

Drainage Calculations Guide

A guide for the provision of drainage designs and supporting information for development sites.

Introduction

This document is intended for those applicants proposing to submit designs and modelling outputs as part of planning applications for sites within Derbyshire.

The document focuses solely on variables so that the outputs from all drainage design software can be submitted. It will specifically detail the appropriate parameters and to use in order to meet the requirements of the LLFA. 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 asked for.

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.

SuDS Planning advice can be sought from the Flood Risk Management Team at any stage of the development process and it is recommended that this be considered if applicants have any questions or concerns regarding designs and their potential to meet standards.

CV Value

A CV value of 1 should be used for sites where the majority of the site area is impermeable. It is expected that a newly developed site should be designed in a way where no surface water can collect and pool unintentionally in areas of depressions or cracks. If large areas of a site are permeable it should be considered whether these large areas will contribute to the positive drainage system. If they do not then an equivalent area should be removed from calculations associated with site runoff.

HR Wallingford have addressed the incorrect use of 84% as a runoff coefficient value on their UKSUDS [website](#) stating that "This approach was justified in a paper in the 1990s based on the original runoff model in the Wallingford Procedure which was issued in 1983. This justification is a misuse of the correlation equation which had been developed and has since which been rendered obsolete based on the fact that the original equation was shown to under-predict runoff for large rainfall events."

Input parameters and system design settings

This section details the input parameters and variable values necessary to design a drainage system that will meet the LLFA's SuDS standards.

M5-60 (mm) and Ratio-R: For software including in built mapping the exact site location should be selected. Where manual location values are entered supporting evidence should be provided to demonstrate the correct location and values have been used.

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

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

Maximum Rainfall Rate (mm/hr): Should be set to the maximum value the software allows. This parameter can cap 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, and 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 Coefficient (CV): This should be set to 1 unless you can provide justification for using a different value as this will remove any losses between rainfall landing and reaching the drainage network.

Minimum Backdrop, Cover Depth and Pipe Flow: This should be set based on conversations and agreements with the body adopting the drainage post completion.

Additional Flow/Climate Change: This should be used to set an appropriate value for urban creep, accepted as 10% of roof areas only. Climate change values should not be entered here. Alternatively, a 10% urban creep allowance on roof areas can be added to the overall site area, however it should be clear within the text that this has been done.

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

MADD Factor: This must be set to 0. The default value assumes that 20m³ of water is lost between hitting the ground and reaching the drainage network. The value has been determined from real world developments where storage is created from things such as localised depressions and cracks in paved surfaces. For new developments these should not exist so to avoid underestimating volumes entering the drainage network this value should be set to 0.

Storage Volume in Pipe Network (m³): This must be set to 0. 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 0.

Storm Modelling

The following parameters should be used when modelling the designed drainage system to check performance during different return period events. Matching system design values should be used where required.

Summer Volumetric Run-off Coefficient (Cv): Set to 1 unless you can justify otherwise.

Winter Volumetric Run-off Coefficient (Cv): Set to 1 unless you can justify otherwise.

Modelled Storms: System performance should be modelled for the 1-, 30- and 100-year return period storms.

Climate Change Values: Appropriate climate change values are required to be included for the 30 year and 100 year return period storms.

Infiltration Coefficient (m/hr): Only values calculated from site infiltration testing should be input. 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.

Safety Factor: An appropriate value should be entered here. For infiltration features, the Safety Factor is most likely to be 2 for individual property soakaways. If a feature is designed to infiltrate surface water from a large area of the site, Safety Factors should align with those outlined within the contents of Table 25.2 in section 25 of the CIRIA C753 SuDS Manual. Justification should be given for any Safety Factors used.

We are aware that some Safety Factors can lead to significant feature sizing which can result in the viability of these features or the use of infiltration being compromised. Where this is the case, we would be willing to consider additional mitigation, such as high-level cut offs and/or exceedance routings to minimise the risk to downstream properties and infrastructure. This would consequently allow for a lower Safety Factor to be considered.

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. They can be provided as pdf documents or excel tables.

The listed variables are the minimum that should be included to meet the requirements of the Design Guide. Please note that failure to provide certain aspects, or failure to include sufficient detail, will result in questions and requests for further information, which will likely cause delays. Whilst additional outputs can be provided, please be aware that these will require additional time to assess and could cause avoidable delays.

The following aspects should be appropriately covered within the outputs to allow them to be assessed:

- Design criteria and input variables
- Drainage network details
- Manhole schedule
- Area summaries
- Outfall details
- Modelled storm details and simulation criteria
- Online flow control structure details
- Offline control structure details (if these exist within the design)
- Summary of results for critical storms. Results should be provided for the 1yr, 2yr (for gradients of 1% or less), 30yr plus X% climate change (site specific %) and 100yr plus 40% climate change storms.
- Greenfield runoff rate calculations
- Storage calculations
- Storage feature details
- A pdf drawing should be provided at an appropriate scale showing the layout of the drainage system/s with the pipe and manhole numbers clearly labelled to allow cross-referencing. The locations of all storage and attenuation features must also be clearly shown. Pipe lengths and gradients must be annotated on to drawings.