Norfolk County Council

Examination Library Document Reference G7

Lead Local Flood Authority
Statutory Consultee for Planning

Guidance Document

Version 6.1, October 2022

i. Purpose of this document

i.i This guidance document is intended to support the development of Norfolk County Council (NCC), as Lead Local Flood Authority's (LLFA) role as a statutory consultee to planning, and to inform stakeholders in this process such as Local Planning Authorities (LPAs) and developers. This document is broken into three parts.

Part A aims to:

- Outline planning policy with regard to local flood risk and surface water drainage;
- Explain the role of the LPA in determining Sustainable Drainage Systems (SuDS) proposals on new developments; and
- Outline the LLFA role as a statutory consultee to planning.

Part B aims to:

- Explain how the LLFA will fulfil this function and when it should be consulted.

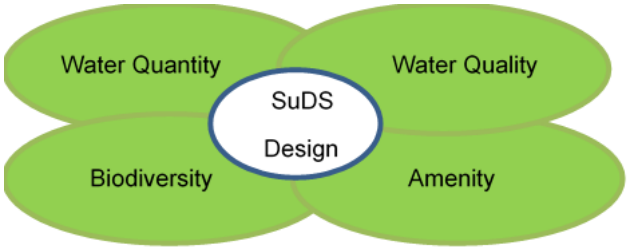
Part C aims to:

- Provide guidance for developers on the information required by the LLFA from applicants to enable it to provide responses to major planning applications.

i.ii This document will be periodically reviewed to ensure that its contents remain accurate and provides an appropriate level of detail. References and links are included within the text of this document to highlight other publications that should be read in conjunction with this guidance. The role the LLFA plays in supporting the development of Local Plans and policies is not currently covered by this document.

ii. What is Sustainable Drainage?

ii.i Surface water drainage systems developed in line with the ideals of sustainable development are collectively referred to as SuDS. Approaches to manage surface water that takes into account water quantity (flooding), water quality (pollution), amenity and biodiversity issues are collectively referred to as sustainable drainage. These are the four pillars of SuDS design. The philosophy of SuDS is to replicate, as closely as possible, the natural drainage from a site before development and to use shallow surface structures to mimic the pre-development scenario and manage water close to where it falls (interception). SuDS can be designed to slow water down (attenuate and / or reuse it) before it enters streams, rivers and other watercourses, they provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground, evaporate from surface water or be transpired from vegetation (known as evapotranspiration).



ii.ii Due to developer concerns of long-term maintenance more conventional piped drainage that conveys water to an attenuation tank are often proposed as SuDS. Whilst these systems provide some elements of SuDS and may meet some of the required standards, they frequently do not consider any water reuse, interception, water quality, amenity or biodiversity benefits. The piped and tanked systems can be put forward for adoption and long-term maintenance by Anglian Water but these will be classed as conventional drainage systems and not SuDS. NCC will require that all four pillars of SuDS design be proposed to be classed as SuDS in a planning application. Sufficient justification would be required to demonstrate why all four pillars can not be achieved.

ii.iii Early engagement with Anglian Water and / or the Highways Authority mean that shallow surface SuDS structures proposed will be considered for adoption. Any proposal needs to meet with the appropriate authorities' standards. NCC Highways Authority will consider adopting SuDS if they are appropriate and only take drainage from the adoptable Highway. In line with new national guidance documents, both Authorities have recently changed the way they review SuDS and adoption, please contact them for up to date information.

iii. Abbreviations and Definitions

iii.i Abbreviations used in this document are set out below:

ASA	Association of SuDS Authorities
DCG	Design and Construction Guidance (Water UK)
EA	Environment Agency
FRA	Flood Risk Assessment
GIS	Geographic Information System
ha	Hectares
IDB	Internal Drainage Board
LASOO	Local Authority SuDS Officer Organisation (superseded by ASA as of Feb 2019)
LFRMS	Local Flood Risk Management Strategy
LLFA	Lead Local Flood Authority
LPA	Local Planning Authority
NCC	Norfolk County Council
NPPF	National Planning Policy Framework
PPG	Planning Practice Guidance
RoFSW	Risk of Flooding from Surface Water
RoSPA	Royal Society for the Prevention of Accidents
RMA	Risk Management Authority
SFRA	Strategic Flood Risk Assessment
SuDS	Sustainable Drainage Systems
100% AEP (Annual Exceedance Probability) flood	Previously referred to as the 1 in 1 year but is an event which is likely to happen every year
10% AEP (Annual Exceedance Probability) flood	Previously referred to as the 1 in 10 year but is an event which has the probability to happen in any single year and not every 10 years
3.33% AEP (Annual Exceedance Probability) flood	Previously referred to as the 1 in 30 year but is an event which has the probability to happen in any single year and not every 30 years
1 % AEP (Annual Exceedance	Previously referred to as the 1 in 100 year but is an event which has the probability to

Probability) flood	happen in any single year and not every 100 years
0.1% AEP (Annual Exceedance Probability) flood	Previously referred to as the 1 in 1,000 year but is an event which has the probability to happen in any single year and not every 1,000 years

Contents

PART A - National Policy Background and Approach

1. Background

1.1 From April 2010 to late 2014 the Government had intended to implement Schedule 3 of the Flood and Water Management Act 2010. The inclusion of SuDS in the Act was seen as essential due to the number of properties flooded from surface water and the overloading of drainage systems in 2007 (as reported in the Pitt Review). Schedule 3 of the legislation would have placed Unitary Local Authorities and County Councils at the centre of a new process (separate from planning), for approving, adopting and maintaining SuDS on new major developments. Subsequent to proposing and delaying the implementation of this Schedule on a number of occasions, the Government resolved to deliver SuDS on new developments using the existing Town and Country Planning process with changes implemented on 15 April 2015.

1.2 As part of the Government's implementation of these changes to planning a Written Ministerial Statement was laid in the House of Commons on 18 December 2014, the Flood Risk and Coastal Change Section of the Planning Practice Guidance (PPG) was updated and non-statutory technical standards for SuDS were published.

1.3 Further information can be found within Annex 1.

2. The role of the LPA in determining planning applications

2.1 The role of the LPA is to determine planning applications in accordance with national policy, local policies and relevant guidance whilst taking into account advice from statutory consultees (such as the LLFA and Environment Agency (EA)) alongside other material considerations. The LPA would also consider advice from other consultees which are none statutory. These include other risk management authorities (RMAs) such as Internal Drainage Boards (IDBs), Anglian Water or the Canal and River Trust.

2.2 Where the planning application falls within the boundary of an IDB[1], they should be consulted along with the LLFA. The IDB, as an RMA, would have a significant role in managing the risk of flooding and the LLFA would want to avoid duplication of advice to the LPA. However, the LLFA would, where appropriate, ensure that SuDS and other local flood risk issues had been considered in a consistent approach across the county of Norfolk.

3. Recent National Policy Update on Flood Risk and SuDS

3.1 In July 2021 the Government updated the National Planning Policy Framework (NPPF). The framework acts as guidance for LPAs and decision-takers, both in drawing up plans and making decisions about planning applications. Section 14 of this document, "Meeting the challenge of climate change, flooding and

[1] IDB boundaries can be found on the LLFA website at Consent for work on ordinary Watercourses

coastal change" (paragraphs 152 to 173) contains key information on how flood risk and SuDS should be considered as part of new development. Paragraph 183 also highlights the need to prevent pollution which is integral to a well-designed SuDS scheme.

3.2 Paragraph 167 and 169 of the NPPF includes key references to flood risk and SuDS for LPAs considering planning applications. It highlights that when determining planning applications, LPAs should for all types of development:

- Ensure flood risk is not increased elsewhere;
- Only consider development appropriate in areas at risk of flooding where it can be demonstrated that within the site:
    - The most vulnerable development is located in areas of lowest flood risk for any source;
    - Development is appropriately flood resilient and resistant and can be brought back into use without significant refurbishment;
    - It incorporates SuDS;
    - That any residual risk can be safely managed; and
    - Safe access and escape routes are included were appropriate as part of an agreed emergency plan.

3.3 Footnote 55 of the NPPF states that a site-specific Flood Risk Assessment (FRA) is required for:

- All development in Flood Zones 2 and 3;
- Development in Flood Zone 1 where the proposal is 1 hectare or greater;
- Land that has been identified by the EA as having critical drainage problems;
- Land that has been identified within any Strategic Flood Risk Assessment (SFRA) that may be at increased risk of flooding in the future; or
- Land that is subject to other sources of flooding where development would introduce a more vulnerable land use.

3.4 There are several updates to national policy that are expected in 2021:

- Planning Policy Guidance to support the changes to NPPF with greater emphasis on sustainability and use of green infrastructure;
- Non-Statutory Technical Standards for SuDS to include more detail on rainwater harvesting, interception, water quality, amenity and biodiversity; and
- The Environment Bill 2020, which includes targets for air quality, nature, water and resource and waste efficiency. Sustainable water management and ‘environmental net gain’ are key parts to this bill.

3.5 In advance of these National updates, Norfolk County Council has published its Environmental Policy to support the Government’s 25 year environmental plan. Key policy aims are as follows and support this guidance document on the reduction of hazards such as flooding and drought, integrated water management, adapting to climate change and SuDS:

- Using and managing land sustainably;

- Recovering nature and enhancing the beauty of landscapes;
- Connecting people with the environment to improve health and wellbeing;
- Increasing resource efficiency and reducing pollution and waste;
- Secure clean, healthy, productive and biological diverse seas and oceans; and
- Protecting and improving our global environment.

Photo showing example of retrofit SuDS: Tree pit Wymondham NCC Recycling Centre, Norfolk. Treating Surface runoff from the hard standing before discharging to a watercourse.

Photo showing example of retrofit SuDs: Planted under drained raingarden, over the edge drainage from the highway and paths. Sheffield Grey to Green Project.

4. Involving the LLFA when determining planning applications

4.1 The Government acknowledged the need for LPAs to access advice from LLFAs as part of its changes to planning. As part of its consultation on further changes to statutory consultee arrangements for the planning application process the Government sought to avoid unnecessary over-consultation of the LLFA and to focus their statutory consultation role on development where LPAs require expert advice to determine the application. The Government's response to this consultation confirmed it was for this reason that they limited the LLFA statutory consultee role to major development.

4.2 As part of the consultation it was suggested that LPAs may find it helpful to agree with the LLFA the circumstances and locations where LLFA advice should be sought about a planning application which raises surface water or other local flood risk issues on a non-statutory basis. It was noted that the risk of over-consultation could also be managed locally by the LLFA informing the LPA that it does not wish to be consulted in certain instances or through providing standing advice. This was reinforced by the Government's New Burdens Assessment that stated it was expected that in the first year of their

statutory consultee role the LLFA will develop standing advice. It is against this background that Part B of this document has been developed.

4.3 The LLFA will provide a substantive response to all consultations received for major development within the statutory timescales. The type of response the LPA can expect are detailed in Table 1 below and Annex Section A4.4, which includes standing advice or where the LLFA choose not to comment. Only in exceptional circumstances would the LLFA not provide a response.

4.4 As of the 1 October 2018, planning permission may not be granted subject to pre-commencement conditions without the agreement of the applicant. The LLFA ask for pre-commencement conditions to ensure that detailed design will be finalised to the appropriate standard and allow room for SuDS / local flood risk management that is compatible with other constrains e.g. layout, landscaping or road network prior to the commencement of works. This is to assist the applicant as the LLFA know that detailed information is not always available at an initial planning application. However, if the applicant does not wish to accept pre-commencement conditions the LLFA request that the information be supplied prior to permission being granted. This is because the LLFA have frequently experienced that modifications to the drainage design cannot be incorporated if the development has commenced.

PART B – Norfolk Lead Local Flood Authority Approach

5. When to consult the LLFA?

5.1 All consultations and correspondence should be directed to the LLFA inbox at llfa@norfolk.gov.uk. Please note it is still necessary to consult other departments of the County Council as is current practice (e.g. for Highways matters). The Flood and Water Management Team will respond to any such consultations within 21 days of being consulted.

5.2 The thresholds at which the LLFA will provide bespoke advice will be periodically reviewed to ensure that the resources of the LLFA are focused where they can make the biggest contribution to mitigating and reducing local flood risk.

5.3 The current LLFA thresholds for bespoke advice are:

- Residential developments with greater than or equal to **100 properties**
- All developments with an area greater than or equal to **2 hectares**

However, there are other high-risk applications which we will aim to respond to under this general threshold (see Table 1 and text below). The LLFA will currently aim to provide bespoke consultation responses for the following application types:

- All residential development applications where the **number of units is greater than or equal to the LLFA threshold**. This would include individual applications of a multi-phased development that in total would be equivalent to or greater than the LLFA threshold;
- All other development applications with an **area greater than or equal to the LLFA threshold**;
- Any major development applications that have a **local flood risk** and are on an obvious flow route or include extensive surface water or fluvial flooding on the site. Significant ponding of surface water over a large proportion of the site boundary also falls within this category. Further information on screening applications against local flood risk is provided in Section 6; and
- Sites adjacent to, or within, areas with **records of local flooding** (as evidenced and provided by the LLFA). Further information on screening applications against local records of flooding is provided in Section 6.

5.4 Standing advice is provided to assist the LPA in determining the remaining developments for which the LLFA would not expect to be consulted. A matrix setting out when the LLFA should be consulted on applications is included as Table 1.

Table 1: Matrix indicating when to consult the LLFA depending on development category and flood risk ranking.

Development Category	Local flood risk	Records of local flooding (internal property flooding only as evidenced by LLFA)	No flood records or local flood risk
Minor development	No consultation required – standing advice applies	No consultation required – standing advice applies	No consultation required – standing advice applies
Major development below LLFA thresholds	**Consult LLFA**	**Consult LLFA**	No consultation required – standing advice applies
Major development above LLFA thresholds	**Consult LLFA**	**Consult LLFA**	**Consult LLFA**

5.5 Standing Advice provided by the LLFA and detailed in Section 8 includes:

- **STANDING ADVICE 1: Developments that may require consent for works within ordinary watercourses**[2] (as represented by the Detailed River Network or Ordnance Survey mapping) on, or within 5 meters of the development sites[3]. Any applicant would still be required to apply separately to LLFA for consent. Further information on this process is available on the NCC website;
- **STANDING ADVICE 2: Major developments outside of the current LLFA thresholds** set out above in Section 5.3. or developments identified as only having potential isolated areas of surface water ponding on the EA's Risk of Flooding from Surface Water (RoFSW) map which indicates local flow points on the site. These are unlikely to be of a depth to cross the threshold of buildings and are usually rationalised during development; and
- **STANDING ADVICE 3: Minor development** for which the LLFA will not be consulted, including domestic extensions, residential developments less than 10 dwellings, basements etc.

5.6 Please note if LPAs determine applications contrary to the LLFA statutory consultee advice they are asked to inform the LLFA (by email at llfa@norfolk.gov.uk). Reporting these decisions aids the LLFA in monitoring the impact of planning on local flood risk in line with our Local Flood Risk

[2] An ordinary watercourse means any watercourse, ditch, stream, culvert or pipe; (except those regulated by IDBs or Main Rivers which are regulated by the EA).
[3] Please note in some instances the watercourse may be culverted or piped.

Management Strategy.

5.7 Failing to adequately consider local flood risk or making adequate provision for SuDS within a development site may result in properties within the development being placed in an area at risk of flooding or alternatively may result in an increase in the risk of flooding elsewhere. This is contrary to the requirements of Paragraph 167 and 169 of the NPPF. As part of our responsibilities as LLFA, when and where incidences of flooding occur within buildings, we investigate the sources and contributing factors to that flooding incident. As part of this investigation, we would review how flood risk had been considered by the development management process.

PRE-APPLICATION ADVICE SERVICE:

The LLFA welcome and encourage early engagement and offer pre-application advice to developers or their consultants on a chargeable basis. Information on charges and how to apply are available on NCC's website. The pre-application advice can range from a simple desk top study of information the LLFA hold, initial scoping meeting, bespoke advice on issues or a full review of documents prior to submission to the LPA. When requesting the service, the LLFA would find it helpful that the extent of advice sought is clear and, as a minimum, a plan showing a red line boundary of the site to discuss is submitted. The LLFA's aim is to discuss and offer advice for technical constraints on specific sites. This advice is most useful prior to applying for planning permission or consent to alter a watercourse.

6. How to screen applications based on local flood risk and local flood records?

Local flood risk

6.1 There are a number of data sources that are available to LPAs to screen planning applications when determining the need to consult the LLFA. The key datasets are:

- The EA's Risk of Flooding from Surface Water (RoFSW) maps specifically the 1% AEP and 0.1% AEP extent maps or the online mapping of long term flood risk service at gov.uk. The District SFRA surface water flood maps, specifically the 1% AEP plus 40% climate change data must also be reviewed; and
- Detailed Rivers Network (DRN) which includes a large number of gravity watercourses and pumped catchments. The DRN is less reliable in pumped catchments but is available for LPA's to download.

6.2 The LLFA should be consulted on development sites that have a current risk of flooding or have the potential to increase local flood risk. Greenfield example sites are shown in Figure 1 and brownfield example site are shown in Figure 2.

6.3 As a guide, the **LLFA expects** to be consulted on developments that:

(a) Have a flow path passing though the development;

(b) Have a risk of surface water flooding along all or part of the development boundary; and

(c) Where there is a risk of flooding to adjacent properties.

6.4 The **LLFA does not expect** to be consulted on applications where there are (d) isolated areas of surface water ponding identified on the site. In the case of brownfield development where there are isolated areas of surface water ponding (d), we do not expect to be consulted but do expect the applicant provide betterment to the current surface water runoff by the provision of surface water drainage runoff and attenuation.

6.5 It should be noted that pumped or artificially managed catchments are not accurately represented by generalised surface water mapping.

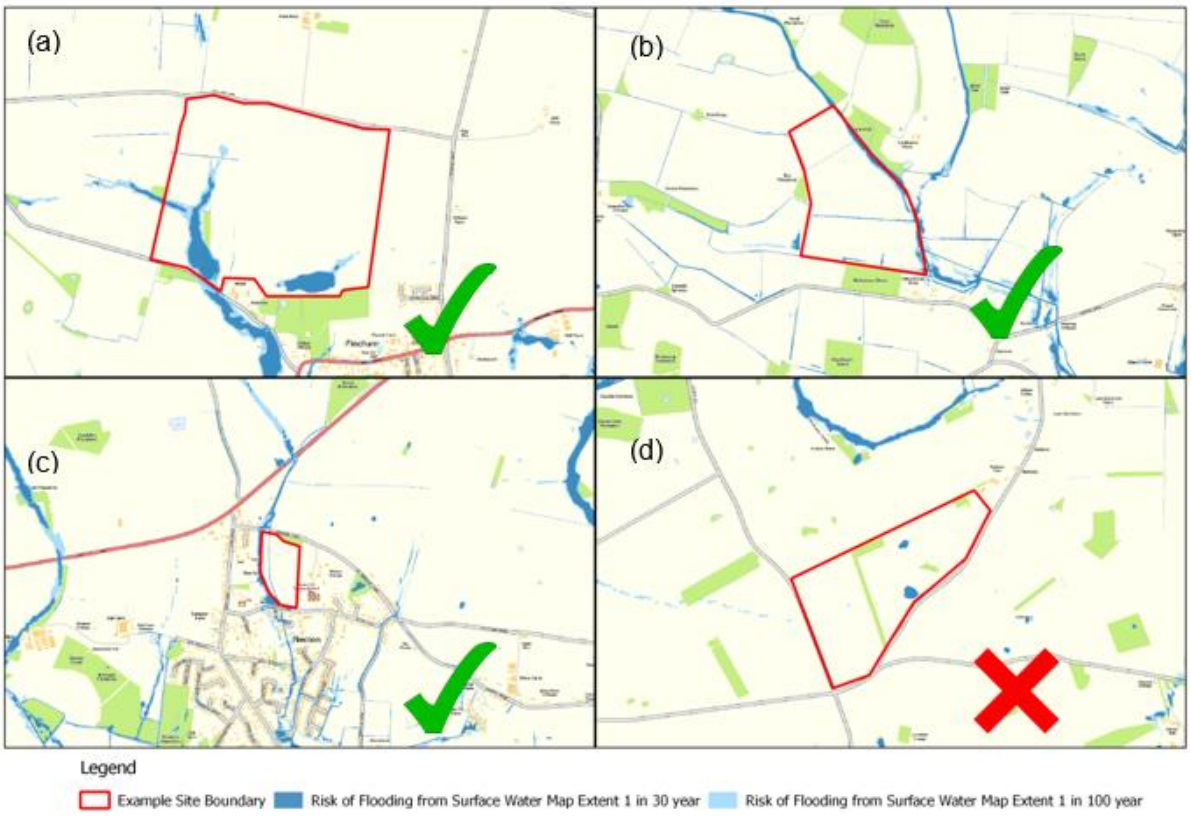


Figure 1: Four maps showing local flood risk consultation examples in greenfield areas

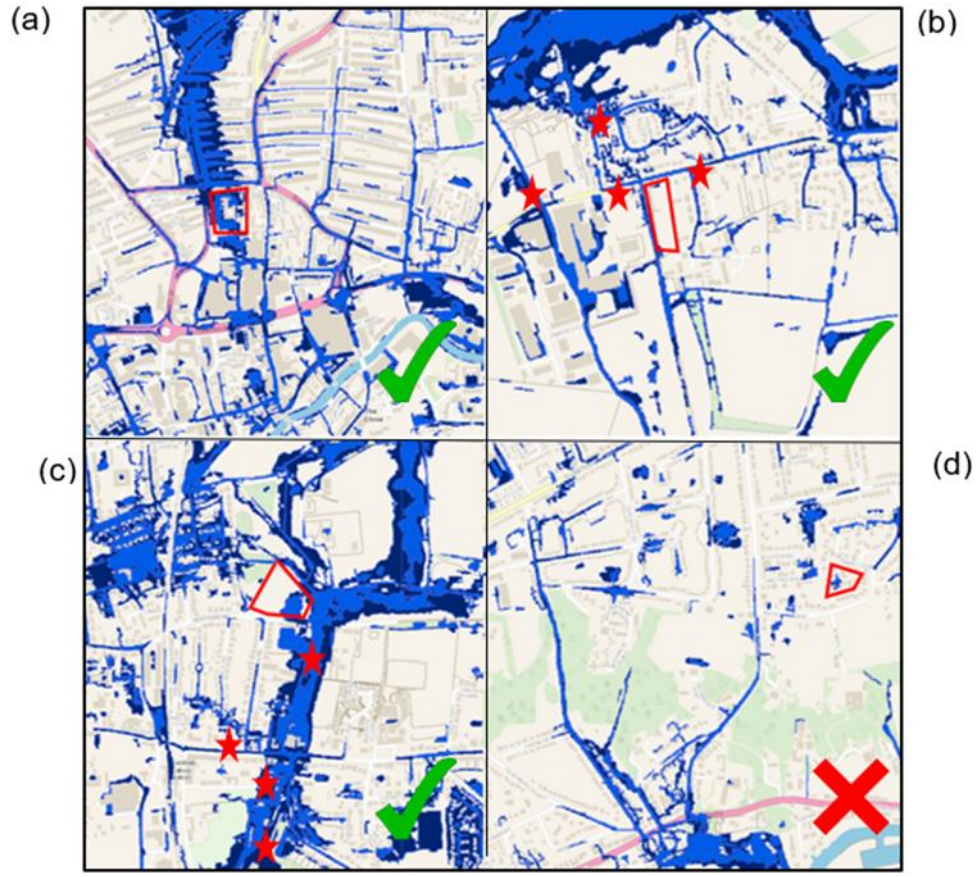


Figure 2: Four maps showing local flood risk consultation examples in brownfield areas (red stars = historical flooding)

Records of local flooding

6.6 There are areas in Norfolk for which there are historic records of flooding. In these areas, the LLFA would expect to be consulted on applications. The LLFA holds a GIS database of recorded flood incidents in Norfolk which have been investigated and published. These records are restricted to those properties which have been internally flooded or certain roads if made impassable due to flooding.

6.7 Local representations may be provided alongside development applications that identify historic incidents of flooding on the site or flood risk issues in the vicinity of the site. The LLFA will review and acknowledge anecdotal evidence where surface water flooding has been experienced on the development site or if local representations identify previous incidents of surface water flooding in the Highway or in properties adjacent to the development site. We do not, however, have sufficient resources to comment on all applications where there are anecdotal records of flooding but where no internal flood incidents have been investigated and published.

7. Other sources of advice for Local Planning Authorities

7.1 In addition to seeking advice from the LLFA, the NPPF Planning Practice Guidance recommends that LPAs consult the following stakeholders as

appropriate:

(a) The relevant sewerage undertaker where a connection with a public sewer is proposed;
(b) The EA, if the drainage system directly or indirectly involves the discharge of water into a watercourse or groundwater (although advice is given only when certain thresholds are passed). It would include if any deep infiltration is proposed to ensure that the development is not contrary to the EA Groundwater Protection Policy Statement G9;
(c) The relevant Highway Authority for an affected road;
(d) The Canal and River Trust, if the drainage system may directly or indirectly involve the discharge of water into or under a waterway managed by them; and
(e) An IDB, if the drainage system may directly or indirectly involve the discharge of water into an ordinary watercourse within a Board's district; or if the site is within the maintenance strip of a Board's maintained watercourse.

8. LLFA Standing Advice

8.1 The standing advice referred to in the matrix of Table 1 are set out below.

Standing Advice 1: Ordinary Watercourse Consenting

Norfolk County Council as the Lead Local Flood Authority (LLFA) for Norfolk is the drainage authority under the Land Drainage Act 1991 for regulating works on ordinary watercourses for the 80% of Norfolk outside of Internal Drainage Board (IDB) areas. If there are any works proposed as part of this planning application that are likely to affect flows in an ordinary watercourse, then the LPA should inform the applicant they are likely to need the approval of Norfolk County Council or the relevant IDB. This approval is separate from the planning process and the LLFA / IDB will issue a consent where appropriate.

In line with good practice, the LLFA seeks to avoid culverting, and its consent for such works will not normally be granted except as a means of access and it can be evidenced that there is no other feasible option. This is supported by LLFA Policy (OW4: Culverting) within Norfolk Local Flood Risk Management Strategy.

Where culverting is proposed, the LLFA expect the application to consider the appropriate design flow considering the local circumstances. This may include design elements for both low and high flow scenarios. Where culverts are being replaced or upgraded then the LLFA expect an assessment to show how flood risk is not increased downstream from the loss of storage of water behind a culvert.

Guidance on this process as well as downloadable applications forms can be found on the "Consent for work on ordinary watercourses" section of the NCC website.

Standing Advice 2: Major Development below LLFA thresholds

To ensure that development is undertaken in line with Paragraph 167 and 169 of the NPPF the LLFA recommends that LPAs satisfy themselves of the following considerations prior to granting permission for major development below LLFA thresholds:

1. *Is the development site currently at risk of flooding?*
2. *How does the site currently drain?*
3. *How will the site drain?*
4. *What sustainable drainage measures have been incorporated into the design?*
5. *How many SuDS pillars (Water Quantity (flooding), Water Quality (pollution), Amenity and Biodiversity) are included?*

At a high level, the following evidence should be submitted by applicants for review by the LPA to demonstrate compliance with Paragraph 169 of the NPPF.

A checklist to assist LPA's determine if this information has been submitted is in Annex 2.

Standing Advice 3: Minor Development

All minor development should be assessed appropriately according to the scale of the development and its location in relation to existing or possible future flooding risk. To ensure that minor development is undertaken in line with Paragraph 169 of the NPPF the LLFA recommends that LPAs satisfy themselves of the following considerations prior to granting permission for minor development:

1. *Is the development site currently at risk of flooding?*
   The risk of flooding on the current site should be acknowledged using national flood risk datasets such as the EA's Risk of Flooding from Surface Water maps and available information from the relevant SFRA. If any areas at risk of flooding are identified, these should be avoided from development or adequate flood resilience measures incorporated in the design. This may include an emergency flood plan where appropriate.
2. *How does the site currently drain?*
   The method through which the site currently drains should be described, such as whether there are existing infiltration features, ordinary watercourses within or at the boundary of the development, or existing surface water sewer infrastructure.
3. *How will the site drain?*
   The proposed method for draining the site should be in accordance with the sustainable drainage hierarchy; with a preference for shallow (<2m deep) infiltration measures, followed by measures to drain to a nearby watercourse, otherwise discharging to a surface water sewer. The last method of draining a site would be to either a combined sewer, or via deep infiltration methods (>2 m below ground level). Discharge of surface water to a foul sewer is not acceptable. Betterment of surface water runoff from an existing brownfield

runoff must be considered. Brownfield surface water runoff rates and volumes should be attenuated as close to greenfield rates as possible. Evidence of at least one achievable drainage proposal (Plan A) should be provided if not, then evidence of an alternative (Plan B) should also be included. Surface water runoff attenuation must include climate change and urban creep allowances.

4. *What sustainable drainage measures have been incorporated into the design?* Surface water drainage systems should replicate natural drainage processes as closely as possible. Sustainable Drainage Systems (SuDS), such as permeable paving, swales, green roofs / walls or attenuation basins should be preferred on all development sites ahead of conventional drainage measures (piped systems). Geocellular storage crates can provide elements of SuDS such as attenuating the amount of water to prevent an increase in flood risk, however without another SuDS component (swales, filter strips or drains) they do not provide any water quality treatment.
5. *How many SuDS pillars (Water Quantity (flooding), Water Quality (pollution), Amenity and Biodiversity) are included?*
   Should the development be prioritised over a site that does not have SuDS? All four pillars need to be considered to enable the application to be classed as SuDS. Some brownfield sites may not be able to meet all four pillars, but justification must be provided why fewer are achieved.

Minor development commonly includes extensions that may build over existing surface water drainage infrastructure. We recommend that any existing drainage scheme is diverted rather than built over as this can lead to internal property flooding if not adequately designed. If it cannot be diverted a minimum of two inspection / maintenance manhole chambers should be provided at either end of the pipework which will be built over in discussion with the LPA and / or Building Control. If the drainage is Anglian Water Services infrastructure, suitable build-over agreements, in consultation with them, should be in place prior to seeking planning approval or starting construction.

Due to the risk of rapid inundation by floodwater, basements should be avoided in areas at risk of flooding. The LPA may hold additional guidance for basement extensions, e.g. within relevant SFRAs.

Standing Advice 4: Solar Farm Development Sites

Generally, with a solar farm proposal a portion of the site will comprise of proposed solar/photovoltaic (PV) panels and energy storage facilities, whilst the remainder of the site comprises of the existing grassed spacing between rows and field margins. The design of PV panels means that the area represented by the proposed panels is not considered impermeable, as the ground beneath all panels will be grassed and as such remains permeable.

This common setup means sites are usually considered 95% permeable, but associated infrastructure like battery storage units, solar stations, substations, internal roads should be considered as fully impermeable.

It should also be noted however that panel arrays can sometimes be very long and also pitched together which needs to be assessed differently and may require a different drainage strategy. Also, some panel types have wide pad foundations which can affect overall PIMP (Percentage Impermeable proportion of a catchment or development contributing to runoff from the site).

Rainfall will drain freely off the panels onto the ground beneath the panels where the surface remains permeable. Thus, the total surface area of the photovoltaic array is not considered to act as an impermeable area and the impact is assumed to be nil. However, the nature of the underlying groundcover and antecedent conditions can have a demonstrable influence on the surface water run-off characteristics of a site, i.e. if the ground cover beneath panels is proposed as bare earth which is susceptible to hardening in summer months, then peak discharges can increase significantly. As such, it should be ensured as part of any proposed scheme that grass or wildflower cover will be well-maintained across the site to ensure that such proposed schemes will not increase the surface water run-off rate, volume or time to peak compared to the pre-development situation. This will also help provide net biodiversity gain.

You should satisfy yourself that the applicant has demonstrated compliance with;

- The National Planning Policy Framework ("NPPF") paragraphs 159 - 169 by ensuring that the proposal would not increase flood risk elsewhere and will incorporate sustainable drainage systems.

The applicant should also demonstrate how the proposal accords with national standards and relevant guidance. If the proposal does not accord with these the applicant should state their reasoning and the implications of not doing so. The key guidance available is set out below;

- Planning Practice Guidance - Flood Risk and Coastal Change

To ensure that development is undertaken in line with Paragraph 167 and 169 of the NPPF the LLFA recommends that LPAs satisfy themselves of the following considerations prior to granting permission for major development below LLFA thresholds:

1. Is the development site currently at risk of flooding? The application submission should include a site-specific assessment of the risk of flooding to the development site from all sources. The risk of flooding on the current site should be acknowledged using national flood risk datasets such as the EA's Risk of Flooding from Surface Water maps. If any areas at risk of flooding are identified, development should avoid these areas in line with NPPF. Where this cannot be achieved a robust strategy should be provided that includes adequate flood resilience measures incorporated in the design. This may require an emergency flood plan where appropriate.
2. How does the site currently drain? The method through which the site currently drains should be described, such as whether there are existing infiltration features, ordinary watercourses within or at the boundary of the development, or existing surface water sewer infrastructure. Land drains are common,

especially in previously agricultural land, and do not comply with good SuDS practise.

3. Restrict vehicular movements on site to designated access tracks. In doing so, the risk of soil compaction is minimised and limited to specific locations. The applicant should design the vehicular access tracks to be permeable (e.g. gravel medium) to mimic the existing surface conditions.
4. Rutting during the operation phase is also another common problem with solar farm sites, especially during intense storms at the foot of the panels. This can alter natural flow paths and should be avoided where possible.
5. Specify what type of vegetation will be planted across the site and how will it be managed/ maintained in perpetuity. The ideal situation is that vegetation is grassed and is kept reasonably high or grazed by livestock. Good vegetation cover will limit the transfer of sediments and slow the flow of water.
6. Where required a Drainage strategy should be provided for any large impermeable substation and compound areas.
7. If there are any concerns with residual risk, due to concentrated rainfall (flash events etc), then simple shallow features (e.g. 0.6m deep) like linear swales or filter drains could be proposed along the lowest parts of the site to capture any exceedance. No runoff should leave the site up to the 1% AEP+CC storm.
8. A Construction Environmental Management Plan (CEMP) should also be provided.

If you are aware of a particular surface water flooding issue at this location which requires further bespoke advice, please re-consult detailing the perceived nature of flooding or details of flooding that has occurred.

Further guidance for developers can be found on our website.

Ref: A study on the hydrological implications of solar farms (Cook, L.M. and Mccuen, R.H. (2013) 'Hydrologic Response of Solar Farms', Journal of Hydrologic Engineering, 18: 536 - 541)

9. Documentation to be provided to the LLFA

9.1 General

9.1.1 To enable the LLFA to provide its response as a statutory consultee, the developer should produce a Flood Risk Assessment (FRA) and / or Drainage Strategy for the development that includes the minimum level of information corresponding to the stage of the application submitted. Table 2 provides a summary of the expected level of information to be submitted with applications. Further information should be provided or may be requested where there are complex local issues. This information is required by the LLFA for all major developments to ensure that the standard of surface water management is appropriate. If an FRA is also required for a site, then the surface water management proposals may be incorporated within this document.

9.1.2 The submitted information should include how the surface water Drainage Strategy demonstrates how the four pillars of SuDS have been considered and also complies with the requirements of the SuDS Non-Statutory Technical Standards. All developments will be expected to meet all four pillars of SuDS. Some developments e.g. brownfield sites may find it difficult to implement all four pillars of SuDS, but evidence must be provided to justify why it cannot be achieved. It will also need to show if a cost-effective source control rainwater harvesting SuDS can be implemented.

9.1.3 It is important that the type of SuDS to be used on a development site is identified at concept design stage. This information, as well as details of the extent and position of the SuDS, should be provided for masterplan, outline and full applications so it is demonstrated that the SuDS can be accommodated within the proposed development. It is not desirable to condition an application and leave the allocation of SuDS to a later application stage as this may preclude certain SuDS elements due to restrictions in the agreed layout. We recommend that 10-15% of land be set aside within allocations to facilitate the implementation of SuDS and maintenance strips along river (blue) corridors. Whilst maintaining a neutral or improved benefit to flood risk, SuDS / blue corridors can also provide multiple biodiversity, amenity and water quality benefits (NPPF paragraph 120, 169, 174 and PPG Paragraph: 027 Reference ID: 8-027-2160211 / Paragraph: 028 Reference ID: 8-028-20160211).

Photo of a rill from a carriageway through a path to a SuDS Basin – Drayton, Norfolk (image E Simpson @ NCC LLFA)

Photo of a swale draining the highway (bus lane and shared use path) located at Queens Hill development, Costessey, Norfolk (image E Simpson @ NCC LLFA)

Table 2: Matrix showing the level of information required for planning applications

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted	Link to PART C Technical Guidance
YES	NO	NO	NO	Flood Risk Assessment / Statement including plans and drawings, detailed pre-development (and ideally post development) hydrology / hydraulic flood modelling if appropriate, indication of mitigation (including compensatory storage or managed surface water flow path creation, consideration for access / egress and if an emergency plan is required) and freeboard allowance. Where appropriate required maintenance easements to watercourses and structures.	10
YES	YES	NO	NO	Drainage Strategy / Statement (evidencing Plan A and Plan B where appropriate) and outline drainage layout plan (evidencing drainage catchment areas for each positive drainage network).	11
YES	NO	NO	NO	Preliminary layout drawings of development including identification of water features such as watercourses or ponds.	No link
YES	NO	YES	NO	Preliminary “Outline” hydraulic calculations (including infiltration rates, existing and proposed runoff rates / volumes, attenuation required including interception, climate change and urban creep).	14/15
YES	NO	NO	NO	Ground investigation report (for infiltration) and infiltration testing if only relying on infiltration.	12/13
YES	NO	NO	NO	Preliminary landscape proposals (showing SuDS component locations and required maintenance easements).	No link
YES	NO	NO	NO	Preliminary indication how each of the four pillars of SuDS will be met. Inclusion of SuDS water quality assessment and consideration if rainwater harvesting can be implemented.	No link
YES	YES	NO	NO	Evidence of ‘in principal' agreement of a third party for SuDS discharge to their system (e.g. Anglian Water, Highways Authority or third-party owner). Identification of the maintenance responsibility of any ordinary watercourse (including structures) within or adjacent the development.	11
YES	YES	NO	NO	Infrastructure and Construction Phasing Plan (Inc. temporary works).	9.2
NO	YES	YES	YES	Flood Risk Assessment / Statement or update, including plans and drawings, detailed post development flood modelling if appropriate, detailed mitigation (including compensatory storage or managed surface water flow path creation) and freeboard allowances. Where appropriate emergency plans indicating safe access and egress and maintenance easements to watercourses.	10
NO	YES	YES	YES	Detailed development layouts showing SuDS locations.	No link

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted	Link to PART C Technical Guidance
NO	YES	NO	YES	Detailed drainage design hydrology / hydraulic calculations and drawings. Showing all locations, dimensions and freeboard of every element of the proposed mitigation and drainage system (e.g. rainwater harvesting, swales, interception and attenuation storage areas, ponds, permeable paving, filter strips (including sewer details if proposed (pipe numbers, gradients, sizes, locations, manhole details etc.))).	11 12 13 14 15 20
NO	YES	NO	YES	Full hydraulic and ground investigations (Geotechnical factual and interpretive reports, including infiltration results).	12/13
NO	YES	NO	YES	SuDS Water Quality Assessment.	16
NO	YES	NO	YES	Detailed landscaping details linking to SuDS amenity and biodiversity elements.	17/18
NO	YES	NO	YES	Detailed Maintenance program and on-going maintenance responsibilities. Consideration for Health and Safety requirements.	19
NO	YES	NO	YES	Exceedance flow plan.	20

9.1.4 The Drainage Strategy should demonstrate how SuDS options have been considered with reference to the SuDS management train and hierarchy. Justification and evidence of how it will be achieved should be provided to document the chosen method(s) of surface water disposal. There are several SuDS components that can make a drainage scheme and combine into a management train to meet the four pillars of SuDS (see Table 3).

Table 3: Matrix of SuDS components and how they can contribute to the four pillars of SuDS (reproduced from Table 7.1 of the SuDS Manual (2015) represented in the table by either LIKELY ('Likely valuable contribution to SuDS design'), POTENTIAL ('May be some potential for contribution to SuDS design') or UNLIKELY ('Unlikely contribution to SuDS design').

Component	Water Quantity at Peak Runoff Rates	Water Quantity Runoff Volumes (Small Events) Interception	Water Quantity Runoff Volumes (Large Events)	Water Quality	Amenity	Biodiversity
Rainwater harvesting	UNLIKELY	LIKELY	LIKELY	UNLIKELY	LIKELY	UNLIKELY
Green roofs	POTENTIAL	LIKELY	UNLIKELY	LIKELY	UNLIKELY	LIKELY
Infiltration systems	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY
Proprietary systems	UNLIKELY	UNLIKELY	UNLIKELY	LIKELY	UNLIKELY	UNLIKELY
Filter Strips	UNLIKELY	LIKELY	UNLIKELY	LIKELY	POTENTIAL	POTENTIAL
Filter Drains	LIKELY	POTENTIAL	UNLIKELY	LIKELY	POTENTIAL	POTENTIAL
Swales	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY
Bioretention Systems	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY	LIKELY
Trees	LIKELY	LIKELY	UNLIKELY	LIKELY	LIKELY	LIKELY
Pervious pavements	LIKELY	LIKELY	LIKELY	LIKELY	POTENTIAL	POTENTIAL
Attenuation Storage tanks	LIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY	UNLIKELY
Detention basins	LIKELY	LIKELY	UNLIKELY	LIKELY	LIKELY	LIKELY
Ponds and wetlands	LIKELY	LIKELY	UNLIKELY	LIKELY	LIKELY	LIKELY

9.2 Master Planning

9.2.1 A multiphase strategic **Masterplan Outline** planning permission should include an FRA and Drainage Strategy with enough 'in principal' evidence to set conditions for individual phases to provide detailed designs. The Drainage Strategy should include sufficient infiltration testing to be representative across the site, pre and post development runoff rates / volumes based on the type of development, how permeable open spaces will drain if not included within the drainage scheme, how SuDS will be implemented in each Phase. Early engagement and pre-planning advice are recommended to assist with an integrated infrastructure delivery.

9.2.2 For larger applications where there may be Master Planning or phased development it is particularly important that any submission considers how each phase will be delivered in relation to the surface water Drainage Strategy as a whole. A phasing plan should be provided, in particular, highlighting where different phases rely on each other for connection to an infiltration basin or the wider watercourse network and how this will be implemented during construction and operation of the development.

9.2.3 Information on how temporary measures will be implemented such as reduced flow control outlets and timing for upgrades linked to the progress of development should be provided. Masterplans led by one developer that contain land that will be developed by others e.g. a school, should also show evidence that at least one drainage option will be achievable e.g. though infiltration testing or connection to a watercourse through the larger masterplan site boundary. Triggers for additional building should also be included e.g. when associate infrastructure such as schools of strategic link roads are required and how these drainage schemes will be progressed ahead of housing development in the area. This is particularly important if final outfalls or drainage basins are distant from the infrastructure. Appropriate legal agreements may be required to show how phases will be able to develop if they are progressed by different applicants or multiple landowners.

9.2.4 Where an application is part of a larger site, which may already have planning permission, it is essential that the new proposal does not compromise the drainage scheme already approved. Information would also need to be provided to show how temporary works would be incorporated to prevent an increase in flood risk considering any phased approach to works over a long period of time e.g. temporary flow control installation until further phases are developed, or how riparian owners will still be able to access watercourses for maintenance until future phases are completed.

9.3 Outline

9.3.1 An application for **Outline** planning permission should include details of one workable solution for managing surface water (Plan A). Where infiltration drainage is proposed, and infiltration testing in accordance with BRE Digest 365 has not been undertaken for example, evidence or agreement in principal of an alternative surface water drainage discharge location proposal will be required (Plan B). Climate change and urban creep should be included at outline planning as these can significantly impact the amount of attenuation storage required.

9.3.2 Where an FRA is required, the LLFA expect the FRA to consider all sources of flooding in detail and for it to be provided with the outline planning application. The FRA should identify how the development has avoided flood risk in the first instance, apply the sequential approach and evidence of achievable mitigation measures that may be employed

during the detailed design of the site, noting any constraints for the development of the future site layout. An 'in principal' agreement of the party expected to manage and maintain surface water features e.g. watercourses and SuDS is expected. In addition, the application should include evidence of the route which the surface water drainage scheme water will take when leaving the site and whether the receiving watercourse or sewer network will be able to convey the proposed discharge.

9.4 Reserved Matters

9.4.1 An application for **Reserved Matters** planning permission should provide sufficient information to demonstrate that adequate space has been allocated within the development layout for the proposed SuDS and surface water drainage measures. It should include calculations as evidence to support the sizing of drainage infrastructure including climate change, urban creep allowances and how the scheme would meet the SuDS National Standards.

9.4.2 Any updated FRA from an outline approval, should assess in detail the risk of flooding from all sources. This should identify the avoidance of risk or mitigation measures to be employed and reflected in the detailed design of the site, noting any constraints for the development of the site layout. We would expect the submitted documents to acknowledge any flood risk constraints on the site, such as existing areas at risk of flooding, and demonstrate how the development layout has been designed to avoid and minimise the risk of flooding. Where additional flood risk information has become available since the original planning application FRA, we would expect any Reserved Matters application to assess the risk of flooding against this updated information.

9.5 Full

9.5.1 An application for **Full** planning permission should provide both a detailed Drainage Strategy and FRA to ensure that there is sufficient information to prevent the need for pre commencement conditions (Table 2). As of the 1 October 2018, planning permission may not be granted subject to pre-commencement conditions without the agreement of the applicant.

9.6 Discharge of Condition

9.6.1 Information to **Discharge a Condition** (including those to be discharged at Reserved Matters stage) should be submitted as one package in a Drainage Strategy rather than in piecemeal submissions. The summary report should include the methodology applied in the calculations for the scheme such as the global variables and any assumptions used. The report should also include an explanation of how the system operates, such as physical access arrangements for maintenance, establishment of legal rights of access in perpetuity and an appraisal of health and safety considerations for construction, operation and maintenance of the

SuDS. Where additional flood risk information has become available since the original planning application, we expect the original FRA to be updated with information such as climate change allowance, flood extent outline or significant flood event evidence. Any application for the Discharge of Conditions is to consider the detailed design of the drainage system against this updated information.

9.7 Drainage Calculations

9.7.1 To assist the LLFA to audit any Drainage Strategy, the minimum following output tables from Micro-Drainage should be submitted with any application. Model: Greenfield and where applicable brownfield runoff calculations, Network Details, Online Controls, Offline Controls, Storage Structures. Simulation: Summary Results – select critical Rank by: Maximum Level and Area Summary. Area summary should include all sub options e.g. flow, max volume etc. At outline stage networks details may not be available but enough information should be submitted clearly showing there is enough space for SuDS features along with the proposed development. Although other drainage simulation software is available, Micro-Drainage is currently most frequently used. For the avoidance of doubt, the LLFA do not recommend any particular software package and will audit any calculations and will update this section when more is known on other software packages such as Causeway Flow. As a minimum the equivalent Causeway Flow outputs to Micro-Drainage, as above, should be submitted. Any drainage network calculations should be supported by an associated labelled plan to show how features such as swales, pipes, infiltration areas relate to the references in the calculations. The LLFA may request the model to assist with an audit of the drainage scheme.

9.8 LLFA response to LPA's

9.8.1 The LLFA will respond to planning applications where we have been consulted. Where we feel there is no or inappropriate information supplied with a planning application to demonstrate achievable mitigation or can advise that appropriate conditions could be set, we will object stating that the FRA or Drainage Strategy is inadequate and does not meet with policy or guidance. A summary of types of responses the LLFA will give to the LPA are as follows:

- A **No objection, with advice and recommendations** response will be submitted if standing advice is provided to the LPA or depending on the scale of development bespoke advice summarising that information has been submitted with only a few concerns, but conditions are not appropriate.

- An **Objection** response will be submitted where bespoke advice summarises that either no FRA or Drainage Strategy has been provided, or the documents submitted have significant information absent or is inappropriate to address the risks of flooding and / or to show that the proposed SuDS is not achievable.

- A **No objection subject to conditions being attached to a consent** response

will be submitted if bespoke advice summarises appropriate information has been attached to the application to show that local flood risk has been adequately considered and at least one feasible SuDS scheme has been proposed. Enough information should be available to meet the PPG standards for setting conditions, that are: necessary; relevant to planning and to the development to be permitted; enforceable; precise; and reasonable in all other respects.

- A **Removal of our objection** response is likely be submitted where bespoke advice summarises that additional information has been submitted to address the LLFA concerns. For example, when information shows a condition can be discharged.

- An **Objection in principal** response will be submitted if bespoke advice summarises that the LLFA do not see that there is a technical solution to the issues with the proposed development. The LLFA will highlight this at an early stage to give an applicant an opportunity to review the commercial viability of the development. A technical review of the proposal will be provided, in the understanding that this does not prejudice the outcome of any decision by the LPA.

- A **No comment** response will be submitted by the LLFA if it has been screened and determined that bespoke comments will not be provided. It does not imply the development meets with all policy, best practice guidance and standards.

PART C – Technical Guidance

This technical guidance sets out the expectations of NCC when reviewing FRA and Surface Water Drainage submissions. The guidance is aimed at providing developers and their consultants with the locally specific technical knowledge to ensure that any submissions are aligned with the expectations of the LLFA. The technical guidance covers a limited range of areas and is expected to be built upon in further submissions. The technical areas considered in this version are:

- Local Flood Risk;
- SuDS surface water drainage disposal destination;
- Infiltration testing;
- Runoff rate and volume;
- Climate Change;
- Water Quality and Water Framework Directive;
- Amenity;
- Biodiversity;
- Management and Maintenance; and
- Resistance and Resilience.

10. Local Flood Risk

10.1 Sequential Approach

10.1.1 All development should consider the existing risk of flooding from all sources; including main rivers, the sea, ordinary watercourses, surface water, groundwater, sewers and artificial waterbodies providing an FRA where required.

10.1.2 The NPPF and associated PPG (see Policy Box 1) sets out the national expectations for the assessment and management of flood risk on the site. The vulnerability of development (Table 2 and 3 of the Flood Risk and Coastal Change section of the PPG) indicates the type of development that is appropriate according to the level of flood risk.

10.1.3 Without early consideration of local flood risk in the planning process the viability for the site can be compromised and affects the layout, housing density, location of strategic infrastructure such as pumping stations, electricity sub stations, SuDS and roads. This may require significant alteration of the layout or trigger the need to re-apply or vary historic planning permissions.

10.1.4 We encourage the identification of greenfield areas within the site boundary that are required to be protected for future flood risk management. Every opportunity to improve an existing local flood risk issue is encouraged (PPG paragraph 050 Reference ID: 7-050-20140306 and LLFA policy within the Local Flood Risk Management

Strategy), particularly within those areas defined by the EA or the LLFA as a Critical Drainage Area or Catchment. Furthermore, the National Policy Statement on Flood and Coastal Erosion Risk Management Strategy (September 2020) indicates that in the future an improvement in the flood risk is likely to be required. In areas highlighted as having existing flood risk problems, new or re-development could provide improvements through careful consideration of available land and the proposed surface water drainage scheme. Within any critical drainage catchment, we expect any brownfield development to limit surface water drainage discharge as close to greenfield rates as possible. Retaining pre-development 100% runoff rates and volume from impermeable areas is unlikely to be acceptable. Opening or daylighting of culverts and reinstating open watercourses should be investigated and undertaken in accordance with CIRIA guide C786 (Culvert Screen and Outfall Manual) where possible. Any proposed strategic infrastructure must consider the changes to local flood risk which includes the construction of new embankments, cuttings or significant alterations to ground levels. These structures or modifications can affect surface water and groundwater flow paths. Mitigation should be included within any proposal which may include cut off channels to manage greenfield runoff.

Policy Box 1: Local Flood Risk Guidance

"When determining planning applications, Local Planning Authorities should ensure flood risk is not increased elsewhere and only consider development appropriate in areas at risk of flooding where, informed by a site-specific Flood Risk Assessment following the Sequential Test, and if required the Exception Test, it can be demonstrated:

• *Within the site, the* ***most vulnerable development*** *is located in areas of* ***lowest flood risk*** *unless there is overriding reasons to prefer a different location; and*

• *Development is appropriately* ***flood resilient and resistant****, including safe access and escape routes where required, and that any* ***residual risk can be safely managed****,* ***safe access and escape routes*** *are included where appropriate as part of an agreed emergency plan;""*

[Paragraph 163 of the National Planning Policy Framework]

"Any development proposal should take into account the likelihood of flooding from ***other sources****, as well as from rivers and the sea. The* ***sequential approach*** *to locating development in areas at lower flood risk should be applied to* ***all sources of flooding****, including development in an area which has critical drainage problems, as notified to the local planning authority by the Environment Agency, and where the proposed location of the development would* ***increase flood risk elsewhere****.*

[NPPF Flood Risk and Coastal Change PPG Paragraph: 033 Reference ID: 7-033-20140306]

10.1.5 The sequential approach is a precautionary one, to avoid the risk of flooding in the first instance. We support this approach as it is the most sustainable form of flood risk management. In accordance with NPPF paragraph 167 (footnote 55), PPG (Paragraph: 018 Reference ID: 7-018-20140306 and Paragraph: 019 Reference ID: 7-019-20140306), development should be steered to areas at the lowest risk of flooding from any sources. Sites in Flood Zones 2 and 3 should only be considered (employing the exception test where required – see NPPF paragraph 162 to 165) where there are no reasonable alternative sites, considering flood risk and the vulnerability of the land use proposed (NPPF Annex 3). Table 1 of PPG which defines Flood Zones (only based on river and sea flooding) can be supplemented with the following information:

- Indicative EA's Risk of Flooding from Surface Water (RoFSW) maps (extent, depth, velocity and Hazard layers) for both the 1% AEP and 0.1% AEP **to identify potential risk of flooding from surface water flow paths and / or significant ponding**. The RoFSW has known limitations in pumped or artificial catchments and should be combined with other sources of information in these locations;
- Indicative EA River and Sea Flood Maps for Planning for both Flood Zone 2 and 3 – or up to 1% AEP and 0.1% AEP **to identify potential risk of flooding from ordinary watercourses**. Where no mapping of fluvial flood risk (watercourses with catchments smaller than 3km^2), or there is uncertainty within the EA mapping, the RoFSW map is used as a proxy and used consistently with river flood mapping probability. To avoid doubt, the 1% AEP flood is deemed equivalent to Flood Zone 3 and 0.1% AEP flood is equivalent to Flood Zone 2 (as per PPG – Flood Risk and Coastal Change Paragraph: 018 Reference ID: 7-018-20140306).

10.1.6 Climate change must be considered within all sources of flooding including surface water flow paths and any ordinary watercourse proxy Flood Zones. The LLFA has produced surface water flood risk maps using 30% climate change of parts of Norfolk within Surface Water Management Plan Documents. There is also additional surface water flood risk mapping including 40% climate change within the Norwich City, Borough Council of West Norfolk and Kings Lynn, South Norfolk, Broadland, North Norfolk and Broads Authority individual SFRA's[4]. Where a site does not fall within any of these maps, the 0.1% AEP flood map can give an indication of the 1% AEP flood map including climate change. It is recognised that this method may over predict in some locations but unless further site-specific information is available this approach should be followed.

10.1.7 For the avoidance of doubt, the LLFA will also use the following sources

[4] "Strategic Flood RIsk Assessment" section of the Broads Authority website

of information to assist with any review of an application:

- Historical information from the LLFA using published flood investigation report locations which highlight those properties which have already flooded both externally and internally. Reports of flooding that are yet to be investigated and published as well as Anglian Water records of reported locations of sewer flooding will also be reviewed as part of a precautionary approach to reviewing applications;
- Current SFRA, Surface Water Management Plans (SWMP) or previous FRAs / Drainage Strategies which the LLFA has been consulted on through the planning process. This would help with other sources of information such as the location of critical drainage catchments and reported groundwater flooding incidences; and
- Other relevant information such as Ordnance Survey current MasterMap; Ordnance Survey Historical Maps (First Edition 1886, Second Edition 1905); Aerial Photography (1988 or 1946); Google Street View or the Detailed River Network (DRN) mapping to highlight surface watercourses or structures; Norfolk County Council produced sub-catchment identification; local officer experience or representations made by the public to the LLFA.

10.1.8 Three key criteria should be met to protect the public from local sources of flooding, both on site and off site. These are:

- Protection against flooding from watercourses;
- Protection against flooding from the drainage system; and
- Protection against flooding from overland flows (from sources within or external to the site).

British Standard BS 8582:2013 Code of Practice for surface water management for development sites also states in Section 6.2.2 the following:

- The layout of the development site and drainage system should be designed so that surface water that enters the site from off-site sources is conveyed safely around or through the site, without compromising the level of service of the proposed drainage system or introducing unacceptable additional risk on-site or downstream;
- Where runoff from off-site sources is drained together with the site runoff, the contributing catchment should be modelled as part of the drainage system in order to take full account of the additional inflows;
- Where runoff from off-site sources is conveyed separately to the proposed drainage system the flood risk should be managed in accordance with BS8533:2011 Assessing and managing flood risk in development – code of practice; and

- The layout of the development site and the drainage system should be designed so that natural low-lying areas and overland conveyance pathways are used to manage surface runoff, where appropriate, where they do not pose an unacceptable risk to the new development or downstream areas.

Photo of a development site located on the mapped surface water flood path that flooded in 2016, Hemsby, Norfolk.

10.2 Surface Water Flooding

10.2.1 If there is a risk of flooding from surface water flooding, the LLFA expects that this risk is assessed (and where appropriate modelled) to show how more vulnerable development (as per Table 2 and 3 of the PPG) is placed outside of the risk of surface water flooding for the 1% AEP rainfall event plus climate change allowance. In the case of surface water overland flow routes, if the areas cannot be avoided, sufficient information should be provided to demonstrate how this overland flow route will be managed within the site without creating a risk to people or property and not increasing the risk elsewhere. We would suggest that public open space is the most appropriate land use for this purpose. If roads or car parks are intended to be used, we would request that the hazard of this management be fully considered, emergency access and egress be assessed and the drainage of these impermeable areas be sized to accommodate the additional catchment of offsite flows (see Section 10.1.8 above).

10.2.2 Flood depths will be minimised in line with Table 12.3 of CIRIA Design for Exceedance in Urban Drainage (C635). This states depth of water in flood events greater than 3.33% AEP should be minimised to 100mm on minor roads that have speeds restricted to 30mph and 200mm within car parks (this assumes that there is a kerb upstand on roads and not level shared spaces). We expect that evidence is provided to show that velocities of flood water will be minimised in these instances and do not impede safe access or egress. This would be in line with the DEFRA / EA Hazard to People Classification / Rating. In addition, we would expect that residual risks are mitigated in the form of raised finished ground floor

levels on residential properties to account for exceedance routes in rainfall events with a probability greater than 1% AEP (see Section 20 of this document).

Photo of Surface Water Flooding in North Norwich (Oct 2019): Surface water in a petrol station and car park, overtopping the kerb, leaving the site uncontrolled and flooding the highway. The traditional drainage system was overwhelmed. Flooding also occurred in 2016 causing significant traffic disruption (Image from E Simpson @ NCC LLFA).

10.2.3 If surface water modelling to define pre- and post-development scenarios is prepared, the following parameters should be used as a basis and any deviation from these parameters should be justified through the provision of site-specific information:

- Contributing catchment for each flow path using local topographic information where possible;
- Model resolution of 2m grid;
- Return periods 3.33%, 1% and 1% plus climate change. If the model is to be submitted to the Environment Agency to update the Surface Water Flood Map, the 0.1% AEP should also be modelled;
- Storm durations of critical storm, 1hr and 3hr should be modelled;
- If direct rainfall modelling is undertaken, it should be consistent with standard FEH procedures. Any Hyetographs input should be provided;
- Allowances for loss to the sewer drainage system will be in line with local Surface Water Management Plan modelling including: 7mm/hr in Norwich, 3mm/hr in Kings Lynn and 3mm/hr in other urban areas around Norfolk;

- Representations of existing building footprints should use specific survey data or a standard of 0.1m to represent floor levels. Basement features should be included where they exist and allowed to flood within the model;
- Ground truthing checks should be undertaken to understand and improve accuracy of any base digital terrain model such as artificial ground height at tops of trees, creating cuttings in linear features to represent culverts or bridges etc.; and
- Calibration modelling scenarios should be run using historic flooding information to the actual recorded rainfall event return period.

10.3 Ordinary Watercourse Flooding

10.3.1 If there is a risk of flooding from an ordinary watercourse, the LLFA expects that this risk is assessed (and where appropriate modelled) to show how the vulnerability of development (as per Table 2 and 3 of the PPG) is assessed and where it is not water compatible, placed outside of the risk of fluvial flooding for the 1% AEP rainfall event plus climate change allowance.

Photos of an ordinary watercourse in North Norwich which is near bank-full during a rainfall event (left) and entirely dry during summer drought (right) (images E Simpson @ NCC LLFA).

10.3.2 Where an ordinary watercourse has been modelled to map the fluvial or tidal flood risk (Flood Zones 2 and 3) this can be used to update the EA's Flood Map for Planning. The model will need to be reviewed by the EA to ensure that it is suitable to be incorporated into the Flood Map (for further advice please contact the local EA office). We would expect that pre- and post-development modelling scenarios follow national guidance for modelling fluvial flood risk, alternative approaches will be considered in heavily urbanised or pumped catchments. The contributing catchment should be defined using local information, and we recommend that ReFH2 or FEH Statistical method is used to define the hydrological inputs. Appropriate roughness of the channel, floodplain

and other land uses should be defined. The downstream boundary should be representative of the onsite conditions, as should be the number cross sections of the channel and structures, to meet with standard modelling procedure. Calibration modelling scenarios should be run using historic flooding information to the actual recorded rainfall event return period.

10.3.3. The LLFA is the drainage authority under the Land Drainage Act 1991 for regulating works on ordinary watercourses for the 80% of Norfolk outside of IDB areas. If there are any works proposed that are likely to affect flows in an ordinary watercourse, then approval of Norfolk County Council or the relevant IDB is required. This approval is separate from the planning process and the LLFA / IDB will issue a consent where appropriate. In line with good practice, we seek to avoid culverting, and its consent for such works will not normally be granted except as a means of access and other alternatives are unfeasible. This is supported by LLFA Policy (OW4: Culverting) within Norfolk Local Flood Risk Management Strategy.

10.3.4 Where culverting is proposed, a risk-based approach to assessment design and operation should be followed in line with CIRIA Culvert, Screen and Outfall Manual (C786, 2019):

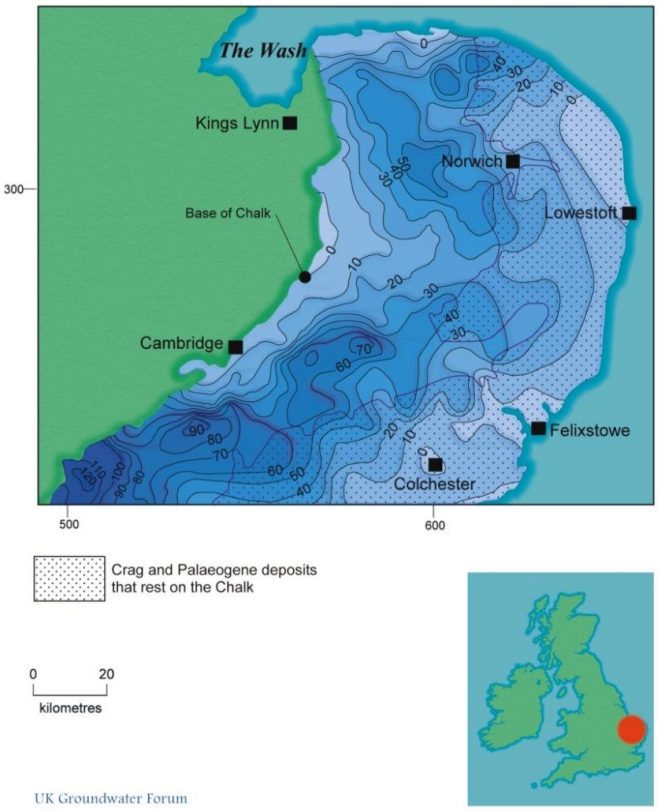
- If a structure is needed, a single span bridge or covered watercourse / tunnel with access track adjacent should be provided to minimise impacts on the hydraulics and environmental impacts on the watercourse;
- If a single span bridge or tunnel cannot be provided, a culvert is proposed and the development is not considered essential infrastructure, the assessment must justify why other options are not viable and there is an overriding need (see Section 3.2 of CIRIA guidance C786); and
- Any proposal to replace or upgrade an existing culvert, must first demonstrate that the watercourse cannot be daylighted and the culvert removed. If a culvert is retained, any improvement to hydraulic, environmental and operational must be demonstrated e.g. removal of a screen or justification of retaining a screen, preventing sediment build up by altering inlet or outlet controls, provision of additional wildlife corridors etc.

10.3.5 Where culverting is proposed, the LLFA expect the application to consider the appropriate design flow considering the local circumstances. This may include design elements for both low and high flow scenarios with appropriate modelling showing that any receptors are not adversely affected. Where culverts are being replaced or upgraded then the LLFA expect an assessment to show how flood risk is not increased downstream from the loss of storage of water behind a culvert. Guidance on this process as well as downloadable applications forms can be found on the NCC website page "Consenting works on ordinary watercourses".

10.4 Groundwater Flooding

10.4.1 Groundwater flooding is difficult to predict. It is most likely to occur in low lying areas underlain by permeable rocks / aquifers e.g. chalk or sandstone and localised in sands and river gravels (regional Norfolk groundwater levels are seen in Figure 3). Groundwater flooding can occur several weeks or months following heavy rainfall or at the same time as surface water / river flooding depending on the local conditions. Flooding may also be slower to happen and have a longer duration than other sources of flooding. It is characterised by coming up through the ground or through floorboards rather than spilling through doors. It may also follow routes of previously dry valleys.

Figure 3: Diagram showing regional groundwater levels in the Chalk aquifer (in m above sea level) from the UK Groundwater Forum. Groundwater hydraulic gradient is from the darker to lighter areas. Localised information will be required to understand groundwater on individual sites.



10.4.2 There are two key types of groundwater flooding, clearwater flooding and alluvial (or permeable superficial deposits) flooding.

10.4.3 Clearwater Flooding happens when groundwater levels within bedrock aquifers rise above ground level. This is normally a result of prolonged rainfall when the groundwater levels are either high or extremely high. This type of groundwater flooding can be prolonged and last for weeks or months until groundwater levels within the aquifer recede naturally. Therefore, this is considered the more disruptive and damaging form of groundwater flooding. It is most likely to occur in 'dry valleys' in e.g. chalk bedrock or form springs on hillsides.

10.4.4 Alluvial or permeable superficial deposits flooding occurs in unconsolidated superficial aquifers when groundwater levels rise in

response to extreme river or tide levels in a hydraulically connected surface water body. Superficial groundwater flooding is often overlooked as it can occur just prior to fluvial or tidal flooding. Groundwater influenced fluvial or tidal flooding can increase the predicted flood level, extent and duration of flooding. It may occur in defended areas if flood defences do not cut off shallow groundwater flow from a river or the sea. If groundwater is not considered during construction of flood defences, groundwater that would naturally discharge to the surface water body is prevented from doing so and can pond against the flood defence without any method of draining.

10.4.5 In addition, there are artificial influences that can lead to groundwater flooding, which include groundwater rebound and mine-water flooding. Groundwater rebound occurs when a rise in groundwater level following the end of long-term groundwater pumping. This may be associated with the closure of a quarry, mine or large industrial groundwater abstraction. Long term pumping can happen over decades and there may also be long term changes to natural surface topography which could alter natural flow paths. If vulnerable development such as housing, occurs during this time, there may need to be significant mitigation to prevent groundwater flooding during rebound.

10.4.6 The impacts from groundwater flooding are often like other sources e.g. surface water or river flooding, however mitigation for groundwater flooding is different. Mitigation can include avoiding the area where groundwater is expected to emerge and flow. Where there are existing problems, floorboards with voids under them can be replaced with more suitable material such as concrete and very occasionally by long term pumping. Construction of new basements should be avoided in areas prone to groundwater flooding. There are UK maps of groundwater susceptibility, however these only provide an indication of where groundwater flooding could possibly occur based on hydrogeological conditions. These maps do not provide a likelihood of the flooding occurring as they are not risk maps for the use of setting development management policies. Summary information on regional groundwater levels each month can be found on the "Monthly Hydrological Summaries" section of the National River Flow Archive website. Further information is available in the DEFRA / Environment Agency Making Space for Water HA5 report, Groundwater Flooding Records Collation, Monitoring and Risk Assessment, Consolidated Report (2007). There is currently a joint Defra and EA research and development project on the overview of groundwater flood management that is ongoing.

10.4.7 To assess the potential of groundwater flooding, an assessment of the hydrogeological setting should be undertaken, using available information. It should also consider whether groundwater flooding at the site is likely or not and then present a conceptual model for feasible mechanisms and suggesting possible mitigation e.g. groundwater flood routes through the site, protection of ground floors etc.

11. SuDS Disposal Destination

11.1 Surface water drainage should be managed in a way that replicates the natural drainage processes on the site as closely as possible. Development sites can be split into sub catchments for drainage and proposals put forward on how to best manage runoff within these sub catchments. All sites will have different constraints and varying degrees of existing drainage provision and condition. However, any proposed strategy for the management of surface water should utilise methods as high up the drainage hierarchy as possible.

11.2 It should clearly be demonstrated in any submission how the proposals follow the NPPF hierarchy (Policy Box 2). Adequate justification and evidence will be required should surface water be proposed to be discharged using methods lower down the hierarchy than infiltration. We expect that at least one option is demonstrated to be feasible, can be adopted and properly maintained and would not lead to any other environmental problems. This is supported by several documents including, CIRIA SuDS Manual (C753), Building Regulations Part H, British Standard BS8582:2013 and LASSOO Practice Guidance. Any proposed surface water discharge to a foul water only sewer will not be considered.

Policy Box 2: NPPF Drainage Hierarchy

National Planning Policy Framework Flood Risk and Coastal Change Planning Practice Guidance

"Generally, the aim should be discharge surface runoff as high up the following hierarchy of drainage options as reasonably practicable:

1. Into the ground (infiltration);

2. To a surface waterbody;

3. To a surface water sewer, highway drain or another drainage system;

4. To a combined sewer."

[Paragraph: 080 Reference ID: 7-080-20150323]

11.3 Water UK Design and Construction Guidance (DCG)[5], was released in March 2020 and states that the top of the hierarchy should demonstrate that surface water runoff is collected for use prior to moving down the hierarchy (Policy Box 3). Rainwater harvesting is an important component of source control SuDS which assists with wider integrated water management strategies. This includes supporting water resource strategies in Norfolk. Norfolk County Council (NCC) is a member of *Water Resources East*, whose vision is to have sufficient water resource to support the region.

One WRE strategy, is to be as water efficient and resilient as possible, linking land and water management effectively enhancing natural systems. Rainwater harvesting is considered an amenity benefit in the four pillars of SuDS due to its benefit in resilience, climate change and water

[5] https://www.water.org.uk/wp-content/uploads/2020/03/SSG-App-C-Des-Con-Guide-v-2-100320-C.pdf

resource availability. Rainwater harvesting to supply non-potable water may be possible in many scenarios including schools, civic or commercial properties, agricultural buildings, landscape or allotment irrigation, garden centres or flat developments where a defined daily rate of demand of the water reuse can be better estimated.

Policy Box 3: DCG Drainage Hierarchy

Water UK Design and Construction Guidance – Sewerage Section Guidance Appendix C.

"The government guidance to local authorities includes a hierarchy of connection, which can be summarised as follows:

a. Surface water runoff is collected for use;

b. Discharge into the ground via infiltration;

c. Discharge to a watercourse or other surface waterbody;

d. Discharge to a surface water sewer, highway drain or another drainage system discharging to a watercourse or other surface waterbody;

e. Discharge to a combined sewer."

[Appendix C: Section C3: Paragraph 12]

11.4 To support the WRE strategy, NCC require each development to consider if a cost-effective rainwater harvesting, source control SuDS can be implemented. This is applicable for both greenfield and brownfield sites. It is noted that brownfield sites can be highly constrained, limiting opportunities to retrofit SuDS, but rainwater harvesting may be an option due to its ability to reduce surface water runoff volumes. This could include green roofs, blue roofs or tanked systems (passive, pumped or combined). Whilst water butts can provide some domestic reuse of water through dry periods, it is difficult to define the benefits as many are full at the time of significant storm events. Information would be required from hydraulic modelling to show how water butts could provide effective surface water management and slow the release of water into downstream drainage systems.

11.5 Any drainage proposal should therefore include the following as a minimum:

- If there is a foreseeable demand for non-potable water in the design life of the development; and
- An estimate of the benefit from a reduction in potable water supply to the development.

11.6 If a rainwater harvesting system is designed the following additional information will be required:

- The type of system being proposed, passive, pumped or combined;
- Consideration of the seasonality of supply and demand patterns;
- Comment on how the SuDS Manuals simple, intermediate or detailed methods have been used to calculate the system size;

- How the system will contribute to interception of water at the start of the rainfall event. If it is proposed that final peak flow rates from the development will be reduced, then significant modelling would be required to demonstrate this;
- How the system will contribute to the management of water storage within the overall SuDS which reduces the need for large attenuation systems elsewhere;
- How the system will connect to an overflow surface water discharge destination next on the hierarchy, as infiltration, watercourse etc.;
- How water quality will be managed for non-potable supply of water; and
- How any shared rainwater harvesting systems will be maintained in the future by individual properties.

Further information can be found within Chapter 11 of the SuDS Manual.

11.7 At least one feasible proposal for the disposal of surface water drainage should be demonstrated and, in all cases, supported by the inclusion of appropriate evidence. Infiltration should be considered first (Plan A) and be supported by BRE Digest 365 testing or equivalent (see Section 12). If infiltration cannot be undertaken or infiltration results are proven to be unfavourable (close to or worse than 1 x 10-6 m/s or 0.036m/hr), we would expect to see in evidence and principal agreements for an alternative solution (Plan B) for the next available discharge location in the hierarchy. If this is connection to a watercourse within the site boundary this should be shown on a plan, however, if there is a need to cross third-party land, an in principal agreement from a landowner to connect across land to a surface watercourse should be provided.

Photo showing a newly created channel as an extension of a watercourse, North Norwich, Norfolk (image E Simpson @ NCC LLFA).

11.8 We would also require evidence, such as a site walkover, plans or photographs, to illustrate that a watercourse is connected to the wider network and able to

convey water away from the development site. In Norfolk, there are many localised drainage soakaway ditches which are cut off from a wider watercourse network (e.g. are “blind”). These watercourses would not be a suitable location to accept the siting of a long-term positive surface water drainage connection.

11.9 When no other practicable alternative exists to dispose of surface water other than a public sewer, the Water Company, the Highways Authority or their agents should confirm that there is adequate spare capacity in the existing system taking future development requirements into account.

11.10 Norfolk LLFA would not see deep infiltration (greater than 2m below ground level) or borehole soakaways as infiltration systems that meet the requirements of the first level of the drainage hierarchy. Whilst they can provide important groundwater recharge via infiltration at depth, it does not mimic the natural drainage system as would shallow infiltration and poses an elevated risk to groundwater quality. We would only expect it to be used as a final option for the location of discharge of surface water on par with a sewer.

11.11 Where an application meets the statutory consultation threshold the EA will comment on issues in respect of potential to pollute groundwater or surface water bodies. However, when the statutory threshold is not met and deep infiltration is proposed, applicants are strongly advised to seek the EA advice. The EA have clear position statements Groundwater Protection and SuDS (G1, G9, G10, G12 and G13) which can be found in The Environment Agency's Approach to Groundwater Protection. Deep infiltration systems may be appropriate in some cases if it is clear that there are no other feasible surface water disposal options. The EA would consider the pollution potential following their risk assessment process, which is likely to involve detailed specific risk assessment of the pollutants likely to be within runoff. Whilst the EA may agree to a deep infiltration soakaway, they no longer have the role to advise the LPA on surface water drainage options. Therefore, the LLFA would still require a clear justification to demonstrate why the SuDS hierarchy cannot be followed (see above).

11.12 If a deep infiltration soakaway is proposed, there is no other feasible way to discharge surface water and this is acceptable to the EA in groundwater pollution prevention terms, the LLFA would still expect that shallow or surface SuDS components be included in the drainage scheme prior to the borehole being the final discharge point. This design of SuDS would be used to provide the necessary protection to the water environment and to incorporate the multi-benefits in accordance with the SuDS philosophy of surface water attenuation, treatment train, amenity and biodiversity benefits.

11.13 The LLFA also expect that the design of the deep infiltration system to be supported by ground investigations, that have been undertaken at the proposed depth and location of the soakaway. Appropriate testing in the target geological horizon should be undertaken to prove the viability of the soakage and that the worst rate (not the average) to be used to define the number and size of borehole soakaways required. The testing would also support and provide an evidence base for any discussions with the EA regarding water quality

treatment potential in the unsaturated zone and protection of groundwater. This may include the environmental sensitivity of groundwater when designing the drainage scheme, such as, principal / secondary aquifer, Source Protection Zone location and depth to groundwater. To define peak seasonal groundwater levels, an extensive monitoring programme may be required. If multiple boreholes are proposed then appropriate space between them should be allowed, so as not to inhibit the infiltration capacity. Additional land take should also be provided to allow access by drilling equipment for future maintenance which may require the re-drilling of the boreholes. Depending on the confidence of the information an applicant may be required to show there is enough land to replace 50% of the deep infiltration boreholes or construct additional boreholes as part of the development that can be used as back up if initial boreholes fail.

11.14 A direct discharge to groundwater, i.e. within the saturated zone, is only acceptable if clean roof water can be separated out and sealed from any other surface water, due to its lower pollution risk. See EA position Statement G12.

12. Infiltration Drainage and Testing

12.1 The LLFA would expect all submitted Drainage Strategies to include an assessment of the suitability of the underlying geology to discharge collected surface water to the ground via infiltration. Information is expected to evidence that infiltration is or is not possible (in the form of testing). Only in very unusual cases where ground investigation reports and British Geological Survey (BGS) superficial and bedrock geological mapping information show infiltration is not considered possible, testing would not be required. The LLFA would expect information to be submitted to provide evidence to support the assumed infiltration rate(s) across the site.

12.2 At outline stage, we would prefer the submission of specific infiltration test results to support the application. Should infiltration testing not be possible, in line with the CIRIA SuDS Manual (C753) Section 25.2.1, an alternative strategy for draining the site (a Plan B) should be detailed in the Drainage Strategy and should include the proposed location of any discharge points, the proposed discharge rate, as well as the volume and location of any required storage. For masterplan development we expect that representative infiltration testing to be undertaken to determine if infiltration is to be included in the Drainage Strategy. If rates are proved to be generally unfavourable further testing at a later stage should be undertaken to determine if localised infiltration can be achieved.

12.4 For full permission, reserved matters or discharge of conditions applications where infiltration drainage is proposed, we would expect the results of infiltration testing to be provided as evidence to support the layout plan and calculation assumptions in the detailed design of the drainage system. This would include testing undertaken at the depth and location of the proposed structure to inform the detailed design.

12.5 If only indicative infiltration testing is provided e.g. at outline design stage, we will expect this to be undertaken again prior to a detailed design stage, at the

location (if large basins are proposed along the length) and depth of the proposed infiltration structures.

12.6 To protect groundwater from pollution, any infiltration structure must be shown to be able to be constructed 1.2m[6] above the anticipated seasonally high groundwater level. Information to support this could include geotechnical trial pits or boreholes on site to demonstrate that groundwater is not present at shallow depths. Ideally groundwater monitoring using telemetry would take place for 12 months prior to development. The 12-month period would include at least one seasonally high groundwater level event (most likely to be between January and March). We are however aware that there can be dry winters followed by dry summers or very wet summers, or specific ground conditions that can alter the timing of seasonally high groundwater levels. Monitoring for 12 months may not be possible at all development locations. If initial geotechnical testing is undertaken (especially at outline planning permission), we recommend that groundwater monitoring is established as soon as possible and remain in place for a long as possible. Professional judgement will be required to determine if conditions during the monitoring would show a representative seasonally high groundwater levels to support the proposals of infiltration.

12.7 Infiltration testing to support surface water Drainage Strategy calculations should be undertaken in line with BRE Digest 365 guidance (see Policy Box 4) or equivalent.

12.8 We consider the following to be a good practice minimum requirement for infiltration testing in Norfolk:

- A minimum of **three tests** undertaken in quick succession at each location (within 24 hours);
- The **lowest value** obtained across the site, or across representative geology, to be used for calculations. Any ingress of groundwater into the trial pit must be noted and considered;
- The **depth** of testing to be **representative** of drainage proposals (multiple depths may be required to represent different drainage methods i.e. permeable paving and soakaways); and
- Any design of infiltration structure should ensure that it can **discharge from full to half volume within 24 hours** in readiness for subsequent storm inflow (CIRIA SuDS Manual (C753) Section 25.7 and BRE Digest 365). The 10% AEP storm event must be able to discharge from full to half volume within 24 hours to comply with the Highways Authority requirements. Where the infiltration storage is designed to accept a storm event greater than 3.33% AEP storm event, large attenuation may be required. If a half drain down time of 24 hours cannot be achieved, and infiltration rates are close to being unfavourable, other options of disposal of surface water should be considered. In unusual circumstances and there is adequate justification (i.e. not in a high flood risk area), we may accept longer half drain down times if additional freeboard can be provided e.g. enough storage to accept a subsequent

[6] In line with local Environment Agency Guidance and Section 6.2 of CD 530 of the DMRB (Design of Soakaways).

10% AEP storm event.

Policy Box 4: Infiltration Testing Guidance

BRE Digest 365: Soakaway Design (2016)

- *Excavate a soakage trial pit to the same depth as anticipated in the full-size soakaway.*
- *The inflow should be rapid so that the pit can be filled to its maximum effective depth in a short time, i.e. to the design invert level of the drain to the soakaway.*
- *Fill the pit and allow it to drain three times to near empty [in quick succession]; each time record the water level and time from filling, at intervals sufficiently close to clearly define water level versus time.*
- *Calculate the soil infiltration rate from the time taken for the water level to fall from 75% to 25% effective storage depth in the pit, using the lowest soil infiltration rate value of the three test results for design.*
- *In general, soakage trials should be undertaken where the drain will discharge to the soakaway. The use of full depth and of repeat determinations at locations along the line of trench soakaways is very important when soil conditions vary.*

13. Infiltration Constraints

13.1 One uncertainty for the design of infiltration systems is the infiltration rate, which may reduce over time, particularly if there is no pre-treatment or there is poor maintenance. To account for this, we expect a **safety factor** to be incorporated into the design, where the factor used is a judgement based on the consequence of failure of the drainage system. Table 25.2 of CIRIA SuDS Manual (C753) should be consulted and used. If the drainage system within a new development is to be offered to NCC Highways Authority to be considered for adoption, the calculations should use at least the middle column of Table 25.2. The safety factors can only be discounted if the infiltration feature is designed in accordance with BRE365 design procedure. For the avoidance of doubt, BRE365 design does not allow infiltration through the base, only the sides of the feature. This must be demonstrated in the supporting information submitted. Design of infiltration features via the SuDS Manual does allow infiltration through the base and sides of the feature and hence the extra factor of safety must be incorporated into the designs.

13.2 The scope for using infiltration may be reduced where soils have poor infiltration capacity, where groundwater levels are high (see Section 12.6 above), there is a groundwater Source Protection Zone constraint (particularly SPZ1), there is ground contamination where infiltration would mobilise pollutants (see EA Groundwater Protection Policy statements G1, G9 and 13) or where ground conditions present particular risks of subsidence from voids and instability in the underlying geology. Chapter 8 of the CIRIA SuDS Manual (C753) considers

how to design SuDS in areas with particular constraints.

13.3 Issues regarding the suitability of development (particularly housing) on a particular geology are for a suitably qualified structural engineer to consider during the design in a particular location. The LLFA are not aware of any widespread subsidence issues across Norfolk except in some parts of Norwich City. It is recognised that areas of Norwich are built on chalk where there have been previous mine workings, and some are especially prone to subsidence. We would not generally consider in detail the impact of a proposed surface water drainage system on the ground stability on the site due to potential solution features unless we are aware of particular issues in the area. In general, we do not see that traditional ring (or point) soakaways as suitable in these locations due to the potential for settlement, however, not all SuDS should be automatically precluded but designed in proportion to the level of risk. Any infiltration testing should be retaken after any groundworks to compact and stabilise soils following identification of subsidence risk. Infiltration should also be avoided where there is a known landslip hazard.

13.4 Shallow infiltration, such as permeable surfaces, may be suitable in areas of known subsidence and close to properties. This is because permeable surface infiltration is shallow, infiltrates over a wide area and replicates runoff processes in a similar way as it would prior to development. We would hence encourage any developer to identify the risk of subsidence and propose suitable SuDS features considering the level of risk during detailed design. We highlight that Section 25.2.3 of the CIRIA SuDS Manual (C753, 2015) states that:

> "*The potential risk of adverse effects from infiltrating water will depend on the volume of water being discharged along with the depth and plan area of the infiltration system. The smaller the area of the system in relation to the drained area, the greater the risk.*"

13.5 Private dwelling soakaways within 5m of shallow foundations have the potential to cause the greatest impact where the geology is susceptible to solution features. A scheme may therefore, during detailed design, need to exclude large or individual private soakaways from the surface water Drainage Strategy in favour of planar infiltration systems such as permeable paving, wide swales and shallow infiltration basins (as in 13.3 above). Further guidance can be found in CIRIA SuDS Manual (C753) Chapter 8, Section 20.3, Chapter 25 and the CIRIA Susdrain Factsheet.

13.6 Norwich City Council has development management policies set for surface water flooding and drainage and subsidence (DM5, DM11). These policies state that "where it is demonstrated that permeable surfaces are likely to be unacceptable for these reasons; hard surfaced paving may be accepted. In these cases, developers will be encouraged to explore alternative means of managing surface water runoff within the development site. Where soils are well drained, impermeable surfaces will only be permitted where it is demonstrated that there is an overriding need for such a surface." We would expect that an appropriately qualified geotechnical engineer would provide a risk assessment

to consider subsidence in high risk areas.

14. Runoff Rate and Volume

14.1 The rate of runoff from a development should be restricted in line with the SuDS Non-Statutory Technical Standards (see Policy Box 5). All proposals should show how they limit post development runoff to the greenfield 1 in 1 year (100% AEP) rainfall event. All events above the 1 in 1 year (100% AEP) event should be limited to equivalent greenfield rainfall events or 2l/s/ha depending on how runoff volumes will be managed (see Section 14.10).

14.2 Interception of frequent everyday rainfall needs to be considered in the design of the SuDS scheme. This would limit the first 5mm of rainfall from being discharged from the site. Interception can occur in any catchment including those with clay soils and does not reply on high infiltration rates. Interception water will be lost through evapotranspiration or infiltrated within 48 hours of a rainfall event. By including interception rainfall, overall extreme rainfall storage volumes of water (1% AEP events) on the site will be reduced. Interception can be provided through rainwater harvesting, green roofs, infiltration components, pervious surfaces, bioretention systems, swales and dry basins. Further information is available can be found in The SuDS Manual, Chapter 7 (applying the approach of SuDS). Designing interception advice is found in Section 24.8 including information on how likely interception will be delivered during summer (80% compliance) and winter (50% compliance) rainfall events. Including interception storage within any drainage design will assist with achieving multifunctional benefits and the four pillars of SuDS.

14.3 Brownfield sites should discharge at the original pre-development (greenfield) runoff rate. If not possible, a significant reduction in the current rate of discharge should be achieved and agreed with the relevant drainage body (LLFA, IDB or Anglian Water) providing evidence as to why an alternative should be considered. It is unlikely to be acceptable to maintain 100% runoff when considering sustainable redevelopment. This would be particularly important in areas which have been defined as Critical Drainage Areas (by the EA) or Critical Drainage Catchments (by the LLFA in conjunction with a District Council). Anglian Water Surface Water Drainage Policy (Nov 2017) for discharging to sewer also states “Where a brownfield site is redeveloped no historic right to connection will exist and any sewer connection be treated as new. The site will be treated as if it was greenfield and therefore the discharge rate limited to the equivalent to the 1 in 1 year (100% AEP event) greenfield rate”.

14.4 All calculations of greenfield runoff rates and volumes should use the most up to date Flood Estimation Handbook (FEH) rainfall data and catchment characteristics. Areas of permeable and impermeable land for both the existing site and the proposed development are to be used to assess the change in surface water runoff. The site characteristics such as how surface water management is functioning on the site at present should be investigated.

Policy Box 5: Runoff Rate

SuDS Non-Statutory Technical Standards (2015)

S2. For greenfield developments, the peak runoff rate from the development to any highway drain, sewer or surface water body for the 1 in 1 year rainfall event [100% AEP] and the 1 in 100 year rainfall event [1% AEP] should never exceed the peak greenfield runoff rate for the same event.

S3. For developments which were previously developed, the peak runoff rate from the development to any drain, sewer or surface water body for the 1 in 1 year rainfall event [100% AEP] and the 1 in 100 year rainfall event [1% AEP] should be as close as reasonably practicable to the greenfield runoff rate from the development for the same rainfall event, but should never exceed the rate of discharge from the development prior to redevelopment for that event.

14.5 Consideration should be given to sub-catchments which may exist across a large site. Calculations for greenfield runoff rates should be based on the area positively drained i.e. proposed area of impermeable land within the sub-catchment of the watercourse for the location of the proposed discharge. Any landscaped areas that have compacted soils e.g. embankments should be considered within the calculation of impermeable contributing area. Where there are large areas of open green space within a development, an allowance for the greenfield runoff rate and volume of the open space should be made. This is to account for water that naturally enters the watercourse that would now be intercepted by a SuDS feature, see Figure 4.

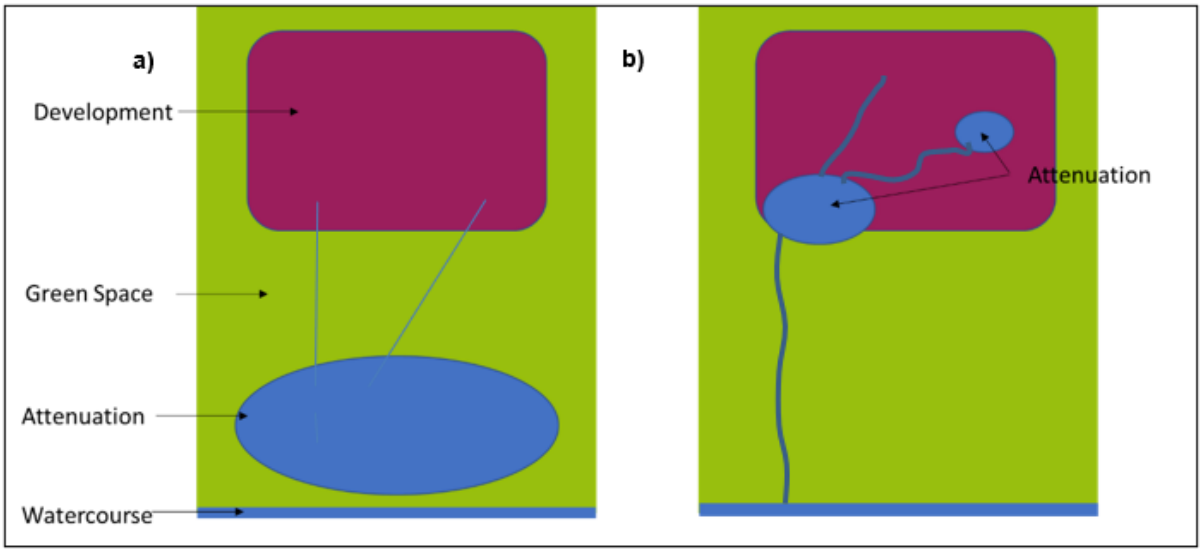


Figure 4: Diagram showing an indication when to allow for open space within greenfield Runoff / Volume calculations of the SuDS storage feature, a) include b) not required

14.6 It may be possible to divert water to a different sub-catchment, only if the greenfield runoff rate for that receiving sub-catchment is not exceeded. It may

be difficult to transfer water from a site which would naturally drain to a different watercourse catchment, as this transfer of water may necessitate large volumes of water being stored on site to achieve these rates.

14.7 If discharging surface water runoff into an Ordinary Watercourse, where there are known high water levels or flooding issues, it should not be assumed that the drainage scheme outfall can be free flowing. We would expect that a flood flow (as a minimum, bank full flood conditions) are represented as an outfall constraint in modelling calculations.

14.8 Where there is a known history of flooding or capacity constraints within a watercourse, such as Dereham Stream, greenfield runoff rates would need to be carefully considered. It is unlikely we would accept a proposed runoff rate that is greater than the greenfield equivalent (100%, 3.33% and 1% AEP event or QBAR) without a robust assessment that the flood risk is not increased elsewhere. This would include any proposed design suggesting a discharge of 5 l/s to avoid blockage where there are lower calculated greenfield runoff rates.

14.9 The updated UK Water DCG (2020), Section C7.12 supports the design process within Chapter 28 of CIRIA SuDS Manual (C753) and that upstream debris control should be included to allow low greenfield runoff flow controls to be installed without risk of blockage. There are proprietary vortex control devices which can limit discharges below 5l/s which have no reported problems of blockage but should be supported by the inclusion of an upstream SuDS treatment train.

14.10 For the avoidance of doubt, the LLFA will agree a runoff rate to a watercourse, Anglian Water will only agree runoff rates to sewers. Where discharge of surface water should be discharged to ground but cannot due to constraints such as contaminated land or seasonally high groundwater levels, greenfield runoff rates would likely produce a low value due to the soil type. The LLFA will consider proposals on a site by site basis in the case of discharges that should go to ground and agree a rate between 1 to 2l/s/ha based on site-specific issues (as in Section 3.3.2 of CIRIA SuDS Manual (C753)).

14.11 Drainage strategies must also consider the potential increase in the volume of runoff from a development as a result of increases in the area of impermeable surfaces. Although runoff rates may be restricted to equivalent greenfield rates, the duration over which the site could discharge at this rate is likely to increase (as shown in Policy Box 6).

Policy Box 6: Runoff Volume

CIRIA SuDS Manual (C753)

"Peak rates of surface water runoff discharged from a development (i.e. relatively impermeable) site, if left uncontrolled, are normally significantly greater than from the site in its greenfield state. This is because most of the runoff drains off the surfaces of the developed site much quicker than the greenfield site and there is much more runoff, as less water is able to penetrate the ground or be intercepted in other ways."

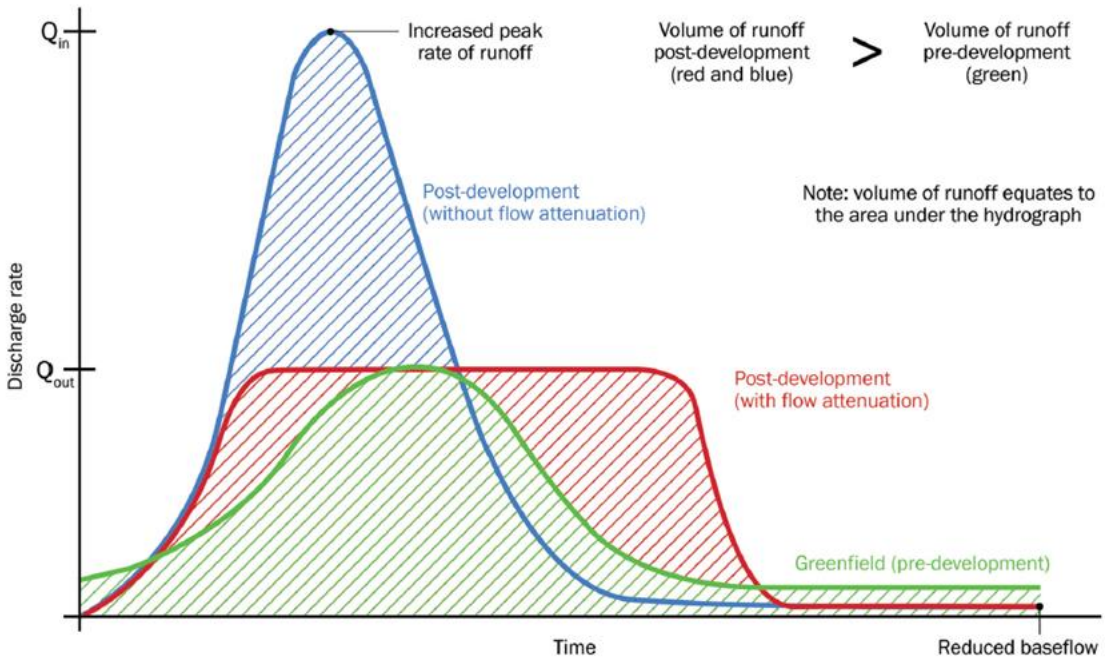


Figure 3.1 Example of a runoff hydrograph

[Reproduced from C753 Suds Manual Section 3.1.1 ©CIRIA 2015]

14.12 Where it is not possible to use or dispose of the additional volume of runoff on the site (i.e. through infiltration or water re-use), we would expect that the final runoff rates from the development be restricted further to ensure compliance with Standard S6 of the SuDS Non-Statutory Technical Standards (2015).

14.13 The CIRIA SuDS Manual presents two approaches for the consideration of runoff volume from a development site:

- Approach 1 (Complex) – The additional volume (i.e. the increase from the volume calculated for the greenfield 1% AEP, 6 hour event as stated in Section 24.10 of the CIRIA SuDS Manual 2015) should be discharged at a rate of 2l/s/ha or less while still allowing greenfield peak runoff rates for the greenfield runoff volume; and
- Approach 2 (Simple) – All runoff from the site should be discharged at a rate of 2l/s/ha or the annual average peak flow rate (QBAR), whichever is the greater.

14.14 Although Approach 2 will require a greater volume of storage than Approach 1, this approach is preferred in Norfolk.

14.15 If complex controls are to be used for control of discharge rates, calculations for the greenfield runoff rate should be provided for the 100%, 3.33% and 1% AEP events. Calculations showing that the greenfield volume is also discharged at these rates and additional runoff volumes are discharged at 2l/s/ha (long term storage).

14.16 An assessment of the volume of attenuation storage that would be required on site should be submitted. This should be based on the 1% AEP 6 hour (checked against the critical storm duration) with climate change for the site and the allowable discharge rate. FEH (Flood Estimation Handbook) rainfall data should be used for all storm durations when identifying the critical storm duration. The method of attenuation should be identified and located on a plan of the site.

14.17 Urban Creep should be considered in any application to account for increases in impermeable surfaces e.g. roof area, paving and driveways, throughout the lifetime of the development. This should be limited to residential development only and use the allowances shown in Table 4 (LASSOO Practice Guidance). If the density of the development is not known then 10% should be applied (Section 24.7.2, The SuDS Manual). Where the inclusion of the appropriate allowance would increase the total impermeable area to greater than 100%, 100% should be used as the maximum. Where an addition of 0% urban creep is recommended (i.e. in dense flat / apartment developments) we expect this to be recognised within a Drainage Strategy to reflect that extensions of impermeable surface are not expected.

Table 4: Urban Creep Allowances

Residential Development Density Dwellings per hectare (ha)	Change Allowance % of Impermeable Area
≤ 25	10
30	8
35	6
45	4
≥ 50	2
Flats & Apartments	0

15. Climate Change

15.1 All FRAs and surface water Drainage Strategies are expected to incorporate any updated EA climate change allowances for peak river flow and rainfall intensity (Policy Box 7).

15.2 For ordinary watercourses or drainage design we expect anyone undertaking an FRA and/or Drainage Strategy to review and apply the most up to date guidance[7], including assessment of the lifetime of the development and the

vulnerability of the proposed land use to justify the choice of allowance applied.

15.3 We highlight that for FRAs and fluvial modelling, peak river flow climate change allowances should be used for ordinary watercourses greater than 5km^2 in the same way that it would be considered for main rivers. Watercourses that have catchments smaller than 5km^2 are generally considered to be dominated by rainfall and so the peak rainfall allowances may be used. There may still be cases where applying peak rainfall allowances will not be appropriate and the hydrology of each catchment should be appropriately assessed.

Policy Box 7: Flood Risk Assessments: climate change allowances

"Making an allowance for climate change in your Flood Risk Assessment will help to minimise vulnerability and provide resilience to flooding and coastal change in the future.

The climate change allowances are predictions of anticipated change for:

- *Peak river flow by river basin district;*
- *Peak rainfall intensity water management catchment;*
- *Sea level rise; and*
- *Offshore wind speed and extreme wave height.*

They are allowances for climate scenarios over different epochs or periods of time over the next century. They include figures for extreme climate change scenarios."

[https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances]

15.4 As there can be a significant time between an outline application and further stages of planning approval, the most current climate change allowances[8] should be used in any detailed design at reserved matters or discharge of conditions planning applications, where previous allowances may originally have been applied.

15.5 In the case of surface water flood risk on developments with a lifetime beyond 2100, including housing developments[9], the '2070s' climate change epoch 'Upper End' allowance **must** be used in the initial design of any surface water drainage system including SuDS. See Table 5.

15.6 This Upper End scenario is to inform any additional mitigation required for the development to be safe from surface water flooding and which might be required to prevent an increased risk of flooding such as additional freeboard allowances on drainage infrastructure and/or housing finished ground floor levels.

[7] Current guidance is at Gov.uk Climate Change Allowances and Gov.uk Peak River Flow and Rainfall Intensity Allowances.
[8] Interactive maps found at DEFRA Climate Change Allowances for Peak Rainfall in England Map and Environment Agency Climate Change Allowances for Peak River Flows in England Map
[9] NCC consider residential development to have a minimum lifetime of a 100 years: Gov.uk Development with a Lifetime beyond 2100

15.7 All surface water generated from a new development should be held within the development site boundary for the 1% AEP rainfall event plus the upper end climate change allowance to ensure there is no increase in flood risk elsewhere.

15.8 For developments with a lifetime between 2061 and 2100, the '2070s' climate change epoch 'Central' allowance is to be applied (Table 5).

15.9 The construction of a commercial or agricultural building is likely to require the use the '2070s' climate change epoch 'Upper End' allowance unless significant justification can be given as to why the drainage scheme will not be expected to be in place for this length of time.

15.10 For development with a lifetime up to 2060 the central allowance for the 2050s epoch (2022 to 2060). Unless the '2050s' climate change epoch allowance is greater than that of the '2070s' climate change epoch allowance, we are likely to query the use of the '2050s' climate change epoch if it is not obvious that the development is temporary in nature (i.e. temporary haul roads or construction sites).

15.11 For any development proposing a design life of up to and including 2100 and applying a climate change allowance less than that required for the '2070s' epoch Upper End allowance, a decommissioning plan will be required to evidence the removal of the development at the end of the proposed design life.

15.12 Climate change allowances are now required to be applied on drainage designed for both the 3.33% and 1% AEP event.

Table 5: Climate change allowances from the EA Peak Rainfall Allowances, split into relevant water management catchments[10] (May, 2022).

ID	Management Catchment	Allowance category	2050s 3.33% AEP (30 year)	2050s 1% AEP (100 year)	2070s 3.33% AEP (30 year)	2070s 1% AEP (100 year)
6	Broadland Rivers	Central	20%	20%	20%	20%
6	Broadland Rivers	Upper End	40%	45%	40%	40%
7	Cam and Ely Ouse	Central	20%	20%	20%	25%
7	Cam and Ely Ouse	Upper End	35%	40%	35%	40%
45	Nene	Central	20%	20%	25%	25%
45	Nene	Upper End	35%	40%	35%	40%
50	North Norfolk Rivers	Central	20%	20%	20%	25%
50	North Norfolk Rivers	Upper End	35%	40%	35%	40%
51	North West Norfolk	Central	20%	20%	20%	25%
51	North West Norfolk	Upper End	35%	40%	35%	40%
55	Old Bedford and Middle Level	Central	20%	20%	25%	25%
55	Old Bedford and Middle Level	Upper End	35%	40%	35%	40%

[10] Water management catchments are embedded in the interactive map found at DEFRA Climate Change Allowances for Peak Rainfall in England.

15.13 In some locations the allowance for the '2050s' climate change epoch is higher than that for the '2070s' climate change epoch. If so, and development has a lifetime beyond 2061, use the higher of the two allowances. This is the case for sites located in Broadland Rivers Water Management Catchment.

16. Water Quality and Water Framework Directive

16.1. An applicant should risk assess the development for water quality and propose mitigation in a SuDS treatment train as in Section 4 and 26 of CIRIA SuDS Manual (C753), reviewing Tables 4.3 and 26.1 in particular. A treatment train should take account of the final discharge location and include extra treatment step/s for any sensitive receptors or if there is a need for an emergency shut off mechanism e.g. at the outlet of a pollution forebay. In general, housing developments would need to assess if the simple index approach (Section 26.7.1 of the CIRIA SuDS Manual (C753)) is a suitable assessment. We would expect this assessment of pollution hazard and mitigation control to be included with an application. There is an online tool provided by UKSuDS which can help with this assessment (Tool for the Design and Evaluation of SuDS). Water Framework Directive (WFD) and sensitive receptors are discussed in Section 16.4 and 16.5 below. The Design Manual for Roads and Bridges (DMRB) Part CD530 – Design of Soakaways should be consulted regarding road runoff and considerations for pollution to groundwater. The LLFA accept the use of the Highways England Water Risk Assessment Tool (HEWRAT) for road infrastructure proposals.

16.2 Inclusion of interception storage (the first 5mm of rainfall) in a SuDS design, will also benefit water quality by treating the high polluting first flush of rainfall runoff. See the SuDS Manual Chapter 7 and Section 24.8 for more information regarding design.

16.3 The EA have standing advice that states, in general they consider pollution of surface water runoff from residential development to be adequately addressed if SuDS have been provided to manage the runoff. Water quality treatment would not be met if traditional piped drainage schemes are promoted. If piped schemes are promoted as part of a SuDS scheme e.g. pipes connecting to geo-cellular crates or attenuation tank(s), other SuDS components, such as permeable paving, swales or filter strips should also be used to treat water prior to the final discharge.

Photo of a newly created swale with over the edge drainage on Broadland Northway, Norwich, Norfolk (Image E Simpson @ NCC LLFA)

16.4 Clean residential roof water that is separated from other runoff can be directly discharged to the water environment (including any watercourse or soakaway) without treatment. The use of proprietary systems such as oil interceptors are not generally seen as a treatment step in SuDS but could be considered as a pre-treatment stage. There are proprietary vortex controls that can treat water to a sufficient standard reported to meet the SuDS mitigation indices required in the SUDS Manual assessment (see Section 16.1 above). However, there will only be considered in exceptional circumstances where open shallow SuDS cannot be achieved e.g. highly constrained brownfield development. These proprietary systems may not be acceptable to an adopting authority. Therefore, pre-application advice should be undertaken and in principal agreements provided if proprietary systems are included in an approval.

16.5 The sensitivity of the receiving waterbody (ground or surface) should be considered, and extra water quality treatment provided if a protected resource is identified. If there is clear evidence that additional water quality treatment has been included considering the protected resource requirements, no further WFD assessment would be required. A full WFD assessment would be required if no treatment or additional requirements for sensitivity are not included in the SuDS proposal. The following designations could be considered 'sensitive' protected resources and require additional mitigation in the SuDS treatment train[11]:

- Groundwater Source Protection Zone 1;
- Principal Aquifers;
- 50m within a private potable of a groundwater abstraction;
- Surface Water drinking water zone;
- RAMSAR site;
- Special Area of Conservation (SAC) and consideration of tributaries;
- Special Protection Area (SPA) and consideration of tributaries;
- SSSI and consideration of tributaries;
- Salmonid fish stretches (in particular, brown trout);

[11] Maps of many of these designations can be found on the DEFRA Magic Map and on the "Flood Risk Activity Permits: Salmonid Main Rivers" section of the gov.uk website

- Chalk Streams;
- National or Local Nature Reserves;
- Nitrate Sensitive Areas; and
- Nitrate Vulnerable Zones.

16.6 The EA have classified the majority of Norfolk's main river channels and surface waterbodies as having a high sensitivity rating e.g. SSSI or salmonid fish stretches. This assessment is based on the species and habitats found in these systems and the rating given is an indication of the surface waterbodies susceptibility to change. The sensitivity of these watercourses is likely to extend to all of the connecting tributaries and ordinary watercourses which flow into these river channels and surface waterbodies. Additionally, Norfolk has many principal aquifers and groundwater drinking water Source Protection Zones which would also be classed as a 'sensitive' protective resource. An applicant would have to consider if there is a significant amount of secondary superficial aquifer above the principal aquifer to provide protection and not be classed as 'sensitive'.

16.7 If you are unable to design your SuDS proposal according to the sensitivity of the receiving surface water or ground waterbody you will need to demonstrate how your proposal is compliant according to WFD through the submission of a detailed WFD assessment (please contact the local EA office for advice). It is the applicant's responsibility to ensure that the drainage scheme does not result in deterioration to any of the qualifying WFD status elements or that the scheme prevents *"good ecological status or potential from being achieved".*

16.8 The Water Framework Directive provides the mechanism to protect and enhance the nation's water environment. All waters are classified in terms of various criteria and water quality measures range from nutrient pollution to fish and plants living in the water. Each waterbody has a target which must be achieved, and any development must not cause the existing quality to decline or risk the chances of the target quality being achieved in the future. If suitable SuDS treatment is implemented, then the development will be considered compliant from a WFD perspective. You will only need to undertake a full WFD assessment if you intend to depart from the following guidance. WFD classification information can be found on the "Anglian River Basin District" section of the environmental.data.gov.uk website.

16.9 Diffuse pollution from roads is considered a primary source of pollution to the water environment. Any proposals should consider open shallow SuDS within the treatment train of drainage schemes to mitigate potential pollution. This is supported by the SuDS Manual (C753) and DMRB (document LA 113). In the first instance, a design without the need for traditional road gullies is likely to significantly reduce the potential for pollution to the water environment.

17. Amenity

17.1 Multi-functional use should be highlighted for any part of the SuDS landscape which is available for use by people when not being used for drainage. This is

an underlying principal of place making urban design, to make a location desirable to live and work.

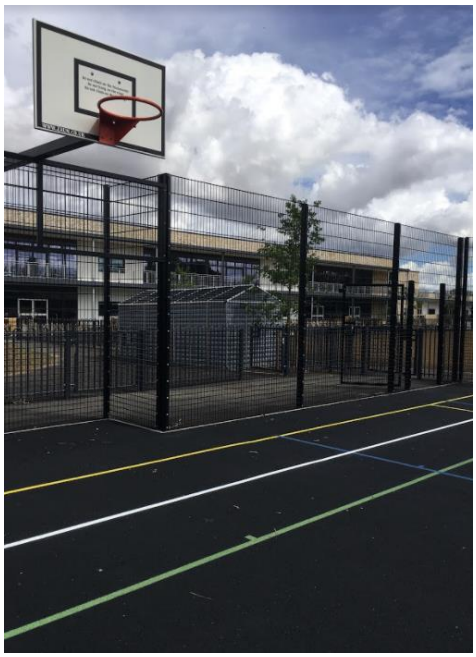


Photo of the use of permeable tarmac on a playground at the SEN School Old Buckingham, Norfolk (Image E Simpson @ NCC LLFA)

Photo of a green wall on a commercial building in an inner-city area, Norwich, Norfolk (Image E Simpson @ NCC LLFA)

17.2 All greenfield developments will be expected to meet all four pillars of SuDS which includes the amenity benefit of the drainage. The use of blue green infrastructure to produce attractive places can increase economic investment, assist with noise and air quality improvements (such as bioretention areas in traffic calming measures).

17.3 Rainwater harvesting can be considered as an amenity benefit due to its resilience of a development to climate change and long-term water resource availability. It can also be retrofitted into brownfield sites where space is constrained. SuDS should be attractive and enhance visual amenity with well-designed features e.g. inlets and outlets of features to show minimal visual impact. Any opportunities to support community educational learning should be highlighted e.g. dipping ponds or appropriate inclusion in play areas.

17.4 Consideration should be given to how the SuDS can be accessed for both recreation and maintenance but also engagement with the wider local community. Further information on amenity design can be found in Chapter 5 of the SuDS Manual.

18. Biodiversity

18.1 Biodiversity will be able to become established if an appropriate water quality treatment train is implemented along with open shallow SuDS features to join habitats together. The design of blue green corridors within any development can create and enhance habitats and ecological connectivity along with its amenity value. The variety of structures e.g. swales, raingardens, wetlands and ponds will allow for a resilient diverse habitat development. Examples of blue green corridors using SuDS can be found in Natural England's Green Infrastructure Guidance (2009) and further information on biodiversity design can be found in Chapter 6 of the SuDS Manual.

Photo of a dragonfly, Norfolk Hawker (*Anaciaeschna isosceles) (Image D White @ NCC)*

18.2 All greenfield developments will be expected to meet all four pillars of SuDS which includes the biodiversity benefit of the drainage. It should be noted that NCC Environment Policy embeds an 'environmental net gain' principal for development including housing and infrastructure. This is in advance of any enactment of the formal Environment Bill. The policy also includes commitment to improve soil health, protecting the environment and improving the health and wellbeing of people. Whilst brownfield developments may be constrained on site size, the inclusion of retrofit SuDS such as green roofs, tree pits or other bio retention areas in traffic calming measures should be considered.

18.3 Use of flood and drought tolerant planting should be considered to ensure functionality of SuDS benefits for e.g. water quality treatment, through the lifetime of the development.

Photo of a green roof with insect habitat, London (Image E Simpson@ NCC LLFA)

19. Management and Maintenance

19.1 The management and maintenance of SuDS should appropriately account for the construction, operation and maintenance requirements of all components of the drainage system (surface and sub-surface), see Policy Box 8. Applicants should sufficiently consider the likely maintenance requirements of new and existing infrastructure, over its design life including the provision of funding during the feasibility and planning stages of a scheme (in accordance with CIRIA SuDS Manual (C753) Part E, Chapter 32, 2015)). It is important that maintenance is also considered in the design of the drainage system and the development site to account for the requirements of undertaking all stages of maintenance work such as ease of access whether this is for personnel, vehicles or machinery (PPG Paragraph 085 Reference ID 7-085-20150323).

19.2 Pumping of surface water drainage as part of SuDS will only be acceptable if it can be demonstrated that it is not reasonably practical to drain those parts of a site by gravity (as stated in standard S12 of SuDS Non-Statutory Technical Standards (2015)). Where pumping is proposed, it should be demonstrated that the site cannot be developed without it and appropriate maintenance proposals are included e.g. back up pumps.

Policy Box 8: Management and Maintenance

House of Commons Written Statement (HCWS161): Sustainable drainage systems

"In considering planning applications, local planning authorities should consult the relevant Lead Local Flood Authority on the management of surface water; satisfy themselves that the proposed minimum standards of operation are appropriate and ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development."

National Planning Policy Framework (Paragraph 165)

Major developments should incorporate sustainable drainage systems unless there is clear evidence that this would be inappropriate. The systems used should:

a) Take account of advice from the lead local flood authority;

b) Have appropriate proposed minimum operational standards;

c) Have maintenance arrangements in place to ensure an acceptable standard of operation for the lifetime of the development; and

d) Where possible, provide multifunctional benefits.

19.3 In accordance with the NPPF paragraph 169, PGG and the SuDS Manual, we require applicants to provide a management plan and maintenance schedule of work detailing the activities required and who will adopt and maintain the surface water drainage features for the lifetime of the development. The operation, management and maintenance of such systems should be accounted for in any proposed drainage works as early as possible.

19.4 Further guidance regarding the typical key operation and maintenance activities for each type of SuDS component are indicated in Table 32.1 of the SuDS Manual (2015). Further consideration of the frequency of such tasks should be provided.

19.5 Where it is proposed that a community will be adopting SuDS, maintenance plans and schedules should be clearly communicated to any future property owners. This should be done in accordance with Section 12 and 11.4 of British Standard BS8582:2013. Such plans should further explain the consequences of not carrying out the maintenance.

19.6 An appropriately designed SuDS scheme should mean that Health and Safety requirements are low e.g. inclusion of wet or dry benches in attenuation basins, requirement for a low fence. The CIRIA guide 'Health and Safety for SuDS: framework and checklist' (CIRIA RP/992 Nov 2013) was written in conjunction with the Royal Society for the Prevention of Accidents (RoSPA) and provides an outline of common issues and puts risks into context. This guide is free to download from the CIRIA website.

19.7 There are several options for adoption and maintenance of SuDS and should be considered on the following hierarchy:

- Anglian Water will consider adoption of a scheme designed to standards set out in the SuDS Design and Construction Guidance. Further information on how to express interest to adopt SuDS can be found on the "Sustainable Drainage Systems" section of the Anglian Water website;
- An Internal Drainage Board will maintain certain watercourses of arterial importance within the IDB Internal Drainage District that are designated by the Board as 'Main Drains' or 'District Drains'. All watercourses within the IDB area generally remain the responsibility of the riparian owner irrespective of their designation as a 'Main Drain'. IDBs also may consider adopting a drainage scheme associated with new development if the site falls within their IDB area. (Details of how to contact the IDB can be found on the "Internal Drainage Boards" section of the Association of Drainage Authorities website)
- NCC Highways Authority will consider the adoption of SuDS and drainage schemes which only drain a highway (not additional housing or open space areas). Further information on general design and landscape standards can be found on the "Adopted and Private Roads" section of the NCC website and the "Drainage" section of the NCC website. This includes the need for a minimum carrier drain to be 225mm in diameter.
- Adoption could be also agreed through a Section 106 Agreement with a Borough, District, Town or Parish Council. This could be combined with any public open space maintenance agreement;
- A third-party company could be established to adopt and maintain a SuDS Scheme across the whole or part of a development; and
- Individual property owners can become responsible for management and maintenance where it falls within their property boundary, however this would not cover any public or open space.

19.8 Third party management companies should only be suggested for maintenance where no other adoption authority is achievable. Evidence should be provided that appropriate adoption authorities have been approach. Stating that an adoption authority's standards cannot be met due to lack of space within the development layout are unlikely to be acceptable. Easement around SuDS features should be provided, and distances required can vary between adopting authorities. For example, NCC Highways Authority require a 3m easement from the extremity of any drainage feature and from a root protection zone. Early consideration for open space, landscaping and easement to SuDS features may avoid conflict at later stage.

19.9 Where ordinary watercourses or other surface water features are bounding or within the development site, these should also be included within a management plan and maintenance schedule. Where the watercourse falls within a large open space of masterplan sites, the riparian owner responsibilities is likely to fall to the authority adopting the open space, e.g. District or Parish Council. These responsibilities need to be clearly communicated and agreed

in principal with any adopting authority. Where new properties bound a watercourse, each property would have riparian owner responsibilities to undertake maintenance and this should be clearly highlighted to future property owners or tenants. An alternative is to provide other management arrangements for these features such as encompassing them in the responsibilities of any third-party company established for the site or the relevant IDB. A maintenance buffer zone of 10m is advocated by British Standard BS 8533:2011(Section 5.3.3) but discussions should be held with the appropriate regulatory authority (including an IDB) to discuss requirements.

19.10 It is recognised that ordinary watercourses can be relatively small in width and depth. If a watercourse is outside of an IDB area, the LLFA recommends that a minimum buffer of 3.5m in width should be allocated to allow for access for maintenance. This should be provided from the top of both banks unless it can be shown that uninterrupted access along the length of the watercourse can be delivered. Locations of outfalls into the watercourse must be identified and plant not be placed directly above it to prevent damage to the structure. Appropriate landscaping e.g. location of trees / plants and permanent structures such as benches must be considered. The width of this recommended buffer zone gives consideration to working room and spoil handling and is based upon the width of the largest likely plant intended for maintenance (such as a tracked excavator or JCB type back hoe machine), multiplied by 2.5 (measured from the top of bank landwards), e.g. a typical 2.5 tonne mini excavator = 1.4m wide x 2.5 = 3.5m buffer (see Figure 5).

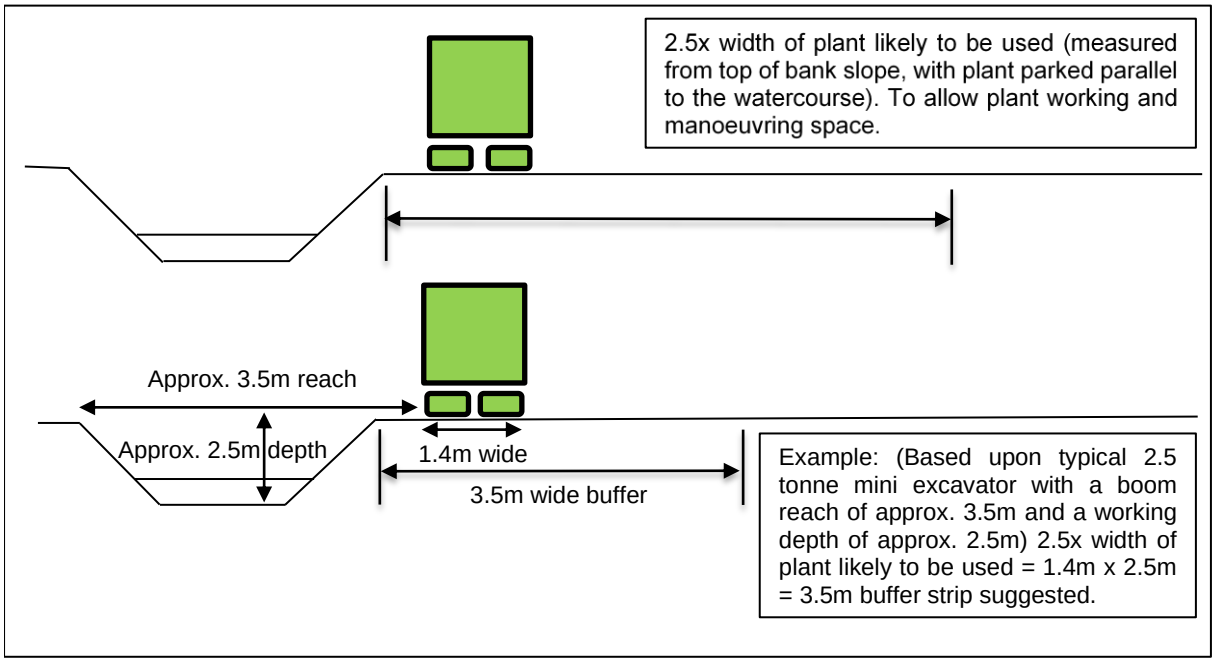


Figure 5: Diagram demonstrating an example distance of easement to a watercourse

19.11 Many development sites are constructed on land which may have had an agricultural use. No dwelling should be constructed over an existing culvert that is to remain active and any field drains intercepted on the boundary of the development should be diverted so overall land drainage discharge can be

maintained.

20. Resistance and Resilience

20.1 Safe access and egress through a new development site should be maintained in accordance with PPG (Paragraph: 039 Reference ID: 7-039-20140306). We expect that any source of flooding is considered and that any areas expected to flood are managed in accordance with DEFRA / EA Hazard to People Classification / Rating. It should be noted that there are currently no flood warnings provided to notify communities / residents of predicted surface water flooding events. The rapid inundation often experienced with surface water flooding, especially those events caused by convective thunderstorms, means that careful consideration should be given to development proposed in areas identified at risk from EA Mapping.

20.2 The Guidance document “Improving the Flood Performance of New Buildings” by DEFRA dated 2007 can be reviewed when approaching the development of a mitigation strategy. This guidance advocates a hierarchy approach to development with the top of the hierarchy being the avoidance of vulnerable development being located in areas at risk of flooding (as stated in NPPF). We expect any resistance and resilience measures to assess the hierarchy of building and site design to avoid the risk in the first instance. Only where it is agreed this is not possible would the other steps be followed e.g. resistance (or prevention) of water entering a building and resilience of the building. Resilience seeks to ensure that if water did enter fabric of the building that the impacts are reduced. The last stage in the hierarchy is repairable design to ensure that any damage is easily repaired or replaced.

20.3 It should be demonstrated that the drainage system must be designed so that unless an area is designated to hold or convey water flooding must not occur in any part of a building or utility plant susceptible to water e.g. pumping station or electricity sub-station (Standard S8 of the SuDS Non-Statutory Technical Standards (2015)). Resistance and resilience measures can also be included where there is a residual risk of flooding e.g. the development has avoided the risk of flooding up to a 1% AEP plus climate change allowance but there are still properties proposed that would be at risk of 0.1% AEP flood event. Where this is the case the LLFA would expect as a minimum that property finished ground floor levels (FFL) throughout the development are recommended to be set to a minimum of 300mm freeboard above the anticipated flood levels in 1% AEP event plus climate change from any source of flooding (See Figure 6 and Policy Box 9). Any source of flooding would also include an assessment to ensure there is 300mm above anticipated flood levels within the drainage system, to provide protection in the event of an exceedance event. Where there is uncertainty in flood levels, this freeboard level should be increased up to 600mm. We would expect that there would be a minimum of at least 150mm freeboard between proposed external ground levels and property FFL. External ground levels should always slope away from any building, especially entrances to avoid ponding of water against or within a structure. An overview of mitigation is expected at an initial planning application stage to establish what is achievable within the development. The LLFA would expect the detailed design to then follow and implement any recommendations.

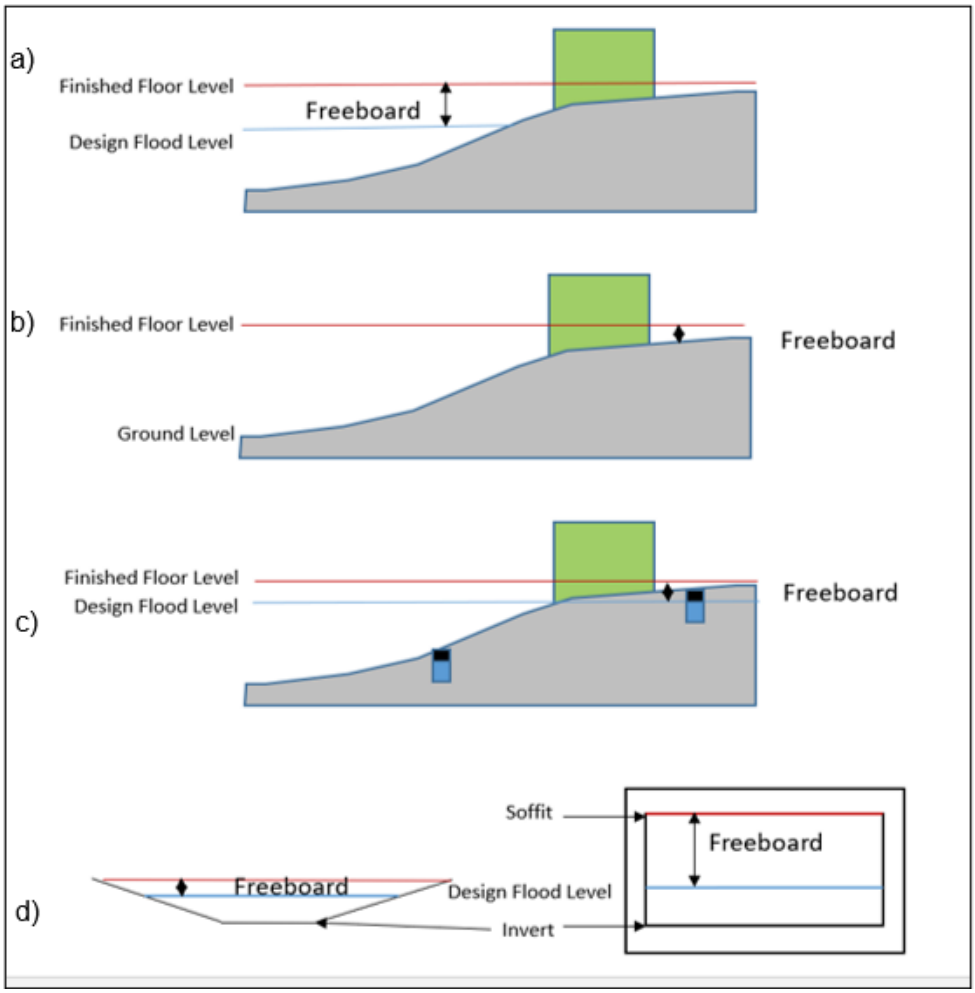


Figure 6 Simplified illustration of freeboard allowances from a) from a source of flooding b) surrounding ground levels c) from a drainage system d) in a culvert or structure.

20.4 The types of mitigation that could be included in any proposal may be limited by the source, depth and velocity of flooding. For example, groundwater flooding may require significantly different mitigation to surface water flooding. Examples of resistance and resilience include providing measures such as landscaping of external ground levels to avoid water entering buildings (including basements) or ensuring that essential electrical equipment is located above the expected water level.

Policy Box 9: Flood level and flow exceedance management

"For the 1 in 100 year return period event [1% AEP event] (including relevant design allowances) for the site, flood levels associated with the surface water drainage system should be not less than 300 mm below the finished ground floor levels and the level of any opening into any basement of the proposed buildings on the site. The design of the drainage system for exceedance flow management should take account of any residual flood risks for the site. An assessment should also be made of the likely significance of risks associated with the following scenarios:

a) A blockage or failure of a drainage system component;

b) Failure of any embanked storage facility; and

c) Rainfall events that are larger than the storms used for the design of the drainage system."

[British Standard BS8582:2013 Section 5.2.2.6]

20.5 The LLFA would expect that any water from a drainage scheme being managed on site during a 1% AEP event plus climate change event outside of structures designed to store or convey water will meet recommendations within Table 12.3 of CIRIA Report C635 (2006), i.e. water on minor roads where speed limits are 30mph will be a maximum of 100 mm deep and car parks would be a maximum of 200mm deep (assuming there is a kerb upstand). We recommend that roads are not routinely used to manage flow paths especially where several parties adopt the surface water drainage network. NCC as Highway Authority will only adopt drainage schemes where it can be shown water draining to them is only from the highway. There may also be significant challenges to ensure that appropriate freeboard to finished floor levels of dwellings can be achieved (see above).

20.6 Standard S9 of the SuDS Non-Statutory Technical Standards (2015) also require an applicant to consider how impacts to people and property will be minimised in the event that the drainage system will be exceeded in an event greater than 1% AEP event plus climate change. The LLFA expect that plans be provided to show how this has been considered within the design of the development layout and comment on confirmation on how resilience has been considered.

20.7 Flood Re insurance is not available for houses built after 1 January 2009. This date was agreed between the Government and the Insurance industry following the Pitt Report into the 2007 flood event and ensure that the risks of flooding are appropriately considered and mitigated at the planning stage. Hence, new developments are subject to risk reflective pricing, meaning those built without due consideration of flood risk may struggle to access affordable insurance. The LLFA advise that any development fully consider the potential available finance and insurance for the future owners and / or tenants of the proposed dwellings (or mobile homes for permanent residential use).

ANNEX 1 – National Policy Background

A1. NPPF and Sequential Approach

A1.1 The sequential approach to the LLFA's advice is based on NPPF (2021) and PPG (online version). This uses up-to-date information to advise the Local Planning Authority at an early stage where best to steer development in line with the sequential test (PPG Paragraph: 019 Reference ID: 7-019-20140306 and associated links to Table 2 and 3). As a statutory consultee on surface water drainage we also have a duty to consider our other responsibilities including, local flood risk management and consenting of works which may affect flow within an ordinary watercourse. It is assumed that LPA's have undertaken a sequential test (and exception test where appropriate) for any allocated site within a Local Plan or windfall site.

A1.2 The sequential approach is a precautionary one, to avoid the risk of flooding in the first instance. We support this approach as it is the most sustainable form of flood risk management. In accordance with NPPF paragraph 167 (footnote 55) PPG (Paragraph: 018 Reference ID: 7-018-20140306 and Paragraph: 019 Reference ID: 7-019-20140306), development should be steered to areas of the lowest flood risk from any source, where there are no reasonable alternative sites, taking into account flood risk vulnerability of land use (NPPF Annex 3) sites in Flood Zone 2 can be considered (employing the exception test where required – see NPPF paragraph 162 to 165). Table 10 details further information that can be used to define Flood Zone 1 (in addition to the EA's river and sea flood maps). It is important to note the following:

- Indicative EA's Risk of Flooding from Surface Water (RoFSW) maps (extent, depth, velocity and Hazard layers[12]) for both the 1% AEP flood (i.e. 1% probability flooding which can occur in any single year or the 1 in 100 year) and 0.1% AEP flood (i.e. 0.1% probability which can occur in any single year or the 1 in 1000 year) **can be used to identify potential risk of flooding from surface water flow paths and / or significant ponding**;
- Indicative EA River and Sea Flood Maps for Planning for both Flood Zone 2 and 3 – or up to 1% AEP and 0.1% AEP of flooding **can be used to identify potential risk of flooding from ordinary watercourses**. Where no mapping of fluvial flood risk (watercourses with catchments smaller than 3km^2), or there is uncertainty within the EA mapping, the RoFSW map can be used as a proxy and should be used consistently with river flood mapping probability. To avoid doubt, the 1% AEP map is deemed equivalent to Flood Zone 3 and 0.1% AEP map is equivalent to Flood Zone 2 (as per PPG – Flood Risk and Coastal Change Paragraph: 018 Reference ID: 7-018-20140306); and
- Climate change must be considered within surface water and proxy Flood Zones. NCC has produced maps using

[12] The RoFSW has known limitations in pumped or artificial catchments and should be combined with other sources of information in these locations.

30% climate change of parts of Norfolk within Surface Water Management Plan Documents. There is also mapping undertaken by some Norfolk SFRA's to include 40% climate change. Where a site does not fall within either of these maps, the 0.1% AEP flood map can give an indication of the 1% AEP flood map including climate change. It is recognised that this method may over predict in some locations but unless further information is available this approach should be followed.

A1.3 It should be noted that the NPPF has other aspirations on sustainability, promoting healthy communities, preventing pollution, green infrastructure and conserving the natural environment for which SuDS are also relevant. The multi-benefits of flood management, climate change consideration, treatment of runoff, public open space and wildlife habitat opportunities can be met through a well designed and implemented SuDS scheme. With regard to NPPF Paragraph 169 an appropriately designed SuDS, incorporating CIRIA SuDS Manual (C753) recommended treatment, is considered to address the quality of surface water runoff effectively. The EA has standing advice that states in general they consider pollution of surface water runoff from residential development to be adequately addressed if SuDS have been provided for the runoff. Water quality treatment would not be met if traditional piped drainage schemes are promoted. If piped schemes are promoted as part of a SuDS scheme e.g. pipes connecting to geo-cellular crates or attenuation tanks, other SuDS components, such as permeable paving, swales, filter drains or strips should also be used to treat water prior to the final discharge. Extra treatment may be required if water is discharged to sensitive locations, e.g. WFD, drinking water designated sites.

A1.4 On the 18 December 2014 the Secretary of State for Communities and Local Government, Eric Pickles made a Written Ministerial Statement on SuDS. This stated that Government **expects** local planning policies and decisions on planning applications relating to major development to ensure that SuDS for the management of runoff are put in place, unless demonstrated to be inappropriate. It was also restated that the current requirement in national policy that all new developments in areas at risk of flooding should give priority to the use of SuDS. This requirement has now been incorporated within NPPF.

A1.5 It was specifically acknowledged that the Written Ministerial Statement on SuDS should be taken into account in the preparation of local and neighbourhood plans and that it may be a material consideration in planning decisions. As such the Written Ministerial Statement on SuDS should be viewed as forming part of national planning policy.

A1.6 No changes to the current planning enforcement mechanisms were made as part of the recent amendments to planning policy as any breach of a SuDS related planning condition can be enforced under the existing planning enforcement regime.

A2. Planning Practice Guidance

A2.1 Government updated PPG as part of its SuDS and LLFA planning changes. These amendments and additions were made to the Flood Risk and Coastal Change section of the PPG. This section advises on how planning should take account of the risks associated with flooding and coastal change in plan-making and planning application processes. This guidance is due to be updated again to reflect the recent changes in NPPF.

A2.2 The PPG highlights that developers and applicants need to consider flood risk to and from the development site. In doing so the PPG recommends that a broad approach of **assessing**, **avoiding**, **managing and mitigating** all forms of flood risk should be followed. A précis of this approach is set out below.

A2.3 LPAs **assess** the flood risk posed to new development by:

- Undertaking a SFRA for their area to inform the preparation of their Local Plan; and
- Requiring developers to undertake a site-specific FRA to support their applications for planning permission for development that meets national and locally set thresholds.

A2.4 LPAs **avoid** the flood risk posed to new development by:

- Applying the 'Sequential Test' and, if needed, the 'Exception Test' to Local Plans to ensure that when selecting sites development is, as far as reasonably possible, located where the risk of flooding (from all sources) is lowest; and
- Applying the Sequential Test and if needed, the Exception Test for specific development proposals to steer development to areas with the lowest probability of flooding.

A2.5 LPAs and developers **manage and mitigate** the flood risk posed to new development by:

- Ensuring development is appropriately flood resilient and resistant, safe for its users for the development's lifetime, and will not increase flood risk overall; and
- Seeking flood risk management opportunities (e.g. safeguarding land) to reduce the causes and impacts of flooding (e.g. through the use of SuDS in developments).

A3. Determining SuDS proposals on new developments

A3.1 As part of the LPAs role in determining planning applications the LPA makes the final decision about the viability and suitability of the SuDS provision and whether it is proportionate to the level of flood risk affecting the site. Clearly this decision is made

in the context of all the other policy and material considerations relating to the proposal.

A3.2 In determining the SuDS element of planning applications the LPA will need to satisfy themselves that any SuDS proposals meet national and local policies. In addition, as set out in the Written Ministerial Statement they also need to:

- Consult the LLFA on the management of surface water, (where appropriate);
- Satisfy themselves that the proposed minimum standards of operation are appropriate;
- Ensure through the use of planning conditions or planning obligations that there are clear arrangements in place for on-going maintenance (of SuDS) over the lifetime of the development; and
- Satisfy themselves that the SuDS are designed to ensure that the maintenance and operation requirements are economically proportionate.

A3.3 The PPG states that the information sought by the LPA in answering the above requirements should be no more than necessary, having regard to the nature and scale of the development concerned.

A3.4 The LPAs Local Plan also remains a key document in relation to directing development away from areas of high flood risk wherever possible, including areas at risk of flooding from surface water. It is expected that the evidence supporting the SFRA should be used by the LPA to inform their judgement both on the appropriateness of the proposed development and on the suitability of the proposed drainage system.

A4. The LLFA role as statutory consultee to planning

A4.1 LLFAs are unitary local authorities and County Councils who are responsible for managing flooding from surface water, groundwater and ordinary watercourses. They were conferred this status by the Flood and Water Management Act 2010 and are required to deliver a strategy for local flood risk management in their areas, to investigate flooding and to maintain a register of flood risk assets. For NCC this role is fulfilled by the authority's Flood and Water Management Team.

A4.2 The LLFA role as statutory consultee to planning is created by the Town and Country Planning (Development Management Procedure) (England) Order 2015. Specifically, Schedule 4 of this statutory instrument sets out the consultations before the grant of permission and paragraph (ze) states that the LLFA should be consulted on "major development with surface water drainage".

A4.3 Major development is defined by Article 2(1) in Part 1 (Preliminary) of the Town and Country Planning (Development Management Procedure) (England) Order 2015 as development involving any one or more of the following:

(a) The winning and working of minerals or the use of land for mineral-working deposits;
(b) Waste development;
(c) The provision of dwelling-houses where -
    (i) The number of dwelling-houses to be provided is 10 or more; or
    (ii) The development is to be carried out on a site having an area of 0.5 hectares or more and it is not known whether the development falls within sub-paragraph (c)(i);
(d) The provision of a building or buildings where the floor space to be created by the development is 1,000 square metres or more; or
(e) Development carried out on a site having an area of 1 hectare or more.

A4.4 As a statutory consultee, in line with the Code of Practice relating to consultations on planning applications, the LLFA is expected to respond to the LPA within 21 days of receiving a consultation. The LLFA has to make a substantive response which can be one of the following:

(a) States that the consultee has no comment to make;
(b) States that, on the basis of the information available, the consultee is content with the development proposed;
(c) Refers the consultor to current standing advice by the consultee on the subject of the consultation; or
(d) provides advice to the consultor.

A4.5 For re-consultations following the submission of further information by an applicant, the LLFA will request the LPA to allow a further 21 days to provide bespoke advice to be given. The LLFA will endeavour to reply to statutory consultations within 21 days of being consulted. If the LPA requires a reply sooner than this, they should inform the LLFA at the point of consultation.

A4.6 The LLFA as a statutory consultee also has a duty to report to Government on their performance in providing a substantive response within that deadline. The annual report to the Government should be provided no later than 1st July and must relate to the previous financial year (e.g. starting 1 April in the preceding year).

ANNEX 2 - Standing Advice Checklist, Major Development when LLFA are not consulted

Is the development site currently at risk of flooding?

The risk of flooding on the current site should be acknowledged. If any areas at risk of flooding are identified, development should avoid these areas in line with NPPF. Where this cannot be achieved, a robust strategy should be provided that includes adequate flood resistant and resilience measures incorporated in the design. This may require an emergency flood plan where appropriate. It should be noted that flood mapping has been considerably improved over time, and any Local Plan Site allocated prior to 2014 is unlikely to have considered surface water flooding as a risk. No development should have a condition relating to defining the flood risk to the site, the only exception would be to condition post development flood modelling scenarios at reserved matters stage following outline permission.

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted to the LPA	Link to Section in LLFA Guidance	Provided? (delete as appropriate)
YES	NO	NO	NO	Flood Risk Assessment / Statement with commentary of all sources of flood risk, using national and SFRA mapping, showing historical incidents especially in urban areas and describing how the development will apply the sequential approach. The document should include plans and drawings, detailed pre- and post-development scenarios, **indication** of mitigation (including compensatory storage or managed surface water flow path creation, consideration for access / egress and if an emergency plan is required) and freeboard allowance. Where appropriate required maintenance easements to watercourses and structures should also be demonstrated.	10	YES / NO
NO	YES	YES	YES	Flood Risk Assessment / Statement or update from outline permission, of all sources of flood risk, as above but may include up to date flood incidents or national / local guidance. The document should include plans and drawings, detailed pre- and post-development flood modelling if appropriate, **detailed** mitigation (including compensatory storage or managed surface water flow path creation) and freeboard allowances. Where appropriate emergency plans indicating safe access and egress and maintenance easements to watercourses.	10	YES / NO

How does the site currently drain?

The method through which the site currently drains should be described, such as whether there are existing infiltration features, ordinary watercourses within or at the boundary of the development, or existing surface water sewer infrastructure. Betterment of surface water runoff from an existing brownfield runoff must be considered. Brownfield surface water runoff rates and volumes should be attenuated as close to greenfield rates as possible. There is no historic right of connection to a surface water sewer if a development is brownfield and being redeveloped.

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted to the LPA	Link to Section in LLFA Guidance	Provided? (delete as appropriate)
YES	YES	NO	NO	Commentary on how the current site drains with information where any existing drainage outlets are. Calculations on pre-development runoff rates and runoff volumes should be provided. If the site is brownfield, pre-development brownfield rates and volumes and equivalent greenfield rates and volumes should be provided.	11 14	YES / NO

How will the site drain?

The proposed method for draining the site should be in accordance with the sustainable drainage hierarchy; with a preference for shallow (<2 m deep) infiltration measures, followed by measures to drain to a nearby watercourse, otherwise discharging to a surface water sewer. The last method of draining a site would be to either a combined / sewer, or via deep infiltration methods (>2 m below ground level). It would be acceptable to condition Plan B if there is evidence that it can be achieved e.g. Plan A is infiltration with generalised testing across the site but is yet to be fully tested at the depth and location of SuDS in an outline application, Plan B is connection to a watercourse and it is adjacent the site with no third party access restrictions.

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted to the LPA	Link to Section in LLFA Guidance	Provided? (delete as appropriate)
YES	YES	NO	NO	Drainage Strategy / Statement and outline drainage layout plan, evidencing the drainage destination that meets with the hierarchy using shallow (<2m deep) (Plan A) ahead of all other destinations. If only indicative infiltration testing has been carried out or if it cannot yet be carried out evidence of an alternative Plan B should be provided. Discharge to foul sewer is not acceptable.	11	YES / NO
YES	NO	NO	NO	Ground Investigation Report (for infiltration) and infiltration testing if only relying on infiltration showing that rates are better than $1x10^{-6}$m/s or 0.0036 m/hr. Worse rates than this can only use infiltration as part of the proposal and a positive discharge outfall to a watercourse or sewer must also be provided. Evidence that seasonally high ground water levels are 1.2m below the base of the infiltration structure.	12 13	YES / NO
YES	NO	NO	NO	Preliminary “Outline” hydraulic calculations and commentary to explain how these meet the SuDS National Standards S1 to S9 and S12. The information should include infiltration rates found in the Ground Investigation Report, existing and proposed runoff rates / runoff volumes, appropriate attenuation required including climate change up to 40% and urban creep allowances up to 10% depending on density of development.	14 15	YES / NO
YES	NO	NO	NO	Preliminary development plan and landscape proposals, showing SuDS component locations and required maintenance easements (minimum of 3m to a linear feature but larger for a pond or basin and including 3.5m to a watercourse. Drainage components should be at least 3m from a proposed or existing root protection zone).	19	YES / NO
YES	YES	NO	NO	Evidence of ‘in principal' agreement of a third party for SuDS discharge to their system (e.g. Anglian Water, Highways Authority or third-party owner). Proprietary SuDS such as vortex pollution control e.g. downstream defender will not be acceptable to some adopting authorities and hence comment from them should be considered. Identification of the maintenance responsibility of any ordinary watercourse (including structures) within or adjacent the development. Consent for any culverts should already have been discussed and evidence provided that ‘in principal’ agreement has been undertaken with appropriate authority (EA, IDB, LLFA).	19	YES / NO
YES	YES	NO	NO	Infrastructure and Construction Phasing Plan (including temporary works to drainage schemes required if the build out time is long).	9.2	YES / NO
NO	YES	YES	YES	Detailed development layouts showing SuDS locations, how the SuDS runoff volumes will be accommodated within the layout, discharge destinations and maintenance easements.	11	YES / NO
NO	YES	NO	YES	Detailed drainage design hydrology / hydraulic calculations and drawings. Showing all locations, dimensions and freeboard of every element of the proposed mitigation and drainage system (e.g. swales, storage areas, ponds, permeable paving, filter strips (including sewer details if proposed (pipe numbers, gradients, sizes, locations, manhole details etc.))). Catchment plans of each part of the drainage system to understand how runoff volumes and water quality assessments have been calculated.	14	YES / NO

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted to the LPA	Link to Section in LLFA Guidance	Provided? (delete as appropriate)
NO	YES	NO	YES	Specific ground investigations (Geotechnical factual and interpretive reports). Commentary should be provided to show how the testing has been undertaken at the proposed location and base depth of infiltration structures.	12	YES / NO
NO	YES	NO	YES	Detailed maintenance program / schedule and on-going maintenance responsibilities of each part of the drainage infrastructure and where appropriate watercourses / culverts (including clear distinction between private / IDB / LLFA / Anglian Water).	19	YES / NO
NO	YES	NO	YES	Detailed plan showing how flows on the site exceeding the 1% plus 40% climate change rainfall event and plan or commentary on how finished ground floor levels may assist with minimising impacts.	20	YES / NO

What sustainable drainage measures have been incorporated into the design?

Surface water drainage systems should replicate natural drainage processes as closely as possible. SuDS such as permeable surfaces, swales, raingardens, tree pits, green roofs / walls or attenuation basins should be preferred on all development sites ahead of conventional drainage measures (piped systems). Geo-cellular storage crates can provide elements of SuDS such as attenuating the amount of water to prevent an increase in flood risk, however without another SuDS component (swales, filter strips or drains) they do not provide any water quality treatment.

Outline / Masterplan	Full	Reserved Matters (unless condition specifies otherwise)	Discharge of Conditions	Documents to be Submitted to the LPA	Link to Section in LLFA Guidance	Provided? (delete as appropriate)
YES	NO	NO	NO	Preliminary indication including plans on how each of the four pillars of SuDS will be met (four pillars should be evidenced at greenfield sites and at least two for brownfield sites). Initial assessments of how the development will meet water quality, amenity and biodiversity requirements.	16 17 18	YES / NO
YES	YES	YES	YES	Brownfield development must consider the improvement it can make through redevelopment proposals. This includes identifying opportunities for retrofitting SuDS (water reuse / green roof / wall, permeable surfaces or raingardens) and improving flood resistance and resilience to buildings where possible. Existing drainage should be diverted rather than built over. All existing runoff rates and runoff volumes should be calculated, and improvements made to get them back as close to greenfield rates / volumes as possible. They must be no worse than existing and justification be given as to why they cannot be improved. It can be justified that infiltration is not possible if an applicant demonstrates that it would mobilise contaminates and would have adverse impacts on the environment.	11 14	YES / NO
NO	YES	NO	YES	SuDS Water Quality Assessment, justifying using the simple index approach or detailed assessment as appropriate. The assessment should be provided for all runoff destinations; hence a separate assessment must be provided for groundwater or surface water depending on discharge location. Deep infiltration structures should undertake a detailed water quality assessment in line with any requirements of the EA.	16	YES / NO
NO	YES	NO	YES	Detailed landscaping plans and commentary linking to SuDS amenity and biodiversity elements of the development.	17 18	YES / NO

ANNEX 3 - Reference Documents

- BETTESS, R. (1996) Infiltration drainage; manual of good practice, CIRIA Report R156. CIRIA: London. ISBN: 978-0-86017-457-8
- BSI Standards Publication (2011) BS 8533:2011 Assessing and managing flood risk in development, 1st Edition. 1st Edition. British Standard Institution. ISBN 978 0 580 67892 9
- BSI Standards Publication (2013) BS 8582:2013 Code of Practice for Surface Water Management for development sites, 1st Edition. British Standard Institution. ISBN 978 0 580 76700 5
- BUILDING RESEARCH ESTABLISHMENT (2016) Soakaway design; Digest 365. Watford: Building Research Establishment. ISBN 978-1-84806-438-6
- CIRIA (2015) The SuDS Manual, CIRIA Report C753.
- CIRIA (2006) Design for Exceedance in Urban Drainage. CIRIA Report C635
- CIRIA (2017) Guidance on the Construction of SuDS. CIRIA Report C768
- MHCLG (2018) National Planning Policy Framework. London: DCLG. ISBN: 978-1-4098-3413-7
- DCLG (2014) Further changes to statutory consultee arrangements for the planning application process; Consultation. London: OGL. ISBN: 978-1-4098-4450-1
- DCLG (2015) Further changes to statutory consultee arrangements for the planning application process; Government response to consultation. London: OGL. ISBN: 978-1-4098-4527-0
- DCLG / ENVIRONMENT AGENCY (2007) Improving the Flood Performance of New Buildings; Flood Resilient Construction. London: RIBA Publishing. ISBN 978 1 85946 287 4
- DCLG / ENVIRONMENT AGENCY (2009) Guidance on the permeable surfacing of front gardens, 2nd Edition. London. ISBN: 978-1-4098-0486-4
- DEFRA (2015) Sustainable Drainage Systems: Non-statutory technical standards for sustainable drainage systems. London: OGL.
- DEFRA / ENVIRONMENT AGENCY / HR WALLINGFORD (2008) Supplementary Note on Flooding Hazard Ratings and Thresholds for Development Planning and Control Purpose – Clarification of Table 13.1 of FD2320/TR2 and Figure 3.2 of FD2321/TR1,
- DEFRA / ENVIRONMENT AGENCY (2013) Rainfall runoff management for developments; Report – SC030219. Bristol: Environment Agency. ISBN: 978-1-84911-309-0
- DEFRA (2021) Recommendations to Update Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS). London. PB [WT15122]
- ENVIRONMENT AGENCY (2014) Flood Risk Assessment required if applying for planning permission
- ENVIRONMENT AGENCY (2018) The Environment Agency's approach to groundwater protection Bristol: Environment Agency.
- KELLAGHER, R. (2012) Preliminary rainfall runoff management for developments; R&D Technical Report W5-074/A/TR/1, Revision E. Bristol: Environment Agency.
- Association of Drainage Authorities (ASA) previously known as Local Authority SuDS Officer Organisation (LASSOO), Non Statutory Technical Standards for Sustainable Drainage – Practice Guidance

- Natural England (2009) Green Infrastructure Guidance
- Norfolk County Council, (2015) Norfolk Local Flood Risk Management Strategy; Norfolk County Council
- Strategic Flood Risk Assessment Level 1 (2017) Breckland Council - "Your Environment" section of Breckland Council website
- Strategic Flood Risk Assessment Level 1 (2017) Brough Council of Kings Lynn and West Norfolk, Flood risk assessment - Level 1
- Strategic Flood Risk Assessment Level 1 (2017) Greater Norwich Local Plan Area (Broads Authority, Broadland District, Norwich City and South Norfolk Council),"Stage A Evidence Base" section of the Greater Norwich Local Plan website
- Strategic Flood Risk Assessment Level 1 (2017) Great Yarmouth District Council, Great Yarmouth Strategic Flood RIsk Assessment Report
- Strategic Flood Risk Assessment Level 1 (2017) North Norfolk District Council - Strategic Flood Risk Assessment
- Strategic Flood Risk Assessment Level 2 (2021) Greater Norwich Authorities (Broads Authority, Broadland District Council, Norwich City Council, South Norfolk Council). Greater Norwich Level 2 Strategic Flood Risk Assessment Report
- Strategic Flood Risk Assessment Level 2 (2019) Borough Council of Kings Lynn and West Norfolk, Strategic Flood Risk Assessment level 2