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Client: FDC Homes Ltd

Flood Risk Assessment for the Proposed Development at Land North of Woodchurch Road, Shadoxhurst

April 2018

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Contents Amendment Record

This report has been issued and amended as follows:

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1 Scope of Appraisal

Herrington Consulting has been commissioned by FDC Homes Ltd to prepare a Flood Risk Assessment (FRA) and Sustainable Drainage Assessment for the proposed development at **Land North of Woodchurch Road, Shadoxhurst, Ashford, Kent, TN26 1LE**.

A Flood Risk Assessment (FRA) appraises the risk of flooding to development at a site-specific scale and recommends appropriate mitigation measures to reduce the impact of flooding to both the site and the surrounding area. New development has the potential to increase the risk of flooding to neighbouring sites and properties through increased surface water runoff and as such, an assessment of the proposed site drainage can help to accurately quantify the runoff rates, flow pathways and infiltration potential at the site. This assessment considers the practicality of incorporating Sustainable Drainage Systems (SuDS) into the scheme design, with the aim of reducing the risk of flooding by actively managing surface water runoff.

This report has been produced to support a full planning application and has been prepared in accordance with the requirements of both national and local planning policy. To ensure that due account is taken of industry best practice, reference has also been made to CIRIA Report C753 'The SuDS Manual' and any relevant local planning policy guidance. The surface water assessment included within this report is not intended to constitute a detailed drainage design.

2 Development Description and Planning Context

2.1 Site Location and Existing Use

The site is located at OS coordinates 597616, 138148, off Woodchurch Road in Shadoxhurst, Kent. In total the site covers an area of approximately 1.3 hectares and currently comprises of a single residential dwelling and an area of greenfield land. The location of the site in relation to the surrounding area is shown in Figure 2.1.

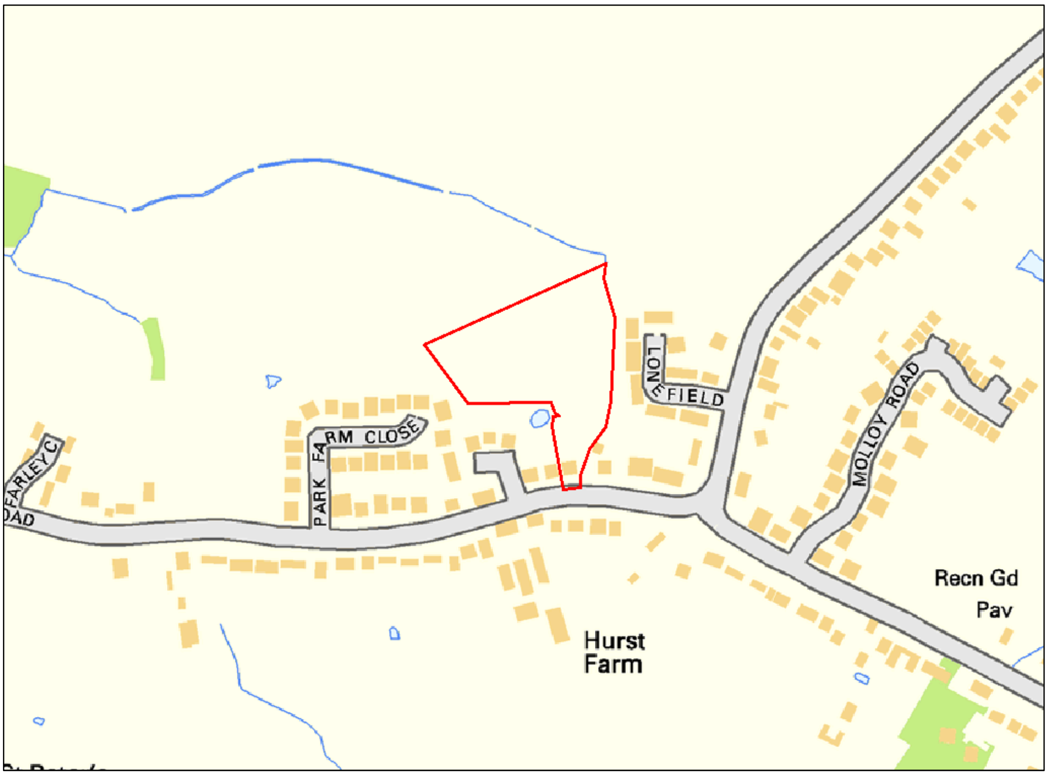

Figure 2.1 – Location map (Contains Ordnance Survey data © Crown copyright and database right 2018).

The site plan included in Appendix A.1 of this report provides more detail in relation to the site location and layout.

2.2 Proposed Development

The proposals for development comprise the demolition of the existing residential dwelling and the construction of 14 new dwellings with associated parking and access road.

Drawings of the proposed scheme are included in Appendix A.1 of this report.

2.3 The Sequential Test

Local Planning Authorities (LPA) are encouraged to take a risk-based approach to proposals for development in areas at risk of flooding through the application of the Sequential Test. The objectives of this test are to steer new development away from high risk areas towards those areas at lower risk of flooding. However, in some areas where developable land is in short supply there can be an overriding need to build in areas that are at risk of flooding. In such circumstances, the application of the Sequential Test is used to ensure that the lower risk sites are developed before the higher risk ones.

The National Planning Policy Framework (NPPF) requires the Sequential Test to be applied at all stages of the planning process and generally the starting point is the Environment Agency's flood zone maps. These maps and the associated information are intended for guidance, and cannot provide details for individual properties. They do not take into account other considerations such as existing flood defences, alternative flooding mechanisms and detailed site based surveys. They do, however, provide high level information on the type and likelihood of flood risk in any particular area of the country. The flood zones are classified as follows:

Zone 1 – *Low probability of flooding* – This zone is assessed as having less than a 1 in 1000 annual probability of river or sea flooding in any one year.

Zone 2 – *Medium probability of flooding* – This zone comprises land assessed as having between a 1 in 100 and 1 in 1000 annual probability of river flooding or between 1 in 200 and 1 in 1000 annual probability of sea flooding in any one year.

Zone 3a – *High probability of flooding* - This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding or 1 in 200 or greater annual probability of sea flooding in any one year.

Zone 3b – *The Functional Floodplain* – This zone comprises land where water has to flow or be stored in times of flood and can be defined as land which would flood during an event having an annual probability of 1 in 20 or greater. This zone can also represent areas that are designed to flood in an extreme event as part of a flood alleviation or flood storage scheme.

The location of the site is shown on the Environment Agency's flood zone map in Figure 2.2 and the information provided by this map has been interrogated and summarised in Table 2.1 below.

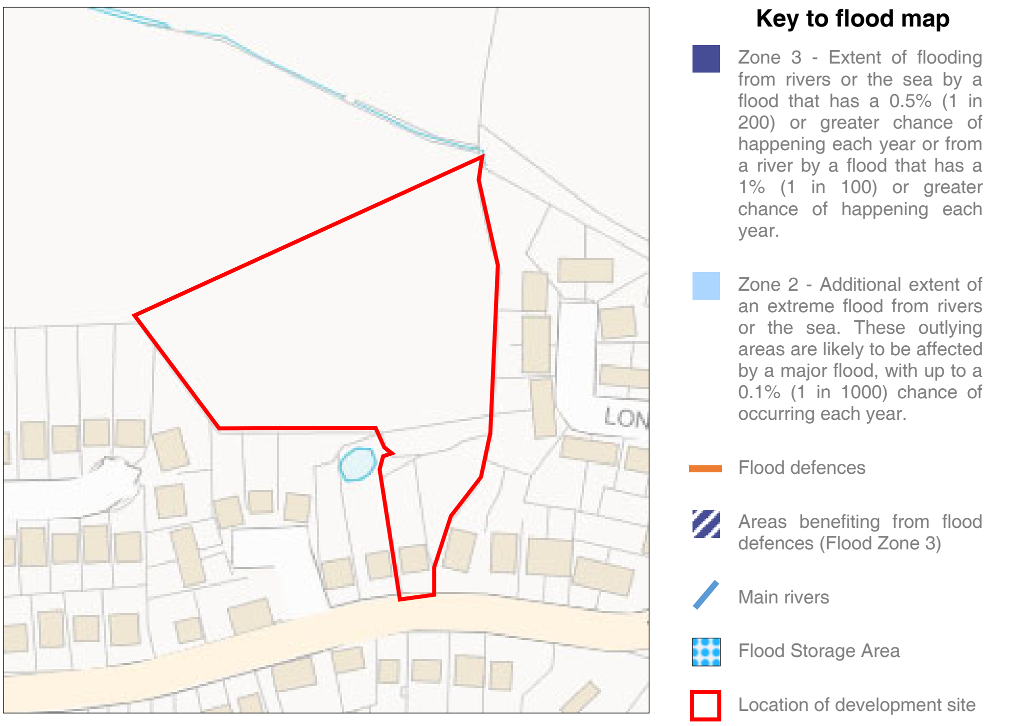

Figure 2.2 – Flood zone map showing the location of the development site (© Environment Agency)

The above mapping shows the development site to be located within Flood Zone 1 (i.e. lowest risk of tidal/fluvial flooding).

The flood zone mapping and associated information has been summarised in Table 2.1 below.

Flood Zone (percentage of site within zone)		Source of flooding	Benefiting from existing flood defences*
Zone 1	**100%**	N/A	N/A
Zone 2	**0%**		
Zone 3a	**0%**		
Zone 3b	**0%**		
(*) The flood zone maps only recognise defences constructed within the last 5 years			

Table 2.1 – Flood zone classification.

In this circumstance, it is recognised that the site is located within Flood Zone 1, and therefore is located in the lowest possible flood risk zone. As such, **the NPPF does not require the Sequential Test or Exception Test to be applied.**

3 Definition of Flood Hazard

3.1 Site Specific Information

In addition to the high level flood risk information shown in the Environment Agency (EA) flood zone maps, additional data from detailed studies, topographic site surveys and other information sources is referenced. This section summarises the additional information collected as part of this FRA.

Information contained within the SFRA – The Ashford Borough Council SFRA (2014) contains detailed mapping of flood extents from a wide range of sources. This document has been referenced as part of this site-specific FRA.

Information provided by Southern Water – Southern Water has provided the results of an asset location search for the site. Their response is included in Appendix A.2.

Site specific topographic surveys – A topographic survey has not been undertaken for the site, however, inspection of aerial height data reveals that land levels at the site vary between 40.9m and 42.0m Above Ordnance Datum Newlyn (AODN). Ground levels fall across the site gently in a north easterly direction.

Geology – Reference to the British Geological Survey map shows that the underlying solid geology in the location of the subject site Weald Clay Formation (mudstone) with no overlying superficial deposits.

Historic flooding – No information on historic flooding in this area has been provided or revealed through desktop searches.

3.2 Climate Change

When the impact of climate change is considered it is generally accepted that the standard of protection provided by current defences will reduce with time. The global climate is constantly changing, but it is widely recognised that we are now entering a period of accelerating change. Over the last few decades there have been numerous studies into the impact of potential changes in the future and there is now an increasing body of scientific evidence which supports the fact that the global climate is changing as a result of human activity. Past, present and future emissions of greenhouse gases are expected to cause significant global climate change during this century.

The nature of climate change at a regional level will vary: for the UK, projections of future climate change indicate that more frequent short-duration, high-intensity rainfall and more frequent periods of long-duration rainfall of the type responsible for the recent UK flooding could be expected.

These effects will tend to increase the size of flood zones associated with rivers, and the amount of flooding experienced from other inland sources. The rise in sea level will change the frequency of occurrence of high water levels relative to today's sea levels. It will also increase the extent of the area at risk should sea defences fail. Changes in wave heights due to increased water depths, as well as possible changes in the frequency, duration and severity of storm events are also predicted.

Whilst the site lies outside of Flood Zones 2 and 3, changes in the climate can still impact upon flood risk and the way in which the development effects flood risk elsewhere. These impacts are primarily linked to the surface water discharge from the site, therefore potential increases in future rainfall need to be taken into account when designing surface water drainage systems.

The recommended allowances for increases in peak rainfall intensity were updated in February 2016 and the allowance is applicable nationally. There is a range of values provided which correspond with the central and upper end percentiles (the 50th and 90th percentile respectively) over three time epochs. The recommended allowances are shown in Table 3.1 below.

Allowance Category (applicable nationwide)	**Total potential change anticipated for each epoch**		
	2015 to 2039	**2040 to 2069**	**2070 to 2115**
Upper End	+10%	+20%	+40%
Central	+5%	+10%	+20%

Table 3.1 – Recommended peak rainfall intensity allowance for small and urban catchments (1961 to 1990 baseline).

To ensure that any recommended mitigation measures are sustainable and effective throughout the lifetime of the development, it is necessary to base the appraisal on the extreme flood level that is commensurate with the planning horizon for the proposed development. The NPPF and supporting Planning Practice Guidance Suite state that for residential development should be considered for a minimum of 100 years. An increase of 20% in peak rainfall intensity has therefore been used to appraise the impacts of climate change on the proposed development.

4 Probability and Consequence of Flooding

4.1 Potential Sources of Flooding

The main sources that pose a potential risk of flooding have been considered as part of this appraisal. The specific issues relating to each source and the impact they could have on this particular development are discussed in Table 4.1 below.

Source of Flooding	Evidence
Risk of Flooding from Rivers	The site is not located within an area identified by the Environment Agency's Flood Zone mapping as being at risk of flooding from a main river. Consequently, the risk of flooding from rivers is *low.*
Risk of Flooding from Sea/Estuaries	The site is located a significant distance inland and is elevated well above predicted extreme tide levels. Consequently, the risk of flooding from this source is considered to be *low.*
Risk of Flooding from Ordinary and man-made watercourses	Inspection of OS mapping of the site and surrounding area reveals that there is a small watercourse to the north of the site which flows from east to west. Inspection of aerial height data reveals that the site is elevated approximately 1m above this watercourse and the Ashford Borough Council SFRA (2014) contains no records of historic flooding in this location. Even in the unlikely event that the capacity of the watercourse is exceeded, flood water would flow away from the site towards lower lying areas to the north. Consequently, the risk of flooding from this source is considered to be *low.*
Risk of Flooding from Overland flow	Inspection of the Environment Agency 'Risk of Flooding from Surface Water' mapping shows that the site is located within an area identified as being at 'very low' to 'low' risk of flooding from surface water. The only topographic depression within the site is an existing sheep dip and small pond, within which surface water could pond following an extreme rainfall event. However, the applicant has confirmed that the pond and sheep dip will be removed as part of the development proposals. The proposals for development shall also include a sustainable drainage system which will be designed to ensure that surface water runoff is managed appropriately. On balance, it is considered that the risk of flooding to the site from surface water is *low.*
Risk of Flooding from Groundwater	Groundwater flooding is most likely to occur in low-lying areas that are underlain by permeable rock (aquifers). The underlying geology across the site is Weald Clay Formation (Mudstone) which is typically impermeable. Additionally, interrogation of aerial height data for the site and surrounding area reveals that land levels to the north and west of the site are significantly lower. Therefore, it is these areas where groundwater would be more likely to emerge. Furthermore, the watercourse to the north of the site acts to drain the soils in this area and maintain lower groundwater levels. This is supported by the Defra Groundwater Flood Scoping Study (May 2004) which shows that no groundwater flooding events were recorded during the very wet periods of 2000/01 or 2002/03 and that the site itself is not located within an area where groundwater emergence is predicted. Consequently, the risk of flooding from groundwater is considered to be *low.*
Risk of Flooding from Sewers	Inspection of the Southern Water Asset Location Search data (Appendix A.2) identifies that there are no sewers on site. The mapping does show that there are foul sewers located to the south and east of the site along Woodchurch Road and Lonefield. The lack of sewers on site significantly reduces the risk of flooding. Additionally, even in the unlikely event that the sewers neighbouring the site were to flood (i.e. due to the system becoming surcharged, or a blockage), the topography suggests that flood water not pond at the site. This is further supported by the Ashford Borough Council SFRA (2014), which shows no record of sewer flooding in this area. Therefore, the risk of flooding from this source is considered to be *low.*

Source of Flooding	Evidence
Risk of Flooding from Artificial Sources	Inspection of the Ordnance Survey mapping for the area shows that there are no artificial sources of flooding within close proximity to the site. In addition, the Environment Agency's 'Risk of Flooding from Reservoirs' website shows that the site is not within an area considered to be at risk of flooding from reservoirs. Consequently, the risk of flooding is considered to be *low*.

Table 4.1 – Summary of flood sources and risks.

From the analysis in Table 4.1, it can be seen that the site is not exposed to any significant risk of flooding from the sources listed. However, the site area is greater than one hectare and therefore, a Surface Water Management Strategy has been prepared (see Section 5) to minimise the risk of flooding due to surface water runoff from the development.

5 Surface Water Management Strategy

5.1 Background and Policy

The general requirement for all new development with respect to surface water runoff is to ensure that the runoff is managed sustainably and that the drainage solution for the development does not increase the risk of flooding at the site, or within the surrounding area.

For undeveloped greenfield sites, the impact of the proposed development will therefore require mitigation to ensure that the runoff from the site replicates the natural drainage characteristics of the pre-developed site. In the case of brownfield sites, drainage proposals are typically measured against the existing performance of the site, although it is preferable (where practicable) to provide runoff characteristics that are similar to greenfield behaviour.

Changes relating to The Flood and Water Management Act 2010 National Standards (Schedule 3 – paragraph 5) for design, construction, maintenance and operation of Sustainable Drainage Systems (SuDS), came into effect from 6 April 2015. These changes provide additional detail and requirements not initially covered by the NPPF and are (non-statutory) Technical Standards for SuDS.

These National Technical SuDS Standards 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). It is, however, recognised that SuDS should be designed to ensure that the maintenance and operation requirements are economically proportionate.

In this instance, the proposed development is for the construction of 14 residential units on land totalling greater than 1 hectare. As a result, the proposals will be classified as 'major development' and the National Technical SuDS Standards will apply. Reference to the Standards has therefore been made throughout the following sections of this report.

5.2 Surface Water Management Overview

The main characteristics of the site that have the potential to influence surface water drainage are summarised in Table 5.1 below.

Site Characteristic	**Value**
Total area of site	1.3 ha
Impermeable area (existing)*	**~ 0 m^2**
Impermeable area (proposed)	Roof area = 1650 m^2 Hardstanding = 3202 m^2 **Total = 4802 m^2**
Current site condition*	Primarily a Greenfield site, 1 existing house is located to the south of the development.
Greenfield runoff rates (based on the ICP SuDS methodology)	QBar = 4.4 l/s/ha Q30 = 10.0 l/s/ha Q100 = 14.0 l/s/ha
Infiltration coefficient	Negligible (assumed based on underlying geology and typical soil conditions)
Current surface water discharge method	Assumed to informally drain to neighbouring watercourses
Is there a watercourse within close proximity to site?	Yes

*Table 5.1 – Site characteristics affecting rainfall runoff. *Although there is an existing house and driveway to the south of the site, runoff from this area is likely to be minimal. A conservative approach has been adopted and the existing hardstanding has been discounted from the following analysis.*

Synthetic rainfall data has been derived using the variables obtained from the Flood Studies Report (FSR) and the routines within the Micro Drainage Source Control software. The peak surface water flows generated on site for the existing and post-development conditions have been calculated by using the Modified Rational Method. In accordance with the LLFA's current guidance the M5-60 value has been increased to 26.25mm for all subsequent calculations.

Runoff rates have been calculated for a range of annual return probabilities including the 100 year return period event with a 20% increase in rainfall intensity to account for future climatic changes. These values are summarised in Table 5.2 for a range of return periods.

Return period (years)	Peak runoff (l/s)	
	Existing site	**Developed site**
1	Undeveloped	126
30		309
100		404
100 + 20%		**483**

Table 5.2 – Summary of peak runoff.

The total volume of water discharged from the site for the 100 year 6 hour event is also summarised in Table 5.3 below, for both the existing and proposed site conditions.

Site condition	Total volume discharged
Existing site (greenfield runoff volume).	130m^3
Proposed development including a 20% increase in rainfall intensity to account for climate change (prior to any mitigation)	460m^3
Difference in volume between existing site (present day) and proposed development (including allowance for climate change)	330m^3

Table 5.3 – Total volume discharged from the 100 yr+20%cc 6 hour event.

Reference to the tables above show the proposed development will increase the percentage of impermeable area within the boundaries of the site and consequently, this will increase the rate and volume of surface water runoff discharged from the site. It will therefore be necessary to provide mitigation measures to ensure the rate of runoff discharged from the site is not increased as a result of the proposed development.

Furthermore, the potential use of SuDS within the proposed development will be considered to assess the practicality of better replicating greenfield behaviour, in accordance with, Local Planning Policy, and S3 and S5 of the National Technical SuDS Standards.

5.3 Existing Drainage

The existing undeveloped site is currently assumed to drain informally, with most runoff from the existing field being directed across the site towards a watercourse located to the north east. A small pond and sheep dip are shown on the topographic survey for the site, however, these features do not appear to drain any surrounding buildings or land.

In addition to the sheep dip and pond, the applicant has also confirmed the location of an existing ditch which runs from south to north along the eastern site boundary. This ditch, which is culverted along part of its length, is located offsite entirely within the gardens of the adjacent properties (to the east).

Southern Water has provided sewer mapping as part of their asset location data for the site and surrounding area. An extract of this mapping is provided in Figure 5.1 below and shows the location of public sewers near to the site.

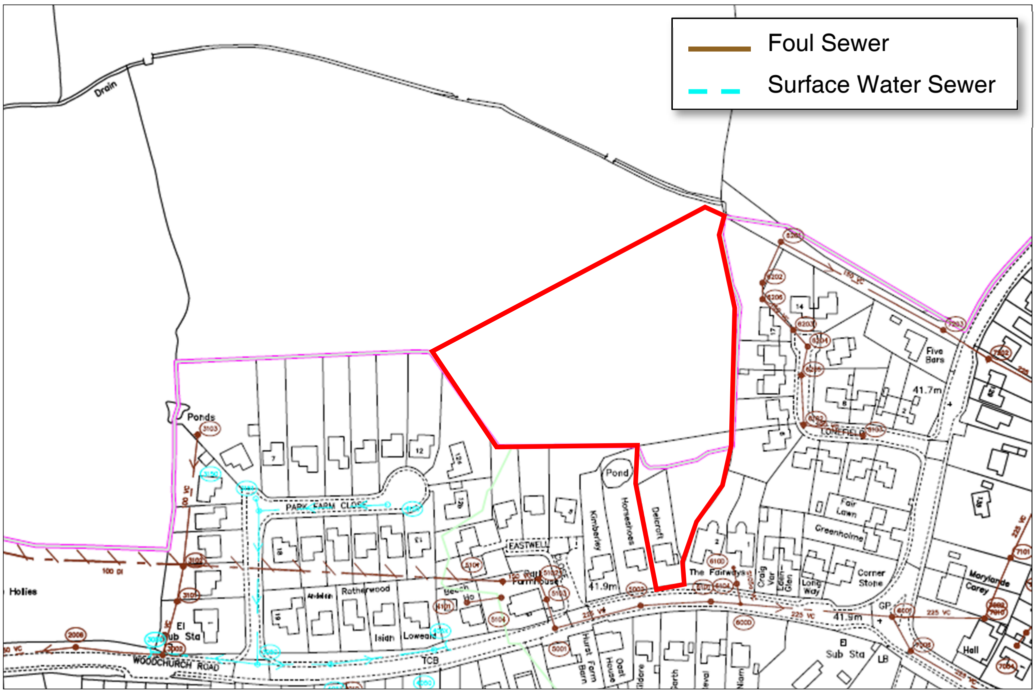

Figure 5.1 – Extract from Southern Waters sewer mapping for the area around the proposed development.

From Figure 5.1 above, it is evident that there are no mapped sewers crossing the site and the nearest surface water sewer is located within Park Farm Close, approximate 120m to the south west of the site.

5.4 Opportunities to Discharge Surface Water Runoff

Part H of the Building Regulations summaries a hierarchy of options for discharging surface water runoff from developments. The most preferential option is to **infiltrate** water into the ground, as this deals with the water at source and serves to replenish groundwater. If this option is not viable, the next option of preference is for the runoff to be discharged into a **watercourse**. Only if neither of these options are possible, the water should be conducted into the **public sewer** system.

The following opportunities for managing the surface water runoff discharged from the development site are listed in order of preference:

Water re-use – Water re-use systems can rarely manage 100% of the surface water runoff discharged from a development, as this requires the yield from the building and hardstanding area to balance perfectly with the demand from the proposed development. Consequently, whilst rainwater recycling systems will be considered for inclusion within the scheme, an alternative solution for attenuating storm water will still be required.

Infiltration – The mudstones which make up most the Weald Clay Formation at this location are generally considered impermeable and cannot support the use of infiltration SuDS. Furthermore, it is unlikely that the required 1m buffer between the base of any infiltration drainage system proposed and the groundwater table can be maintained due to the anticipated high groundwater levels at the site. Consequently, the use of SuDS which rely on deep infiltration are not considered appropriate for the development site.

Discharge to Watercourses – A connection to the watercourse located to the north east of the site is likely to present the most viable solution for draining surface water runoff from the proposed development.

Discharge to Public Sewer System – As a more sustainable solution for draining surface water runoff from the proposed development is available, a connection to the public surface water sewer system is unlikely to be required.

5.5 Constraints and Further Considerations

There are a number of potential constraints that should be considered as part of the drainage strategy. The key constraints that are relevant to this development are listed below:

- Due to the limited infiltration at the site it will not be possible to discharge all surface water runoff via infiltration. Consequently, the use of Type B SuDS is recommended (where possible) to minimise the volume of surface water discharged from the proposed development.

- If a new connection to the existing watercourse is required, it will be necessary to obtain ordinary watercourse consent from the Lead Local Flood Authority before construction can commence. It may also be necessary to gain consent for the new connection from the River Stour Internal Drainage Board who should be consulted as part of the connection proposals.

- To avoid the need for a dedicated management company, or complex covenants, it is envisaged that each property will have a separate drainage system and it will be the owner’s responsibility for the continued maintenance.

- To reduce the risk of polluting receiving waterbodies, in accordance with Ashford Borough Councils Supplementary Planning Documentation, additional pollution control measures such as sediment traps and oil interception devices should be considered within the detailed drainage design for the development.

- The existing biodiversity constraints and general principles of sustainable drainage systems mean that the proposed drainage solution must be integrated into the existing site in a way that will promote biodiversity and minimise the risk of damage to existing natural habitats.

- Greenfield runoff rates for the site have been calculated for Q100, Q30, and Qbar, these are 6.7l/s, 4.8l/s, 2.1l/s respectively. To provide long term storage for storm water, it is envisaged that during the design rainfall event runoff will be discharged from the site at a rate no greater than QBar. This is also considered to be as close as reasonably practicable to Ashford Borough Council's limiting discharge rate for the site of 4.0l/s/ha.

5.6 Proposed Surface Water Management Strategy (SWMS)

The drainage strategy which discusses each of the different elements of the proposed scheme is set out below, along with the calculations that have been undertaken to demonstrate how the overall objectives can be achieved. This does not represent a detailed surface water drainage design; it is simply an assessment to demonstrate that the objectives and requirements of the NPPF can be met at the planning stage.

Water Butts

To reduce the developments reliance on potable water supplies there is the potential to incorporate water butts within the gardens of each property. Typical sizes and dimensions of water butts are outlined below.

Typical House Water Butt Options	Dimensions of a typical house water butt	Volume of storage provided (litres)
Type 1 (wall mounted – Small)	1.22m high x 0.46m x 0.23m	100
Type 2 (Standard house water butt)	0.9m high x 0.68m diameter	210
Type 3 (Large house water butt)	1.26m high x 1.24m x 0.8m	510
Type 4 (Column tank – Very large)	2.23m high x 1.28m diameter	2000

Table 5.4 – Estimated storage capacity of available water butts.

The yield from the roof of each property is likely to be relatively large, and the gardens are likely to have a fairly high demand for potable water. Consequently, the use of standard house water butts, or large house water butts, is likely to be most the appropriate for inclusion within the scheme.

Permeable Surfacing

Permeable surfacing will be used across the private hardstanding areas such as the driveways and patios. This permeable surfacing system will be designed to store a small volume of water within a porous open graded sub-base which underlies the paving surface. Water stored within the paving system will be discharged to a series of swales which cross the site. Although the volume of water stored within the paving system is likely to be relatively small, these systems will provide benefits to the quality of water filtering through the sub-base material.

Swales

To convey runoff across the site a series of swales can be used. Runoff from some of the outflows from the permeable surfacing systems can be directed into swales and subsequently transported across the site into the pond/wetland area (discussed further below). It is envisaged that the swale, planted with species suitable for the wet environment, would be based with gravel and an underdrain used to maximise its capacity.

By using swales, there is potential for more runoff to be discharged to the ground via infiltration, thus minimising the volume of water discharged offsite. In addition, these features will integrate water within the design of the development and provide additional pollution control benefits, as well as habitats for wildlife.

Wetland Area/Pond

Surface water runoff discharging from the roofs and hardstanding areas across the site will drain via the water butts, swales, permeable surfacing, and piped elements of the drainage network to a pond/wetland area located to the north of the site. The rate at which runoff is discharged from the wetland area to the existing watercourse will be restricted to QBar, using a vortex flow control device (e.g. Hydro-Brake or similar). The Micro-Drainage Calculations for the pond/wetland is summarised in Table 5.5.

Parameter	**Value (1:100yr+20%cc event)**
SuDS	Pond/Wetland Area
Area draining to Pond / Wetland Area, including an additional 10% allowance for urban creep.	5280 m^2
Infiltration	Permitted (although assumed negligible)
Dimensions	1200m^2 x 0.5m (deep)
Flow control device	Hydro-Brake
Limiting discharge rate	2.0l/s
Critical storm duration	2160 minutes
Return Period	**Peak discharge rate**
1 in 2yr+cc	2.0 l/s
1 in 30yr+cc	2.0 l/s
1 in 100yr+cc	2.0 l/s

Table 5.5 – Summary of Micro Drainage analysis for the pond/wetland area (100 yr+20%cc) and peak discharge rates for a range of return period events (+20%cc).

From Table 5.5 it is evident that, with the inclusion of the pond/wetland area, there is potential to accommodate all the surface water runoff from the site up to, and including, the design rainfall event. This assumes the rate at which water is discharged to the adjacent watercourse will be attenuated to a rate which is no greater than 2.0l/s (QBar). By achieving a discharge rate approximately equal to QBar this will ensure that the proposed development minimises the volume of runoff discharged off site and it is considered that this will be acceptable to the IDB, LLFA and LPA.

5.7 Sensitivity Testing

The proposed drainage system has been designed for an extreme rainfall event with a return period of 1 in 100 years, including a 20% increase in peak rainfall intensity (to account for the impacts of climate change). Nonetheless, based on the EA's most contemporary climate change guidance an Upper End climate change allowance of 40% has been used to test the proposed drainage system to reflect further increases in peak rainfall intensity.

Calculations have therefore been undertaken to assess the performance of the drainage system under the design rainfall event, including a 40% increase in peak rainfall intensity due to climate change. The results of this analysis are summarised in Table 5.6.

Parameter	Pond/Wetland Area
Maximum depth of water above base of drainage system	~380 mm
Remaining freeboard	~120 mm
Peak discharge rate	2.0l/s
Critical storm duration	2160 minutes

Table 5.6 – Summary of Micro Drainage analysis for the Pond / Wetland Area (100 yr+40%cc).

From Table 5.6 it is evident that under the design rainfall event including a 40% allowance for climate change the pond/wetland area would not surcharge and will continue to operate as designed. Consequently, the risk of flooding will be minimised. The sensitivity of the proposed drainage system to changes in peak rainfall intensity (due to climate change) is therefore considered to be low.

5.8 Indicative Drainage Layout Plan

Figure 5.2 below is an indicative drainage layout plan delineating how the proposed SuDS can be incorporated into the scheme proposals.

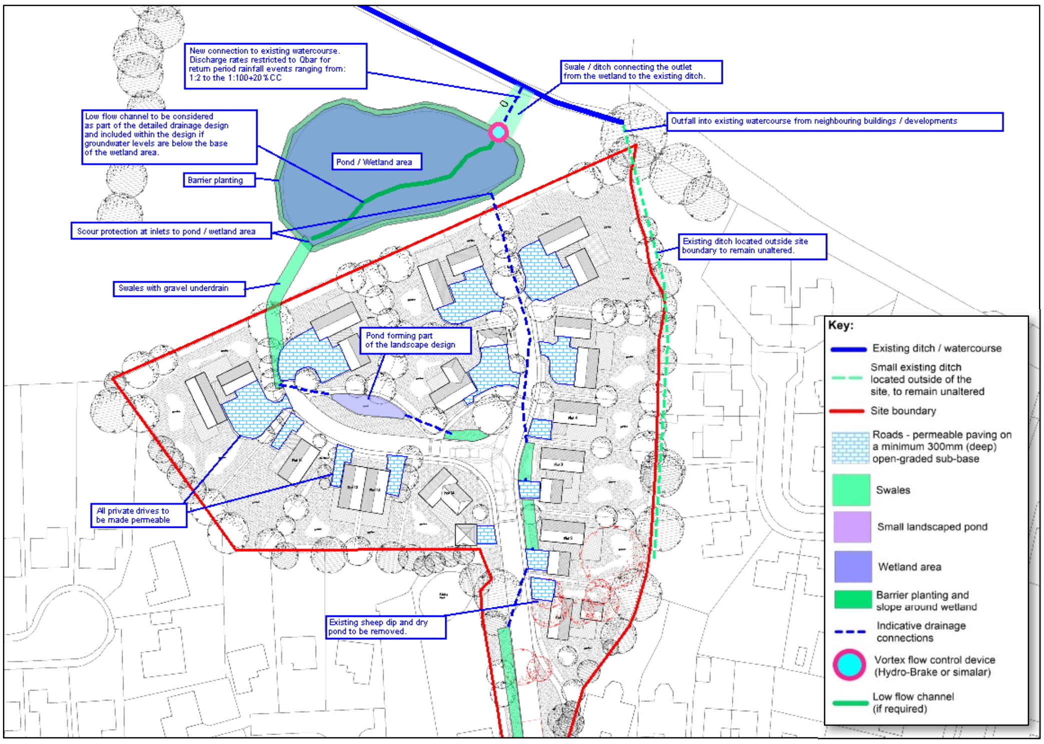

Figure 5.2 - Indicative drainage layout plan showing the proposed location of SuDS.

A full copy of this layout is located in Appendix A.4 of this report.

5.9 Management and Maintenance

For any surface water drainage system to operate as originally designed, it is necessary to ensure that it is adequately maintained throughout its lifetime.

The key requirements of any management regime are routine inspection and maintenance, when the development is taken forward to the detailed design stage an 'owner's manual' will need to be prepared. This should include:

- A description of the drainage scheme,
- A location plan showing all of the SuDS features and equipment such as flow control devices etc.
- Maintenance requirements for each element, including any manufacturer specific requirements
- An explanation of the consequences of not carrying out the specified maintenance
- Details of who will be responsible for the ongoing maintenance of the drainage system.

For the SuDS features recommended by this assessment, the most obvious maintenance tasks will be the cleaning of the permeable paving and the de-silting of the swales and pond/wetland area.

For developments such as this that rely to some extent on the ongoing inspection and maintenance of SuDS, it will be necessary to ensure that measures are in place to maintain the system for the lifetime of the development. For the SuDS located within the curtilage of each property it is envisaged that responsibility for maintenance will be tasked to the owner/occupiers. For the communal SuDS it is likely that a management company will be tasked with the responsibility for maintaining these elements of the drainage system.

5.10 Residual Risk

When considering residual risk, it is necessary to consider the impact of a flood event that exceeds the design event, or the implications if the proposed drainage system was to become blocked. In this case the proposed pond/wetland area could potentially overflow resulting in flooding if there is a prolonged rainfall event (which exceeds the design rainfall event), or if there is a blockage, or failure of the outfall and/or the flow control device.

Given the topography of the site, any water exiting the pond/wetland area is likely to be directed towards the existing ditch to the north, away from existing properties and the proposed development. As a result, there is likely to be minimal risk to the occupants of the site as a result of the pond/wetland area overflowing.

Notwithstanding this, to minimise the potential risk of floodwater exiting the pond/wetland area in an uncontrolled manner, an overflow pipe should be incorporated into the design of the pond. This pipe would be used to bypass the flow control device, allowing excess water to drain directly to the ditch/watercourse in the event of a blockage within the primary flow control device.

In addition to the primary storage system and flow control device, there is also potential for the swales, permeable paving, water butts, and piped elements of the drainage network to fail. However, failure of these features is only likely to result in small localised areas of flooding within driveways, gardens and the access road. Therefore, to protect the proposed dwellings it is recommended that each property is raised at least 150mm above the proposed ground level.

Based on the analysis above, the drainage proposals will minimise the potential risk of flooding to the proposed development and surrounding area even if the drainage system was to fail or become overwhelmed.

6 Foul Water Drainage

6.1 Background

The objective of this foul water drainage strategy is to ensure a viable solution for managing foul waste from the proposed development site is available.

In general, there are two methods for draining effluent from proposed developments. The preferred solution is a connection to the public sewer network, which is controlled by the sewerage undertaker (Southern Water). Nonetheless, if there are no sewers near to the development site, as is commonly the case in rural locations, then the use of package treatment systems or cesspits is permitted.

The Environment Agency's "Binding Rules" control the use of package treatment systems by requiring developments to connect to the public sewer system if the site boundary is within 30m (plus an additional 30 meters for every proposed unit), from an existing sewer. The location of existing sewers in relation to the site has been confirmed from Southern Water's sewer mapping Figure 6.1 (below).

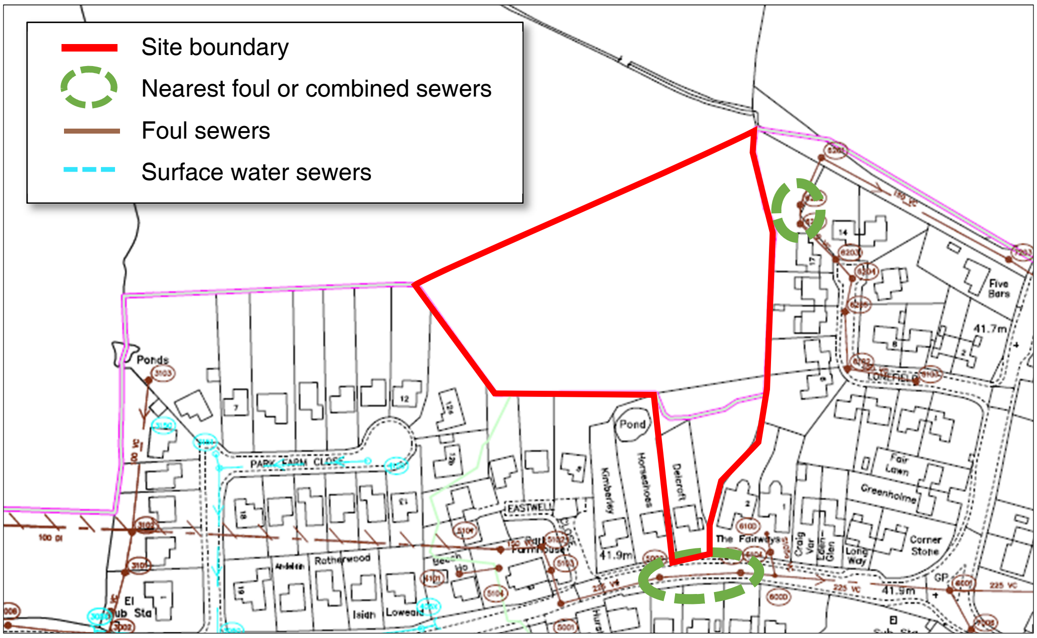

Figure 6.1 – Extract from mapping provided by Southern Water.

In this case, there are several sewers located in close proximity to the development site and as a result, the use of package treatment systems is unlikely to be appropriate. A connection to one of these existing foul sewers will therefore be required.

6.2 Proposed Peak Discharge Rate for Foul Effluent

The estimated peak foul flow from the development has been calculated using best practice guidance from Sewers for Adoption 7. For the 14 proposed units, it is estimated that the peak discharge of foul effluent from the site will be approximately 0.65 l/s.

6.3 Capacity Checks/Pre-Development Enquiry

Before any additional foul effluent can be discharged to the public sewer system it will be necessary to confirm that there is sufficient capacity within the existing foul sewers at this location to accommodate the increase in the rate at which foul waste is discharged to the public sewer system.

To determine if capacity is available at the pre-planning stage, a pre-development enquiry could be undertaken by Southern Water. At this stage in the development design process a pre-development enquiry has not been undertaken, however, in the absence of this information a worst-case scenario has been considered, i.e. where capacity within the existing public sewer network will not be available. If capacity is not available, then it may be necessary to upgrade the existing sewers in this location to accommodate the additional peak flow of foul effluent discharged from the development. The following sections of this report discuss this option in more detail.

6.4 The Water Industry Act

The Water Industry Act (WIA) 1991 provides developers with a mechanism for connecting to the public sewerage infrastructure. The type of connection depends on the type and location of the sewers in relation to the site and third-party land.

To requisition a new connection along with upgrades to the public sewer system, it will be necessary to undertake a Section 98 or Section 106 application. In this case, it is likely that the cost of the connection and any additional works which are required to upgrade the public sewer system (to accommodate the additional foul effluent from the development) will be charged to the developer.

Under Section 101 of the WIA, the sewerage undertaker must undertake any works as part of this process within a reasonable timeframe, which is typically 6 months following the agreement being made. Mitigating circumstances and Grampian planning conditions can, however, result in different timescales. It is therefore recommended that the LPA impose a Grampian condition which requires any necessary upgrades to the public sewer system to be completed *prior* to construction.

Following the award of planning permission, a full detailed design of the site layout and foul drainage system will be required as part of the Section 98/106 application.

Although it is acknowledged that additional works may be needed, under the WIA there is an automatic right for the developer to connect to the public sewer system via the Section Agreements and consequently, whilst the details cannot be confirmed at this stage, a solution for draining foul effluent from the proposed development will be available.

6.5 Foul Water Drainage Strategy

Foul effluent from the proposed development will be discharged to the public foul sewer located within Woodchurch Road. The peak rate at which foul waste is discharged from the site will be approximately 0.65l/s. Any required increases in the capacity of the existing public sewers at this location will be made prior to construction. Figure 6.2 (below) is an indicative layout plan showing the proposed foul drainage system and connection to the existing foul sewer within Woodchurch Road.

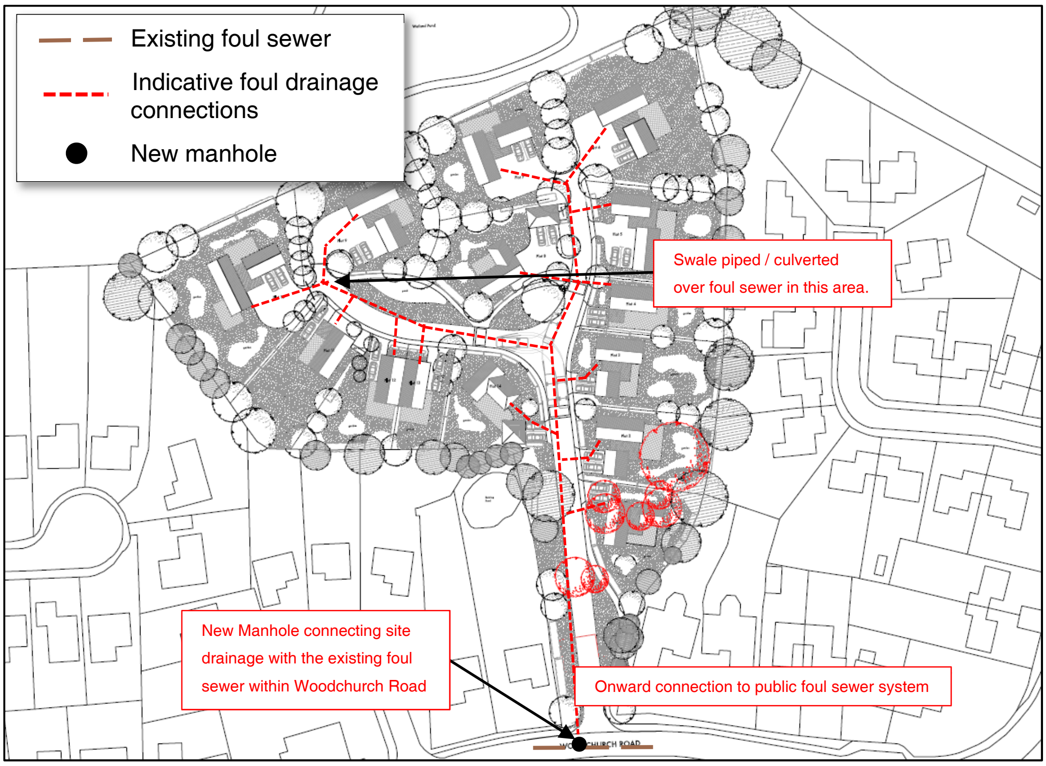

Figure 6.2 – Indicative drainage layout plan for the proposed foul drainage at Woodchurch Road.

A detailed drainage design in accordance with Sewers for Adoption will need to be completed prior to construction. Nonetheless, Figure 6.2 indicates that a solution for draining foul effluent from the proposed development at Woodchurch Road, will be available.

6.6 Summary

The opportunities for managing foul effluent discharged from the proposed development have been analysed and it is concluded that the most viable solution will be to discharge all foul effluent directly to one of the existing foul sewers located near to the site.

Following the award of planning, a full detailed design of the site layout and foul drainage system will be required and will need to be approved by Southern Water. At this point, a hydrological study into the impact that the development will have on the existing combined sewer network may need to be commissioned and any upgrades to the public sewer system agreed and implemented under either Section 98 or 106 of the WIA. It is, however, recognised that a solution for managing foul waste at the site is available and consequently, the requirements of the foul water drainage strategy are met.

7 Conclusions

The overarching objective of this report is to appraise the proposals for the development at Woodchurch Road, Shadoxhurst to ensure that the risk of flooding to the occupants of the proposed residential units is acceptable and that the risk of flooding offsite will not increase as a result of the development proposals. This report has therefore been prepared to appraise the risk of flooding from all sources and to provide a sustainable solution for managing the surface water runoff discharged from the development site, in accordance with the NPPF and local planning policy.

As part of this assessment, the risk of flooding has been considered for a wide range of sources and it has been identified that the risk of flooding to the proposed development is low. In addition, this report has also demonstrated that the development will not increase the risk of flooding elsewhere. The Surface Water Drainage Strategy that has been identified at this early stage achieves the aspirational objective of reducing peak discharge rates to QBar under the design rainfall event.

Under high return period rainfall events i.e. the design rainfall event 1:100+20%CC, the proposed surface water management stagey will decrease the peak rate at which runoff is discharged offsite, thereby minimising the risk of flooding. Under lower return period rainfall events runoff discharged from the site will be restricted to rates which closely replicate the current greenfield discharge from the existing undeveloped site. It has therefore been possible to meet the requirements of the drainage policy set by the, LPA (Ashford Borough Council) and Lead Local Flood Authority's (KCC).

This has been achieved by incorporating a range of sustainable drainage systems (SuDS) into the development, including permeable surfacing, swales, water butts, and a large pond/wetland area. The peak flow restriction to QBar has been achieved through the use of a vortex flow control device (e.g. a Hydro-Brake or similar).

In addition to controlling the rate at which runoff is discharged from the site the proposed SuDS will also provide benefits to the quality of water passing through the drainage system as well as creating new habitats for wildlife within the swales and pond/wetland area. Based on the above, it is evident that a sustainable solution for managing surface water runoff discharged from the proposed development at Woodchurch Road is available.

In addition to managing surface water runoff, it is also important to ensure that a solution for managing foul effluent from the proposed development is available. Based on the analysis that has been undertaken it is evident that the most suitable option for draining effluent from the site will be to connect the site to one of the existing foul sewers within the surrounding area. An indicative plan showing one potential connection and how foul effluent can be drained from the development has been produced, and it is concluded that a solution for managing foul effluent will be available.

In conclusion, it is evident that the risk of flooding from all sources is low, foul effluent can be drained from the site, and a sustainable solution for managing surface water runoff is available. Consequently, it has been demonstrated that the development can meet the flooding and drainage requirements of the NPPF, LLFA, and LPA.

8 Recommendations

The findings of this report conclude that the development will not increase the risk of flooding at the site, or elsewhere. However, in order to achieve this a number of recommendations are listed below. These comprise the following.

- It is recommended that the finished floor level of each property is raised at least 150mm above the proposed ground levels.
- The surface water management strategy for the development will need to be developed into a detailed drainage design.
- Prior to construction it will be necessary to gain consent from the Internal Drainage Board for any new drainage connection to the existing watercourse north of the site. During this process the Lead Local Flood Authority should also be consulted regarding the proposed connection.
- The foul water drainage strategy will need to be developed into a detailed drainage design.
- The detailed design for the foul drainage strategy will need to be agreed with the sewerage undertaker and a section 98 or section 106 application for the proposed new foul drainage connection made.
- It is recommended that any necessary upgrades to the public sewer system are made prior to construction. The LPA should consider imposing a Grampian condition to ensure that any such works are completed.

With the above mitigation measures incorporated into the design of the development the proposals will meet the requirements of the NPPF and its Planning Practice Guidance and will therefore be acceptable and sustainable in terms of flood risk.

9 Appendices

Appendix A.1 – Drawings

Appendix A.2 – Southern Water Asset Location Data

Appendix A.3 – Surface Water Management Calculations

Appendix A.4 – Indicative Drainage Layout