

## **Contents**

Please note: The following document is only a basic summary of what we expect to see within an application for developments within Essex. If you require further information or details, please refer to the <u>Ciria SuDS Manual C753</u> and/or consider using our <u>SuDS Planning Advice</u> service (the link to which can be found throughout this guide).

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# **1.1 Surface water and urbanisation**

Sustainable Drainage Systems (SuDS) are nothing new. They have been nature's way of dealing with rainfall, since time began. At its simplest, rain falling on the land may evaporate or be absorbed into the soil, nourishing our natural habitat, or else flows overland into ponds, ditches, watercourses and rivers, helping to sustain life by replenishing our precious water resource.

It is only recently that the balance of this natural water cycle has been disrupted. Modern urban development with its houses, roads and other impermeable surfaces has increasingly altered the way that rainwater finds its way into our soils, rivers and streams. Surface water has for many years been allowed to be collected and piped directly into our ditches and rivers. Conveying water away as quickly as possible from a development may adequately protect the immediate development from flooding but increases the risk of flooding occurring downstream. This unsustainable approach to surface water drainage, together with the potential effects of a changing climate, has contributed to some very serious consequences on life, property and the environment as evidenced by the disastrous experiences throughout the UK during the summer of 2007.

## 1.2 Planning requirements

The Sustainable drainage systems: Written Statement (HCWS161) laid in the House of Commons in December 2014 set out changes to planning policy and sustainable drainage systems that apply for major development as from April 2015. This Statement confirmed that in considering planning applications, local planning authorities are required to consult the relevant Lead Local Flood Authority (LLFA) 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. This statement should be read in conjunction with policy in the revised National Planning Policy Framework (paragraphs 155 to 165) in February 2019 and advice in the Planning Practice Guidance – Planning and Flood Risk. These policy requirements should be taken into account in the preparation of local and neighbourhood plans and may be a material consideration in planning decisions. Planning Practice Guidance (Paragraph: 049 Reference ID: 7-049-20150415) also states that when considering the potential impacts of permitted



Bio-retention planters, Portland, Oregon, USA

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SuDS wetlands, Wellesley College, USA

development on local flood risk, a local planning authority may consider making an Article 4 direction to remove national permitted development rights to protect local amenity or the well-being of an area.

Furthermore, to assist local planning authorities in their determination of an application as to whether their prior approval is required for a change of use of agricultural buildings, or a change from office to dwelling houses in an area at risk of flooding, the applicant should provide with their application an assessment of flood risk. This should demonstrate how the flood risks to the development will be managed so that it remains safe through its lifetime.

On 24 March 2015, the Government laid a statutory instrument making the LLFA a statutory consultee in relation to these major applications which applies from 15 April 2015. As part of this role, in advising on 'surface water' the LLFA will consider surface water flood risk to and from the development as well as the provision of appropriate SuDS in line with best practice and the criteria outlined in this guide.

The Town and Country Planning (Development Management Procedure) (England) Order 2015 defines a 'major development' as any development involving one or more of the following:

- 1. The winning and working of minerals or the use of land for mineral-working deposits
- 2. Waste development
- 3. The provision of dwelling houses where
  - i) the number of dwellings to be provided is 10 or more
  - 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 subparagraph 3i)
- 4. The provision of a building or buildings where the floor space is to be created by the development is 1,000 square metres or more
- 5. Development carried out on a site having an area of 1 hectare or more

This guide forms the local standards for Essex and, together with the National Standards, strongly promotes the use of SuDS to help reduce surface water runoff and mitigate flood risk.

A return to more natural, sustainable methods of dealing with surface water from development will also have additional benefits for:

- Water quality SuDS can help prevent and treat pollution in surface water runoff, protecting and enhancing the environment and contributing towards Water Framework Directive objectives.
- Amenity SuDS can have visual and community benefits for the community.
- Biodiversity SuDS can provide the opportunity to create and improve habitats for wildlife, enhancing biodiversity, and enable multi-functional green infrastructure.

#### See also:

Water Framework Directive on the Environment Agency's website: http://www.wfduk.org/

# 1.3 Sustainable development

Essex County Council is committed to making our county a place which provides the best possible quality of life for all who live and work here. Making it more sustainable is an important part of supporting this vision and it is therefore implicit that new development should incorporate sustainability measures that help achieve this goal.

Appropriately designed, constructed and maintained SuDS support sustainable development through combining water management with green space with benefits for amenity, recreation and wildlife. SuDS are more sustainable than conventional surface water drainage methods as they can mitigate many of the adverse effects that stormwater run-off has on the environment. This can be achieved by:

- Reducing run-off rates, thereby lessening the risk of flooding downstream.
- Minimising additional run-off emanating from urban development, which could

- exacerbate the risk of flooding and impair water quality.
- Encouraging natural groundwater recharge (as appropriate) and so reduce the impact on aquifers and rivers.
- Reducing pollution risks associated with development.
- Contributing to and enhancing the amenity and landscape of an area and to promoting community involvement and enjoyment.
- Providing habitats for wildlife and opportunities for biodiversity enrichment.

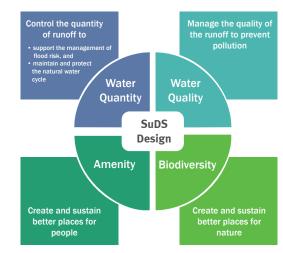


Figure 1.2.1 What are SuDS? (Adapted from CIRIA SuDS Manual, 2015)

#### 1. Introduction

#### 1.4 The purpose of this guide

At present, the majority of planning applications submitted to the LLFA do not satisfactorily address the flood risk issues affecting a development site or those identified in the accompanying site-specific flood risk assessment. Consequently, a 'holding objection' is often necessary by the LLFA until further evidence base work is submitted. The most common reasons we issue holding objections for are:

- Insufficient water quality
- Incorrect discharge rates
- Insufficient storage volumes
- Incorrect or missing infiltration testing
- Failure to meet the **drainage hierarchy**
- Missing urban creep
- Missing <u>drainage plan</u>
- Incorrect climate change provision

This guide is primarily intended for use by developers, designers and consultants who are seeking guidance on the LLFAs requirements for the design of sustainable surface water drainage in Essex. It provides guidance on the planning, design and delivery of attractive and high-quality SuDS schemes which should offer multiple benefits to the environment and community alike. It should also show that meeting these requirements need not be an onerous task and can help add to development. By doing this it should improve the calibre of the applications received.

The County Council, as LLFA, will refer to this Guide when it is consulted on planning applications relating to sustainable drainage. **SuDS Planning advice** may be sought from the County Council as early on in the process as possible. This guide provides a steer as to what is expected and should complement national requirements whilst prioritising local needs. The SuDS philosophy and concepts are based upon and derived from **The Ciria SuDS Manual C753 (2015)**. This guide seeks to complement The SuDS Manual and both should be incorporated into any SuDS proposals for the development.

The level of information required at each stage of the planning application process varies. A list of what is required at each stage can be seen in **Appendix 2**. At the outline stage it is required that the drainage strategy includes enough information to demonstrate that the principles of our requirements are met and that the drainage system itself is viable. As an application progresses through the planning process it is expected that there will be increasing levels of detail provided. Where necessary, conditions will be placed on an application to require further information, however this recommendation will only be made following a sufficient level of information at the outline stage.

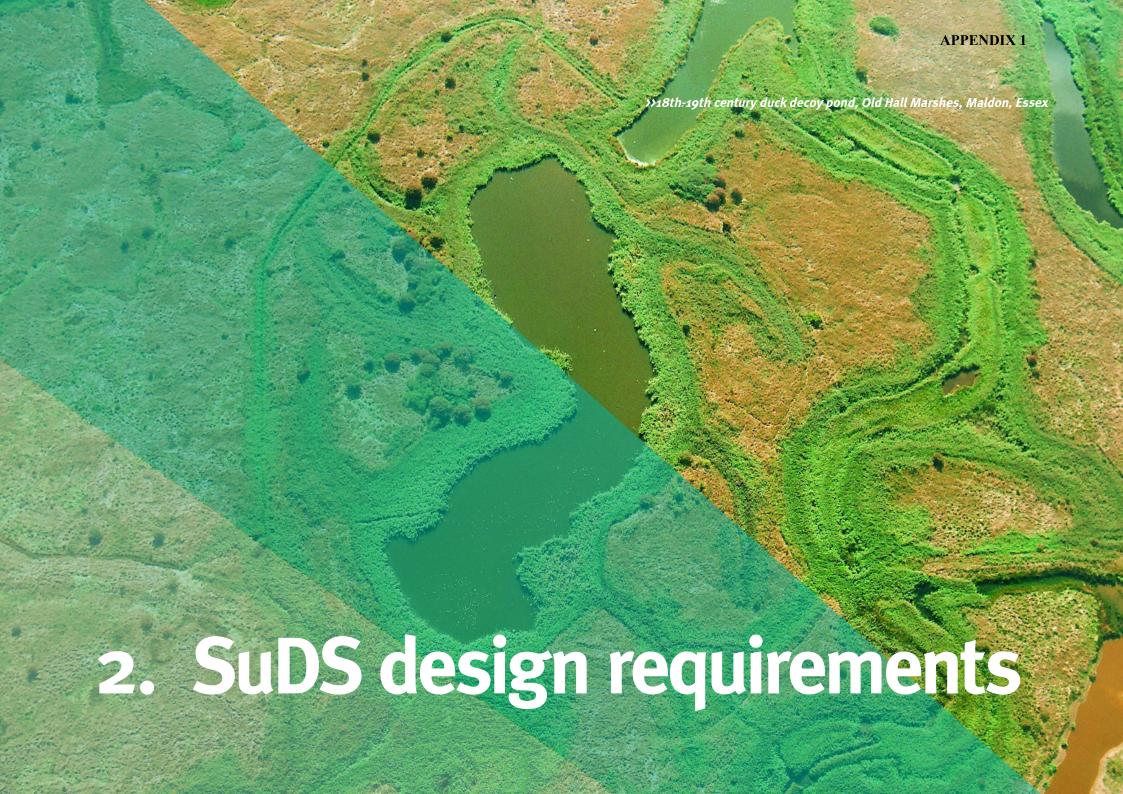
When applying for planning permission, a completed the proforma is required as outlined in **Appendix 1**. This will help facilitate a more efficient review of individual planning applications as well as identify any missing key information necessary for considering the planning application and its impacts.

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ECC, as LLFA, provides a <u>SuDS Planning Advice</u> <u>service</u> which can be used at any point during the planning process. It is recommend that the LLFA is consulted as early as possible to ensure sufficient space is provided within the site layout for necessary SuDS features. The SuDS Planning Advice service can significantly increase your chances of satisfying the LLFA's SuDS requirements therefore reducing delays in the determination of the application. Where appropriate for large scale development, suds planning advice may be provided via <u>planning</u> <u>performance agreement (PPA)</u>.



Multi-functional open space, Rieselfeld, Freiburg, Germany



## 2.1 The drainage hierarchy

## All sites must manage surface water via the following hierarchy:

When managing rainfall, the SuDS network must be designed to match natural drainage routes, infiltration rates and discharge speeds as far as possible. In addition to this, with concern over climate change and increasing risk of water scarcity, re-use of rainwater wherever possible must be utilised. Therefore, in accordance with the drainage hierarchy contained in **Approved Document H of the Building Regulations**, **Planning Practice Guidance**, and the need to mitigate against water scarcity, all surface water run off must aim to be discharged as high up the following hierarchy as possible:

- Rainwater re-use (rainwater harvesting/ greywater recycling).
- An adequate soakaway or other infiltration system.
- Hybrid solution of infiltration and discharging to a surface water body.
- To a surface water body.
- To a surface water sewer, highway drain, or another drainage system.
- To a combined sewer.

#### Rainwater re-use

Rainwater re-use helps to control discharge volumes and it helps to mitigate against water scarcity.

Where possible new developments should employ rainwater re-use, which helps reduce potable water demand and the discharge of water. Rainwater can be utilised for a variety of applications e.g. cleaning, irrigation. Designers and planners must obtain from the local water supply company information about the degree of water scarcity (including climate change implications for water resource security and likely increases in demand) in the area of the development. Where there is pressure on water resources, rainwater re-use systems should form part of the surface water management strategy for the site. It is also good for sites where it is difficult to meet the 1 in 1 greenfield discharge rate. Rainwater re-use must be seen as both a stand-alone option, as well as part of a wider strategy including SuDS, flood alleviation and water conservation measures. in response to changing climate and increased usage pressures. Whilst water butts fall within the definition of rainwater harvesting, their

use must not be included in any storage calculations, as they rely on their owners emptying them before storm events.

Any rainwater re-use system must have 4 main elements; collection, treatment, storage and distribution of water. Any system must be economic and practical; considering the local rainfall pattern, the size of the collection surface, the surface's materials and their drainage characteristics, sizing and material of piping systems, the levels of pollution of the collection surface and the risk of contaminating the system. Effective rainwater treatment must consider the materials coming into contact with the runoff e.g. traffic/industry. Rainwater must not discharge into open gullies due to potential risk of contamination. Treatment covers several options; removal of coarse particles upstream of the storage, retention of fine particles by sedimentation and flotation in the storage device and filtering downstream of the storage device which depends on the intended use.

Overflows must also have provisions in place to avoid pollution risk. Potential overflows should be accounted for to ensure rainwater harvesting systems do not cause flooding. Storage devices shall be equipped with an overflow to allow excess water to be discharged. Ideally the over flow should be set at a height that would allow the temporary storage of a small event to be slowly released to the main SuDS system, with a high-level overflow which prevents the tank from flooding the property. Any additional excess water should be infiltrated or otherwise evacuated into surface water bodies. The sizing of the volume of the rainwater storage device results from an analysis of the relationship between the rainwater that can be harvested and the demand of the non-potable water. The following factors shall be considered in order to be able to calculate the size of the storage device; namely the rainfall data (amount, intensity, pattern of rainfall, dry periods), the size and type of the collection surface, the number and type of intended applications, both present and future and the hydraulic efficiency of equipment used (e.g. filters).

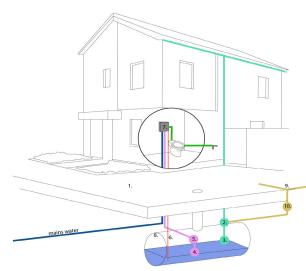
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Storage devices must be protected against frost, extreme temperatures and direct sunlight. The location of an underground storage device must be a minimum distance of 3 m from any tree or plant that develops a significant root system. Site specific factors, such as contamination risk,

must be considered. There must be labelling of systems to distinguish between non-potable water distribution systems and potable water distribution systems. A control and monitoring system must be incorporated into the rainwater system to ensure, as a minimum, that users are aware of whether the system is operating effectively. The system must inform about the status of the water supply and any malfunctions.

A risk assessment must be carried out to determine whether the system is safe and fit for purpose, considering the potential effects on people, the environment and physical assets. Maintenance of the system should be undertaken regularly, and details should be provided on the frequency and type of maintenance within the maintenance plan. Where greywater recycling is proposed, average water use across the site must be demonstrated over a year to show the likely storage capacity provided at any given period of time.

The information provided in this section is based upon BS EN 16941-1:2018 article on Onsite non-potable water systems - Part 1: Systems for the use of rainwater.



A typical collection, treatment and storage system. 1. Rainwater is collected from the roof area or hard standing, 2. Filter system prevents solids from entering the holding tank, 3. Water enters tank through smoothing inlet which stops settled sediment from being disturbed, 4. A suction filter prevents the uptake of floating matter when water is drawn up, 5. A pump pressurises the water, 6. A control unit monitors water levels - if these drop too low mains water will top the system up, 7. An air gap installed in order to prevent back flow of rainwater into the mains, 8. An overflow trap allows floating material to be skimmed off into the storm drain, 9. Rainwater soaking through a permeable pavement can also be collected, 10. Oil trap fitted to prevent contamination entering the system from ground surfaces, though additional filtration and disinfectant might also be needed.

#### Infiltration

Where possible infiltration must be used in order to prevent increased volumes of water leaving the site.

After reuse, infiltration is the next option within the drainage hierarchy. As the potential for infiltration can vary across the county due to soil types, ground water levels, and topography, sufficient ground investigations and infiltration testing must be undertaken and supplied to support any application.

Any ground investigations must include data from the British Geological Society, intrusive testing such as borehole tests (to determine soil type, depth and the depth of water table), detailed topographic drawings, and infiltration testing in line with the **BRE365** testing procedure.

At the outline stage of the planning process it is accepted that intensive infiltration testing is not always achievable, therefore a preliminary investigation in order on the soil and geology of the site is acceptable. The LLFA would accept borehole testing with the condition that infiltration testing is undertaken at a later stage. If infiltration is the chosen discharge option within an outline application and detailed testing has not been possible, then an alternative approach must also be provided in case subsequent infiltration testing demonstrates that discharge to the ground will not be viable.

Ground stability must be taken into consideration when infiltration is proposed. The base of the soakaway must be 1 metre or higher than the ground water level. Soakaway features must not be within 5 metres of a building, except for those that offer blanket infiltration such as permeable paving and are managing water within 1m of source. In addition, Highways require that point infiltration should not be within 6m of the highway.

Blanket infiltration however, (such as **permeable paving**) can be located as close as possible as long as there is an impermeable barrier between the two.

The minimum acceptable rate of infiltration is 1x10-6. Rates found to be slower than this may potentially have to deliver a **hybrid drainage solution**. If rates are found to be too slow for formal infiltration this does not rule out the possibility of some soakage taking place. Features (for example permeable/porous paving) should be unlined wherever possible regardless of infiltration rates in order to maximise infiltration capacity. This approach must be approached with care, as should all infiltrating sites, when dealing with areas that are subject to previous contamination.



SuDS infiltration basins have been integrated with highways at Ravenswood in Ipswich. The scheme is estimated to have saved over £600,000 in the long term (Ipswich Borough Council, 2011)

#### Greenfield runoff rates

Runoff rates must be limited the greenfield runoff rate in order to not increase flooding offsite from its natural drainage scenarios.

SuDS networks must be designed to mimic natural drainage routes. When discharging to a watercourse it must be proven that the final discharge location is the same as where it currently drains otherwise runoff is being increased elsewhere due to the development. In addition, where the predevelopment site has multiple discharge locations, a catchment-based approach must be utilised in order to not increase runoff.

Surface water runoff can be discharged in three ways:

#### Restricting to the 1 in 1-year greenfield rate

The LLFA preference is that runoff must not increase due to the development and all runoff must be first restricted to the greenfield 1 in 1-year runoff rate during all events up to and including the 1 in 100-year rainfall event with climate change.

#### Restricting to flow matching rates

Alternatively, if restricting to the 1 in 1-year greenfield rate approach is not possible discharge rates can be limited to a range of equivalent greenfield discharge rates. For

example, the 1 in 1-year storm event will be limited to the 1 in 1-year greenfield run off rate, the 1 in 30-year storm event will be limited to the 1 in 30-year storm event and so on. However, if this alternative approach is used then an inclusion of **long-term storage** will be required.

#### Discharging to a tidal estuary

In instances where the final discharge location is to a tidal estuary then it is accepted that discharge rates are unrestricted. However, evidence must be provided to ensure that the surface water will be managed during a tide locking scenario. This must be demonstrated by showing that the surface water can be managed for a 1 in 100-year pluvial storm event and a 1 in 20 year fluvial/tidal storm event coinciding. Likewise, when discharging to a main river, consideration must be given to a 1 in 20-year fluvial event coinciding with a 1 in 100-year event plus climate change at the development site.

The LLFA do not accept discharge rates being limited to QBAR (mean annual maximum flow rate). The QBAR estimation procedure is based

on higher return periods (>2), and results in higher estimated values for final discharge from the site than 1 in1 Greenfield runoff rates. There are significant differences in storage volumes and final discharge rates when considering QBAR as an allowable discharge from the site. Further it could have potential increase in risk of surface water flooding due to increased discharge rates that opposed natural greenfield runoff. On these assumptions the LLFA require discharge rates to be limited to 1 in 1 Greenfield rates.

Historically, minimum discharge rates have been limited to 5l/s due to the risk of blockage of outlets with an orifice size of smaller than 50mm. However, through the innovation of vortex flow control devices, orifice sizes can be made larger with discharge rates being limited far below 5l/s without causing an unacceptable risk of blockage. The LLFA require that runoff rates are limited to 1l/s or the 1 in 1 year greenfield rate, whichever is higher unless discharge is via **permeable paving** which is further able to reduce the risk of blockage. If all surface water first goes through permeable/porous paving then the majority of pollution

and debris will be prevented from reaching the outfall, therefore discharge rates will be able to be lower than 1l/s. Additionally to minimise the risk of blockage, we require materials that may cause blockages to be removed from the system as high up the system as possible.

Where it is not possible to limit rates back to the 1 in 1-year greenfield rate because this may cause blockages, additional consideration must be given to <u>rainwater re-use</u> to minimise the impact of smaller storm events.

When discharging to a surface water sewer we still expect the 1 in 1-year greenfield runoff rate discharge limit to be met and you must not limit discharge rates to the sewers maximum capacity as given by the provider.



SuDS at Wellesley College are connected to wetlands outsite the site boundary to create valuable green corridors for wildlife.

#### Brownfield runoff rates

Brownfield sites must where possible revert the drainage back to its natural state.

The LLFA expects surface water drainage schemes on brownfield development sites to follow the same principles as if the site is greenfield. If it is unfeasible to restrict runoff rates back to the 1 in 1-year greenfield runoff rate or the alternative flow matching approach, the LLFA will accept discharge rates to be restricted to as close as feasibly possible to the 1 in 1-year greenfield runoff rate with a maximum limit of 50% betterment of the brownfield 1 in 1 year runoff rate. If this approach is to be chosen then it must be clearly evidenced that restricting to the greenfield rate is unfeasible and that the new rate proposed is as close as feasibly possible to the 1 in 1-year greenfield runoff rate. This supporting evidence must include a range of rates and the corresponding storage volumes associated with those rates.

## Hybrid drainage plans

Where infiltration can be utilised hybrid solutions may be possible.

Where a site has some infiltration capacity, but rates are too slow to meet formal infiltration requirements for the site  $(1 \times 10^{-6} \text{ m/s})$ , the LLFA accept a well-designed hybrid solution, which uses low level infiltration for smaller storm events and a piped outfall for larger events. This maximises the capacity of the attenuation storage for larger infrequent events and allows for appropriate half drain times to be met for all events. An example of this would be where a site has demonstrated infiltration rates of 1 x 10 -7 m/s. Infiltration could be used for events up to the 1 in 5-year event assuming that 50% of the attenuation capacity of the storage feature is available 24 hours after a storm. Any event larger than the 1 in 5-year event would then discharge via a piped network at the 1 in 1-year greenfield rate.







Rain gardens

### Calculating runoff rates

Calculating runoff rates must be completed using the most conservative rates in order to prevent an increase in flooding offsite.

Runoff rates must be calculated based on the full site area subtracting any areas of large open space that will not be draining via the proposed SuDS. Unrestricted rates will only be allowed where the outfall is to a tidal estuary.

The LLFA preference is that greenfield runoff rates must be calculated using the following rainfall data: FSR and FEH, and they should also use the following calculation methods IH124, or ICP SuDS. These should be adjusted as appropriate to site conditions. Calculations of greenfield rates can use a range of calculation methods, as rates and storage requirements will vary depending on different storm criteria it must be demonstrated during the later stages (reserved matters or discharge of conditions) of the planning process that the method selected is the most conservative of the options available. For brownfield sites, the Modified Rational Method must be used to calculate the peak brownfield rate. Alternatively, runoff from a brownfield site can be estimated using the urbanisation methods within the ReFH2 software.

When providing runoff rates, the LLFA require that the calculations and processes used are provided in order to demonstrate that the correct greenfield runoff rates have been provided.

## Climate change

An allowance for rainfall intensities changing due to climate change must be incorporated into storage capacities.

In February 2019 the Government updated it's 'Flood risk assessments; climate change allowances' document. This guidance provides updated climate change figures which must be used for flood risk assessments and drainage strategies to help minimise vulnerability and provide resilience to flooding and coastal change in the future. Within this is an update on the Peak Rainfall Intensity Allowance in small and urban catchments as shown in the table below. The LLFA take a conservative, risk adverse approach to flood and water management and therefore expect the Upper End figures to be used.

Table below shows the peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline).

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change antic- ipated for the '2050s' (2040 to 2069)	Total potential change antic- ipated for the '2080s' (2070 to 2115)
Upper end	10%	20%	40%
Central	5%	10%	20%

### Water quality

All surface water must go through stringent treatment in order to protect water sources and biodiversity.

The level of pollution found within surface water runoff will depend on the nature of the development from which it arises, the time since the last rainfall event, and the duration and intensity of rainfall. An appropriate 'train' of SuDS components must be installed to reduce the risk of pollutants entering watercourses and groundwater. This must incorporate treatment from all sources of pollution, including rooftops. A well planned, and designed SuDS network can be cost effective when the appropriate conveyance, infiltration, and attenuation work harmoniously with surface water treatment.

Interception storage must be utilised as part of the beginning of the treatment train to ensure that pollutants are managed as close to the source as possible. In addition to this sediment must be removed as far upstream in the system as possible. Doing so provides the important removal of a range of contaminants that are adsorbed onto sediment surfaces and at the same time protects downstream components from damage or poor performance due to sediment built up. When selecting

features it is important to minimise the risk of remobilisation of, and washout of any pollutants such as sediments. Although some gullypots and catchpits can trap sediment, their performance is linked closely to the regularity of their maintenance. There is a significant risk of pollutants contained within them being dislodged and washed downstream; and hence the LLFA do not consider these an appropriate form of treatment.

A SuDS system can employ a myriad of processes in order to treat surface water, for example: infiltration, sedimentation, filtration, adsorption, biodegradation, oxidisation, reduction, separation. These processes are strongly linked to the hydraulic control of runoff i.e. the velocity control and the retention time. However, with these processes' biodiversity is a sensitive contributing factor and therefore polluted surface water runoff must not run directly into permanent ponds in order to protect biodiversity and amenity, and to prevent maintenance problems caused by heavy silts and oil.

Chapter 26 of <u>The CIRIA SuDS Manual C753</u> offers a range of different features and their

treatment values through it's Simple Index Approach. To measure and mitigate the potential pollution hazard risk that certain surfaces give, the LLFA require all sites to follow the Simple Index Approach to demonstrate that appropriate treatment is applied to mitigate the impact of new development. When submitting an application, it is necessary to demonstrate that the pollution hazard impact indices being created by the development, are offset by the pollution hazard mitigation indices that the proposed SuDS scheme offers. In addition, when assessing the pollution hazard level, the LLFA recommend that the national trip analysis, which suggests that an average of 5 traffic movements per day per dwelling is used unless a more specific transport risk assessment can be provided. When proprietary systems are proposed (such as vortex separators) the LLFA require details about the level of mitigation provided to be consistent with the Simple Index Approach.

The potential pollution hazard indices and the SuDS features mitigations indices stated within **The CIRIA SuDS Manual C753** can be seen below.

Table below shows pollution hazard indices for different land use classifications.

Land use	Pollution hazard level	Total suspended solids (TSS)	Metals	Hydrocarbons
Residential roofs	Very low	0.2	0.2	0.05
Other roofs (typically commercial/industrial roofs)	Low	0.3	o.2 (up to o.8 where there is potential for metals to leach from the roof)	0.05
Individual property driveways, residential car parks, low traffic roads (e.g. cul de sacs, home zones and general access roads) and non-residential car parking with infrequent change (e.g. schools, offices) i.e. <300 traffic movements/day	Low	0.5	0.4	0.4
Commercial yard and delivery areas, non-residential car parking with frequent change (e.g. hospitals, retail) all roads except low traffic roads and trunk roads/motorways	Medium	0.7	0.6	0.7
Sites with heavy pollution (e.g. haulage yards, lorry parks, highly frequented lorry approaches to industrial estates, waste sites), sites where chemicals and fuels (other than domestic fuel oil) are to be delivered, handled, stored, used or manufactured; industrial sites; trunk roads and motorways	High	0.8	0.8	0.9

- Motorways and trunk roads should follow the guidance and risk assessment process set out in the Highways Agency (2009).
- Where a site land use falls outside the defined categories, the indices should be adapted (and agreed with the LLFA) or ese the more detailed risk assessment should be adopted.

Indicative SuDS mitigation indices for discharges to surface waters:

Mitigation indices					
Types of SuDS component	TSS	Metals	Hydrocarbons		
Filter strip	0.4	0.4	0.5		
Filter drain	0.4	0.4	0.4		
Swale	0.5	0.6	0.6		
<b>Bioretention system</b>	0.8	0.8	0.8		
Permeable paving	0.7	0.6	0.7		
<b>Detention basin</b>	0.5	0.5	0.6		
Pond	0.7	0.7	0.5		
Wetland	0.8	0.8	0.8		

- SuDS components only deliver these indices if they follow design guidance with respect to hydraulics and treatment set out in this guide and The CIRIA SuDS Manual C753.
- Filter drains can remove coarse sediments, but their use for this purpose will have significant implications with respect to maintenance requirements and this should be taken into account in the design and maintenance plan.
- Ponds and Wetlands can remove coarse sediments, but their use for this purpose
  will have significant implications with respect to the maintenance requirements
  and amenity value of the system. Sediment should normally be removed upstream,
  unless they are specifically designed to retain sediment in a separate part of the
  component, where it cannot easily migrate to the main body of water.
- Where a wetland is not specifically designed to provide significantly enhance treatment it should be considered as having the same mitigation indices as a pond.



SuDS Pond, Western Harbour, Malmo, Sweden

#### 2. SuDS design requirements

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#### Attenuation storage

Where discharge rates have to be restricted, attenuation storage must be utilised in order to prevent flooding.

The provision of storage helps to reduce flooding whilst helping to control the peak allowable runoff rate. In addition, well-designed SuDS schemes can significantly improve and promote biodiversity and amenity in an area through the use of above ground storage.

Storage must be provided to manage all storms up to and including the 1 in 100-year storm event plus climate change. If this is unfeasible storage must be provided for the all storms up to and including the 1 in 30-year storm event with all excess water (flooding) to be maintained within suitable exceedance areas and routes which avoid risk to people and property whilst containing all flows on site. Above ground storage should primarily be considered in order to enhance biodiversity and green areas. If above ground storage is not proposed the LLFA will need to be satisfied through evidence the reasons why it is not feasible. The provision of SuDS and green infrastructure provides numerous socio-economic benefits and is consistent with national and local policies in seeking to conserve and where appropriate enhance biodiversity. In order to minimise the land take associated with SuDS features in developments wherever possible, above ground storage should be integrated with public open space.

Any site subject to unplanned development, for example through permitted development rights, must account for an additional 10% of roof area within the storage calculations to accommodate for urban creep.

Where necessary, suitable features must be provided upstream of attenuation storage to prevent the build-up of silt and sediment which would have a negative effect on the storage volume provided. This can be achieved through features such as sediment forebays, **permeable paving**,

**swales** etc. Furthermore, appropriate **maintenance** measures must be in place to retain the capacity within storage features over the longer term.

When developing on a flood plain, either partially or entirely, attenuation storage must be avoided, where possible, from being located within the defined flood plain. If attenuation storage is necessary on a flood plain then it must be designed in a way that does not affect the areas capacity to cope with flooding from fluvial sources.



Swale at Woodverry Down in Hackney, London.

## Capacity for consecutive events

Storage features must be able to half drain within 24 hours for all storms up to and including the 1 in 30-year storm.

When sizing <u>attenuation storage</u> it is necessary to demonstrate that all storage features have a half drain time, following a 1 in 30-year critical event, of less than 24 hours. If it is not possible to do this the LLFA will require that the feature is capable of storing a subsequent 1 in 10-year event.

#### Long term storage

Where using flow matching long term storage will be required.

The introduction of new areas of hardstanding as part of development is likely to increase runoff volumes from a site. When limiting all discharge back to the 1 in 1-year greenfield rate the benefit of the reduction is discharge rates for larger events will offset the negative impact that this increase in volume may have. However, if flow matching is used to manage discharge rates from a site then such benefits will not be gained, and it will be necessary to provide additional mitigation for the impact of increased

volumes of water leaving the site. This can be achieved through the use of online long-term storage (LTS). Where ground conditions allow LTS should be delivered in a method similar to the **hybrid approach** mentioned earlier in this document. Infiltration should be used to manage discharge for the initial LTS volume and piped discharge should only be considered when this volume of water has been accounted for. On sites that do not allow this approach LTS volumes should be limited back to 2l/s/ha.

# Green spaces/promotion of biodiversity

The implementation of SuDS can greatly benefit green spaces and biodiversity and therefore must be used as much as feasibly possible.

SuDS can become even more advantageous in providing multi-functional benefits where they can deliver green infrastructure and support high quality development. Green infrastructure is defined as being:

"Made up of natural and semi-natural assets and habitat types, of green and blue spaces, and of other environmental features that maintain and enhance ecosystem services. It provides multi-functional benefits integral to the health and wellbeing of our communities and to the ecology and economy of the county. Green infrastructure is often referred to as a network of these natural and semi-natural assets and spaces, which are joined together connecting urban and rural areas and are habitually strategically planned." (Emerging Green Essex Strategy, 2019).

Green infrastructure can contribute to making areas less vulnerable to flood risk whilst ensuring development doesn't increase flood risk to third parties. Through its key role in:

- sustainable drainage,
- drought mitigation,
- · flood and water stress reduction,
- providing opportunities for attenuation or infiltration that can help to recharge aquifers,
- maintaining levels in watercourses or other blue infrastructure features,
- influence water quality through limiting diffuse pollution in watercourses.

Using SuDS in the context of green infrastructure, especially the end design

#### solutions offer opportunities to create:

- attractive amenity features with the development,
- provide for habitat and biodiversity enhancement,
- vegetated green open spaces,
- green and blue corridors; and
- deliver multi functions and benefits to a community (e.g. recreational opportunities, improve health and wellbeing and place making).

Place making recognises the character and distinctiveness of different locations and can provide the opportunity to use water management, in the case of SuDS to help deal with flood risks whilst integrating into and enhancing the landscape settings. Especially when natural flood management techniques are considered within the flood management schemes design.

Natural flood management involves techniques that aim to work with natural features and characteristics to manage the sources and pathways of flood waters, rather than through engineered process. Techniques could include for example:

- The creation of water rain gardens.
- Green roofs and walls.
- Bio retention areas (i.e. Swales, infiltration trenches, ponds and wetlands).
- Coastal and estuary management (i.e. saltmarshes).
- Woodland creations and leaky dams.



Sutcliffe Park, London: A common sense approach to health and safety near water (lan Yarham 2010)

Effective SuDS management should incorporate green infrastructure to maximise the opportunity for flood management and to improve water quality in Essex by:

- Ensuring that SuDS and other urban natural flood management measures are linked into the overall green infrastructure network.
- Create SuDS which are appropriate to the distinctive local context which will enhance landscape character and quality.
- Seek to positively influence urban design and landscape value through provision of green space / blue corridors, vegetation and by integrating water into the built environment, while protecting and conserving the historic environ-ment, and providing opportunities for biodiversity.
- Consider how the retained water from SuDS can be used for active and pas-sive irrigation for urban plants and green spaces, for example by designing green corridors and street trees as stormwater planters.
- Encourage take up of small-scale urban drainage measures such as green roofs, green facades, rain gardens and ponds to be implemented on an indi-vidual level by households and businesses.

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- Explore possibilities of returning arable land to woodland and grassland in mid and upper catchments to stabilise soils, reduce sediment and nutrient run-off and improve flood management.
- Use of SuDS and other urban flood management measures to be incorpo-rated into new developments and into proposals to refurbish existing neigh-bourhoods.
- Design SuDS for wildlife and amenity (e.g. by planting native species, provid-ing ponds, green space paths, implementing street/park furniture (i.e. bench-es, interpretation etc.) where appropriate).
- Natural barriers (e.g. planting) should be introduced to help manage per-ceived safety risks
- Determine the suitability of SUDS for different soil
- Allow sufficient land take for SUDS when planning the site layout.

Ensure there is an operational and maintenance plan in place and explore funding mechanisms for the long-term management of SuDS and Green infrastructure.

## Multiple Phases

When an application proposal is subject to multiple phases, clear information must be provided.

When submitting planning applications with multiple phases of development an executive summary or a technical note must be provided with every application describing how the whole drainage system is linked over the different phases. This will provide the LLFA with the wider context needed to fully understand how the drainage system works which will make the assessment and review a much smoother and more straight forward procedure.



Cambourne development, Cambridgeshire)

#### 2. SuDS design requirements

### **Construction Management**

A Construction Management Plan (CMP) must be in provided to ensure that during construction the drainage network and surrounding environments are not impacted negatively.

A CMP is most commonly required at the discharge of conditions stage. Any scheme must ensure that appropriate mitigation procedures are in place to limit the impact of construction works on off-site flooding through surface water run off or on ground water. If left unmanaged the removal of topsoil prior to construction may result in excess water being discharged from site.

Unless temporary drainage solutions are provided during construction all drainage features and SuDS features must be fully maintained and restored to their full intended working capacity. This includes processes such as removing all sediment build up that may have occurred during construction. Care must be used in order to not remobilise these and flush them into the water system. Care must be taken to minimise the compaction of any soil during construction particularly when infiltration is relied upon to manage surface water on site.

# Ordinary Watercourse Consent

If works are to be undertaken involving an ordinary watercourse then consent must be given by the LLFA.

The Land Drainage Act 1991 gave Essex County Council the responsibility for ordinary water course consents or section 23 consents (S23 Consents).

This mean that if you are proposing to undertake the following works you will require

ordinary watercourse consent from the Lead Local Flood Authority (Essex County Council) under Section 23 of the Land Drainage Act 1991:

- a) erection of any mill dam, weir or other like obstruction to the flow of any ordinary watercourse or raise or otherwise alter any such obstruction; or
- b) erection of a culvert in an ordinary watercourse, or
- c) alteration a culvert in a manner that would be likely to affect the flow of an ordinary watercourse.



Infiltration basin at Ravenswood, Ipswich, Suffolk.

SuDS Design Guide. 2019

For works affecting main rivers the prior written consent of the Environment Agency is required under the Water Resources Act 1991 and Environment Agency Byelaws.

Therefore, if you would like to pipe, bridge or alter a watercourse as a part of your application then a S23 Consent is required from the LLFA. However, it must be made clear that a S23 Consent is a separate application and not part of the planning application process. More information on how to apply for consent can be found **here**.

#### **SuDS** Maintenance

All Surface Water Drainage proposals must be accompanied with a stringent maintenance plan in order to ensure its efficiency throughout its intended lifespan.

Every surface water drainage scheme will require a stringent maintenance plan to ensure that the features will work at optimum levels throughout the lifespan of the development. Without this maintenance, the reliability and efficiency of the drainage network will be affected and consequently the risk of flooding and damage to the surrounding environments

will be dramatically increased. Therefore, a maintenance plan detailing what maintenance is required, who will undertake the work, and at what frequency the work will be carried out must be provided. The majority of common SuDS features available have their maintenance requirements and frequencies outlined in the **Ciria SuDS Manual C753.** 

The maintenance plan must incorporate details over who is responsible for the maintenance of individual SuDS features, and how they are to be funded in the long term. Who will be carrying out the maintenance is very important, and there are a range of potential adopters. It must be assured and clear that the design of the features meets both the adopters design criteria and those specified by the LLFA. Where necessary, features may have to be privately adopted.

It must be noted that Highways do not generally adopt SuDS, however this must not be regarded a reason for avoiding their use. Where the use of SuDS is necessary to manage surface water runoff from the highway, features must be located outside the adoptable carriageway and must be privately maintained. Further

information on construction within the Highways can be found within their <u>Developers</u> <u>Construction Manual</u> and their <u>Street Materials</u> <u>Guide.</u>

Applications which have soakaways/
features serving more than one household
(for example, across two gardens) should
refrain from assigning maintenance
responsibility to homeowners, as in the event
of neighbour disputes there is an increased
risk of maintenance stands lapsing. Where
homeowners are assigned to the maintenance
of features, they must be given clear
instructions on what needs doing, how it can
be done, and how maintenance can be carried
out on their behalf by any onsite maintenance
company.

Compliance with the proposed maintenance strategy for a site will typically be required by planning condition. Additionally, it is requested that yearly logs are maintained and are made available to the Local Authority upon request. There may also be occasions when compliance is managed via legal agreement in consultation with the local planning authority.



SuDS Design Guide. 2019

Each SuDS feature has its own specific design specifications, which are required to be followed unless agreed otherwise with the LLFA.

#### 3.1 Green roofs

A green roof is a multi-layered system that covers the roof of a building with vegetation/landscaping/permeable car parking, over a drainage layer. These features will not be considered for adoption by the SuDS Team.

- Designed for interception storage
- Minimum roof pitch of 1 in 80, maximum 1 in 3
- Multiple outlets to reduce risk from blockages
- Lightweight soil and appropriate vegetation.
- There are two types; extensive and intensive
- Extensive green roofs are not usually accessible, think (20-150mm), lightweight, cheap, suitable for retrofits and require little or no need for irrigation and specialised drainage systems.
- Intensive green roofs are accessible as public spaces/garden, thicker, have higher maintenance requirements, have good surface water retention capacity.
- Falls for the green roofs must be designed at a minimum of 1 in 40, they must be consistently graded without deflections of depressions.
- A high quality, robust waterproofing layer is required and is vital.



### 3.2 Soakaways

These are square or circular excavations, filled with aggregate or lined with brickwork, or pre-cast storage structures surrounded by granular backfill.

- Must be designed for the 1 in 100-year rainfall event as a minimum.
- Infiltration testing carried out in accordance with BRE Digest 365.
- Fill material must provide >30% void space.



- Base of soakaway at least 1m from groundwater level.
- Minimum of 5m away from foundations.
- Effective pre-treatment to ensure suitable capacity throughout lifetime.
- Permeability greater than surrounding soil.
- Stability of surrounding ground must be considered.
- Must half drain within 24 hours.
- Must be no closer than 6m to an adjacent highway.
- Best suited for small areas such as individual roof areas or driveways.
- A safety factor of 10 should be used within the calculations.

## 3.3 Filter Strips

These are vegetated strips of land designed to accept overland sheet flow.

- Recommended minimum width of 6m.
- Recommended depth 1-2m.
- Where infiltration is proposed, there must be a minimum of 1 metre between the invert level and the ground water level.
- Runoff must be evenly distributed across the filter strip.
- Slopes not exceeding 1 in 20, minimum of 1 in 50.
- The peak flow velocity must be lower than o.3m/s to promote particulate settlement.
- The time of travel of runoff across the filter strip should be at least 9 minutes.



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# 3.4 Filter trenches and drains

These are shallow excavations filled with stone to create temporary surface water attenuation.

- Excavated trench 1-2m depth filled with stone aggregate.
- Effective upstream pre-treatment to remove sediment and fine silts.
- Infiltration must not be used where groundwater is vulnerable or to drain pollution hotspots.
- Observation wells and/or access points for maintenance of perforated pipe



#### 3.5 Swales

These are linear vegetated features in which surface water can be stored or conveyed. They can be wet or dry. Can be designed to allow infiltration where appropriate.

- Limit velocities during extreme events to 1-2 m/s.
- Maximum side slopes of 1 in 3, 1 in 4 preferred.
- Base width of o.5-2.om.
- Must be designed for shallow flows and adequate water quality treatment, whilst preventing flows from concentrating and creating erosion channels.

- Maximum flow velocity must be 0.3m/s to ensure adequate runoff filtration.
- The time of travel of runoff along the swale should be at least 9 minutes.
- Check dams and appropriate pre-treatment systems can be used to improve both hydraulic and water quality performance by reducing velocities increasing resistance time and increasing infiltration/storage.
- Flow velocities for extreme events must be kept below 1m (2m max) to prevent erosion.
- Water should be preferably directed laterally into a swale rather than entering the swale as a single point inflow to minimise erosion and to disperse pollution widely.



## 3.6 Bioretention

These are shallow landscaped depressions or pre-cast units which rely on engineered soil and vegetation to remove pollution and reduce runoff.

- Sufficient area to temporarily store the water quality treatment volume
- The water quality treatment event must half drain within 24 hrs to provide adequate capacity for multi-event scenarios
- Minimum depth to groundwater of 1m, if unlined
- Overflow/bypass facilities for extreme events.
- Maximum recommended area that must drain to a bioretention system is o.8ha.
- Typically, the surface area of the bioretention system must be 2-4% of the overall site area to be drained to prevent rapid clogging of the bioretention surface



Bioretention



Permeable pavement

# 3.7 Pervious/permeable pavements

Permeable surface allow rainwater to infiltrate through into underlying layer where it is temporarily stored.

- Pervious sub-base to be structurally designed for site purpose
- Temporary sub-surface storage must provide infiltration and/or controlled discharge
- Geotextile may be specified to provide filtration treatment
- Surface infiltration rates must be an order of magnitude greater than the design rainfall intensity.
- 30% porosity or Type 3 sub-base must be used.
- Unless unfeasible, pervious/permeable pavements must be left unlined to encourage as much infiltration as possible.
- Can be up against buildings
- Are not adoptable by Essex Highways

#### 3.8 Geocellular structures

Modular Geocellular systems have a high void ratio that can be used to create below ground infiltration (soakaway) or storage device.

- Standard storage design using limiting discharges to determine storage volume.
- Structural design must be to relevant standards for appropriate surface loadings.
- Use appropriate geotextile (for infiltration) or geomembrane (for storage).
- Effective upstream treatment is crucial to allow the capacity to be maintained and uncompromised by sediment build up.
- Geocellular systems must be at a minimum 1metre above the ground water level.



## 3.9 Infiltration basins

These are vegetated depressions designed to store runoff and allow infiltration gradually into the ground.

- Pre-treatment is required to remove sediments and fine silts.
- Infiltration must not be used where groundwater is vulnerable or to drain pollution hotspots.

### 3.10 Detention basins

These are surface storage basins that provide attenuation of stormwater runoff and facilitate settling of particulate pollutants. They are normally dry and may also function as a recreational facility.

- Maximum side slopes of 1:3.
- Bioretention and/or wetland/micro pools at outlets for enhanced pollution control.
- The maximum flow velocity for such an event must be 0.3m/s to ensure adequate runoff filtration.
- The time of travel of runoff from inlet to outlet must be at least 9 minutes.





#### **3.11 Ponds**

These provide for stormwater attenuation and treatment. Permanent pools to support aquatic vegetation and retention time promotes sediment removal.

- Permanent pool for water quality treatment and temporary storage volume for flow attenuation.
- Sediment forebay to maintain capacity.
- Aquatic benches so support planting, acting as a biological filter and providing ecology, amenity and safety benefits.
- Maximum water depth for open water areas of 1.2m.
- Maximum side slopes of 1:3.



### 3.12 Wetlands

These are shallow ponds and marshy areas for attenuation and water treatment. Aquatic vegetation and extended detention allow sediments to settle.

- Shallow, temporary storage for attenuation.
- Sediment forebay or equivalent upstream pre-treatment.
- Combination of deep and shallow areas (maximum depth <2m).
- Length: width ratio of greater than 3:1, shallow side slopes.



### **3.13 Rainwater harvesting**

Rainwater harvesting is the process of collecting and using rainwater. If designed appropriately the systems can be used to reduce the rates and volumes of runoff.

- Can range from complex district-wide systems to simple household systems linked to a water butt
- Most simple rainwater harvesting systems are relatively easy to manage
- Rainwater harvesting systems can be combined with grey water recycling systems to form an integrated process.
- The sizing of storage tanks for water conservation (supply) systems are either 5% of the annual runoff yield or 5% of the annual property water demand.
- Rainwater harvesting must not be incorporated into site storage calculations due to the efficiency being down to the regular emptying before storm events by the homeowner.
- Primary screening devices used to prevent leaves and debris from entering the tank must be installed to maintain capacity and

to prevent blockages.

- First flush devices can also be used to divert the initial flush of heavily polluted (debris, leaves, bird poo, etc) flush away from the tank/butt.
- They need to have either an inlet valve or an overflow arrangement that conveys excess surface water runoff away from the building without causing damage.

## 3.14 Greywater recycling

Greywater recycling is the re-use of waste water collected from showers, baths, washbasins, washing machines and kitchen sinks.

- Common features include a tank if storing water, a pump, a distribution system and, where it is needed, some sort of treatment
- Greywater stored for any length of time has to be treated as otherwise it deteriorates rapidly.

# **3.15 Proprietary treatment systems**

Proprietary treatment systems are manufactured systems that can treat surface water. They are usually below ground features which can support landscaped features and storage features.

- They must be accompanied by their simple index approach mitigation indices
- The choice of proprietary systems is dependent on space, access, types of pollutants removed, and the range of flow events for which contaminant removal is desired.
- Must be located as shallow as possible
- Can be considered as pre-treatment devices before certain features.
- Must be considered after above ground and biodiversity friendly methods ruled out.
- To ensure that they work as planned, they may require more frequent and routine maintenance than other methods.





#### SuDS Water quantity and Quality - LLFA Technical Assessment Proforma

#### Introduction

Instructions for use

This proforma identifies the information required by Essex LLFA to enable technical assessment the Designers approach to water quantity and water quality as part of SuDS design approach in compliance with Essex SuDS Design Guide Local Standards 1 and 2.

Completion of the proforma will also allow for technical assessment against Non-statutory technical standards (NSTS) for Sustainable Drainage.

Please complete this form in full. This will assist with a smoother and quicker application.

	the units defined for input of figures ers in brackets refer to accompanying not	es.			
Where	em <sup>3</sup> m <sup>3</sup> /m <sup>2</sup> are noted – both	values should be	filled in.		
Site o	letails				
1.1	Planning application reference				
1.2	Site name				
1.3	Total application site area <sup>(1)</sup>	ha			
1.4	Predevelopment use (4)				
1.5	Post development use				
1.6	Urban creep applicable				
1.7	Proposed design life / planning application	ion life			
1.8	Method(s) of discharge (5) Infiltration	Waterbody	Storm sewer	Combined sewer	Reus
1.9	Is discharge direct to estuary / sea				

Have agreements in principle (where applicable) for discharge been provided

1.10



#### SuDS Water quantity and Quality – LLFA Technical Assessment

#### **Calculation inputs**

2.1	Area within site which is drained by SuDS (2)		$m^2$
2.2	Impermeable area drained pre development (3)		$m^2$
2.3	Impermeable area drained post development (3)		$m^2$
2.4	Additional impermeable area (2.3 minus 2.2)		$m^2$
2.5	Method for assessing greenfield runoff rate		
2.6	Method for assessing brownfield runoff rate		
2.7	Coefficient of runoff (Cv) (6)		
2.8	Source of rainfall data (FEH Preferred)		
2.9	Climate change factor applied	%	
2.10	Urban creep factor applied	%	

#### Attenuation (positive outlet)

- 2.11 Drainage outlet at risk of drowning (tidal locking, elevated water levels in watercourse/sewer) Note: Vortex controls require conditions of free discharge to operate as per manufacturers specification.
- 2.12 Invert level at final outlet mAOD
- 2.13 Design level used for surcharge water level at point of discharge (16) mAOD

#### Infiltration (Discharge to Ground)

- 2.14 Have infiltration tests been undertaken
- 2.15 Infiltration rate (where applicable) m/hr
- 2.16 Depth to highest known ground water table mAOD
- 2.17 Depth of infiltration feature mAOD
- 2.18 Method for assessing required infiltration temporary storage
- 2.19 Factor of safety used for sizing infiltration storage



### SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

**Calculation outputs**Sections 3 and 4 refer to site where storage is provided by full attenuation or partial infiltration. Where all flows are infiltrated to ground go straight to Section 6.

u. o	milated to ground go et algin to conton o	•						
3.0	Proposed maximum rate of runoff from site (incl. CCA and Urban Creep) (7)							
3.1	1 in 1 year rainfall	l/s/ha,		I/s for the site				
3.2	1 in 2 year rainfall	l/s/ha,		I/s for the site				
3.3	1 in 30 year rainfall	l/s/ha,		I/s for the site				
3.4	1 in 100 year rainfall	l/s/ha,		I/s for the site				
4.0	Attenuation storage to manage flow ra	tes from site (ir	ncl. CCA a	and Urban Creep)				
4.1	Storage - 1 in 1 year		$m^3$	m <sup>3</sup> /m <sup>2</sup> (of developed impermea	able area)			
4.2	Storage - 1in 30 year <sup>(8)</sup>		$m^3$	$m^3/m^2$				
4.3	Storage - 1 in 100 year plus 40% CC (S	9)	$m^3$	$\mathrm{m}^3/\mathrm{m}^2$				
4.4	50% storage drain down time		hours					
5.0	Controlling volume of runoff from the sit	te(10)						
5.1	Pre development runoff volume <sup>(12)</sup>			m <sup>3</sup> for the site				
5.2	Post development runoff volume (unmitigated) (12)			m <sup>3</sup> for the site				
5.3	Volume to be controlled (5.2 - 5.1)			m <sup>3</sup> for the site				
5.4	(4.4)	m <sup>3</sup> m <sup>3</sup> m <sup>3</sup>						
-	Attenuation	m <sup>3</sup>						
-	Separate area designated as long term storage <sup>(15)</sup>			m <sup>3</sup>				
5.5	Total volume control (sum of inputs for 5.4)			m <sup>3</sup> (17)				
6.0	Site storage volumes (full infiltration only)							
6.1	Storage - 1in 30 year plus CCA (8)		$m^3$	m <sup>3</sup> /m <sup>2</sup> (of developed impermea	able area)			
	- (11)		2	2 0				

 $m^3/m^2$ 

 $m^3$ 

6.2

Storage - 1 in 100 year plus CC (11)



### SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

### **Design Inputs**

Proposed site use

Pollution hazard category (see C753 Table 26.2)

Method of risk assessment (see C753 Table 26.1)

Infiltration screening risk assessment required

Are very high pollution risk areas present on site (define use)

High risk area defined as area storing fuels chemicals, refuelling area, washdown area, loading bay.

### **Design Outputs**

List order of SuDS techniques proposed for treatment

Note that gully pots, pipes and tanks are not accepted by Essex LLFA as a form of treatment (for justification see C753 Section 4.1, Table 26.15 and Box B.2)

Infiltration screening risk assessment score C753 Table 26.5

Are very high pollution risk areas drained separate from SuDS to foul system



### SuDS Water quantity and Quality – LLFA Technical Assessment Proforma

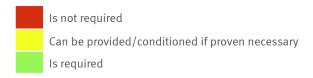
### **Notes**

- 1. All area with the proposed application site boundary to be included.
- The site area which is positively drained includes all green areas which drain to the SuDS system and area of surface SuDS features. It excludes large open green spaces which do not drain to the SuDS system.
- 3. Impermeable area should be measured pre and post development. Impermeable surfaces include, roofs, pavements, driveways and paths where runoff is conveyed to the drainage system.
- 4. Predevelopment use may impact on the allowable discharge rate. The LLFA will seek for reduction in flow rates to GF (Essex SuDS Design Guide).
- 5. Runoff may be discharge via one or more methods.
- 6. Sewers for Adoption 6<sup>th</sup> Edition recommends a Cv of 100% when designing drainage for impermeable area (assumes no loss of runoff from impermeable surfaces) and 0% for permeable areas. Where lower Cv's are used the applicant should justify the selection of Cv.
- 7. It is Essex County Council's preference that discharge rates for all events up to the 1 in 100 year event plus climate change are limited to the 1 in 1 greenfield rate. This is also considered to mitigate the increased runoff volumes that occur with the introduction of impermeable surfaces. If discharge rates are limited to a range of matched greenfield flows then it is necessary to provide additional mitigation of increased runoff volumes by the provision of Long-term Storage.
- 8. Storage for the 1 in 30 year must be fully contained within the SuDS components. Note that standing water within SuDS components such as ponds, basins and swales is not classified as flooding. Storage should be calculated for the critical duration rainfall event.
- 9. Runoff generated from rainfall events up to the 1 in 100 year will not be allowed to leave the site in an uncontrolled way. Temporary flooding of designated areas to shallow depths and velocities may be acceptable.
- 10. The following information should only be provided if increased runoff volumes are not mitigated by limiting all discharge rates back to the greenfield 1 in 1 year rate.
- 11. Climate change is specified as 40% increase to rainfall intensity, unless otherwise agreed with the LLFA / EA.
- 12. To be determined using the 100 year return period 6 hour duration rainfall event.
- 13. Where Source Control is provided Interception losses will occur. An allowance of <u>5mm rainfall depth</u> can be subtracted from the net inflow to the storage calculation where interception losses are demonstrated. The Applicant should demonstrate use of subcatchments and source control techniques.
- 14. Please refer to Rain harvesting BS for guidance on available storage.
- 15. Flow diverted to Long term storage areas should be infiltrated to the ground or discharged at low flow rate of maximum 2 l/s/ha.
- 16. Careful consideration should be used for calculations where flow control / storage is likely to be influenced by surcharged sewer or peak levels within a watercourse. Outlets can be tidally locked where discharge is direct to estuary or sea. Calculations should demonstrate that risk of downed outlet has been taken into consideration. Vortex controls require conditions of free discharge to operate as per specification.
- 17. In controlling the volume of runoff the total volume from mitigation measures should be greater than or equal to the additional volume generated.



SuDS Design Guide. 2019

## What we require and when



With any stage of the application, we would expect submission of all relevant documents from the previous stages. This would help give a full overview of the history of the application and will help the review process.

Outline	Reserved Matters	Full	Discharge of Conditions	Documents Required
Preliminary information is acceptable				The LLFA required <b><u>Pro Forma</u></b>
				Flood Risk Assessment (as required in the NPPF)
				Drainage strategy (this can be included within the FRA)
				Preliminary layout drawings showing exceeding routing, and location of discharge points
				Preliminary landscape proposals
				Preliminary Ground investigation report, to show potential viability of infiltration
				Evidence of third-party agreement for discharge to their system (in principle/consent)
				Detailed storage calculations
				Detailed drainage network calculations
				Detailed development layout
				Detailed landscape proposals
				Detailed flood and drainage design engineering drawings
				Full structural, hydraulic and ground investigations, including detailed infiltration testing in line with BRE365, groundwater level
				Development management and construction phasing plan
				Maintenance program and on-going maintenance responsibilities



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## **Minor responses**

As LLFA we are now looking to provide comments on minor applications, applying slightly less stringent criteria than we do for major applications. As we have been consulted, we are assuming that there is a potential flood risk on site, therefore we are considering the impact of increased run off rates. The cumulative impacts of minor developments can increase flood risk in an area. Current processes for assessing major applications cannot be applied in the same way to minor applications as reduced orifice sizing to meet the greenfield 1 in 1 rate can increase the risk of blockages and therefore flood risk.

Minor sites must minimise the areas of hardstanding, and where hard surfaces are necessary unlined permeable paving should be used. This allows any infiltration potential on the site to be utilised, reducing off-site run off. This is in line with the drainage hierarchy if water re-use is not possible on the site. If the site is directing water to a single point of infiltration, then we would need to see infiltration testing for that location. However, if the water is being distributed evenly across the site as the rain lands on the ground then we do not require infiltration testing as it is mimicking natural processes.

Information regarding existing surface water risk at the site must be submitted in order for us to make a complete assessment of potential flood risk on the site. Discharge rates must be limited to the 1 in 1-year greenfield rate or 11/s, whichever is greater. The required storage volume and run off for the site can be calculated using the **UK SUDS website**. A 10% allowance for urban creep should also be included when calculating the required storage. Where it is not possible to meet the 1 in 1-year greenfield rate, rainwater re-use should be used to reduce the run off rate from the site. It must be demonstrated why this is not feasible if it is not proposed. Please refer back to the section on rainwater re-use for more information.

All water must have sufficient treatment before leaving the site in line with the Simple Index Approach of the **Ciria SUDS Manual C753**. The use of above ground features is preferable in order to provide treatment on site, and to provide biodiversity and amenity benefits. A maintenance plan detailing the maintenance arrangements of the SUDS features must be submitted including who is responsible for different elements of the surface water drainage system and the maintenance activities/frequencies.

A drainage plan must be submitted which includes the site layout, location of features, outfall location and conveyance. The drainage plan must also consider exceedance flows to ensure potential off-site flooding is managed. Engineering drawings of the components being used within the scheme should also be included.



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### What we offer

### SuDS Planning Advice

We strongly recommend the use of our SuDS Planning Advice service. We suggest that you use the SuDS Planning Advice service as early on in the planning process as possible in order to avoid complications and unnecessary delays. Despite best being utilised at the beginning, this service can be used at any stage during the planning application process.

We understand that each application is unique and encounters its own difficulties and challenges, that's why we offer a range of varying services to meet your requirements.

The SuDS Planning Advice Service can:

- indicate whether your SuDS drainage proposal would be unacceptable, saving you the cost of a formal application;
- reduce the time you spend on developing a SuDS drainage strategy;
- confirm all relevant information is included within your SuDS drainage strategy;
- save you time and avoid any unnecessary delays during the planning application process.

To apply for SuDS planning advice, please complete our Flood and Water Management Products and Service Application form. As part of your application, we would require supporting documentation to improve our understanding of your development and maximise the benefits of your planning service. The documents will differ on a case by case basis, but can include:

- A drainage plan, layout or proposal
- A location map
- A site plan
- A draft Flood Risk Assessment (FRA)
- A summary of the site restrictions

To apply for our SuDS Planning Advice service please follow the below link: https://flood. essex.gov.uk/new-development-advice/ apply-for-suds-advice/

### Flood Information Request

We can also provide information on flood and water management in the form of either basic or detailed requests.

#### **Basic Requests**

When you make a basic request, we will provide you with all historic flood incidents relating to your site along with any known watercourse issues in the area.

We will also confirm whether your site falls within a Critical Drainage Area (CDA) and if we have carried out any flood investigations within a 5-mile radius.

Examples of information available through a basic request include:

- Sites at risk of flooding as identified on the Essex County Council flood map.
- Surface Water Management Plans (SWMP) for different areas located on the map.
- Critical Drainage Areas in Essex.
- Records of historic flood incidents.
- Information about property flood incidents.
- Highway flood incidents we have recorded.
- Flood investigations we have conducted.
- The types of assets on our asset register.
- The types of watercourses in Essex.
- Designated assets.

#### **Detailed Requests**

When you make a detailed request, we will provide you with the above information along with any engineer or judgement or commentary on that particular request plus:

- Information about timing;
- Results of reported incidents and;
- Information on rainfall patterns and flooding events. For example, date, time, intensity and location.

To submit a flood information request please follow the below link: <a href="https://flood.essex.gov.uk/know-your-flood-risk/make-an-information-request/">https://flood.essex.gov.uk/know-your-flood-risk/make-an-information-request/</a>

## Guidance on an ordinary watercourse consent

The SuDS team do not comment on watercourse consents. They must be dealt with by the appointed Ordinary Watercourse Consent Engineer. Ordinary watercourse consent forms a separate application.

To apply for ordinary watercourse consent please use the following link: <a href="https://flood.essex.gov.uk/maintaining-or-changing-a-watercourse/apply-for-a-watercourse-consent/">https://flood.essex.gov.uk/maintaining-or-changing-a-watercourse/apply-for-a-watercourse-consent/</a>

You can contact us to check if you need consent for your development or whether it could affect the flow of water in an ordinary watercourse. If you do need consent, you will need to:

- Fill in the watercourse consent application form and show that your work will not have a negative effect on the environment or flood risk.
- Attach any required documents such as drawings.
- Make a payment of £50 per structure.

Within the application we will require certain information, and includes:

- A description of your development. We would like you to tell us the purpose of the development / works and the number of structures you need consent for.
- Reasons for it to be built. Please ensure that all proposed works are in line with our Culvert Policy. Please not that applications made for the purpose of gaining garden space will most likely be rejected.

- Construction details. Is your structure permanent or temporary? We will need details of when you plan to carry out the work and how long it will take.
- Planning approvals. You'll need to provide details of planning permissions you may have or are applying for that relate to your development.
- Information on the maintenance of the structure. You must tell us in your application who will be responsible for maintaining the structure during development and after.
- Information on the effect of the watercourse on the environment. We will consider the effects your structure may have on the environment. We will need detailed evidence that shows the impact on the environment and you may need to include an Ecological Statement.
- An assessment to make sure you are meeting the terms of the Water Framework Directive (WFD). Your development proposal must meet the terms of the Water Framework which protects watercourses and wildlife that live in them.

We also need detailed information on the design proposals and methodology to include:

- 1. Site location plan highlighted in Red.
- 2. Site as existing prior to development.
- 3. Plans and drawings showing all of the structures, Location and the adjacent watercourse.
- 4. Sections for the drawings.
- 5. Photographs.
- 6. Flood maps.

Essex County Council also offers a pre-app service for ordinary watercourse consent. This is a 1-month process and will require a description of your development and reasons for it to be built. It would also be beneficial to include:

- A site location plan highlighted in Red
- A plan showing the site as existing prior to development
- Plans and drawings showing proposed structures, location and the adjacent watercourse
- Photographs

Flood maps

The ordinary watercourse consent form can be found on this link <a href="https://flood.essex.gov.uk/maintaining-or-changing-a-watercourse/">https://flood.essex.gov.uk/maintaining-or-changing-a-watercourse/</a>
apply-for-a-watercourse-consent/



## Microdrainage for sites in Essex: Guide on input parameters and required outputs

This document is intended for those applicants proposing to submit MicroDrainage (MD) designs and outputs as part of planning applications for sites within Essex. It will specifically detail the appropriate parameters and settings to use in order to meet the requirements of the Essex Sustainable Drainage Design Guide (2019). In doing so this will allow for the more efficient processing of applications and reduce the likelihood of comments and questions being returned and minimise the risk for design changes to be required.

This document will be given in the form of screenshots from MD (version 2018.1) with correctly completed information to allow for maximum clarity.

The following key MD parameter input stages will be covered:

- Network / System 1: Design Criteria
- Network / System 1: Simulation Criteria
- Network / System 1: Seasonal Return Period Wizard
- Source Control: Global Variables
- Source Control: Rainfall Network Details

- Source Control: Rural Runoff Calculator: ICP SuDS
- Source Control: Quick Storage Estimate

Parameters and the specific values that are required to be used to meet the Essex requirements are given in **RED**. Values that are advised but can be changed from the recommended figures are given in **BLUE**. All other values should be left as defaults. Justification will need to be provided where advised values are changed from those suggested and also where parameters not specifically referred to are changed from their defaults.

Details on the specific outputs Essex Council Councils' SuDS Team require to a assess applications will also be given for the following:

- System 1 (drainage network designs)
- Source Control: Storage Design

Pre-application advice can be sought from the SuDS Team at any stage of the development process and it is strongly recommended that this be considered if applicants have any questions or concerns regarding designs and their potential to meet requirements.

## This section details the input parameters and variable values necessary to design a drainage system that will meet the required Essex SuDS standards.

## Network/System 1: Design Criteria

When starting a system design in Network or System 1 the 'Design Criteria' dialogue box automatically pops up. If not, or if changes are required, the dialogue box can be found at the top of the 'Network' drop down box in the command bar. The below screenshot shows parameters correctly completed for Essex, excluding the site-specific rainfall parameters, with further details on the required and recommended parameters listed below:

**UK Rainfall:** It is advised that FSR rainfall is used unless FEH data has been purchased for the site.

**Return Period:** Should be set to 1 year as a default.

**Map:** For FSR Rainfall only. The exact site location should be selected using the in-built map. Justification and supporting evidence should be provided if manual values are entered.

**Global Time of Entry (mins):** Should be set to 5 minutes as a default.

Max. Rainfall (mm/hr): Should be set to the

maximum enterable value of 550 mm/hr. This caps the maximum rainfall intensity able to enter a system so if a modelled storm has an intensity higher than the input value then all water above this is lost. Whilst few events exceed this, an only for short periods when they do (meaning the volume lost by capping is small), it can still lead to water being unaccounted for. Therefore it is recommended that the maximum value be entered to avoid this. Justification and details must be provided if values less than 150 mm/hr are used.

Volumetric Run-off Coeff: This can be left as the default value but it is preferred to set it to 1 to remove any losses between rainfall landing and

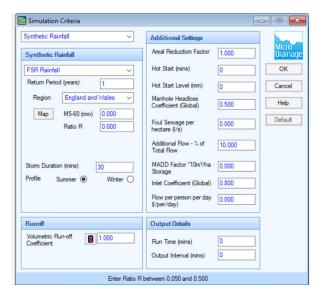
Additional Flow/Climate Change: This should be used to set an appropriate value for urban creep, accepted as 10%. Climate change values should not be entered here

reaching the drainage network.



## Network / System 1: Simulation Criteria

'Simulation Criteria' can be found from the 'Site' drop down box and gives the base variables for modelling storm events on a designed system. The below screenshot shows parameters correctly completed for Essex, excluding the site-specific rainfall parameters.



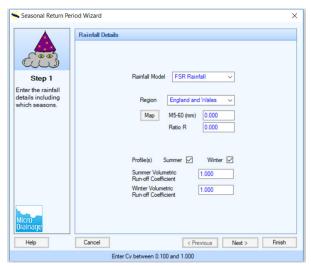
**Synthetic Rainfall:** It is advised that FSR rainfall is used unless FEH data has been purchased for the site.

**Volumetric Run-off Coefficient:** This can be left as the default value but it is preferable to set it to 1.

**Areal Reduction Factor:** Should be left as the default value of 1 unless a site is of a significant size.

Additional Flow - % of Total Flow: This should be used to set an appropriate value for urban creep, accepted as 10%. Climate change values should not be entered here.

MADD Factor: This must be set to o.

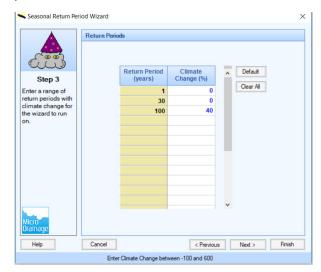


### Network / System 1: Seasonal Return Period Wizard

The following screenshots set out the parameters that should be entered when modelling the impacts of storms on a designed system using the seasonal return period wizard. **Summer Volumetric Run-off Coefficient:** This can be left as the default value but it is preferable to set it to 1.

Winter Volumetric Run-off Coefficient: This can also be left as the default value but it is preferable to set it to 1.

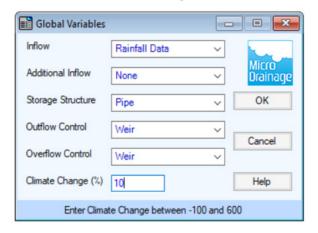
Climate change percentage (40%) should be entered here and only when modelling the 100 year storm.



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**Variables** 

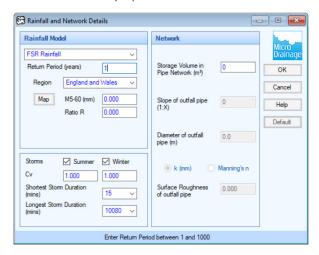
# When initially opening Source Control the following dialogue box appears. Most inputs will vary by site depending on the specific storage structures and outlets being utilised.



**Climate Change:** This should be used to set an appropriate value for urban creep, accepted as 10%. Climate change values should not be entered here.

## Source Control: Rainfall and Network Details

After clicking 'OK' on the above 'Global Variables' box the 'Rainfall and Network Details' box automatically opens.



**UK Rainfall:** It is advised that FSR rainfall is used unless FEH data has been purchased for the site.

**Return Period:** Should be set to 1 year as a default.

**Map:** For FSR Rainfall only. The exact site location should be selected using the in-built map. Justification and supporting evidence should be provided if manual values are entered.

**Cv:** These can be left as the default values but it is preferable to set the values for both summer and winter storms to 1.

**Storage Volume in Pipe Network (m3):** This must be set to o. If pipes have been deliberately oversized to provide storage this volume will be taken account of in the modelling and this value should still be set to o.

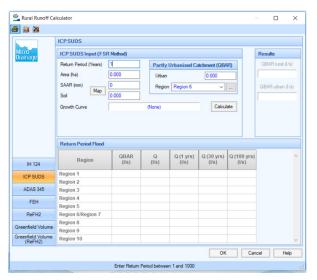
## Rural Runoff Calculator: ICP SuDS

The Rural Runoff Calculator can be found from the 'File' command bar within the Source Control Module. Unless FEH data has been purchased for the site it is recommended that greenfield runoff rates be calculated using the ICP SuDS method.

The IH124 method can also be used, and requires the same parameters as the ICP SuDS method, however all sites less than 50ha must

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be scaled appropriately by calculating runoff for a 50ha site and multiplying by the result by the site area divided by 50. Note that the Q (1yrs) (l/s) pre-development runoff values are required to be met by developments in Essex for greenfield sites. For brownfield sites a 50% betterment must be achieved and therefore rates cannot exceed 50% of the calculated pre development runoff rate.



**Area (ha):** Must be the total pre-development site area, in hectares.

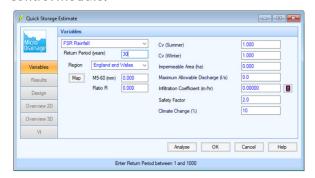
**Urban:** This must be set to o to allow

calculations for an undeveloped site.

**Region:** This must be set to Region 6. This can be input by selecting from the drop down box or by clicking Essex on the map from the '...' button.

### Source Control: Quick Storage Estimate

The Quick Storage Estimate can be found from the 'File' command bar within the Source Control Module.



**UK Rainfall:** It is advised that the FSR rainfall is used unless FEH data has been purchased for the site.

**Return Period:** Should be set to an appropriate value to size the storage, most likely 30 or 100

to meet NPPF requirements.

**Map:** For FSR Rainfall only. The exact site location should be selected using the in-built map. Justification and supporting evidence should be provided if manual values are entered.

Cv (Summer): This can be left as the default value but it is preferable to set it to 1.
Cv (Winter): This can also be left as the default value but it is preferable to set it to 1.

- This is the 1 in 1 year greenfield runoff rate calculated for the site. If the 'Rural Runoff Tool' is not utilised the value should be determined from another appropriate source and iustification and evidence of the calculations provided. For brownfield sites a 50% betterment is required and therefore discharge rates cannot exceed 50% of the calculated 1 year rate. Infiltration Coefficient (m/hr): Only values calculated from site infiltration testing should be input here. A specific value can be entered manually or a rate can be calculated by clicking on the calculator to the right and entering the appropriate site test result values. Generic infiltration rates based on publicly available soil and geology data can be used for outline applications and these values and information sources must be clearly stated.

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**Climate Change:** This should be used to set an appropriate value for urban creep, accepted as 10%. Climate change values should not be entered here.

**Safety Factor:** An appropriate value should be entered here, most likely 2. Safety Factors should align with the contents of the Table 25.2 in section 25 of the CIRIA C753 SuDS Manual, however in Essex it has been agreed that a factor of 10 for infiltration structures has a significant impact on sizing and therefore a value of 2 can be used instead of this.

### Outputs

This section provides details on the specific outputs that can be included with planning application submissions to allow the drainage to be appropriately assessed. The listed outputs are the minimum that will be accepted. Whilst additional outputs can be included please note that these will require additional time to assess and therefore may delay an application. Relevant outputs can be selected and generated by clicking 'File' and then 'Print'.

### Network / System 1

Within the print dialogue box the following information must be provided for each of the listed sub sections:

#### Model:

- Design Criteria
- Network Details
- Manhole Schedule
- Area Summary
- Outfall Details
- Simulation Criteria
- Online Controls

- Offline Controls (if these exist within the design)
- Storage Structures

#### Results:

Summary of Results (for critical storm). The default print style should be used and results should be provided for the 1:1, 1:30 and 1:100 plus 40% climate change storms.

#### Drawing:

A pdf drawing should be provided showing the layout of the drainage system/s with the pipe and manhole numbers clearly labelled. The locations of all storage and attenuation features should also be clearly shown.

### **Source Control: Storage Design**

Summary of Results (for all modelled events). Separate outputs should be provided for all storage features with half drain times for those incorporating infiltration. Calculations showing how these were reached must also be included.

This document is issued by:
Sustainability and resilience
Flood and Water Management Team
Place Services
Essex County Council

### Contact us:

floods@essex.gov.uk www.essex.gov.uk/flooding 0345 743 0430

Flood and Water management Team
Essex County Council
County Hall
Chelmsford
Essex CM1 1QH



The information contained in this document can be translated, and/or made available in alternative formats, on request.

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