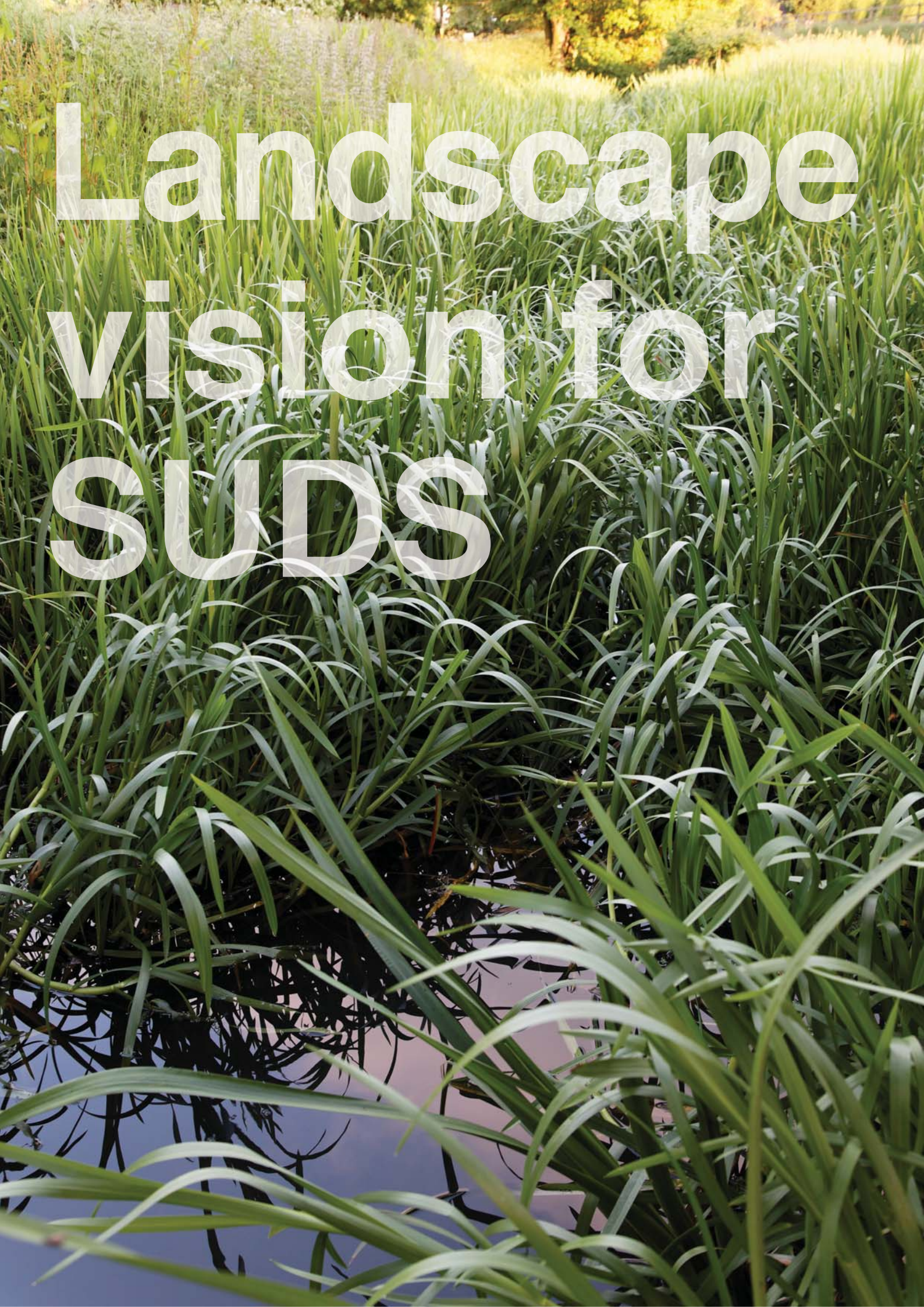




Landscape vision for SUDS

The landscape vision for SUDS

The Cambridge landscape

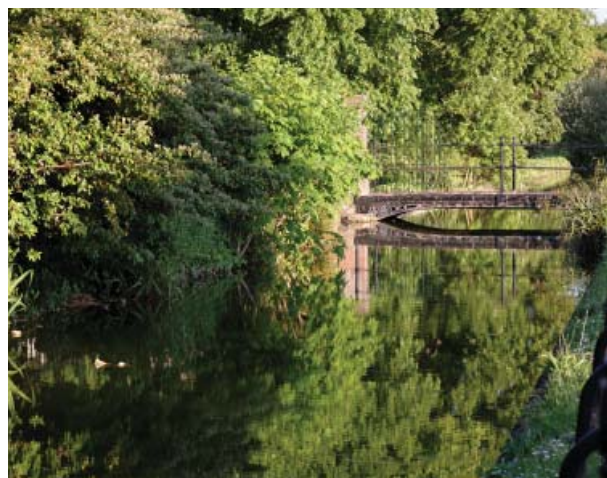
Cambridge lies at the edge of the East of England fenlands with its open, flat and low-lying landscape dissected by numerous rivers, dykes and drainage ditches. Cambridge itself has a distinct and unique local landscape character where water has always been present and has been woven into the fabric of the city by way of the River Cam, its tributaries, and its water meadows.

The city will experience considerable growth over the next decade as a result of being designated as part of one of the four national growth areas. Ensuring this growth is implemented sensitively, with due regard to the existing character of the City, and championing a high standard of design, will be paramount in protecting and maintaining the distinctiveness of the Cambridge landscape.

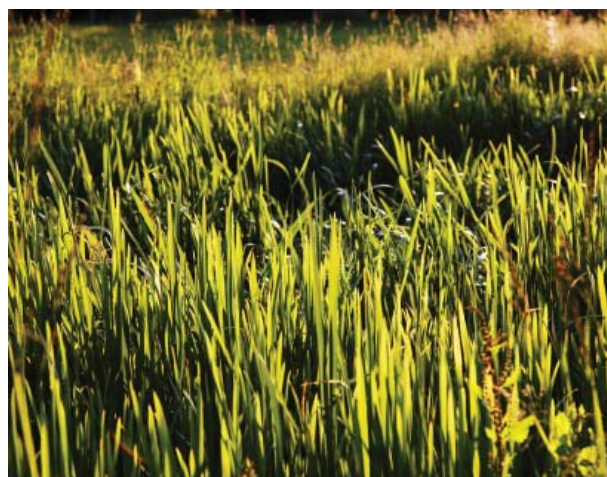
The promotion of SUDS is one measure whereby the council's aims for quality, sustainable development, work hand-in-hand with its aim to ensure that the vital character of the city is maintained and enhanced.

By using the landscape to manage rainfall and harness water in a creative way, SUDS will strengthen local distinctiveness and add value to the local environment. For this reason, it is important that design teams have a strong landscape focus.

It is important to remember that the primary and overriding function of SUDS is to drain surface water effectively, and this function must not be compromised by other design considerations. Effectiveness and quality of design must be considered together.



Hobson's Conduit – Water in the landscape in central Cambridge



Coe Fen – Wetland in central Cambridge



Wetland, The Backs, Cambridge

SUDS & landscape design

New SUDS features, based on the existing historic watercourses and features, are a most appropriate method of providing efficient drainage to new developments and will integrate these developments into the character of the city.

However, the use of SUDS will only help deliver better quality development and amenity improvements across the city, if:

- The design of SUDS has a strong landscape and urban design focus – design teams must comprise landscape and engineering disciplines;
- Reference to and consideration of the 'Cambridge Landscape Character Assessment' is undertaken at the earliest stage in the design process to enable judgments to be made to ensure that the design and execution of SUDS takes account of the existing character and achieves environmental and visual improvement;
- SUDS measures are fully integrated with the overall master plan for a development at an early stage to ensure that the maximum benefits are achieved and, most importantly, SUDS measures are not added after the key elements of the development layout have been determined. When this is achieved land-take is accounted for early and the SUDS features are invariably less costly to construct and are more effective as a drainage system. Cambridge City Council will also ensure that strategic planning of sites allow sufficient space for SUDS as part of the master planning process.
- Careful consideration is applied to the position and design of SUDS elements to ensure that they form an appropriate and integrated component of the landscape -taking into account all site constraints, including issues of access and safety. This does not cover just the general layout but also the design character and distinctiveness of schemes to ensure special landscapes are retained or established;
- The use of advanced planting is considered to enable SUDS to provide amenity and biodiversity value from the outset;

"To ensure space can be provided for SUDS, it is essential that there is early consideration at the overall concept stage."

"Developers, particularly when undertaking master plans for developments, will need to allow for sufficient land for SUDS features, as it is more difficult and costly to incorporate these once detailed design is underway."

From Planning Policy Statement 25: Development and Flood Risk, Practice Guide

Specific opportunities in Cambridge

Local character types should be used to guide the choice of SUDS features used in each scheme. Within the city there are distinct local character types, each determined by the presence of landscape features such as rivers or water meadows or particular types of built forms. The use of SUDS will help safeguard the character of rivers and their immediate floodplain, as well as improving opportunities for informal recreation and nature conservation enhancement. This is primarily provided through the creation of a variety of habitats - including rough grasslands, wildflower meadows, aquatic planting and open water. A series of SUDS elements can provide wildlife corridors, linking existing nature conservation features.

Wetlands

Historically, areas around Cambridge have comprised low lying wetlands that have been subsequently drained to allow the town to develop. The use of wetland features in SUDS provides an opportunity to replace some of this lost landscape and habitats.

Even in the confined historic core of the city, where collegiate and vernacular buildings were developed side-by-side within a tight pattern of narrow streets, there has always been watercourses and drainage features. An example of this is Hobson's Conduit which once brought drinking water into the city from fresh springs to the south of the city.

Hobson's Conduit still delivers water into the city, but not for drinking. It does this via a brook, rill and canal system, which forms open, lined watercourses.

The urban runnel or rill

Cambridge already displays some architectural water features that can be applied to SUDS design. The open rill or runnel is an effective surface conveyance feature that carries water in a shallow channel from one place to another. This can be a simple channel or ribbed paver delivering roof water to another feature or a roadside gutter taking water down the street.

Open channels can be designed to be attractive with imaginative crossing points and are always a source of interest when rain brings them to life. Although they are not commonly used in the UK in modern housing, they were a common way of dealing with surface water in many historic cities, and the Cambridge examples, demonstrate that they can be used throughout the urban fabric of urban spaces.



SUDS can replace lost wetland landscape

The urban canal

Just outside the city centre, Hobson's Conduit is a slow moving canal with a formal character that is appropriate for urban areas. It is particularly suitable for courtyards and as part of a conveyance system between urban development centres. Although the canal may have a formal design, the content of the canal can be designed with high biodiversity value with access points for wildlife along the edge.

Another famous Cambridge characteristic is its water meadows or floodplain adjacent to the River Cam, which are in parts bounded by residential developments. These water meadows are often grazed and are unique in as much as they extend into the city itself, for example Sheep's Green. Again, these are a much loved feature and typify the Cambridge landscape.



Hobson's Conduit in Trumpington Street

Specific constraints in Cambridge

A large part of Cambridge is underlain by clayey soils (Gault Clay to the west of the River Cam and Chalk Marl to the east) which will limit the opportunities to use infiltration methods such as soakaways. However, this is not always the case; in some areas there are sand and gravel deposits over the top of the clay soils that may be suitable for infiltration. In many areas there is shallow groundwater in the sand and gravels and the variation in water levels must be understood and their effect on the operation of infiltration systems allowed for.

Each site should be evaluated on its own merits by undertaking comprehensive soil Standard BS 5930: 1999, Code of practice for site investigations, including infiltration testing and groundwater level monitoring. This will identify any opportunities for infiltration.

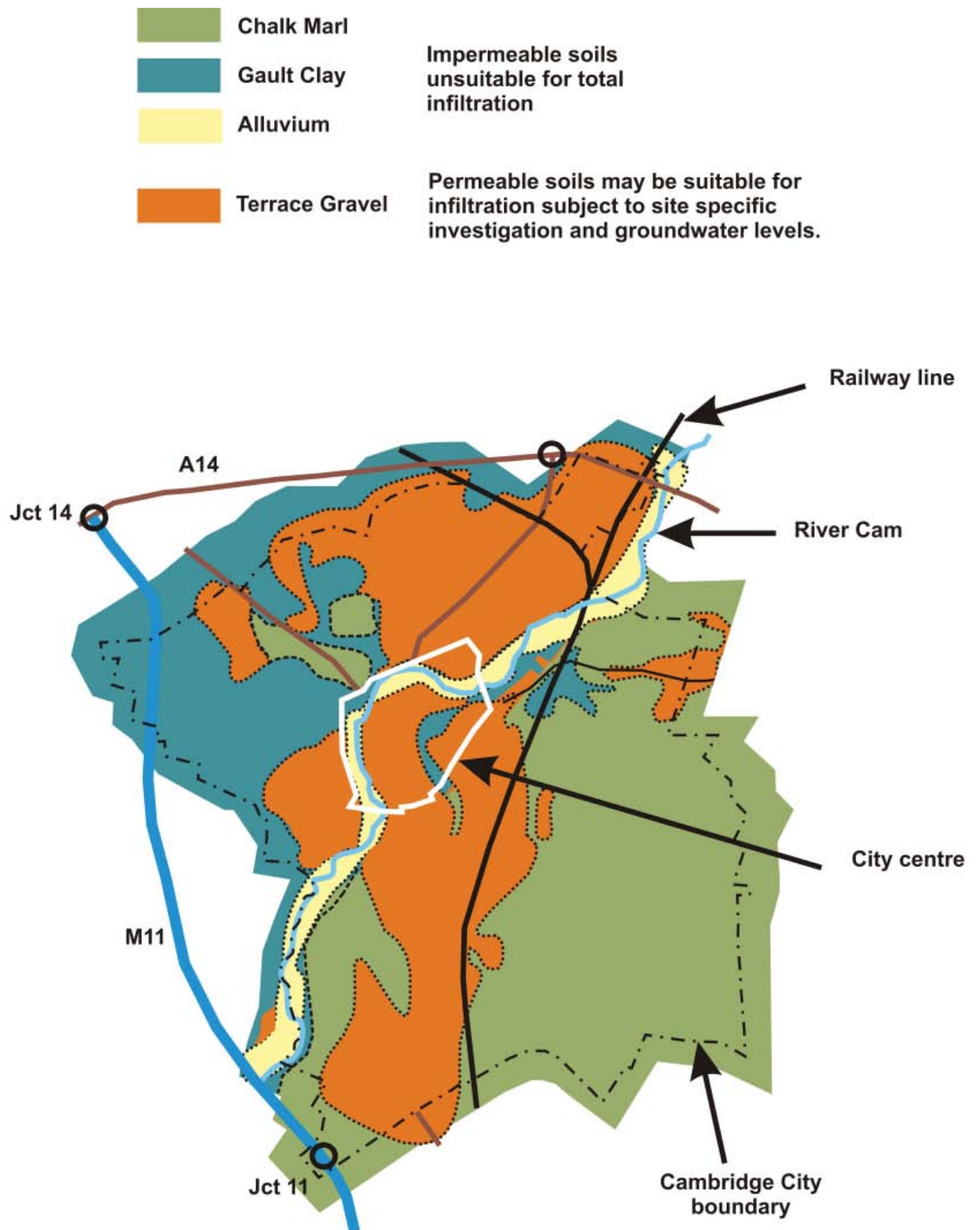
Although clay soils may prevent a complete infiltration solution it will still be possible to use other SUDS features such as ponds, wetlands and swales. It is also possible to allow some water to soak into the ground, even if the drainage design calculations do not allow for it (for example out of the bottom of an unlined swale).



Sheep's Green water meadow near Cambridge city centre



Rill leading to an urban wetland - Malmö



Simplified geological map of Cambridge

Swales in Cambridge

One particular character of watercourses in the fen landscape is the shallow gradient of ditches and wetlands where water moves slowly under hydraulic pressure rather than by gravity and a topographical gradient.

This hydraulic pressure results in ditches with a very gentle or negligible slope and shallow, slow moving permanent water in the base. This allows the development a linear wetland with say, common reed (*Phragmites communis*) the dominant plant. The use of a wet swale retaining water in the bottom for most of the year creates a SUDS feature that reflects the character of the fen landscape and provides enhanced biodiversity. The growth of common reed both in summer and in winter, when the stems remain until spring, provides a visual route marker or informal hedge to develop a subtle space hierarchy.

Therefore, the normal swale profile, which has a fall to drain by gravity, is modified to a local variant that drains by hydraulic pressure to create a linear fenland wetland with a local character. The fenland swale provides a visual link through the landscape with high biodiversity value.

The flat gradients can cause problems for piped drainage because it often results in very deep trenches and large pipe diameters. SUDS can deal with the shallow or even totally flat gradients in the same way that nature has done, by using wide shallow features to manage water flows.



Watercourse at Clay Farm, in Trumpington with common reed

Landscape and nature conservation considerations for SUDS

There are a number of common practices in landscape design that may need to be modified for SUDS:

- Planting areas are often raised slightly above surrounding hard surfaces. For SUDS they should be lower than adjacent surfaces and dished wherever possible to avoid excessive volumes of silt washing onto permeable surfaces.
- Grass edges in landscape are usually specified at 10-20mm above hard surfaces to allow for mowing. In SUDS where surfaces shed water to grassed areas, it must be 20 to 25mm below the edge of the hard surface, assuming the grass will be cut to a height of 50 to 100mm.
- The vegetated side slopes of SUDS features should not exceed a gradient of 1:3 in order to avoid soil slippage and the resultant non-establishment of vegetation.
- Subsoils and topsoils should not be compacted by excessive tracking of machinery. Compaction results in roots not being able to penetrate the soil and anaerobic soil conditions.
- Planting techniques in SUDS areas should also be varied slightly. Where drainage systems are to be planted the use of grass or a dense ground cover is preferable, without mulch. This avoids soil erosion and prevents soil and mulch washing into the SUDS.
- When undertaking planting design and selecting plant species, consideration should be given to the surrounding landscape or urban character, e.g. extensive reed beds would not be appropriate in high density areas.
- Plant choice should be carefully researched and be undertaken in close liaison with the SUDS designer. For example, a swale may have a very different soil/moisture profile at the top of the bank (very dry) to the bottom of the bank (very wet). Considered choice of plants will be the key to success in these conditions.
- Every effort should be made to create new habitats that enhance nature conservation and amenity space.
- Planting for nature conservation requires minimum topsoil, i.e. nutrient poor soil, to encourage wild flowers and a natural vegetation. SUDS need rapid establishment of a dense grass/wildflower sward that is self-repairing. Therefore a minimum of 50mm topsoil blinding should be used on wildflower areas adjacent to SUDS to ensure rapid establishment and 100-150mm topsoil used on vegetated SUDS features to ensure a robust surface for the life of the development.
- Planting areas should be designed to avoid initial fertilizers. Also ongoing maintenance should require only physical cutting with no application of herbicide, fertilizer or other chemical applications, which can cause pollution.



Banded Demoiselle Damselflies quickly take up residence in SUDS ponds

- The form of a swale may well be designed by the landscape designer. However, the drainage performance should always be checked by the SUDS engineer, who may require adjustments to the shape and form. For instance if the swale is designed to only accommodate occasional inundation, it may be more appropriate to provide an underdrain to avoid a muddy lower level to the swale, or to plant it as a vernal wetland.
- Bridge design for crossing swales and other water features should also take account of the surrounding landscape and urban character and should provide a positive addition to the landscape. For instance, it may be more appropriate to use a metal and timber or brick structure in high-density areas, rather than timber on its own.
- Likewise, the design of headwalls should be appropriate to their surroundings and not always purely functional. A well-designed headwall with the incorporation of, say, a brick arch or even a large gargoyle feature could add a highly valued design feature to a development.
- Similarly, the ecologist must understand SUDS requirements (see above) and recognize that immediate flower-rich vegetation will need to be sacrificed to the need for robust grass surfaces in the first instance. These will develop good biodiversity over time.
- Only one third of a linear water feature should be accessible and on one side only;
- Crossovers (bridges, culverts, etc.) should be kept to a minimum and balanced with people access/connectivity between neighbourhoods and places.
- Maintenance tracks/ paths should not be accessible by the public, in order not to disturb feeding and nesting faunal species and some BAP species.

SUDS on previously developed sites

Previously developed sites (brownfield sites) should not be seen as a barrier to using SUDS. The use of shallow surface features can often be a benefit in brownfield sites as they limit excavations into contaminated soils. The impact of the proposed SUDS features on any contamination and vice versa needs to be carefully assessed by an experienced professional.

The presence of contamination in the ground may limit the use of certain features (e.g. soakaways) or require liners below ponds, basins and permeable pavements. However, it will never prevent use of all SUDS features and a suitable system can be designed.

Further information is provided in The SUDS Manual (CIRIA C697).

There are several BAP species and habitats that can be supported by well designed SUDS. Good design for biodiversity should consider the integration of well designed sanctuary areas into ponds and wetlands wherever possible, to give spaces for the more sensitive faunal wildlife species such as king fisher, heron, water vole, etc. The provision of such areas will be dependent on the location of the SUDS (for example this would not apply to a small SUDS water feature in an urban street setting). Where suitable, the principle design features are:

SUDS in high density developments

In some new developments there may be limited landscape features; for example high density housing developments or in commercial and industrial developments. It is still possible to use SUDS in these locations, but it is more likely that engineered features such as permeable pavements or treatment channels will be appropriate.

Green roofs are also a useful feature on buildings with flat or gently sloping roofs. Further guidance and information is provided in the document 'Use of SUDS in High Density Developments', HR Wallingford Report SR 640.



Children pond dipping in a SUDS feature

Flood plain issues

The Environment Agency promotes SUDS but the natural floodplain must be protected. Therefore the Environment Agency is unlikely to agree to the location of SUDS within a floodplain, since the SUDS feature will fill up with river flood water when the area floods and will not have capacity to hold the rainfall runoff from the site as originally intended. The features may also remove valuable flood plain storage.