Northern Ireland Assembly

Research and Library Service Briefing Paper

Paper 000/00 29th October 2010 NIAR 525-10

Des McKibbin

Sustainable Urban Drainage Systems SUDS

1 Introduction

Urbanisation interrupts the natural hydrological cycle, leaving the ground impermeable and therefore requiring drainage.[1] Conventional urban drainage systems are designed to remove surface water quickly using underground pipe systems,[2] but while they are effective in removing localised water, at times, and particularly during periods of intense precipitation, problems can occur elsewhere in the catchment.[3] These problems lead to flooding, pollution of rivers and groundwater as well as damage to the wider environment, affecting amenity landscapes and natural habitats.

2 SuDS

Given the high levels of development/urbanisation combined with more frequent intense and prolonged rainfall, attributed to climate change, flash flooding is becoming increasingly common in both Northern Ireland and the UK. Conventional drainage systems are not designed with consideration of the wider impacts of poor surface water drainage, and as such are unsustainable. Methods that are sustainable are collectively

[1] Hennely, B. (2005) *"SUDS - Principles and Drivers"*. Dublin City Council: Dublin [online] available from:
[2] (NIEA) Northern Ireland Environment Agency (2009) *"Managing storm water. A Strategy for Promoting the Use of Sustainable Drainage Systems (SUDS) within Northern Ireland.* [online] available from:
[3] The area contributing surface water to a point on a drainage or river system.

referred to as Sustainable Urban Drainage Systems (SUDS).[4] They are sustainable because they do consider the wider implications of poor surface drainage as conveyed in The Flood and Water Management Act (England and Wales) 2010 definition:

> *Sustainable drainage is a means of managing rainwater (including snow and other precipitation) with the aim of:*
>
> *a) Reducing damage from flooding;*
>
> *b) Improving water quality;*
>
> *c) Protecting and improving the environment;*
>
> *d) Protecting health and safety; and*
>
> *e) Ensuring the stability and durability of drainage systems.*[5]

Examples of different SUDS and how each of them work are shown in table one.

Table 1: Examples of Sustainable urban Drainage Systems (SUDS)

SUDS	Description of SUDS
Infiltration trenches	An infiltration trench is a shallow, excavated trench that has been backfilled with stone to create an underground reservoir. Storm water runoff diverted into the trench gradually infiltrates into subsoil. An emergency overflow may be provided for extreme rainfalls which exceed the capacity of the reservoir.
Infiltration basin	Infiltration basins are shallow, surface impoundments where storm water runoff is stored until it gradually infiltrates through the soil of the basin floor. An emergency overflow may be provided for extreme rainfall events which exceed the capacity of the reservoir.
Filter drain	The gravel in the filter drain provides some filtering of the runoff, trapping organic matter and oil residues which can be broken down by bacterial action through time. Runoff velocity is slowed, and storage of runoff is also provided. Infiltration of stored water through the membrane can also occur and some filter drains need not lead to a watercourse at all.
Swales	Swales are grassed depressions which lead surface water overland from the drained surface to a storage or discharge system, typically using the green space of roadside margins. When compared to a conventional ditch a swale is shallow and relatively wide, providing temporary storage for storm water and reducing peak flows. They are appropriate close to source and can form a network within a development scheme, linking storage ponds and wetlands
Filter strips	Filter strips are vegetated sections of land designed to accept runoff as overland sheet flow. In order to be effective they should be 5 – 15 metres wide and they may adopt any natural vegetated form, from grassy meadow to small wood. The wider the strip and the more dense the vegetative cover the better the pollutant removal

[4] Ward, J. (2009) *"Sustainable Urban Drainage Systems (SUDS) and the Draft Flood and Water Management Bill"* Briefing for UK Roads Board. CIHT

[5] Flood and Water Management Act 2010, Schedule 3(2)

SUDS	Description of SUDS
Detention basins	Detention basins are designed to hold back storm runoff for a few hours to allow the settlement of solids. Bypasses may be included to ensure the "first flush" is detained. Detention basins drain via an orifice or similar hydraulic structure into a watercourse or surface water drainage system.
Retention ponds	Retention ponds retain a certain volume of water at all times. This can avoid possibly unsightly exposure of banks of collected sediment and enhance performance in removing nutrients, trace metals, coliforms and organic matter. Allowance for a considerable variation in water level during storms should be incorporated in the design, so that a significant storage volume can still be provided.
Porous pavement	Porous pavement is a permeable pavement surface with a stone reservoir underneath. The reservoir temporarily stores surface runoff before infiltrating it into the subsoil. Runoff is thereby infiltrated directly into the soil and receives some water quality treatment. Porous pavement often appears the same as traditional asphalt or concrete but is manufactured without "fine" materials, and instead incorporates void spaces that allow for infiltration.

3 SUDS in Action

SUDS have been in use worldwide for some time, allowing for the generation of knowledge and expertise. SUDS are now particularly well established in Sweden, the USA, New Zealand, Australia and Scotland.[6] Some of the benefits associated with SUDS are:[7]

Comment [N1]:

Comment [N2]:

- Reduced runoff rates, thus reducing the risk of downstream flooding;
- Reduced runoff volumes and runoff frequencies that tend to be increased as a result of urbanisation, and which can exacerbate flood risk and damage receiving water quality;
- Encouragement of natural groundwater recharge (where appropriate) which minimises the impacts on aquifiers and river base flows in the receiving catchment;
- Reduced pollutant concentrations in storm water, thus protecting the quality of the receiving water body;
- They Act as a buffer for accidental spills by preventing direct discharge to combined sewer systems, thus reducing discharges of polluted water to watercourses via Combined Sewer Overflow (CSO) spills;
- Contributing to the enhanced amenity and aesthetic value of developed areas; and
- Providing habitats for wildlife in urban areas and opportunities for biodiversity advancement.

[6] Hennely, B. (2006) "*SUDS – Principles and Drivers*". Dublin City Council: Dublin [online] available from:

[7] CIRIA (2007) "*The SUDS Manual*". CIRIA: London. Available from

SUDS in Scotland

The use of SUDS has become standard practice in Scotland since 2001 when planning guidance stipulated all planning applications for new developments should incorporate drainage strategies and designs, including proposals for SUDS.[8] This guidance was augmented by the Water Environment (Controlled Activities) (Scotland) Act 2005 as amended, which makes it a requirement for new developments to use SUDS.[9]

The Scottish Environment Protection Agency (SEPA) is the statutory agency responsible for protecting the water environment in Scotland, under the Water Environment Water Services (WEWS) Act and as such they take responsibility for ensuring that effective, appropriate SUDS features in new developments. To ensure this happens, developers, SEPA and Scottish Water are encouraged to discuss proposed developments at an early stage, even before approaching the planning authority.

What also makes the adoption of SUDS in Scotland so widespread is a statutory requirement under the Water Environment and Water Services (WEWS) Act 2003 for Scottish Water to adopt and maintain public SUDS as they have equal status to conventional sewers.[10] No similar provision exists in any of the other UK jurisdictions and this is perhaps one of the biggest barriers to the widespread adoption of SUDS. All in all it appears that the statutory requirements placed on both developers and sewerage undertakers rather than equivalent 'suggestions' across the other jurisdictions, have seen SUDS become standard practice in new developments.

Flood and Water Management Act

A report published by DEFRA in 2007 noted that the construction of SUDS was quite uncommon in England and Wales"[11] due largely to the fact that adoption of SUDS remains voluntary. The report notes that neither Local Authorities, nor sewerage undertakers, nor developers found the prospect of adopting SUDS attractive, mostly due to cost. This situation will be addressed by The Flood and Water Management Act, which received Royal Assent on 8th April 2010. The Act aims to improve both flood risk management, and the management of English and Welsh waterways by encouraging the uptake of SUDS. The Act removes the automatic right to connect to sewers while it places a duty on local authorities to adopt SUDS for new developments and redevelopments. Private house builders and developers will also be required to incorporate SUDS into new developments. It is expected that the Act will be commenced in April 2011.[12]

[8] Scottish Executive (2001) *"Planning Advice Note PAN 61 – Planning and Sustainable Urban Drainage Systems"* Scottish Executive Development Department, July 2001
[9] SEPA (2010) *"Sustainable Urban Drainage System"* [online] available from
[10] CIRIA (2007) *"The SUDS Manual"*. CIRIA: London. Available from
[11] DEFRA (2007) *"Funding and charging arrangements for sustainable urban drainage systems"*. DEFRA: London
[12] (LGA) Local Government Association (2010) *"Flood and Water Management Act 2010"*. LGA Briefing. LGA: London