

# GEOSMART SUDS INFILTRATION SUITABILITY MAP

## Notes to accompany SD50 Version 1.0

GeoSmart SD50 provides an assessment of the capacity of the ground to receive infiltration depending on the nature, thickness and permeability of the underlying material and the depth to the high groundwater table. The map uses data from the BGS and GeoSmarts unique groundwater model.

Property professionals must assess the feasibility of infiltration SuDS at an early stage in support of the site development process. This will allow outline site assessment of the cost implications and initial master planning of the development prior to the requirement for detailed design. Lead Local Flood Authorities also need clear guidance on the site suitability for infiltration SuDS when they are assessing proposed developments.

The GeoSmart SuDS Infiltration Suitability Map (SD50) provides screening level information on the potential of using infiltration systems to manage rainfall runoff at a site, and an indication of where infiltration systems can be located given the distribution of geological and hydrological conditions. It is designed to support property developers in understanding the types and possible configurations of infiltration systems that may be deployed at a site.

GeoSmart Information delivers insight on environmental risk and suitability for property development and infrastructure at a range of scales and risk resolutions to meet client requirements. For further details, visit our web site [www.geosmartinfo.co.uk](http://www.geosmartinfo.co.uk).

### What are SuDS?

Government policy for England is to introduce sustainable drainage systems (SuDS) via conditions in planning approvals. SuDS are designed to replicate, as closely as possible, the natural drainage from the Site (before development). Guidance indicates that capturing rainfall run-off on site and infiltrating it into the ground (infiltration SuDS) is the preferred method for managing surface water without increasing flood risk downstream. SuDS can significantly improve the quality of water leaving the Site and can enhance the amenity and biodiversity that a site has to offer. SuDS should be designed to maximise the opportunities and benefits that can be secured from surface water management. For more detailed information see The SuDS manual (C753) from CIRIA.

## Drainage Hierarchy

Generally, the aim of drainage in any development should now be to discharge surface water runoff as high up the following hierarchy of drainage options as reasonably practicable:

- into the ground (infiltration);
- to a surface water body;
- to a surface water sewer, highway drain, or another drainage system;
- to a combined sewer.

Options for the destination for the run-off are set out in the Building Regulations Part H document (HM Government, 2010) and DEFRA's Draft National Standards for SuDS (2011).

## Infiltration SuDS

The greatest benefit to general flood risk is if all run-off is infiltrated on site, however, this may not be feasible due to physical and economic constraints in which case infiltration may be considered as a part of an integrated drainage solution. The final design capacity for an infiltration SuDS system depends on the site constraints and the requirements of the individual Planning Authority and the Lead Local Flood Authority.

The capacity of the ground to receive infiltration depends on the nature, thickness and permeability of the underlying material and the depth to the high groundwater table. The final proportion of the site drained by infiltration will depend on topography, outfall levels and a suitable drainage gradient. It is important to note that, even if the whole site cannot be drained by infiltration, the use of partial infiltration is encouraged, with the remainder of run-off discharged via other SuDS systems.

A wide range of infiltration components can be deployed at a site, including soakaways, infiltration trenches, infiltration basins, and infiltration blankets, and the selection of a component is based on the rate of runoff it can accommodate, as well as on the available area and planned land use at the site.

## Infiltration Potential

Infiltration components are installed to manage significant volumes of runoff from a drainage area that usually exceeds their footprint, and to accommodate large storm events, with the 1 in 10 year storm generally being the minimum design standard. Infiltration SuDs are therefore designed to receive rainfall runoff at a greater rate than they can discharge via infiltration, and store the excess runoff allowing it to infiltrate gradually into the surrounding material. The rate at which they can discharge runoff via infiltration is a function of their internal surface area across which infiltration occurs and the infiltration capacity of the soil, a hydraulic property which is closely related to its permeability.

The rate of runoff that can be managed by an infiltration component is therefore a function of its storage capacity, the surface area across which infiltration can occur, and the infiltration capacity of the soil. The dimensions and construction of an infiltration component, which determine its storage capacity and the area across which infiltration can occur, are usually adjustable design parameters. However, given physical and economic constraints on the construction of an infiltration component, the infiltration capacity of the soil is considered to be the primary constraint on whether an infiltration system can be deployed at a site. Given sufficient infiltration capacity, two other conditions must be met to ensure that the infiltration system can discharge runoff effectively: the soil into which

infiltration occurs must be unsaturated (the base of the infiltration system should be 1m above the seasonally high groundwater level, CIRIA 2015), and the permeable formation(s) receiving the infiltrated runoff must be of the sufficient thickness and extent to disperse the water effectively.

The GeoSmart SuDS map provides an assessment of the potential for infiltration SuDS at a site based on the evaluation of these key hydrogeological constraints.

### Map Description

In response to the need for national-scale information to support sustainable drainage and land-use planning, GeoSmart have produced the SuDS Infiltration Suitability Map (SD50) for preliminary site assessment. In producing the map, GeoSmart used data from the British Geological Survey on groundwater levels, geology and permeability to screen for areas where infiltration SuDS may be suitable.

The map classifies the cells of a 50m grid covering England, Wales, and Scotland into one of three categories: High Potential, Moderate Potential, and Low Potential for Infiltration SuDS. The classification is based on the likelihood that the geological layer closest to the surface in each cell will have a sufficiently high infiltration capacity to allow the successful installation of an infiltration system. Where this surface most stratum consists of a thin layer of superficial deposits, information on the permeability of underlying bedrock is also used in the classification. A final adjustment to the classification is made for cells where the seasonally high water table may approach the base of a typical infiltration component (e.g. typical soakaway with base at 2m depth).

The map classifies areas into 3 categories of High, Medium and Low suitability for infiltration SuDS which can then be informed by additional data on site constraints to give recommendations for SuDS and further investigation.

The primary constraint on infiltration potential is the minimum permeability of the underlying material and in some cases the range in permeability may be considerable, ranging down to low. The map classifies these areas as moderate infiltration suitability requiring further investigation. In cases where the thickness of the receiving permeable horizon is less than 2 meters then additional site investigation is recommended. It is noted that in some circumstances an infiltration system utilising a deep borehole that penetrates overlying low permeability layers may be considered. These systems lie outside the scope of the SuDS infiltration map and would require a cost benefit analyses and a site specific assessment.

The SuDS map incorporates unique data on groundwater flooding from the Geosmart groundwater flood risk map. A modification to the infiltration potential is applied to all cells where seasonal high groundwater levels may approach the surface, to reflect the uncertainty that a sufficient depth of unsaturated soil occurs below the base of the soakaway system. These cells are identified using information from the GeoSmart Groundwater Flood Risk map, which is based on a map of high groundwater levels produced from a combination of BGS and other third party datasets and in house modelling. As the mapped groundwater levels are estimated to have an annual probability of approximately 1% (a return period of 1 in 100 years), they are used to conservatively identify areas where the seasonally high water table may approach the base of an infiltration system. For these areas, site-specific assessment is especially recommended to ensure that the water table remains below the base of the soakaway. Furthermore, a

detailed assessment of groundwater flood risk is also recommended for these areas, including whether it may be exacerbated by the infiltration system and how it may affect the functioning of the drainage scheme. In affected areas there is potential for a failure of the drainage scheme leading to on site flooding.

Infiltration systems should not be used where there is a risk of contaminating groundwater by infiltrating polluted runoff. In some cases, infiltration systems which are hydrogeologically feasible, as indicated by the GeoSmart SuDS map, may require further evaluation in relation to site layout, ground stability, groundwater contamination and flooding. These constraints should be evaluated by an experienced professional. The SuDS map may be used in conjunction with the GeoSmart SuDS report range to identify SuDS infiltration suitability, water quality and flow/volume design data.

### **Infiltration Classification**

Mapped classes combine our understanding of likelihood, model and data uncertainty. The map uses a high medium or low classification to show on a national mapping scale the areas within which infiltration may be feasible. The following 3 classes are mapped on a 50m grid covering England, Wales and Scotland.

#### **Low infiltration potential:**

There is a low potential for infiltration SuDS.

*Comments:* Infiltration SuDS are unlikely to be suitable due to the low permeability of the receiving formation.

*Recommendations:* Infiltration SuDS should be focused in more suitable parts of the site. If a site investigation confirms that infiltration SuDS are not possible then attenuation SuDS with a controlled discharge into a nearby surface water feature or existing surface water drainage is recommended.

#### **Moderate infiltration potential**

There is a moderate potential for infiltration SuDS.

*Comments:* It is likely that the permeability of the underlying material would be suitable for infiltration drainage. However, there may be constraints on the use of infiltration SuDS as a result of any of the following: a high water table, the limited thickness of the receiving formation, the potential for a significant range in permeability in the underlying geology and confirmation of the infiltration capacity is recommended.

*Recommendations:* A site investigation is recommended to investigate groundwater levels and formation thickness and to confirm that infiltration rates at the Site are sufficient to accommodate an infiltration SuDS feature. If a site investigation confirms that infiltration SuDS are possible at the Site then various options can be considered for infiltration SuDS and these include infiltration trenches, soakaways, swales, permeable pavements and infiltration basins without outlets.

#### **High infiltration potential**

There is a high potential for infiltration SuDS.

*Comments:* It is likely that the underlying geology is highly permeable and an infiltration SuDS scheme should be possible. Groundwater levels are expected to be sufficiently deep at the site.

Recommendations: A site investigation is recommended to confirm the high infiltration capacity and the depth of the winter water table. Various options can be considered for infiltration SuDS and these include infiltration trenches, soakaways, swales, permeable pavements and infiltration basins without outlets.

### Further Details

GeoSmart is an adviser on groundwater infiltration and also provides specialist reports and services to assist clients in assessing SuDS design. This experience at the leading edge of UK groundwater science ensures that our model represents best practice in this field at a pragmatic, albeit necessarily preliminary, level. However, given the various limitations of national-scale mapping and the available data which do not represent local, small-scale subsurface features that may control pathways of infiltration and groundwater flow, the map may represent 'false positives', where it suggests high infiltration potential which for local reasons or errors does not occur, and 'false negatives', where it suggests that infiltration potential is negligible when it may for similar reasons be high. Information on confidence level and ways to improve this can be provided for any location on written request to [info@geosmartinfo.co.uk](mailto:info@geosmartinfo.co.uk) or via our website.

The map should be interpreted as an initial indicative screening tool to help focus resources, but site specific assessment remains necessary prior to detailed design. GeoSmart provides a tiered range of services to assist where a more detailed assessment is required.

### User Group:

Updates to our model are on-going and additional information is being collated from several sources to improve the database and allow increased confidence in the findings. Please contact us if you would like to join GeoSmart's SuDS Infiltration User Group and help with feedback on infiltration potential and mapping suggestions. We can be reached at [info@geosmartinfo.co.uk](mailto:info@geosmartinfo.co.uk) or at +44 (0)1743 298 100.