City of York Council Sustainable Drainage Systems Guidance for Developers

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1. Introduction

The information provided in this document provides outline guidance for delivering and integrating sustainable drainage systems (SuDS) into the planning of future developments. This guidance complements existing guidance on SuDS design, maintenance and operation with an emphasis on best practice for the City of York. The following information is best understood and used in combination with the York Strategic Flood Risk Assessment.

In April 2014 the Department for Communities and Local Government issued a Written Ministerial Statement 16 outlining the Government's response regarding the future of SuDS. Following consultations, the Government's formal response was published in March 2015. The Planning Practice Guidance has subsequently been amended to reflect the new approach to implementation of SuDS in development.

From 6th April 2015, Local Planning Authorities must ensure that SuDS are implemented within all major developments[1]. Where appropriate, through the use of planning conditions or planning obligations, clear arrangements must be in place for the ongoing maintenance of the SuDS, over the lifetime of the development. The legislation also encourages the use of SuDS in minor developments[2].

City of York Council require developers to implement SuDS, where possible, for all new development and redevelopment. Proposals are expected to comply with current national standards and the guidance set out in this document.

There are numerous authoritative sources for guidance on the planning, design, construction and maintenance of SuDS. A comprehensive list of these can be found on the susdrain website http://www.susdrain.org/resources/

Figure 1: Example of SuDS integrated into a development

[1] Major development is defined by The Town and Country Planning (Development Management Procedure) (England) Order 2015 http://www.legislation.gov.uk/uksi/2015/595/article/2/made

[2] Guidance on the definition of minor developments can be found at https://www.gov.uk/guidance/flood-risk-and-coastal-change

The requirement for a sustainable surface water management strategy is vital for all new developments within the City of York. If not managed, new development and urban creep leads to a decrease in interception, absorption and transpiration of rainfall and surface water. This generates additional surface flows that have to be discharged via surface water sewers and watercourses. In turn, this leads to an increased risk of flooding from surface runoff and watercourses.

All new development must therefore demonstrate that there is a site level drainage strategy that will be implemented to mitigate any additional impermeable area, and that is consistent with that of the wider area, Ideally surface water should be managed at source, and drainage strategies should also consider the requirements to provide water quality, amenity and biodiversity benefits.

This document sets out the approach and requirements that need to be implemented to satisfy City of York Council's requirements in regards to surface water management.

2. The Purpose of SuDS

SuDS provide an approach to managing direct rainfall and surface water through replication of the natural drainage parameters in an urban environment. A key aim of SuDS arrangements is to manage flow rates and runoff volumes emitted from a site, providing a downstream flood risk reduction.

The inclusion of sustainable drainage offers a wide range of benefits other than reducing the impact of surface water runoff from source to outfall. The four pillars of SuDS design are considered to be Water Quantity, Water Quality, Amenity and Biodiversity as defined by The SuDS Manual[3]. A selection of key SuDS benefits are considered in Table 1 below.

SuDS Benefits

Flood Risk Management	SuDS aim to have an attenuating affect by slowing down and potentially storing surface water runoff reducing the risk of flooding on and off site.
Drainage Resilience	SuDS can be designed to be resilient against climate change by future proofing.
Natural Flow Regime Protection	SuDS mimic natural drainage arrangements to more closely emulate a natural flow regime on and off site.
Water Quality	SuDS act as filters to remove pollutants from surface water runoff before returning cleansed water into the natural environment.
Water Reuse	SuDS can be strategically placed to capture rainwater and surface water for it to be reused as grey water.
Biodiversity and Ecology	SuDS use vegetation and the natural landscape to support biodiversity and ecology through suitable environments.
Amenity/Environment Aesthetics/Green Space	SuDS are able to improve the visual integrity and the desirability of the site by implementing green and blue features.
Carbon Reduction	SuDS can reduce carbon use throughout its lifecycle including construction, maintenance and demolition.
Microclimate	SuDS can regulate local temperatures by introducing water and vegetated features which mitigate the urban heat island effect.
Education	SuDS are able to educate and engage the general public with surface water management.

Table 1: Benefit of SuDS

[3] CIRIA SuDS Manual C753 (2015) http://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

3. Planning Application Guidance for Developers

3.1 Water management agencies

The following list outlines the main consenting bodies within the York City Boundary who will act as consultees for any development proposals. A local authority/consultee can set local requirements for planning permission that have the effect of more stringent requirements than those found in the National Standards.

1. City of York Council – The council is the Lead Local Flood Authority and Local Planning Authority. City of York Council's responsibilities under these roles include a responsibility for controlling planning and development through the planning system and acting as a consultee for all development (with surface water drainage). The Council is responsible for surface water, ground water and ordinary watercourse flood risk management. Local roads within the City of York are managed by City of York Council. The Council works closely with The Environment Agency, Yorkshire Water, Internal Drainage Boards and The Emergency Services. The Council also acts as Foss Navigation Authority for the publically navigable 1.5 mile length of the River Foss running from the old railway bridge crossing Huntington Road to the confluence with the River Ouse near Blue Bridge. Foss Navigation Authority planning interests include surface water outfalls and development adjacent to The Foss.

2. Environment Agency – The Environment Agency has operational responsibility for managing flood risk associated with Main Rivers and is a statutory consultee for any development proposed within Flood Zone 2 or 3, or works in the bed of or within 8m of a Main River. The Environment Agency is continually improving and updating their Main Rivers flood map and has permissive powers to carry out flood defence works, maintenance and operational activities for these assets. However, overall responsibility for maintenance lies with the riparian owner. The Environment Agency maintain an interest in the rate of any surface water discharge to a main river, to ensure fluvial flood risk is not increased as a result.

3. Yorkshire Water Services Ltd – Yorkshire Water has a duty as a statutory undertaker to provide clean and waste water services across the Vale of York and is responsible for the management, maintenance and operation of surface water attenuation structures. Where the receiving system is an adopted sewer, Yorkshire Water is responsible for surface water drainage from a development, if the system is built to adoptable standards.

4. Internal Drainage Board (IDB) - There are four Internal Drainage Boards within the vicinity of the City of York. The Ainsty, Foss and Ouse and Derwent drainage boards and are administered by the York Consortium of Drainage Boards. The Kyle and upper Ouse IDB is administered independently. IDB's are the 'local land drainage authority' in an IDB District (Land Drainage Act 1991), many IDB's span multiple planning authority and Lead Local Flood Authority areas, IDB's even if jointly managed in arrangements such as consortium are all independent with individual policies. IDB's have permissive powers to carry out works on ordinary watercourses, maintenance and operational activities. However, overall responsibility for maintenance lies with the riparian owner. IDB Bylaws can also constrain planning applications beyond the planning process consultation with IDB's is crucial as they are not statutory consultees in the planning process. (eg constraints of culverts/watercourses running under/through development sites) The IDB districts, where they overlap the City, are shown in Figure 2[4].

[4] https://www.york.gov.uk/downloads/file/11064/sfra_idb_boundaries

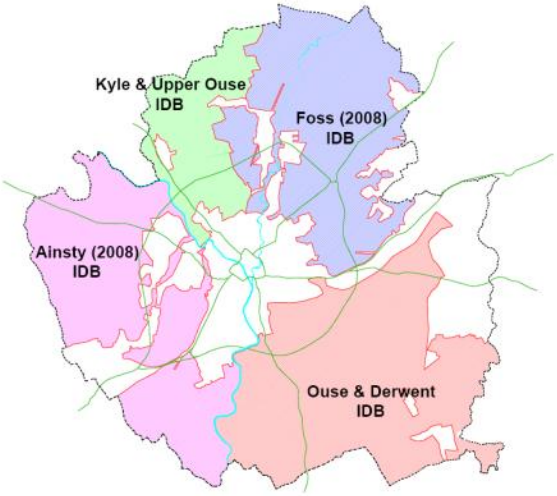

Figure 2: IDB Boundaries

5. Highways England – Highways England is the government company charged with operating, maintaining and improving England's motorways and major A roads. Formerly the Highways Agency, they became a government company in April 2015. Only one road with the Vale of York is operated by Highways England - the A64 running to the south of the city.

6. Canal and River Trust – The trust is a charity with the aim of protecting waterways in England and Wales. Their specialisms include, but are not limited to, maintaining canals and rivers. This includes bridges, embankments towpaths, aqueducts, docks and reservoirs. The trust maintains the River Ouse Navigation throughout the Vale of York, from Ripon to the Humber Estuary.

7. Private/riparian Owners - If the proposed development affects private/riparian surface water drainage/watercourses, the owner is to be consulted but any proposals will still require the approval of City of York Council.

3.2 Planning Gateways

A developer of a site is to initially investigate the requirement for a Flood Risk Assessment. If a Flood Risk Assessment is required, the proposal is required to achieve specific objectives (see York Strategic Flood Risk Assessment 2017) before advancing to the planning applications stage. Figure 3 provides an overview of the planning procedures based on the National Planning Policy Framework

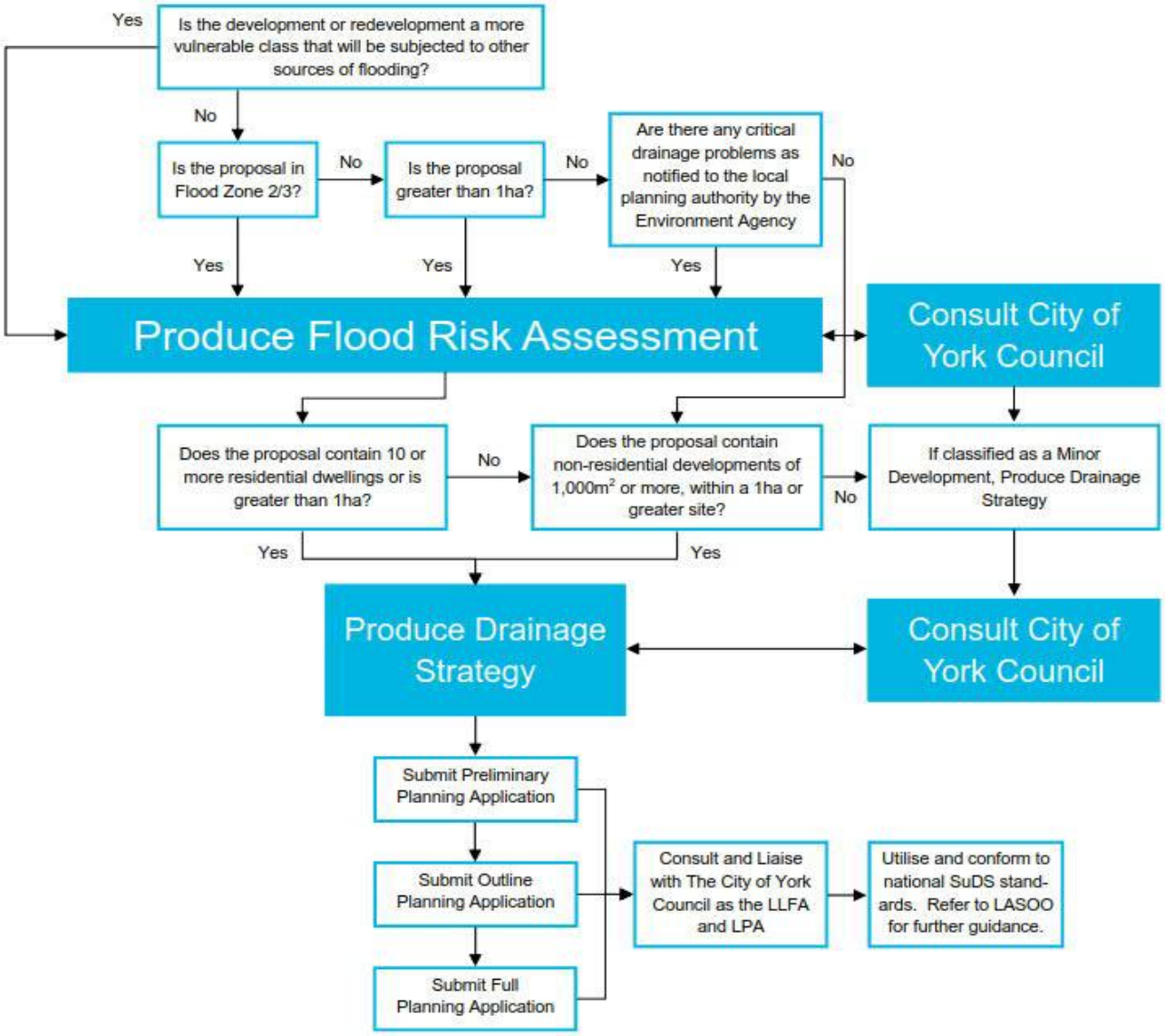

Figure 3: Drainage Planning Requirments Schematic

As Lead Local Flood Authority and Local Planning Authority, City of York Council is the statutory consultee for SuDS applications. They must be consulted on the drainage elements of planning applications for development that falls into the above categories to ensure they conform to necessary national standards and guidance set out in this document. Applications submitted will be assessed on the demonstration of maximising the benefits of SuDS.

SuDS design should be considered early in the planning stage with source control measures and above ground techniques. This ensures the cost effectiveness of SuDS over conventional drainage methods. City of York Council will only consider alternatives to SuDS as an acceptable drainage solution in exceptional cases.

Developers are recommended to pass through a three stage process to ensure a SuDS scheme is developed appropriately. Each stage is listed below:

1. Stage 1: Preliminary Planning Application
2. Stage 2: Outline Planning Application
3. Stage 3: Full Planning Application

The local Authority SuDS Officer Organisation[5] (LASOO) has published guidance regarding the process of delivering sustainable drainage. This document can be used as guidance for details of information required at each stage. An overview of information required by the Lead Local Flood Authority is defined below.

3.2.1 Planning Application Guidance

It is anticipated that as designs are progressed through the planning process the level of detail will be refined by the developer and provided to the LPA as part of a 'Surface Water Drainage Strategy'. To assist developers, the level of detail required at each planning stage is outlined below:

Stage 1: Preliminary Planning Application

The preliminary planning application allows the developer to enter into discussions with the lead local flood authority, local planning authority and any other consultees such as Yorkshire Water Services and the Environment Agency. The objective of this stage is to agree the overarching drainage/SuDS strategy to be implemented. The more issues that can be resolved at the pre-application stage result in time and costs savings along with a more comprehensive design at completion.

Stage 2: Outline Planning Application

The outline planning application can be viewed as a detailed design. All hydraulic calculations are to be completed, and high level plans and sections of the drainage system should be created. The SuDS arrangement should be fully formed hydraulically and physically. The specific level of detail required is to be agreed with City of York Council following review of the Preliminary Planning Application.

Stage 3: Full Planning Application

The full planning application is considered to be a final design stage. The application must provide all details to justify and demonstrate SuDS proposals have been optimised for the site, the development and surrounding area in the present and future. By the time the full planning application is developed it is expected that a robust long term maintenance plan has been agreed with the council and a suitable adopting authority agreed.

Table 2 below outlines the information that should be provided to City of York Council as part of the Surface Water Drainage Strategy at each planning stage. It is anticipated that some of these requirements will need to be further developed and resubmitted as the design passes through the planning gateways.

Table 2: Drainage Planning Requirments

Planning Application Requirements		Preliminary Planning Application	Outline Planning Application	Full Planning Application
General		Stage 1	Stage 2	Stage 3
Site Location	Site location plan	✓	✓	✓
	Site Description	✓	✓	✓
	Current and historical site use	✓	✓	✓
	Site Coordinates	✓	✓	✓
Consultations - Identify and consult with organisations and individuals affected by proposed developments	City of York Council	✓	✓	✓
	Environment Agency	✓	✓	✓
	Yorkshire Water Services Ltd	✓	✓	✓

[5] http://www.lasoo.org.uk/non-statutory-technical-standards-for-sustainable-drainage

Planning Application Requirements		Preliminary Planning Application	Outline Planning Application	Full Planning Application
	Internal Drainage Board	✓	✓	✓
	Highways England	✓	✓	✓
	Canals and Rivers Trust	✓	✓	✓
	Private Proprietor	✓	✓	✓
Existing Site Characteristics	**Application Information**	**Preliminary Planning Application**	**Outline Planning Application**	**Full Planning Application**
Existing Drainage Arrangement and Outfalls - Demonstrate how the site currently drains surface water and links to off site drainage	Existing drainage system plans and schedules with description	✓	✓	✓
	Provide plan and describe existing outfalls	✓	✓	✓
	Provide plan and describe existing waterbodies	✓	✓	✓
	Provide Plan and describe existing overland flow routes	✓	✓	✓
Flood Risk - Identify any historical or potential flood risk	Plan and describe historic, and any existing, sources of flood risk	✓	✓	✓
Site and Surrounding Topography	Provide topographic land survey plans of the site and the surrounding landscape		✓	✓
Geology and Groundwater	Provide description and any available ground investigation information regarding the existing strata conditions		✓	✓
	Identify site ground water levels and ground water protection zones		✓	✓
Existing Runoff Rate - Quantify the existing brownfield or greenfield runoff rate.	Calculate 1in 1 year return period runoff rate	✓	✓	✓
	Calculate 1in 30 year return period runoff rate	✓	✓	✓
	Calculate 1in 100 year return period runoff rate	✓	✓	✓
	Calculate 1in 100 year return period plus climate change runoff rate	✓	✓	✓
Proposed Site Characteristics	**Application Information**	**Preliminary Planning Application**	**Outline Planning Application**	**Full Planning Application**
Proposed Site Details	Provide masterplan and description of proposed development		✓	✓
Proposed Drainage	Provide description, plans and schedules of the overall proposed drainage arrangement		✓	✓
	Provide hydraulic calculations (hand calculation, hydraulic modelling or other).		✓	✓
	Provide construction specification			✓
	Demonstrate Climate Change has been applied		✓	
Proposed SUDS	Provide plans and descriptive overview on proposed SUDS		✓	✓
	Comment on SUDS benefits including Water Quality, Amenity, Biodiversity		✓	✓
	Comment on the management train		✓	✓
	Demonstrate Climate Change has been applied		✓	✓
Proposed Outfalls	Provide plan of outfall/s		✓	✓
	Provide consent to discharge		✓	✓
Site Discharge	Provide calculations of discharge rate based on the final masterplan layout		✓	✓

Planning Application Requirements		Preliminary Planning Application	Outline Planning Application	Full Planning Application
Flow Routes and Flood Risk	Identify proposed overland flow routes with a plan and descriptive overview			✓
	Demonstrate residual and exceedance surface water is controlled on and off site			✓
Drainage Standards - Demonstrate the proposed surface water drainage system complies with national and City of York Council standards.	Demonstrate the level of service		✓	✓
	Exceedance level of service			✓
	Soakaways		✓	✓
	Demonstrate appropriate freeboards have been specified			✓
	Demonstrate the inclusion of climate change		✓	✓
	Specify any urban creep and demonstrate its inclusion within the design		✓	✓
Storage	Specify predicted flow at the inlet and outlet		✓	✓
	Specify the storage volume		✓	✓
	Specify outlet control type		✓	✓
	Specify level of service		✓	✓
Proposed Topography	Provide proposed topography plan	✓	✓	✓
Proposed Impermeable Area	Quantify proposed impermeable area. Identify the % increase of impermeable area from the existing arrangement		✓	✓
Maintenance - Clarify who will adopt and maintain the drainage system and how it will be undertaken.	Submit an Operation and Maintenance Plan		✓	✓

4. SuDS Design Guidance for Developers

The design of SuDS must comply with the parameters and policies detailed within this guidance document. The table below provides an overview of the design limits to be adhered to.

4.1 Catchment and System Parameters

The policies detailed in this guidance should be applied to all new development / re-development, irrespective of which flood zone it resides.

Guidance	Greenfield Sites	Brownfield Sites
Discharge Limit (Catchment Size 0-50ha)	IOH 124 Greenfield Runoff Rate	IOH 124 Greenfield Runoff Rate*
Discharge Limit (Catchment Size Over 50ha)	FEH	FEH*
Level of Service Design	Accommodate a 1 in 30-year storm with no surface flooding in system and storage[6].	

[6] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/415773/sustainable-drainage-technical-standards.pdf

Exceedance Level of Service	Flooding (generated on site) must not occur within buildings, key assets or off site up to and including a 1 in 100 year rainfall event including an allowance for climate change. Climate change values vary dependent on the development type and location[7].
Climate Change	New climate change advice was issued by the Environment Agency in February 2016 and should be applied to all Flood Risk Assessments with 30% used for all drainage designs in the City of York area.
Storage	Source control SuDS methods should be employed to minimise the need for downstream / end of systems storage where possible. Storage volume calculations, using computer modelling, must accommodate a 1:30 year storm with no surface flooding, along with no internal flooding of buildings or surface run-off from the site in a 1:100 year storm. Storage should be designed to empty within 48 hours of any rainfall event.
Soakaway	The developer's attention is drawn to Requirement H3 of the Building Regulations 2000 with regards to hierarchy for surface water dispersal. Consideration should be given to discharge to soakaway, infiltration system and watercourse in that priority order. Surface water discharge to the existing public sewer network must only be as a last resort, therefore sufficient evidence should be provided i.e. infiltration tests to BRE Digest 365 (2016) (preferably carried out in winter) for the viability of infiltration before other dispersal techniques are considered. Storage requirements as per above. CYC will only accept infiltration test results where the test was witnessed by a member of the CYC Flood Risk Management Team.
Freeboard	Freeboard is to be considered in line with national standards and best practice guidance.
Groundwater	The long term level of the ground water table is to be considered during SuDS design (particularly for soakaway design and design of storage systems).
Surface Water Discharge	The surface water collected by a proposed drainage system is to discharge or outfall into one of the following receptors, in order of favourability; Soakaway, Watercourse / Waterbody, surface water system, combined water system.
Urban Creep	A +10% (minimum) increase of urban creep is to be applied to SuDS designs. City of York Council is to be consulted if urban creep is predicted to be more than +10%. Urban Creep guidance is provided in LASOO, page 28-29.

*Where greenfield discharge rates cannot be achieved on brownfield sites consultation should be undertaken with CYC

4.2 Greenfield and Brownfield Runoff

When developing a site, the natural flow regime is disrupted and normally results in an increase of rainfall runoff. To mitigate this effect a pre-development runoff rate must be calculated. Once the site is developed it is required to discharge surface water off site at the pre-development runoff rate, thereby maintaining the natural flow regime. There are two types of pre-development considered in this report: Greenfield and Brownfield.

Greenfield - "Greenfield" is undeveloped land in a city or rural area used for agriculture, recreational grassland or natural rough.

1. Greenfield sites are to limit the discharge rate to the pre developed run off rate. The pre development run off rate should be calculated using either IOH 124 or FEH methods (depending on catchment size).
2. Where calculated runoff rates are not available the widely used 1.4l/s/ha rate can be used as a proxy, however, if the developer can demonstrate that the existing site discharges more than 1.4l/s/ha a higher existing runoff rate may be agreed and used as the discharge limit for the proposed development. If discharge to public sewer is required, and all alternatives have been discounted, the receiving public sewer may not have adequate capacity and it is recommend discussing discharge rate with Yorkshire Water Services Ltd at an early stage.
3. Greenfield sites which are known to become waterlogged, sit low in the catchment or are surrounded by higher land should maintain the same level of surface water storage to ensure the catchment flow regime remains un-changed.

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

Brownfield - "Brownfield" is a term used in urban planning to describe land previously developed. When developing Brownfield sites, every effort should be made to ensure that the post development runoff rate is as close to the Greenfield runoff rate for the site as possible. If necessary the following policies should be applied to the redevelopment of Brownfield sites:

1. City of York Council to confirm justification to relax discharge rates is reasonable based on the evidence provided by the applicant.
2. Brownfield sites are to limit the discharge of surface water off site based on 140 l/s/ha of proven connected impermeable areas for the 1 in 1 year storm or better. A site survey of the existing drainage will be required to prove discharge and will not be assumed all impermeable areas drain to sewer.
3. Brownfield sites drainage proposals will be measured against the existing performance of the site based on its proven connected impermeable areas. Proposals are to better the previously developed surface water runoff rate by a minimum of 30%.

Early consultation with the relevant IDB is encouraged to highlight how a development may impact on the wider drainage network that they manage.

4.3 Surface Water Discharge

Based on the requirements of The Building Regulations 2010 Part H: Drainage and Waste disposal[8], the discharge of surface water should follow the hierarchy set out below. The methods are to be prioritised in order; infiltration, watercourse, and combined/surface water sewer. Discharge to an existing public sewer network must only be specified as a last resort with sufficient evidence that other methods are not appropriate.

Soakaway - The suitability of the use of soakaway within York will be limited, due to the unsuitable clay ground encountered throughout most of the city. However, the viability of infiltration may vary and should be determined through physical site specific survey to BRE Digest 365 (2016)[9]. Building Regulations – Shall be located at least 5m from building foundations. CYC will only accept infiltration test results where the test was witnessed by a member of the CYC Flood Risk Management Team.

Watercourse/Waterbody - Any culverting or development that will affect the flow of a watercourse requires the prior written consent of either; the Environment Agency (Environmental Permits for Main Rivers), or City of York Council/Internal Drainage Boards (Land Drainage Consent for Ordinary Watercourses). Formal Byelaw consent may also be required to be obtained by the Environment Agency or Internal Drainage Boards.

Surface Water Sewer - Yorkshire Water should be consulted at an early stage for all developments over 10 dwellings or sites exceeding 0.5ha and where new connections are required as new connections to sewers suffering from under capacity may result in exacerbation of any existing problems downstream. Under capacity sewers may also cause the proposed site to flood due to surcharge during intense summer storms.

Yorkshire Water will not allow the connection of ground water to public sewers, to prevent hydraulic over-loading of the sewerage system and problems associated with siltation.

Highway Drainage –The City of York Council Surface Water Management Plan identified that much of the city's highway drainage infrastructure is unrecorded and its condition is consequently unknown, however considerable work has followed and large parts of the system have been surveyed and is now better understood. Highway drainage generally only serves the highway and should not be used to prevent or reduce the risk of flooding. Any required connection to a highway drain would require agreement from City of York Council.

[8] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf

[9] https://www.brebookshop.com/details.jsp?id=327631

Combined Sewer - Surface water from developments shall not connect to combined drains or sewers, if a suitable surface water sewer is available and unless expressly authorised by Yorkshire Water. Surface water discharge to the existing public sewer network must only be specified as a last resort: the developer is required to eliminate all other means of surface water disposal.

4.4 Exceedance

SuDS should be designed to a specified level of service as defined in this guidance document. Once the system capacity is exceeded by cause of a higher design event, an exceedance level of protection is required to ensure residual runoff is contained on site and is not detrimental to the sites development. Surface water during events larger than the level of service is known as the exceedance flow.

The designer is to initially consider utilising SuDS as flood mitigation, but other techniques can be used if SuDS are not appropriate including; high finished floor levels and car park/recreational areas/minor roads temporary storage. See City of York Council SFRA and Ciria C635 for further information on exceedance design.

4.5 Minor Developments

Minor developments (less than 10 residential properties or non residential less than 1,000m2) not covered by the statutory legislation will still be subject to local planning permission restrictions and by-laws. It is expected that minor developments will also be required to demonstrate a robust drainage strategy that manages flood risk at a local level.

The requirement to manage excess flows on minor development should be consistent with that on larger sites by use of SuDS where care should be taken to ensure that surface water flows post development are no greater than 70% of that of the pre developed site and to a Greenfield run-off rate for the undeveloped site.

In some instances design flows from minor developments may be so small that the restriction of flows may be difficult to achieve. However, through careful selection of source control or SuDS techniques it should be possible to manage or restrict flows from the site to a minimum 0.5 l/sec for individual residential properties, please discuss any design issues with the City of York Council Flood Risk Management Team.

To mitigate against the effect of urban creep, where multiple existing minor developments with unrestricted discharge contribute to increased flood risk over a wider catchment, City of York Council will not accept discharge rates from individual residential properties in excess of 0.5 l/s, unless it can be demonstrated that the discharge rate for pre developed site is greater than this – see 4.2. Planning applicants should also be aware that discharges from minor developments may not be granted to IDB watercourses unless compliant with section 4.2

To achieve these reduced flow rates it is expected that source control techniques or proprietary products are used. However, designers should demonstrate that these systems can be adequately maintained by the end users to prevent blockage or failure.

Where the discharge rates from minor developments may be lower than the minimum required by adopting authorities, such as Yorkshire Water Services Ltd (minimum 75mm orifice for vortex flow controls and is appropriately 3.5 l/s. Minimum 100mm diameter for orifice plate.) it would be the responsibility of the new owner to maintain the surface water system up to the point at which it can be adopted.

Householder Development applications for alteration or renovation of a property not covered by the statutory legislation should consider the above guidance for minor developments, where necessary early consultation with City of York Council or the relevant Internal Drainage Board is encouraged.

5. SuDs Selection

A comprehensive list of SuDS can be found in The SuDS Manual (C753) by CIRIA. SuDS are to be carefully selected based on their drainage benefits along with environmental and economic qualities.

5.1 SuDs Water Management Trains

SuDS are implemented on a site to minimise the impact of runoff from impermeable surfaces and replicate the natural drainage regime. SuDS systems should be designed holistically and interlock by use of a combination of conveyance and storage systems. The following hierarchy of management techniques should be considered:

1. Prevention - the use of good site design and housekeeping measures to prevent runoff and pollution.
2. Source control - control of runoff at or very near its source (e.g. the use of permeable/infiltrating drainage or green roofs)
3. Site control - management of runoff from specific site sections (e.g. routing water from roofs and car parks to infiltration or using swales to transport water through the site allowing infiltration and evaporation).
4. Regional control - management of runoff from the entire site or several sites, typically in a storage arrangement such as a detention basins or wetland.

Design foresight is required to build SuDS into the developable space. A drainage network incorporating SuDS are to initially manage runoff close to its source. This increases the potential treatment of water and minimises the size of downstream storage.

The number of SuDS techniques implemented into a management train from a treatment perspective is proportional to pollution risk on the environment. Generally, a higher risk of pollution normally requires a greater number of treatment levels. In cases where the receiving waters are highly sensitive or protected, an appropriate number of SuDS techniques is to be proposed for a desired level of protection.

5.2 SuDs based on Site Condition

SuDS can be potentially applied to all sites. However, the selection of SuDS very much depends on the site conditions, dictating how SuDS are designed and implemented. Some of these conditions and constraints to be considered are described below:

SuDS Space	Allocation of space for SuDS should be considered as part of the masterplan. Developers should encourage the masterplan designers to have an understanding of how much space should be allocated. Multiple uses of space should be encouraged.
Flood Plain	The City of York is generally low lying. As a consequence the city is susceptible to fluvial (river) flooding. However, SuDS can still be implemented into classified flood zones in accordance with the SFRA.
On Site and Off Site Flood Risk Sources	Implementing SuDS at source or as part of the drainage systems can reduce on and off site flooding by slowing and storing runoff. Consideration of flows affecting the drainage system from outside the site boundary should be considered to maintain the existing flow regime.
Site Topography	The City of York is generally flat as a whole. As a consequence SuDS should be implemented at source to take advantage of treatment trains and maintain an above ground system. Slack gradients are advantageous for treating runoff in all stages of a treatment trains to allow suspended solids and hydrocarbons to drop out before the exit site.
Site Permeability	York is known to be a low lying catchment and generally has unsuitable soil conditions for surface water infiltration. However, site specific test (witnessed by CYC FRMT) to BRE Digest 365 (2016) should still be undertaken to determine the viability of infiltration.
Contaminated Land	Understanding the sites historic and current land use is essential in understanding if land is contaminated. Any contamination is to be isolated from the proposed flow regime and potentially removed to prevent contamination of the natural environment.
Groundwater and Ground Water Protection	SuDS implemented could be detrimentally affected by the ground water

	table. Ground water can damage SuDS and increase system flows from ground water infiltration to the system. SuDS are to take account of environmentally sensitive areas such as groundwater protection zones such as potable water supplies.
Water Quality	The SuDS treatment train needs to consider to quality of the waterbody into which it is discharging. The type and number of SuDS implemented will depend on the nature of the drained surfaces and the quality of the receiving system..
Ecological Environment	SuDS can be blended into the existing natural environment or be designed to replicate what was once there to contribute to biodiversity and ecology. Careful consideration is required if merging with conservation areas or areas with protected habitats and species.
Adoption and Maintenance	City of York council does not adopt SuDS features. An adopting party should be specified as part of the preliminary planning application. The design of SuDS should include a consideration for future maintenance requirements.

The Vale of York is well known to suffer from fluvial flooding. Any development proposed within a flood plain should still look to implement SuDS. Those sites should also increase their adaptability and robustness to variable present day and future rainfall events. The York Strategic Flood Risk Assessment contains guidance on measures to be applied when developing land in a flood risk zone.

Table 3 SuDS Selection Matrix based on Site Conditions

Unsuitable ✓Suitable		Green Roof*	Rainwater Harvesting*	Soakaway	Permeable Paving	Filter Strip	Bio-retention Area	Swale	Hardscape Storage	Pond	Wetland
Flood Plain	Located in the floodplain?	✓	✓	✓	✓	✓	✓	✓			
Ground Water	Groundwater less than 3 metres below ground surface	✓	✓		✓ With liner and underdrain (no treatment)	✓	✓ With liner and underdrain	✓ With liner	✓ If aboveground	✓ With liner	✓
Topography	Sited on a flat site?	✓ Source control	✓ Source control	✓ Source control	✓ Source control	✓ Source control	✓ With short kerb or ill length	✓ Careful to provide some gradient	✓	✓ Try to keep flow above ground	✓ Try to keep flow above ground
	Sited on a steep slope (5 – 15%)?	✓	✓		✓ If terraced		✓ If terraced	✓ If installed along contour	✓ If terraced		✓ If terraced
	Sited on a very steep slope (>15%)?	✓	✓								
Soils and Geology	Impermeable soil type (e.g. clay – based type)?	✓	✓		✓ With underdrain (no treatment)	✓	✓	✓	✓	✓	✓
Contaminated and made ground	Are there contaminated soils on site?	✓	✓		✓ With underdrain (no treatment)	✓ With liner	✓ With liner and underdrain	✓ With liner	✓ With liner	✓ With liner	✓ With liner
Existing Infrastructure	Are there underground utilities in the SuDS area?	✓	✓		✓ If possible relocated into a marked corridor for future maintenance	✓	✓ Possible with structural grid in soil				
Space constraints	Limited space for SuDS components	✓	✓	✓	✓		✓	Rill or channel more suitable	✓		✓ Micro-wetland
Runoff characteristics	Suitable for inclusion in high risk contamination area	✓ Source control	✓ Source control		✓ With liner and spill isolation		✓ With liner and spill isolation	✓ With liner and spill isolation	✓ With liner and spill isolation		✓ If designed for treatment of predicted wastes
Protected species or habitat	Proximity to designated sites and priority habitats	✓	✓	✓	✓	✓	✓	✓	✓	✓ If designed and maintained appropriately	✓ If designed and maintained appropriately
Ownership and Maintenance	Can the Feature be designed for adoption	✓	✓		✓	✓	✓	✓	✓	✓	✓
					Dependant on design and local adoption policies						

*Where Green Roof are proposed to provide attenuation care should be taken by the designer to ensure that any assumed attenuation volume half drains within 24hours and the total discharge rate from the development does not exceed 70% of pre-development or maximum 0.5 l/sec. *Rain Water Harvesting volumes cannot be used solely as a form of attenuation and the calculated attenuation volume should be in excess of any volume stored to be used for recycling.

6. SuDS Adoption, Construction and Maintenance

One of the key objectives of the adoption process is to ensure that any installed SuDS can be maintained easily over the development's lifetime and beyond. Therefore, the SuDS must be designed with maintenance in mind. Proposals for SuDS must include an operation and maintenance document, setting out the following:

1. A description of the SuDS scheme and how it works.
2. 'As built' Drawings.
3. A management plan including a SuDS plan identifying the SuDS techniques used. This should include inlets, outlets and control structures.
4. Inspection and maintenance tasks. Details on who would be best qualified to undertake such tasks should be identified (e.g. standard landscape contractors).
5. A specification for maintenance actions, based on agreed standards and including frequency.
6. A checklist for day-to-day site checks for pre, during and post rainfall events.

Care should also be taken to ensure that SuDS elements are protected from damage or overloading during a developments construction phase. Best practice guidance on the construction of SuDS such as those developed by CIRIA should be employed to ensure that the adopted SuDS features provide the intended design life / level of service.

At the time of writing, based on current legislation, City of York Council does not adopt SuDS systems. It is possible that future developments to legislation may mandate responsibility for the adoption of SuDS. Therefore, it is recommended that developers discuss the current requirements for adoption with City of York Council during the preliminary consultation process to agree an adopting authority. Identification of a long term funding mechanism for the maintenance of SuDS should be agreed at this stage. An adopting party is to be agreed at the preliminary design stage.

At the time of writing, Yorkshire Water is constrained to adopting only pipe systems that have a defined outfall and fall within the legal definition of a "sewer" (as defined in the Water Industry Act 1991) and do not have a duty to accept flows from land drainage. Yorkshire Water works to the Interim Code of Practise for SuDS published in July 2004 which provides guidance on SuDS adoptable by Yorkshire Water.

Appendix A References

A.1 References

1. HM Government, 2015, The Town and Country Planning (Development Management Procedure) (England) Order 2015, http://www.legislation.gov.uk/uksi/2015/595/part/1/made

2. HM Government, 2014, Flood risk and Coastal Change, https://www.gov.uk/guidance/flood-risk-and-coastal-change

3. CIRIA, 2015, Report C753, Ballard et al, The SuDS Manual, http://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx

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5. Local Authority SuDS Officer Organisation, Non Statutory Technical Standards for Sustainable Drainage Practise Guidance, http://www.lasoo.org.uk/non-statutory-technical-standards-for-sustainable-drainage

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8. HM Government, 2010, The Building Regulations Drainage and Waste Disposal Document H, https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/442889/BR_PDF_AD_H_2015.pdf

9. BRE, 2016, Report DG 365, Stephen L Garvin, Soakaway Design