min Winter	1.056	0.0	6483.6	5072	
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Discharge From The Site	
Date 19/05/2015 File Source Control.srcx	Designed by SAH Checked by SMB	
Micro Drainage		Source Control 2014.1.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 4.351

Time (mins)	Area
From:	To: (ha)

0	4 4.351
---	---------

Time Area Diagram

Total Area (ha) 0.000

Time (mins)	Area
From:	To: (ha)

0	4 0.000
---	---------

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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Discharge From The Site	
Date 19/05/2015 File Source Control.srcx	Designed by SAH Checked by SMB	
Micro Drainage		Source Control 2014.1.1
<p style="text-align: center;"><u>Model Details</u></p> <p style="text-align: center;">Storage is Online Cover Level (m) 10.000</p> <p style="text-align: center;"><u>Pipe Structure</u></p> <p style="text-align: center;">Diameter (m) 2.000 Length (m) 5.000 Slope (1:X) 10.000 Invert Level (m) 8.000</p> <p style="text-align: center;"><u>Pipe Outflow Control</u></p> <p style="text-align: center;">Diameter (m) 2.000 Entry Loss Coefficient 0.500 Slope (1:X) 10.0 Coefficient of Contraction 0.600 Length (m) 5.000 Upstream Invert Level (m) 8.000 Manning's n 0.015</p>		
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ			Bird In Eye Farm Permeable Paving		
Date 19/05/2015 File Permeable Paving.srcx			Designed by SAH Checked by SMB		
Micro Drainage			Source Control 2014.1.1		
Summary of Results for 100 year Return Period (+30%)					
Half Drain Time : 17 minutes.					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
15 min Summer	9.844	0.044	398.2	431.4	Flood Risk
30 min Summer	9.855	0.055	450.0	533.3	Flood Risk
60 min Summer	9.860	0.060	450.0	581.2	Flood Risk
120 min Summer	9.854	0.054	450.0	524.9	Flood Risk
180 min Summer	9.847	0.047	420.7	456.3	Flood Risk
240 min Summer	9.842	0.042	375.8	404.8	Flood Risk
360 min Summer	9.834	0.034	308.3	331.2	Flood Risk
480 min Summer	9.829	0.029	263.2	281.9	Flood Risk
600 min Summer	9.825	0.025	227.2	246.7	Flood Risk
720 min Summer	9.823	0.023	204.8	219.5	Flood Risk
960 min Summer	9.819	0.019	168.8	181.1	Flood Risk
1440 min Summer	9.814	0.014	128.3	136.6	Flood Risk
2160 min Summer	9.810	0.010	92.2	101.3	Flood Risk
2880 min Summer	9.808	0.008	74.3	81.8	Flood Risk
4320 min Summer	9.806	0.006	56.2	58.6	Flood Risk
5760 min Summer	9.805	0.005	42.7	47.6	Flood Risk
7200 min Summer	9.804	0.004	38.3	39.2	Flood Risk
8640 min Summer	9.804	0.004	33.8	34.5	Flood Risk
10080 min Summer	9.803	0.003	29.2	29.7	Flood Risk
15 min Winter	9.851	0.051	450.0	498.0	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
15 min Summer	122.433	0.0	14		
30 min Summer	82.239	0.0	23		
60 min Summer	52.662	0.0	40		
120 min Summer	32.503	0.0	72		
180 min Summer	24.118	0.0	102		
240 min Summer	19.386	0.0	132		
360 min Summer	14.268	0.0	192		
480 min Summer	11.460	0.0	254		
600 min Summer	9.659	0.0	314		
720 min Summer	8.396	0.0	374		
960 min Summer	6.724	0.0	492		
1440 min Summer	4.907	0.0	736		
2160 min Summer	3.573	0.0	1104		
2880 min Summer	2.849	0.0	1468		
4320 min Summer	2.067	0.0	2200		
5760 min Summer	1.644	0.0	2936		
7200 min Summer	1.377	0.0	3680		
8640 min Summer	1.193	0.0	4352		
10080 min Summer	1.056	0.0	5104		
15 min Winter	122.433	0.0	15		
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ		Bird In Eye Farm Permeable Paving			
Date 19/05/2015 File Permeable Paving.srcx		Designed by SAH Checked by SMB			
Micro Drainage		Source Control 2014.1.1			
Summary of Results for 100 year Return Period (+30%)					
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status
30 min Winter	9.863	0.063	450.0	607.5	Flood Risk
60 min Winter	9.864	0.064	450.0	624.7	Flood Risk
120 min Winter	9.852	0.052	450.0	504.9	Flood Risk
180 min Winter	9.843	0.043	389.3	418.1	Flood Risk
240 min Winter	9.837	0.037	330.7	356.9	Flood Risk
360 min Winter	9.829	0.029	258.8	277.1	Flood Risk
480 min Winter	9.824	0.024	213.7	228.6	Flood Risk
600 min Winter	9.820	0.020	182.3	194.9	Flood Risk
720 min Winter	9.818	0.018	159.7	170.2	Flood Risk
960 min Winter	9.814	0.014	128.3	137.0	Flood Risk
1440 min Winter	9.811	0.011	96.7	102.2	Flood Risk
2160 min Winter	9.808	0.008	69.7	73.3	Flood Risk
2880 min Winter	9.806	0.006	56.2	58.6	Flood Risk
4320 min Winter	9.805	0.005	42.7	44.0	Flood Risk
5760 min Winter	9.804	0.004	33.8	34.5	Flood Risk
7200 min Winter	9.803	0.003	29.2	29.7	Flood Risk
8640 min Winter	9.803	0.003	24.8	24.8	Flood Risk
10080 min Winter	9.802	0.002	20.3	20.7	Flood Risk
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)		
30 min Winter	82.239	0.0	24		
60 min Winter	52.662	0.0	42		
120 min Winter	32.503	0.0	74		
180 min Winter	24.118	0.0	104		
240 min Winter	19.386	0.0	136		
360 min Winter	14.268	0.0	196		
480 min Winter	11.460	0.0	256		
600 min Winter	9.659	0.0	314		
720 min Winter	8.396	0.0	384		
960 min Winter	6.724	0.0	494		
1440 min Winter	4.907	0.0	744		
2160 min Winter	3.573	0.0	1076		
2880 min Winter	2.849	0.0	1448		
4320 min Winter	2.067	0.0	2216		
5760 min Winter	1.644	0.0	2896		
7200 min Winter	1.377	0.0	3672		
8640 min Winter	1.193	0.0	4360		
10080 min Winter	1.056	0.0	4992		
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Permeable Paving	
Date 19/05/2015 File Permeable Paving.srcx	Designed by SAH Checked by SMB	
Micro Drainage		Source Control 2014.1.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 3.300

Time (mins)	Area
From:	To: (ha)

0	4 3.300
---	---------

Time Area Diagram

Total Area (ha) 0.000

Time (mins)	Area
From:	To: (ha)

0	4 0.000
---	---------

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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Permeable Paving																									
Date 19/05/2015 File Permeable Paving.srcx	Designed by SAH Checked by SMB																									
Micro Drainage Source Control 2014.1.1																										
<p style="text-align: center;"><u>Model Details</u></p> <p style="text-align: center;">Storage is Online Cover Level (m) 10.000</p> <p style="text-align: center;"><u>Porous Car Park Structure</u></p> <table> <tr> <td>Infiltration Coefficient Base (m/hr)</td> <td>0.10000</td> <td>Width (m)</td> <td>180.0</td> </tr> <tr> <td>Membrane Percolation (mm/hr)</td> <td>1000</td> <td>Length (m)</td> <td>180.0</td> </tr> <tr> <td>Max Percolation (l/s)</td> <td>9000.0</td> <td>Slope (1:X)</td> <td>0.0</td> </tr> <tr> <td>Safety Factor</td> <td>2.0</td> <td>Depression Storage (mm)</td> <td>5</td> </tr> <tr> <td>Porosity</td> <td>0.30</td> <td>Evaporation (mm/day)</td> <td>3</td> </tr> <tr> <td>Invert Level (m)</td> <td>9.800</td> <td>Cap Volume Depth (m)</td> <td>0.000</td> </tr> </table>			Infiltration Coefficient Base (m/hr)	0.10000	Width (m)	180.0	Membrane Percolation (mm/hr)	1000	Length (m)	180.0	Max Percolation (l/s)	9000.0	Slope (1:X)	0.0	Safety Factor	2.0	Depression Storage (mm)	5	Porosity	0.30	Evaporation (mm/day)	3	Invert Level (m)	9.800	Cap Volume Depth (m)	0.000
Infiltration Coefficient Base (m/hr)	0.10000	Width (m)	180.0																							
Membrane Percolation (mm/hr)	1000	Length (m)	180.0																							
Max Percolation (l/s)	9000.0	Slope (1:X)	0.0																							
Safety Factor	2.0	Depression Storage (mm)	5																							
Porosity	0.30	Evaporation (mm/day)	3																							
Invert Level (m)	9.800	Cap Volume Depth (m)	0.000																							
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Summer</td><td>9.231</td><td>0.931</td><td>0.2</td><td>6.3</td><td>O K</td></tr><tr><td>600 min Summer</td><td>9.210</td><td>0.910</td><td>0.2</td><td>6.1</td><td>O K</td></tr><tr><td>720 min Summer</td><td>9.187</td><td>0.887</td><td>0.2</td><td>6.0</td><td>O K</td></tr><tr><td>960 min Summer</td><td>9.140</td><td>0.840</td><td>0.2</td><td>5.6</td><td>O K</td></tr><tr><td>1440 min Summer</td><td>9.053</td><td>0.753</td><td>0.2</td><td>5.1</td><td>O K</td></tr><tr><td>2160 min Summer</td><td>8.942</td><td>0.642</td><td>0.2</td><td>4.3</td><td>O K</td></tr><tr><td>2880 min Summer</td><td>8.848</td><td>0.548</td><td>0.2</td><td>3.7</td><td>O K</td></tr><tr><td>4320 min Summer</td><td>8.700</td><td>0.400</td><td>0.2</td><td>2.7</td><td>O K</td></tr><tr><td>5760 min Summer</td><td>8.591</td><td>0.291</td><td>0.1</td><td>2.0</td><td>O K</td></tr><tr><td>7200 min Summer</td><td>8.511</td><td>0.211</td><td>0.1</td><td>1.4</td><td>O K</td></tr><tr><td>8640 min Summer</td><td>8.450</td><td>0.150</td><td>0.1</td><td>1.0</td><td>O K</td></tr><tr><td>10080 min Summer</td><td>8.404</td><td>0.104</td><td>0.1</td><td>0.7</td><td>O K</td></tr><tr><td>15 min Winter</td><td>8.854</td><td>0.554</td><td>0.2</td><td>3.7</td><td>O K</td></tr></tbody></table> <table><thead><tr><th>Storm Event</th><th>Rain (mm/hr)</th><th>Flooded Volume (m³)</th><th>Time-Peak (mins)</th></tr></thead><tbody><tr><td>15 min Summer</td><td>122.433</td><td>0.0</td><td>18</td></tr><tr><td>30 min Summer</td><td>82.239</td><td>0.0</td><td>33</td></tr><tr><td>60 min Summer</td><td>52.662</td><td>0.0</td><td>62</td></tr><tr><td>120 min Summer</td><td>32.503</td><td>0.0</td><td>122</td></tr><tr><td>180 min Summer</td><td>24.118</td><td>0.0</td><td>180</td></tr><tr><td>240 min Summer</td><td>19.386</td><td>0.0</td><td>210</td></tr><tr><td>360 min Summer</td><td>14.268</td><td>0.0</td><td>272</td></tr><tr><td>480 min Summer</td><td>11.460</td><td>0.0</td><td>338</td></tr><tr><td>600 min Summer</td><td>9.659</td><td>0.0</td><td>408</td></tr><tr><td>720 min Summer</td><td>8.396</td><td>0.0</td><td>478</td></tr><tr><td>960 min Summer</td><td>6.724</td><td>0.0</td><td>616</td></tr><tr><td>1440 min Summer</td><td>4.907</td><td>0.0</td><td>892</td></tr><tr><td>2160 min Summer</td><td>3.573</td><td>0.0</td><td>1280</td></tr><tr><td>2880 min Summer</td><td>2.849</td><td>0.0</td><td>1672</td></tr><tr><td>4320 min Summer</td><td>2.067</td><td>0.0</td><td>2420</td></tr><tr><td>5760 min Summer</td><td>1.644</td><td>0.0</td><td>3168</td></tr><tr><td>7200 min Summer</td><td>1.377</td><td>0.0</td><td>3888</td></tr><tr><td>8640 min Summer</td><td>1.193</td><td>0.0</td><td>4576</td></tr><tr><td>10080 min Summer</td><td>1.056</td><td>0.0</td><td>5248</td></tr><tr><td>15 min Winter</td><td>122.433</td><td>0.0</td><td>18</td></tr></tbody></table>							Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	15 min Summer	8.793	0.493	0.2	3.3	O K	30 min Summer	8.949	0.649	0.2	4.4	O K	60 min Summer	9.099	0.799	0.2	5.4	O K	120 min Summer	9.215	0.915	0.2	6.1	O K	180 min Summer	9.247	0.947	0.2	6.4	O K	240 min Summer	9.249	0.949	0.2	6.4	O K	360 min Summer	9.245	0.945	0.2	6.4	O K	480 min Summer	9.231	0.931	0.2	6.3	O K	600 min Summer	9.210	0.910	0.2	6.1	O K	720 min Summer	9.187	0.887	0.2	6.0	O K	960 min Summer	9.140	0.840	0.2	5.6	O K	1440 min Summer	9.053	0.753	0.2	5.1	O K	2160 min Summer	8.942	0.642	0.2	4.3	O K	2880 min Summer	8.848	0.548	0.2	3.7	O K	4320 min Summer	8.700	0.400	0.2	2.7	O K	5760 min Summer	8.591	0.291	0.1	2.0	O K	7200 min Summer	8.511	0.211	0.1	1.4	O K	8640 min Summer	8.450	0.150	0.1	1.0	O K	10080 min Summer	8.404	0.104	0.1	0.7	O K	15 min Winter	8.854	0.554	0.2	3.7	O K	Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)	15 min Summer	122.433	0.0	18	30 min Summer	82.239	0.0	33	60 min Summer	52.662	0.0	62	120 min Summer	32.503	0.0	122	180 min Summer	24.118	0.0	180	240 min Summer	19.386	0.0	210	360 min Summer	14.268	0.0	272	480 min Summer	11.460	0.0	338	600 min Summer	9.659	0.0	408	720 min Summer	8.396	0.0	478	960 min Summer	6.724	0.0	616	1440 min Summer	4.907	0.0	892	2160 min Summer	3.573	0.0	1280	2880 min Summer	2.849	0.0	1672	4320 min Summer	2.067	0.0	2420	5760 min Summer	1.644	0.0	3168	7200 min Summer	1.377	0.0	3888	8640 min Summer	1.193	0.0	4576	10080 min Summer	1.056	0.0	5248	15 min Winter	122.433	0.0	18
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ			Bird In Eye Farm Soakaways			
Date 19/05/2015 File Soakaways.srcx		Designed by SAH Checked by SMB				
Micro Drainage		Source Control 2014.1.1				
Summary of Results for 100 year Return Period (+30%)						
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Volume (m³)	Status	
30 min Winter	9.031	0.731	0.2	4.9	O K	
60 min Winter	9.202	0.902	0.2	6.1	O K	
120 min Winter	9.341	1.041	0.3	7.0	O K	
180 min Winter	9.385	1.085	0.3	7.3	O K	
240 min Winter	9.391	1.091	0.3	7.3	O K	
360 min Winter	9.382	1.082	0.3	7.3	O K	
480 min Winter	9.362	1.062	0.3	7.1	O K	
600 min Winter	9.333	1.033	0.2	6.9	O K	
720 min Winter	9.300	1.000	0.2	6.7	O K	
960 min Winter	9.230	0.930	0.2	6.3	O K	
1440 min Winter	9.103	0.803	0.2	5.4	O K	
2160 min Winter	8.943	0.643	0.2	4.3	O K	
2880 min Winter	8.815	0.515	0.2	3.5	O K	
4320 min Winter	8.625	0.325	0.1	2.2	O K	
5760 min Winter	8.494	0.194	0.1	1.3	O K	
7200 min Winter	8.404	0.104	0.1	0.7	O K	
8640 min Winter	8.351	0.051	0.1	0.3	O K	
10080 min Winter	8.345	0.045	0.1	0.3	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Time-Peak (mins)			
30 min Winter	82.239	0.0	33			
60 min Winter	52.662	0.0	62			
120 min Winter	32.503	0.0	118			
180 min Winter	24.118	0.0	174			
240 min Winter	19.386	0.0	228			
360 min Winter	14.268	0.0	284			
480 min Winter	11.460	0.0	362			
600 min Winter	9.659	0.0	440			
720 min Winter	8.396	0.0	514			
960 min Winter	6.724	0.0	664			
1440 min Winter	4.907	0.0	952			
2160 min Winter	3.573	0.0	1364			
2880 min Winter	2.849	0.0	1760			
4320 min Winter	2.067	0.0	2508			
5760 min Winter	1.644	0.0	3232			
7200 min Winter	1.377	0.0	3896			
8640 min Winter	1.193	0.0	4408			
10080 min Winter	1.056	0.0	5080			
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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Soakaways	
Date 19/05/2015 File Soakaways.srcx	Designed by SAH Checked by SMB	
Micro Drainage		Source Control 2014.1.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 0.015

Time (mins) Area

From: To: (ha)

0 4 0.015

Time Area Diagram

Total Area (ha) 0.000

Time (mins) Area

From: To: (ha)

0 4 0.000

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Micro Drainage Source Control 2014.1.1																				
<p style="text-align: center;"><u>Model Details</u></p> <p style="text-align: center;">Storage is Online Cover Level (m) 10.000</p> <p style="text-align: center;"><u>Cellular Storage Structure</u></p> <p style="text-align: center;">Invert Level (m) 8.300 Safety Factor 2.0 Infiltration Coefficient Base (m/hr) 0.10000 Porosity 0.96 Infiltration Coefficient Side (m/hr) 0.10000</p> <table border="1"> <thead> <tr> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> <th>Depth (m)</th> <th>Area (m²)</th> <th>Inf. Area (m²)</th> </tr> </thead> <tbody> <tr> <td>0.000</td> <td>7.0</td> <td>7.0</td> <td>1.201</td> <td>0.0</td> <td>19.7</td> </tr> <tr> <td>1.200</td> <td>7.0</td> <td>19.7</td> <td></td> <td></td> <td></td> </tr> </tbody> </table>			Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)	0.000	7.0	7.0	1.201	0.0	19.7	1.200	7.0	19.7			
Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)															
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Date 19/05/2015
File Cellular Storage.srcx

Micro Drainage

Bird In Eye Farm
Cellular Storage

Designed by SAH
Checked by SMB

Source Control 2014.1.1

Page 1



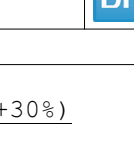
Summary of Results for 100 year Return Period (+30%)

Half Drain Time : 1144 minutes.

Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status
15 min Summer	8.666	0.366	0.0	22.3	22.3	984.5	O K
30 min Summer	8.789	0.489	0.0	22.3	22.3	1314.7	O K
60 min Summer	8.919	0.619	0.0	22.3	22.3	1665.0	O K
120 min Summer	9.049	0.749	0.0	22.3	22.3	2014.6	O K
180 min Summer	9.119	0.819	0.0	22.3	22.3	2202.6	O K
240 min Summer	9.163	0.863	0.0	22.3	22.3	2320.9	O K
360 min Summer	9.221	0.921	0.0	22.3	22.3	2476.3	O K
480 min Summer	9.253	0.953	0.0	22.3	22.3	2562.9	O K
600 min Summer	9.271	0.971	0.0	22.3	22.3	2610.6	O K
720 min Summer	9.280	0.980	0.0	22.3	22.3	2633.4	O K
960 min Summer	9.279	0.979	0.0	22.3	22.3	2631.9	O K
1440 min Summer	9.260	0.960	0.0	22.3	22.3	2580.8	O K
2160 min Summer	9.219	0.919	0.0	22.3	22.3	2471.4	O K
2880 min Summer	9.171	0.871	0.0	22.3	22.3	2341.8	O K
4320 min Summer	9.058	0.758	0.0	22.3	22.3	2038.0	O K
5760 min Summer	8.954	0.654	0.0	22.3	22.3	1757.7	O K
7200 min Summer	8.863	0.563	0.0	22.3	22.3	1513.1	O K
8640 min Summer	8.784	0.484	0.0	22.3	22.3	1300.7	O K
10080 min Summer	8.717	0.417	0.0	22.3	22.3	1120.9	O K
15 min Winter	8.711	0.411	0.0	22.3	22.3	1103.8	O K

Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)
15 min Summer	122.433	0.0	877.8	19
30 min Summer	82.239	0.0	1189.2	34
60 min Summer	52.662	0.0	1647.9	64
120 min Summer	32.503	0.0	2037.2	124
180 min Summer	24.118	0.0	2265.1	182
240 min Summer	19.386	0.0	2423.3	242
360 min Summer	14.268	0.0	2663.1	362
480 min Summer	11.460	0.0	2835.8	482
600 min Summer	9.659	0.0	2967.1	602
720 min Summer	8.396	0.0	3067.9	720
960 min Summer	6.724	0.0	3193.0	934
1440 min Summer	4.907	0.0	3138.0	1156
2160 min Summer	3.573	0.0	4135.6	1556
2880 min Summer	2.849	0.0	4387.8	1960
4320 min Summer	2.067	0.0	4743.1	2764
5760 min Summer	1.644	0.0	5126.9	3520
7200 min Summer	1.377	0.0	5364.6	4256
8640 min Summer	1.193	0.0	5563.4	5008
10080 min Summer	1.056	0.0	5722.2	5656
15 min Winter	122.433	0.0	988.4	19

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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Cellular Storage							
Date 19/05/2015 File Cellular Storage.srcx	Designed by SAH Checked by SMB							
Micro Drainage	Source Control 2014.1.1							
<u>Summary of Results for 100 year Return Period (+30%)</u>								
Storm Event	Max Level (m)	Max Depth (m)	Max Infiltration (l/s)	Max Control E (l/s)	Max Outflow (l/s)	Max Volume (m³)	Status	
30 min Winter	8.849	0.549	0.0	22.3	22.3	1475.0	O K	
60 min Winter	8.995	0.695	0.0	22.3	22.3	1869.4	O K	
120 min Winter	9.144	0.844	0.0	22.3	22.3	2268.8	O K	
180 min Winter	9.224	0.924	0.0	22.3	22.3	2483.5	O K	
240 min Winter	9.274	0.974	0.0	22.3	22.3	2616.9	O K	
360 min Winter	9.340	1.040	0.0	22.3	22.3	2796.3	O K	
480 min Winter	9.379	1.079	0.0	22.3	22.3	2901.0	O K	
600 min Winter	9.402	1.102	0.0	22.3	22.3	2963.4	O K	
720 min Winter	9.415	1.115	0.0	22.3	22.3	2998.4	O K	
960 min Winter	9.422	1.122	0.0	22.3	22.3	3016.7	O K	
1440 min Winter	9.396	1.096	0.0	22.3	22.3	2946.0	O K	
2160 min Winter	9.342	1.042	0.0	22.3	22.3	2801.7	O K	
2880 min Winter	9.276	0.976	0.0	22.3	22.3	2623.9	O K	
4320 min Winter	9.118	0.818	0.0	22.3	22.3	2199.0	O K	
5760 min Winter	8.950	0.650	0.0	22.3	22.3	1746.8	O K	
7200 min Winter	8.812	0.512	0.0	22.3	22.3	1375.5	O K	
8640 min Winter	8.700	0.400	0.0	22.3	22.3	1075.5	O K	
10080 min Winter	8.615	0.315	0.0	22.2	22.2	848.0	O K	
Storm Event	Rain (mm/hr)	Flooded Volume (m³)	Discharge Volume (m³)	Time-Peak (mins)				
30 min Winter	82.239	0.0	1329.8	33				
60 min Winter	52.662	0.0	1848.2	62				
120 min Winter	32.503	0.0	2280.1	122				
180 min Winter	24.118	0.0	2531.0	180				
240 min Winter	19.386	0.0	2704.1	240				
360 min Winter	14.268	0.0	2961.9	356				
480 min Winter	11.460	0.0	3139.4	472				
600 min Winter	9.659	0.0	3262.7	586				
720 min Winter	8.396	0.0	3340.0	700				
960 min Winter	6.724	0.0	3359.8	922				
1440 min Winter	4.907	0.0	3203.7	1324				
2160 min Winter	3.573	0.0	4630.3	1644				
2880 min Winter	2.849	0.0	4908.8	2108				
4320 min Winter	2.067	0.0	5287.8	3028				
5760 min Winter	1.644	0.0	5744.5	3800				
7200 min Winter	1.377	0.0	6012.1	4536				
8640 min Winter	1.193	0.0	6236.7	5184				
10080 min Winter	1.056	0.0	6419.7	5840				

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Micro Drainage		Source Control 2014.1.1

Rainfall Details

Rainfall Model	FSR	Winter Storms	Yes
Return Period (years)	100	Cv (Summer)	0.750
Region	England and Wales	Cv (Winter)	0.840
M5-60 (mm)	20.000	Shortest Storm (mins)	15
Ratio R	0.350	Longest Storm (mins)	10080
Summer Storms	Yes	Climate Change %	+30

Time Area Diagram

Total Area (ha) 4.351

Time (mins)	Area
From:	To: (ha)

0	4 4.351
---	---------

Time Area Diagram

Total Area (ha) 0.000

Time (mins)	Area
From:	To: (ha)

0	4 0.000
---	---------

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Unit 6 - Barham Business Park Elham Valley Road Barham CT4 6DQ	Bird In Eye Farm Cellular Storage	
Date 19/05/2015 File Cellular Storage.srcx	Designed by SAH Checked by SMB	
Micro Drainage Source Control 2014.1.1		

Model Details

Storage is Online Cover Level (m) 10.000

Cellular Storage Structure

Invert Level (m) 8.300 Safety Factor 2.0
Infiltration Coefficient Base (m/hr) 0.00000 Porosity 0.96
Infiltration Coefficient Side (m/hr) 0.00000

Depth (m)	Area (m ²)	Inf. Area (m ²)	Depth (m)	Area (m ²)	Inf. Area (m ²)
0.000	2800.0	2800.0	1.201	0.0	3054.1
1.200	2800.0	3054.0			

Hydro-Brake Optimum® Outflow Control

Unit Reference MD-SHE-0206-2240-1200-2240
Design Head (m) 1.200
Design Flow (l/s) 22.4
Flush-Flo™ Calculated
Objective Minimise upstream storage
Diameter (mm) 206
Invert Level (m) 8.300
Minimum Outlet Pipe Diameter (mm) 225
Suggested Manhole Diameter (mm) 1500

Control Points	Head (m)	Flow (l/s)
Design Point (Calculated)	1.200	22.3
Flush-Flo™	0.382	22.3
Kick-Flo®	0.834	18.8
Mean Flow over Head Range	-	19.0

The hydrological calculations have been based on the Head/Discharge relationship for the Hydro-Brake Optimum® as specified. Should another type of control device other than a Hydro-Brake Optimum® be utilised then these storage routing calculations will be invalidated

Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)	Depth (m)	Flow (l/s)
0.100	7.0	1.200	22.3	3.000	34.6	7.000	52.1
0.200	19.7	1.400	24.0	3.500	37.3	7.500	53.9
0.300	22.1	1.600	25.6	4.000	39.8	8.000	55.6
0.400	22.3	1.800	27.1	4.500	42.1	8.500	57.3
0.500	22.0	2.000	28.5	5.000	44.3	9.000	58.9
0.600	21.6	2.200	29.8	5.500	46.4	9.500	60.5
0.800	19.6	2.400	31.1	6.000	48.4		
1.000	20.5	2.600	32.3	6.500	50.3		

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Appendix A.3 – Master Plan Layout



CDM 2007 Health & Safety Information:
This information relates only to 'Significant Hazards' identified on this drawing
and is to be read in conjunction with the Designer's Risk Assessment Register.

	Existing Main road		Potential emergency access
	Site Boundary 9.96 Ha		Approximate location of badger sett(s) with 20m radius
	Residential Interface		Proposed hedging to the boundaries
	Sensitive edge to Ancient Woodland + countryside		Proposed Main roads
	Rural views from site		Proposed Secondary roads
	Views into Site		Green Lane
	Flood plain		Public Square
	15m Buffer Zone from Ancient Woodland		Focal Point
	Ancient Woodland		Proposed Residential Blocks
	Main Vehicular entrance		Community hall & parking
	Vista		Public open space

Client's Name
Croudace

Job Title
Bird in Eye Farm
Bird in Eye Hill, Uckfield

Drawing Title
Block Plan

Scale
NOT TO SCALE

Drawn
JD

Checked
KE/EY

Date
07.05.15

Job No
6225

Drawing No
02

Status
INFORMATION

Rev Date Revision Details Dr C

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