Report: 9507/FRA1
Date: March 2009

DRAINAGE IMPACT/FLOOD RISK ASSESSMENT

FOR PROPOSED DEVELOPMENT

at

LESLIE ROAD, KENDRAY, BARNSLEY

Prepared for

Keepmoat Homes

ENCIA ENVIRONMENTAL LIMITED
Audby House
Audby Lane
Wetherby
West Yorkshire
LS22 7RD

Tel: 01937 589955
Fax: 01937 589944

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Drainage Impact/Flood Risk Assessment

For proposed development

at

Leslie Road, Kendray - Barnsley

1 INTRODUCTION

1.1 Encia Environmental (EE) have been appointed by Keepmoat Homes to prepare a Drainage Impact/Flood Risk Assessment (FRA) for the proposed residential development at Leslie Road, Barnsley

1.2 The FRA will be undertaken in accordance with Environment Agency (EA) guidance, and will focus on :

1.3 Site Use and Current Drainage regime, Flooding History, Ground Conditions and use of SUDS, Impact of development and proposed drainage strategy, overland flooding routes and the overall impact of development on the site and surrounds.

1.4 This report is for the sole use of Keepmoat Homes, and presents information and conclusions, based on available data at the time of preparing the report. Encia reserve the right to alter the conclusions in the event of further information becoming available at a later date.

2 BACKGROUND

2.1 Keepmoat Homes are applying for detailed consent for the erection of 98No residential dwellings at land located on Leslie Road, Kendray, Barnsley. The site was formerly occupied by local authority housing, which was recently demolished. The development will feature a mix of dwellings, with associated adopted highways and parking courts. A copy of the application layout enclosed with the outline application is included within appendix F.

2.2 In the process of preparing this report, EE have undertaken a site walkover and liaised with Yorkshire Water(sewerage undertakers), and Barnsley MBC (land drainage authority). A detailed GeoEnvironmental Investigation has been undertaken to provide an overview of the Geological conditions below the site (Encia report ref 9507/1, dated May 2008).

2.3 A detailed topographical survey for the site has been completed and is enclosed within appendix D. In addition a photographic survey record of the site has been completed and selected photographs are enclosed within appendix C.

3 REGULATORY GUIDANCE

3.1 Planning Policy Statement 25 (PPS25) provides the regulatory framework and guidance for planning authorities in relation to Flood Issues for new developments. Any application lodged with a local planning authority will be considered in conjunction with this guidance and dependant on the nature and location of the application the planning authority may request a Flood Risk Assessment as part of the planning application documents.

3.2 The Environment Agency are a statutory consultee to the Planning Authority in relation to flood risk issues. In addition, Barnsley Borough Council Drainage Department will be consulted with respect to the proposals.

3.3 The agency has produced a matrix for local planning authorities, which provides advice in terms of the requirements for risk assessment. 'Environment Agency Standing Advice – Development and Flood Risk' dated October 2005 tabulates the requirements relative to the scale of the development and the applicable Flood Zone.

3.4 The Environment Agency have undertaken a national study of flood risk across England and published flood maps covering the country. The maps can be viewed on the agency web site at **www.environment-agency.gov.uk**. Specific locations can be studied by searching either using postcode or address.

3.5 The EA flood maps identify 3 zones. Zone 1 being the area where risk of flooding from fluvial or tidal sources is lowest and Zone 3 being the area of greatest potential risk. PPS 25 provides guidance to local authorities with respect to the assessment of proposed development within the 3 flood zones, and the allocation of different development, dependant on their associated risk, in areas of potential flooding.

3.6 The level of detail and complexity of a Flood Risk Assessment can vary considerably, dependant on the scale, nature and location of the planned development. EA guidance sets out the criteria for the level of information which should be included within the FRA. The Leslie Road site falls within 'Development within Flood Zone 1', thereby FRA guidance Note 1 is relative to this application. A copy of the EA standard guidance notes is included within appendix A.

4 SITE DESCRIPTION AND HISTORY

4.1 A site location plan is included within Appendix B of this report. Site details are summarised in the Table below.

Detail	Remarks
Location	3.5 Km SW or Barnsley Town Centre
NGR	SE 368 054
Area	2.08 Ha
Current Use	Open land – former housing site

4.2 A walkover survey of the site was undertaken in February 2009.

4.3 The site was originally developed for housing in the early 1950's. Prior to the housing development the site had been undeveloped. The housing was demolished in 2007, however the road infrastructure was retained. At the time of writing this report the site has been left covered by a layer of demolition rubble.

4.4 The site features a sloping topography, typical slopes range between 1:12 to 1:20. The highest point of elevation is 76.1m in the south western part of the site, with a low point of 68.5m in the south east. Site slopes generally fall west to east, and are broken by the existing Leslie Road alignment. To the east of the site there is an existing railway line, which is elevated approximately 4m above the boundary fence.

4.5 To the north and west of the site there is existing residential development. To the south there is an equipped play area and open space.

5 EXISTING SITE DRAINAGE

5.1 Encia obtained a copy of the existing adopted Yorkshire Water sewer records. A copy is enclosed within appendix E. In addition during the detailed walkover a surface inspection was made for manhole covers and drainage features.

5.2 Inspection of the sewer plan confirms that the site is crossed by a number of foul and surface water sewers, many of which serve adjacent development. The foul network features 2 separate outfall points. In the northern part of the site, foul water drains to an existing 225mm diameter sewer which passes below the railway line heading north. This sewer also receives flows from dwellings 45-55 Leslie Road, which are outside the site. Foul drainage from the southern part of the site outfalls to the existing Yorkshire Water foul sewer in the south eastern corner of the site, adjacent to the play area. This network also receives flows from properties to the west of the site.

5.3 Surface water drainage is split into 2 catchments. A surface water outfall is indicated to the northern part of the site, which would have drained a limited number of properties into Raymond Road. The majority of the site drains to the existing 300mm diameter sewer adjacent to the play area to the south of the site. It is assumed that the sewer network remains below the site, and was not affected by the demolition.

5.4 The site catchment area prior to demolition, has been assessed using the sewer record plans together with ordnance survey data. A detailed cctv survey of domestic drainage was not undertaken prior to demolition, therefore some assumptions have been made with respect to the specific outfall points for properties. In general we have assumed that dwelling outfalled to the nearest surface water sewer.

5.5 The overall site catchment has been measured as 5988m^2, with 220m^2 outfalling to the north into Raymond Road and 5768m^2 outfalling to the south adjacent to the play area. Using the Wallingford Rational Method (Qp=2.78ACi) where:

Qp = Maximum Discharge

A = Contributing Area (Ha)

C = Runoff Coefficient

I = Rainfall Intensity (60mm/hr)

Existing run off rates are - Catchment 1 3.6 litres/sec

Catchment 2 96.2 litres/sec

Total Discharge 99.8 litres/sec

5.6 Groundwater flows from site would flow in an easterly direction towards the railway line. Greenfield flows from unpaved areas are estimated as around 7 litres/sec (based on typical 5 litres/sec/Ha Greenfield rate).

6 PROPOSED DEVELOPMENT

6.1 The proposed development will consist of 98 new dwellings. Encia have undertaken an initial assessment of impermeable areas, and can confirm that the impermeable area of the proposed scheme is in the order of 1.18 Ha(57% of gross area).

6.2 Whilst no detailed drainage design has been undertaken for the site to date, based on the site areas above, it is estimated that, if all hard surfaces were drained positively, the proposed development would provide a total surface water run-off rate of approximately 196 litres/second (typical 1 in 2 year event).

7 FLOOD SOURCES

7.1 Flooding can occur from a variety of sources, including tidal, rivers, watercourses, overland run-off, sewers and culverts.

7.2 Inspection of the EA flood map indicates that the site falls within Flood Zone 1, and is not considered at significant risk of flooding from rivers/watercourses.

7.3 Pluvial flooding is flooding from drains or flooding caused by drains being unable to receive water due to being at capacity. This can cause overland flooding from outside the site to enter the site in specific low lying areas. This mechanism has been considered below.

7.3 The existing residential development to the west and south lies at a higher elevation than the site, and as a consequence overland flows from these areas would enter the site if the drainage system became innundated. Three primary routes for overland flows to enter the site have been identified, and are shown on the plan contained within appendix H.

7.4 Flood route 1 (see plan), would enter the site from the south, flowing in a northerly direction within the carriageway of Laurel Avenue. Flows would follow the line of Leslie Road and are likely to breach the footway at the low spot and flow towards the eastern boundary with the railway embankment. Any changes in the vertical alignment of Leslie Road may affect the flood route.

7.5 Flood Route 2 would enter the site from Birch Road to the west, and would flow within the carriageway of Reginald Road in a northerly direction towards the junction of Birk House Lane and Raymond Road. Flows from this point would head north towards the railway embankment underpass without posing significant risk to the site.

7.6 Flood Route 3 would be generated from Reginald Road to the west. Flows would trend down Raymond Road and pose no significant threat to the site.

7.7 Leslie Road has been retained, however it is in poor condition and will require substantial re-construction to bring it up to a suitable standard. The current vertical alignment is almost flat in areas. Given the higher elevation of the area of the site to the west of Leslie Road, there is the potential for overland flows to breach the carriageway and inundate the system. Detailed design should consider the location of any designed low spots within the alignment and provide a flood route through the development towards the eastern boundary with the railway embankment.

7.8 If carriageway construction is being undertaken as part of the proposals, the vertical alignment at the junction can be designed to protect against overland flows in Raymond Road.

7.8 Flash flooding is likely to be an increasingly common event given the trend towards global warming and extreme weather conditions. In flash floods water generated from rainfall landing within the site can cause flooding to low lying areas.

7.9 In July 2007 areas of the UK in Yorkshire and Gloucestershire were subject to extreme unprecedented flooding, estimated to be the equivalent to a 1 in 200 year event. This flooding was caused by a prolonged period of relatively low intensity rainfall, which produced total saturation of the ground. In these conditions moderate intensity rainfall can cause severe problems with regards to overland flows and inundation of large volumes of flood water in low lying areas. During the events of 2007, many storage systems designed to attenuate high flow rates were noted as being part full. This is likely to be due to the low intensity of the storm. The prolonged storm duration however generated significant overall volume, and hence the flooding in low lying areas.

7.10 The issues associated with the weather conditions described in 7.9 are considered a rare occurrence. There is however a risk that similar conditions could apply in the future. The operating characteristics of drainage systems designed to current guidance does not preclude flooding downstream from prolonged rainfall, and overland flows from saturated ground.

8 FLOOD RECORDS AND IMPACT ON EXISTING SITE

8.1 Based on the site walkover and the EA maps, the site is not considered to be at significant risk of flooding. Detailed external works design should consider the potential for overland flows entering the site from higher areas to the west and south as described in section 7.

8.2 Following our consultation exercise, Encia are not aware of any previous flooding history on the site.

9 SUDS

9.1 Building Regulations and Environment Agency advice notes require the consideration of sustainable drainage techniques for new developments. Guidance on SUDS techniques can be found in various publications and web sites.

9.2 The use of SUDS techniques is designed to regulate the impact of development on receiving watercourses, to reduce the possibility of flooding downstream. This effectively mirrors the drainage flow characteristics of the catchment prior to development.

9.3 The use of soakaways and other suitable measures should be considered for new developments. Building regulations provides a hierarchy of drainage methods for consideration, with the emphasis on provision of sustainable methods of drainage wherever possible.

9.4 The most common forms of sustainable drainage on developments of this size are soakaways or flow attenuation, via storage tanks/ponds/swales. The effectiveness of soakaways is dependant on the percolation rate of natural strata below the site, and the continuation of the permeable strata with suitable outfalls.

9.5 The site investigation has characterised the ground conditions below the site. Natural ground consists of a sequence of sandy clays over gravelly clays. Five soakaway tests were undertaken on site, and the report confirms that percolation rates were not measurable, and the site is not suitable for soakaways.

10 PROPOSED DRAINAGE STRATEGY

10.1 The development of the site will require a new drainage system designed to suit the final approved layout, and in compliance with current Building Regulations, British Standards and the 6th edition of Sewers for Adoption.

10.2 Encia have not been instructed to undertake a detailed drainage design at this stage, however, based on our consultation with Yorkshire Water and Barnsley MBC, the following strategy is envisaged:

10.3 Foul water from the new dwellings will be drained to the existing adopted system adjacent to and within the site. Given the extent of adopted sewers within the site, and its layout which related to previous development, a significant number of sewers will need to be abandoned in agreement with Yorkshire Water. Sewers within the site which receive flows from outlying areas will need to be diverted under agreement with Yorkshire Water. Drainage flows should be maintained at all times during the construction process. Yorkshire Water have confirmed that the sewage treatment works has sufficient capacity to accept flows from the development.

10.4 The surface water drainage strategy should consider the potential net increase in flows generated from the new development, and should, in accordance with PPS25, seek to reduce flows to downstream watercourses in areas where there are known flooding issues.

10.5 Discussion with Barnsley MBC indicate that the existing surface water sewer to the south of the site discharges into a watercourse offsite. The council report capacity and potential flooding issues within the watercourse, and confirm that a net 20% reduction in base flows from site will be required. This policy is in line with PPS25, and many local authorities within the West/South Yorkshire area.

10.6 Based on the existing flows identified in section 5.5, design flows from the site should be regulated to the following rates:

Catchment 1 - 5 l/s (no net reduction on existing flow- see below)

Catchment 2 - 80 l/s (20% net reduction on existing flows)

Given the likely small existing outflow rate for catchment 1, it is considered that reduction in flows by a further 20% would lead to potential maintenance risks associated with the small diameter of the control device. In this situation a controllable discharge of 5 l/s is recommended. This rate will provide protection to the downstream sewer in severe rainfall events, without creating additional risk due to blockage within the control device.

10.7 Flows from the majority of the site (catchment 2) should be directed to the existing surface water system within Leslie Road which falls to the 300mm diameter pipe east of the play area. Flows should be restricted to no greater than 80 litres/second in all storm events.

10.8 Flow attenuation can be achieved by the installation of a surface water storage tank. The detailed design should meet the following criteria:

No surcharging for the 1 in 2 year storm (all duration)

No flooding from the system for the 1 in 30 year storm (all durations)

Flood water from the 1 in 100 year event should be modelled and be capable of being stored above ground within the site in a location which does not pose risk to dwellings.

10.9 The affect of climate change should be considered, and all drainage modelling should allow for a 20% increase in rainfall rates in line with the recommendations of PPS25.

11 IMPACT OF DEVELOPMENT AND RESIDUAL RISK

11.1 A detailed Drainage Impact/Flood Risk Assessment has been undertaken with respect to the planned redevelopment at Leslie Road, Barnsley. The assessment has included a site walkover, topographical survey, desk top site investigation report, liaison with Yorkshire Water and Barnsley MBC.

11.2 The assessment has identified the current site drainage characteristics and also established the current level of risk from flooding.

11.3 The existing run off from the site has been estimated at 99.8 litres/second.

11.4 The proposed redevelopment will result in an increase in impermeable area discharging to the public surface water sewer. In order to ensure that flood risk is not increased within the downstream watercourse, a final discharge rate from the site of 85 litres/second (over 2 catchments) is recommended.

11.5 The detailed arrangements for storage design, and the final stored volumes will need to be determined once the layout is approved. Final design drawings would be submitted to Yorkshire Water for approval and incorporation into adoption agreements. Design details may need to be submitted to the local authority in response to Planning Conditions.

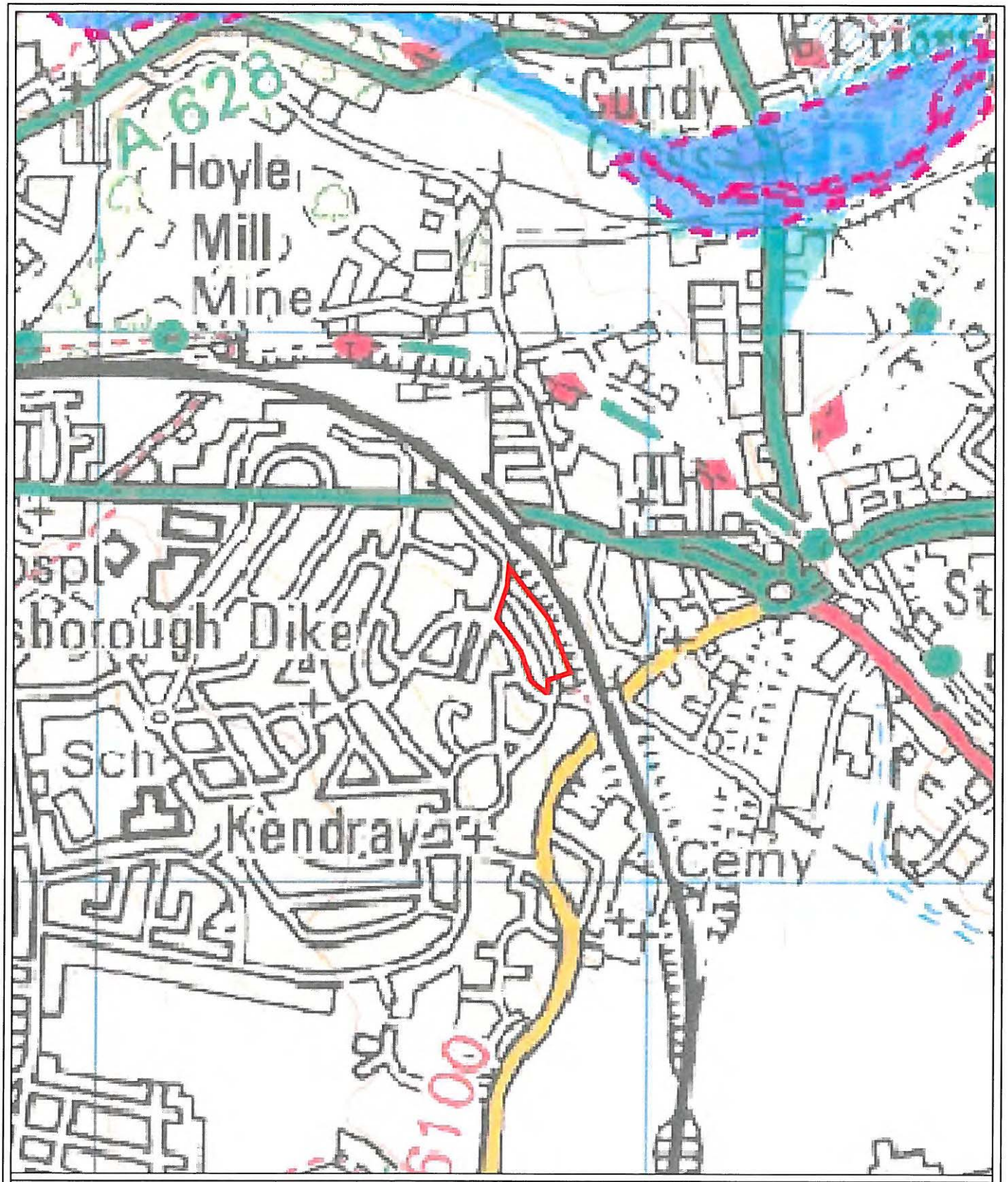
11.6 Soakaway drainage is not possible on this site due to underlying natural clays.

11.7 The potential risk of pluvial flooding has been assessed, and the detailed design should consider the possible overland flood routes and ensure that properties are not at risk.

11.7 The conclusions of this report, and measures recommended should be agreed with the planning authority, water authority and EA prior to commencement of construction.

11.8 On the basis of the provision of the required surface water attenuation, the development is not considered to pose a flood risk to downstream areas during periods of high intensity rainfall (up to the 1 in 100 year event).

APPENDIX A
ENVIRONMENT AGENCY FLOOD MAP AND RISK ASSESSMENT GUIDANCE (FRA 1)



DO NOT SCALE FROM THIS DRAWING

ENCIA Environmental

Encia Environmental Limited
Encia House, Audby Lane WETHERBY LS22 7RD
T 01937 589955 F 01937 544760 E info@enciagroup.co.uk W www.enciagroup.co.uk

PROJECT: Leslie Road, Barnsley

CLIENT: Keepmoat Homes

DRAWING TITLE: EA Flood Zone Plan

REV.	DESCRIPTION	DATE

DRAWN	DATE	APPROVED	DATE
D.L.	23/03/09		

SCALE	SHEET	DRAWING NO
Not to scale	A4	9507/FRA2

Flood Risk Assessment (FRA) Guidance Note 1

Development Greater Than 1 Hectare (ha) in Flood Zone 1 (and Critical Drainage areas less than 1ha)

Environment Agency guidance on requirements for undertaking a Flood Risk Assessment (FRA) for planning applications.

Flood Risk Assessments at all levels should be undertaken under the supervision of an experienced flood risk management specialist (who would normally be expected to have achieved chartered status with a relevant professional body such as the Institution of Civil Engineers (ICE) or the Chartered Institution of Water and Environmental Management (CIWEM)).

This guidance note principally relates to the commissioning and undertaking of FRA studies for development greater than 1.0 ha in Flood Zone 1 (see footnote1). It is designed:

a. to consider the principles of the sustainable drainage[2] of surface water;
b. for use where works may affect watercourses or flood defences; or
c. for use where a Critical Drainage[3] area has been identified by the Environment Agency, or where the Local Planning Authority (LPA) has identified that a drainage problem exists on which they would like assurance from the developer that flood risk has been addressed.

Exceptions to this guidance note

For sites less than 1 hectare in Flood Zone 1, a formal FRA will not *usually* be required (see Table D1 of Planning Policy Statement 25 - PPS25). In these cases, applicants are advised to refer to the standard comments on managing surface water drainage as set out in our standing advice on development and flood risk. However, where (b) and/or (c) above apply, a FRA may still be required for development of less than 1 hectare and this guidance note can be used to inform the FRA.

[1] Flood Zone 1 comprises land assessed as having a less than 1 in 1000 annual probability of river or sea flooding (<0.1%) in any year.

[2] ~~Sustainable Drainage Systems (SUDS)~~ seek to mimic natural drainage systems and retain water on, or near to the site in contrast to traditional drainage approaches which tend to pipe water off site as quickly as possible. When considering site drainage in Flood Zone 1, the focus within the FRA must be on flood risk management, but the use of SUDS should also seek to maximise opportunities for water quality and amenity benefits.

[3] Critical Drainage Areas are areas with drainage problems that have been identified as such by the Environment Agency. A full list of Critical Drainage areas can be access from the Environment agency website on the Flood Risk Standing Advice pages - www.environment-agency.gov.uk

Why is a FRA required?

In Flood Zone 1, where the risk of flooding from rivers or the sea is classified as low, a FRA is still required **but it should be focused on the management of surface water run-off**. Development that increases the amount of impermeable surfaces can result in an increase in surface water run-off, which in turn can result in increased flood risk both on site and elsewhere within the catchment[4]. This is particularly important for larger scale sites, which have the potential to generate large volumes of surface water run-off. In addition, the site may also still be at risk from other sources of flooding (e.g. groundwater and overland runoff), which are not considered in the mapping of Flood Zones. Further information on flooding from other sources is provided in Annex C of PPS25.

What should be in the FRA?

The detail and technical complexity of a FRA will reflect the scale, nature and location of the development. Where available, reference should be made to the Strategic Flood Risk Assessment (SFRA) for locally specific guidance and information.

The following list sets out information that should be submitted as a FRA for developments covered by this guidance note:

Plans

- A location plan that includes geographical features, street names and identifies the catchment, watercourses or other bodies of water in the vicinity.
- A plan of the site showing:
  i. existing site;
  ii. development proposals; and
  iii. identification of any structures (e.g. embankments), which may influence local flood flow overland or in any watercourses (e.g. culverts) present on the site.

Surveys

- Site levels - both existing and proposed. Reference to Ordnance Datum[5], may be required where details of context of the site to its surroundings is needed.

Assessments

The Applicant should submit:

- Proposals for surface water management that aims to not increase, and where practicable reduce the rate of runoff from the site as a result of the

[4] Catchment - The land which drains (normally naturally) to a given point on a river or drainage system.
[5] Ordnance Datum or the abbreviation 'OD' is the mean level of the sea at Newlyn in Cornwall from which heights above sea level are taken. The contour lines on Ordnance Survey maps measure heights above OD for example, though these are not accurate enough for a FRA.

development (in accordance with sustainable drainage principles, and the Local Planning Authority's published SFRA).

- Information about the surface water disposal measures already in place and their state of maintenance.
- An assessment of the volume of surface water run-off likely to be generated from the proposed development.
- Allowance in design for how the increased frequency and intensity of rainfall that is predicted as a result of climate change will affect the proposal (see Annex B of PPS25).
- Information about other potential sources of flooding, if any, that may affect the site e.g. streams, surface water run-off, sewers, groundwater, reservoirs, canals and other artificial sources or any combination of these; including details on how these sources of flooding will be managed safely within the development proposal.
- Confirmation as to whether Environment Agency consent is needed for any aspect of the work, and whether this has been applied for or not.

Dry islands

Some areas within Flood Zone 1 are surrounded by areas at a higher risk of flooding i.e. areas falling within Flood Zones 2 and 3. In certain cases development within such 'dry islands' can present particular hazards to public safety such as people being surrounded by water and needing to be rescued. The distribution of dry islands and risks posed by them in terms of access/exit vary considerably across the country. If you are in any doubt about how flood risks associated with 'dry islands' may affect your area, please contact your local Environment Agency Planning Liaison team on 08708 506 506.

Climate Change

As highlighted above, the frequency and intensity of rainfall is predicted to increase as a result of climate change and an allowance for how this will affect the proposal will need to be factored into design.

In addition rising sea levels may put some areas currently within Flood Zone 1 at risk from tidal flooding. These areas should have been identified in your Local Planning Authority's Strategic Flood Risk Assessment.

What is the Environment Agency's Role?

We recommend that pre application discussions take place for developments covered by this guidance note. We will usually provide comments at the planning application stage on FRAs covered by this guidance note (unless indicated otherwise by Environment Agency Planning Liaison team in the area where the development is proposed).

We have three main interests:

- Ensuring that the design of the site drainage system meets the aims of sustainable drainage management, and does not increase, and where practicable reduces, the current runoff from the site.
- If the proposal is within the Byelaw Distance[6] of a Main River[7], sea defence, or flood defence structure; or includes diversion, culverting or erection of control structures in an Ordinary Watercourse[8], then formal consent for the proposal may also be required from us.
- Prior to carrying out a FRA, developers should contact the Environment Agency and other operating authorities (such as the engineering department of the local authority or Internal Drainage Board as appropriate) to establish whether information is available relating to flood risk at the site they propose to develop. Account should also be taken of local knowledge of flooding held in the community. Our records of flooding are not exhaustive and the absence of information does not mean that a site will not flood. Whilst we can provide information on flooding from rivers and the sea, we only record known problems relating to other sources.

Sources of information:

1. PPS25 Practice Guide and Appendix F of the PPS[9].
2. CIRIA C522 - Sustainable Urban Drainage Systems-design manual for England and Wales.
3. Interim Code of Practice for Sustainable Drainage Systems[10].
4. The Local Planning Authority's Development Plan and Strategic Flood Risk Assessment.

[6] Byelaw distance varies across the country. To find out what distance applies in your area call 08708 506 506 and ask to speak to a member of your local Development Control team in the area where the development is planned.
[7] Main Rivers are watercourses designated as such on Main River maps and are generally the larger arterial watercourses. Main Rivers are indicated with a red line as part of the Flood Zones on maps held by the Local Planning Authority and on maps held by the Environment Agency.

[8] An Ordinary Watercourse is any watercourse that doesn't form part of a Main River
[9] PPS25 and the PPS25 Practice Guide can be viewed at - http://www.communities.gov.uk/planningandbuilding/planning/planningpolicyguidance/planningpolicystatements/planningpolicystatements/pps25/?lang=_e
[10] Interim Code of Practice for Sustainable Drainage Systems – this document provides advice on design, adoption and maintenance issues and a good overview of other technical guidance on SUDS. It is available electronically on both the Environment Agency's web site at: www.environment-agency.gov.uk and CIRIA's web site at: www.ciria.org.uk.