British Geological Survey
NATURAL ENVIRONMENT RESEARCH COUNCIL

SuDS in the Thames: suitability of the ground for infiltration

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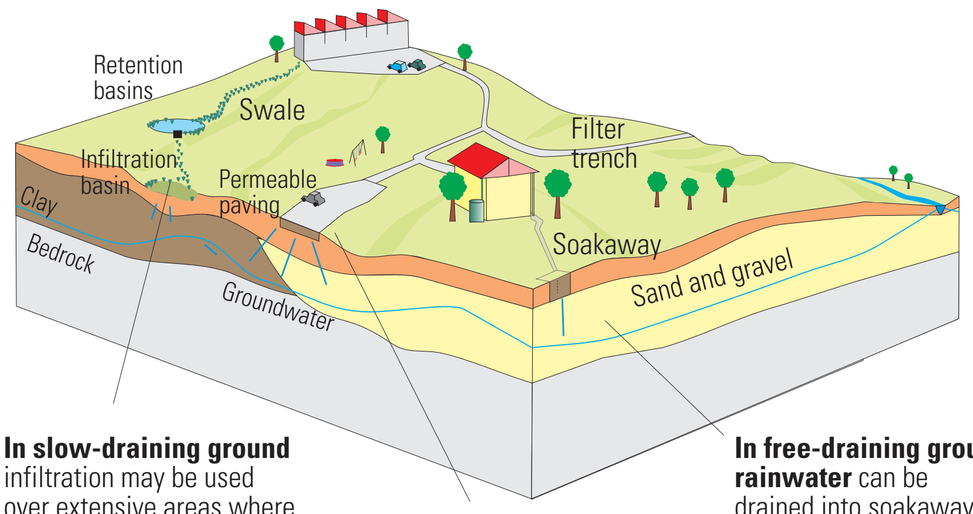
Introduction

Following large-scale flooding in 2007, the Pitt Review (Pitt, 2008) established that surface water was a primary cause of flooding. In response, the Floods and Water Management Act, enacted in 2010, includes the provision for sustainable drainage systems (SuDS), which aim to tackle this problem as well as improve water quality in rivers. A key sustainable drainage technique is infiltration to the ground; these systems utilise the storage capacity of the subsurface to attenuate rainfall and include, for example, soakaways, infiltration basins, infiltration trenches and free-draining permeable pavements (Figure 1). In the UK, the subsurface in many areas provides effective and practical opportunities for the attenuation of rainwater, however a number of considerations must be taken into account during the planning, design and installation process.

To promote these techniques, the British Geological Survey is developing a national dataset that incorporates a wealth of subsurface data necessary for preliminary desk-based site assessment.



In slow-draining ground infiltration may be used over extensive areas where temporary standing water is acceptable. Such infiltration basins are usually operated as overflow capacity for other SuDS schemes.

In moderate to free-draining ground infiltration may be effective through permeable paving, which allows infiltration over a large surface area. Permeable paving systems incorporate storage components to allow temporary water storage prior to infiltration.

In free-draining ground rainwater can be drained into soakaways that focus infiltration over a relatively small surface area.

Figure 1 The properties of the subsurface are key considerations when planning infiltration SuDS.

Infiltration-to-the-ground: what do I need to consider?

Figure 2 Collapse features around a soakaway in Bowling Green, Kentucky.

- **Is there potential for significant, infiltration-related hazards?** Focussed infiltration to the subsurface over a small fraction of the UK may lead to ground instability (Figure 2), increased flooding (Figure 3) or groundwater contamination and hence infiltration-based SuDS should be avoided in these areas.
- **Will the ground drain?** The infiltration system must be designed in accordance with ground conditions to ensure effective functioning. Key considerations include the permeability of underlying deposits and the unsaturated zone thickness.
- **Will the ground be stable?** In some geological deposits, the infiltration of water can change the properties of the ground leading, in some cases, to ground instability. Hazards include soluble rocks (Figure 4), landslides (Figure 5), compressible ground, collapsible deposits, running sands, shrink-swell clays and shallow mining.
- **Will infiltration cause deterioration in groundwater quality?** To prevent deterioration in groundwater quality, potential sources of contamination should be avoided. Sources may include contaminants within the infiltrating surface water or extant pollutants within the subsurface.

Figure 3 In areas affected by groundwater flooding (e.g. Oxfordshire), soakaways may fill naturally with groundwater.

Figure 4 Infiltration into underlying soluble rocks may result in collapses such as these in Fontwell, Surrey, which occurred following leakage from a mains water pipe (© Sealand Aerial Photography).

A national dataset: subsurface suitability for infiltration

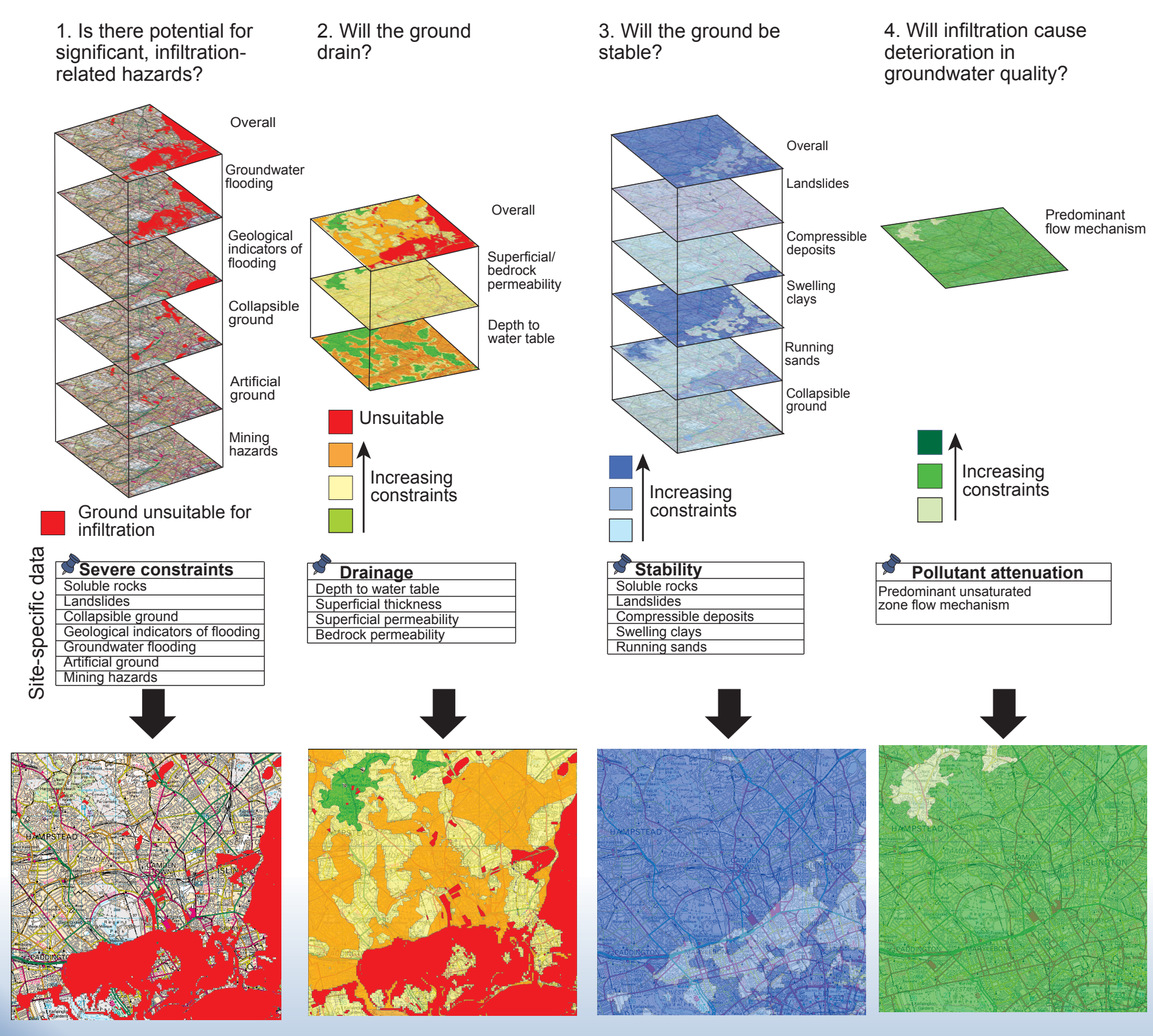


Figure 6 Demonstration of the infiltration-to-the-ground suitability dataset in the Islington and Camden Town area. OS topography © Crown Copyright. All rights reserved. 100017897/2011.

Figure 5 Example of an Infiltration basin.

The prototype national dataset provides: (i) information on ground conditions that is useful when planning to install infiltration-based SuDS schemes and (ii) subsurface information that warns the user of potential subsurface considerations that may limit the use of infiltration. The dataset guides the user through the necessary ground considerations and hence minimises the possible environmental impact of infiltration systems on the subsurface, ground stability and water quality. The dataset is intended for use prior to and alongside a site assessment; it is not a replacement for infiltration testing or site investigation. The dataset uses BGS data at 1:50 000 scale to answer the four key questions in the blue box.

The Camden Town–Islington area of the Thames Catchment was used as a test area for the prototype national dataset (Figure 6). The south-eastern section of the area is generally unsuitable for infiltration due to the susceptibility to groundwater flooding, the proximity to river deposits and the presence of collapsible and artificial ground. The central, west and north of the area are potentially suitable for infiltration, however system design may need to accommodate sub-optimal infiltration rates and groundwater levels in some areas (e.g. where London Clay is present). The foremost concern with regards to ground instability is the presence of swelling clays; these may expand and contract as a result of changes in moisture content causing ground instability. The attenuation of pollutants travelling through the unsaturated zone is likely to be moderate as a result of flow being predominantly through both fractures and the matrix; hence providing some pollutant filtration.

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Pitt, M (2008) Pitt Review: Learning lessons from the 2007 floods. HM Government.