

# **Implementing sustainable drainage systems for urban surface water management within the regulatory framework in England and Wales**

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## **Abstract**

The UK 2007 floods resulted in damages estimated to exceed over £4 billion. This triggered a national review of strategic flood risk management (Pitt, 2008) with its recommendations informing and implemented by the Flood and Water Management, Act (FWMA, 2010). Estimating that up to two-thirds of properties flooded in the 2007 event as a direct result of overloaded sewer systems, the FWMA set out an ambitious overhaul of flood risk management approaches including identifying bodies responsible for the management of local flood risk (local municipalities) and the development of over-arching Lead Local Flood Authorities (LLFAs) at a regional level. LLFAs duties include developing local flood risk management strategies and, aligned with this, many LLFAs and local municipalities produced sustainable drainage system (SUDS) guidance notes. In parallel, changes to the national planning policy framework (NPPF) in England give priority to the use of SUDS in new major developments, as does the related Town and Country Planning Order (2015). However, whilst all three pieces of legislation refer to the preferential use of SUDs, these requirements remain “economically proportionate” and thus the inclusion of SUDS within development controls remain desirable - but not mandatory - obligations. Within this dynamic policy context, reignited most recently by the December 2015 floods, this paper examines some of the challenges to the implementation of SUDS in England and Wales posed by the new regulatory frameworks. In particular, it examines how emerging organisational procedures and processes are likely to impact on future SUDS implementation, and highlights the need for further cross-sectoral working to ensure opportunities for cross-sectoral benefits – such as that accrued by reducing stormwater flows within combined sewer systems for water companies, property developers and environmental protection – are not lost.

*Keywords:* Surface water; SUDS; Regulation and planning; Permeable paving

## **Highlights**

- Maps legislative developments influencing use of SUDS in England and Wales
- Identifies key challenges to the use of SUDS posed by emerging frameworks
- Examines how evolving procedures will impact on future use of SUDS
- Highlights the need for cross-sectoral working to ensure full benefits are realised

# **Implementing sustainable drainage systems for urban surface water management within the regulatory framework in England and Wales**

## **1. Introduction**

The severity of the UK 2007 floods, which inundated 55,000 properties and was estimated to cause over £4.0 billion of damage, triggered a national review of strategic flood risk management (Pitt, 2008) which led to the introduction for England and Wales in 2010 of the Flood and Water Management Act (FWMA) (SO, 2010). The Pitt review estimated that up to two-thirds of these properties were flooded as a direct result of surface water from impermeable surfaces (stormwater) overloading the sewer system. Major recommendations of the Pitt review incorporated into the FWMA included local authorities (LAs) having the lead role in the management of local flood risk, including responsibilities for local surface water (pluvial) flooding and coordination of flood risk planning. In addition to this lower tier (i.e. borough and district councils) arrangement, upper tier authorities (county councils and unitary authorities such as metropolitan areas e.g. London, Birmingham etc.) were charged with establishing Lead Local Flood Authorities (LLFAs) to prepare local flood risk management (LFRM) strategies and to review approval of mitigation works for reducing flood risks. LLFAs were given responsibility for flood defence consents and enforcement powers in implementing LFRM strategies. The FWMA further gave LLFAs and highway authorities a duty to contribute towards the achievement of sustainable development when planning flood mitigation works. In association with these activities, many LLFAs and LAs have also produced sustainable drainage system (SUDS) policy statements which include an interpretation of how such schemes are expected to demonstrate compliance with national sustainable drainage standards which are currently only available as non-statutory technical guidance (DEFRA, 2015).

In England and Wales, the Environment Agency (EA) and latterly Natural Resources Wales (NRW) retained the national responsibility for formulation of a strategic overview of and policies for flood risk (including risk assessment procedures) as well as full responsibility for surface water quality. As part of this strategic responsibility these regulators have produced surface water flood maps to help the identification of susceptible flood zones within urban areas to support LLFA and LA local flood risk management planning. In England a reformed national planning policy framework (NPPF) has also been put in place with the intention of recognising the importance of avoiding development in flood prone areas and as a basis to help reduce the causes and impacts of future pluvial flood exceedance events. The NPPF gives priority to the use of SUDS in new major developments and the related 2015 Town and Country Planning Order (TCPO) expects that SUDS should be installed unless demonstrated to be inappropriate in terms of site circumstances or cost. At the same time, the NPPF and TCPO indicate that planning applications should ensure any SUDS installed within a development should meet minimum standards of operation and have clear arrangements for lifetime ongoing maintenance, but that these requirements should remain “economically proportionate”. Thus the NPPF and TCPO only carry a presumption in favour of sustainable development and SUDS controls rather than any mandatory obligation.

There are therefore new regulatory and organisational frameworks emerging for urban surface water drainage in England and Wales in respect of new developments with several organisations carrying potentially overlapping duties and responsibilities. These include local authorities, water and sewerage companies, highways agencies and environmental

protection agencies. In addition to these, a range of national organisations have also developed their own guidance/statements on surface water drainage and the use of SUDS, including the Royal Society for the Protection of Birds, Wildfowl and Wetlands Trust (RSPB and WWT, 2012), Natural England (undated) and the Blue Print for Water coalition (2015). At the same time, there is a growing awareness of the need for cross-organisational and cross-sectoral partnerships and associated consultee arrangements in the planning process which also have particular significance for future SUDS implementation (DCLG, 2015). For example, the inclusion of a wider consideration of the benefits and costs of reducing stormwater flows in combined sewers through enhanced uptake of SUDS on sewer network performance, energy footprints and property developers at both local and national scales. This paper examines some of the challenges to the implementation of SUDS posed by the new regulatory frameworks and organisational arrangements. In particular, the paper considers whether the new regulatory and organisational frameworks, procedures and processes are likely to make any substantial difference to future SUDS implementation and introduce an increased awareness of their design, operation and maintenance requirements.

## **2. SUDS regulatory guidance**

Generic national non-statutory technical guidance for SUDS in England has been published by DEFRA (2015) which covers (peak/volume) flow controls and brief considerations for design and maintenance. Consideration of water quality was briefly included in an earlier draft version of the DEFRA (2015) technical guidance, but was omitted from the final publication. Further to the non-statutory technical guidance, a collaborative LA working group has produced a companion guidance manual to the technical standards to help clarify and interpret the proposed standards in respect of national sustainable drainage policy and in terms of drainage design (LASOO, 2015). In Wales, Planning Policy Wales (Welsh Government, 2016a) and the related advice on development and flood risk under Technical Advice Note, TAN 15 (Welsh Assembly Government, 2004) emphasise the benefits of the SUDS approach for new developments; the use of SUDS in re-development contexts is not covered. The 2015 update to TAN 15 included new development advice maps enabling improved flood information and modelling to be incorporated into the site selection process and in the determination of planning applications. Section 8 of TAN 15 sets out recommendations for the use of SUDS referenced against appropriate technical standards. In 2016, the Welsh Government produced its own non-statutory standards which are considerably more comprehensive in nature and scope than the DEFRA (2015) equivalent, taking into detailed consideration water quality, amenity and biodiversity (Welsh Government, 2016b).

Separate to but complementing these activities, the Construction Industry Research and Information Association issued an interim guide to national SUDS practice (CIRIA, 2004) and its updated, comprehensive, SUDS manual covering the planning, design, construction, operation and maintenance of a range of SUDS was more recently published (Woods-Ballard et al., 2015). The Welsh standards are closely aligned with the new CIRIA (2015) SUDS manual update. Following the publication of its non-statutory standards for SUDS, the Welsh Government is now proposing to work with stakeholders to consider the best approach to improving the uptake of SUDS in new developments, including the possibility of implementing Schedule 3 of the FWMA which remains unenforced in England.

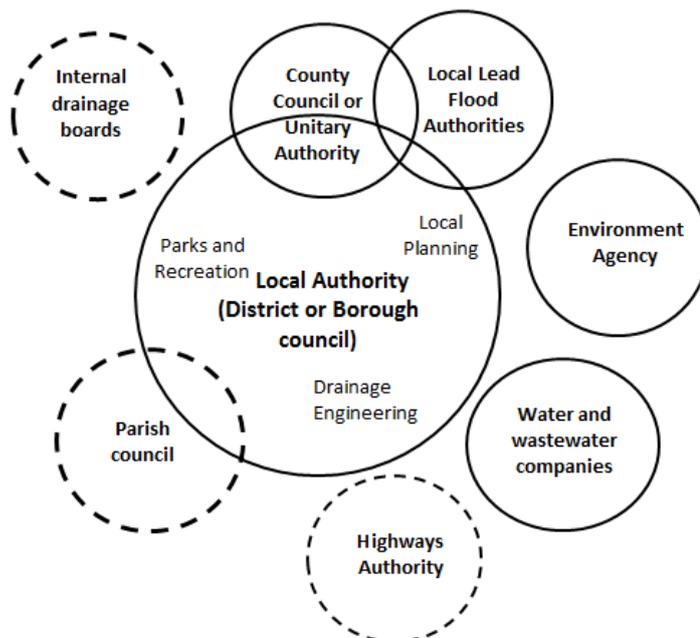
Schedule 3 of the FWMA requires the inclusion of SUDS in new major developments, giving powers to Ministers to establish SUDS approval bodies (SABs), by default at the upper tier local authority level, whose role would be the approval of proposed SUDS designs and their

subsequent adoption and maintenance. In preparation for full implementation of the FWMA (2010), several LAs established pilot SABs e.g. Cambridge, Kent and Greenwich. However, following a government DEFRA-led consultation for England over the summer of 2014 (DEFRA, 2014), where LAs and housebuilders raised concerns over the requirement to, in effect, receive two sets of permission before new development works could commence, the SABs approach was set aside with the government considering that a more effective SUDS delivery mechanism could be delivered through an amended local planning policy arrangement. A significant proportion of UK LAs have now produced formal advice and guidance for developers on SUDS implementation within their local administrative areas and which is readily accessible through their websites and planning portals (e.g. Cambridge City Council, 2015), with water companies also producing planning guides that outline their position on adopting SUDS (e.g. Yorkshire Water, undated). Under the new governance structures for flood risk management, the LLFA requires that all major developments should have a surface water management plan (SWMP) which may be incorporated into the wider LFRM strategy (BSI, 2013). However in terms of determining whether SUDS are actually included within development plans, it has been argued that the strength of a LA/LLFA SUDS policy statement is much less significant than the role of an active, motivated “champion” or the pro-active presence and implementation of innovative, integrated sustainability principles (White and Alarcon, 2009).

### 3. The regulatory framework in England

#### 3.1 Organisational structures

Figure 1 shows the new proposed regulatory framework and organisational arrangements for local urban flood risk management and SUDS design, installation and maintenance set out in the FWMA. The solid circles indicate the organisations which have statutory consultee status



**Figure 1.** Regulatory framework and organisational arrangements for urban flood risk management and SUDS design in England.

within the new regulatory framework in respect of major development proposals; the dashed

circles indicate examples of discretionary consultees with overlaps indicating common membership. A much simpler diagram would apply for Wales as the LA, LLFA, HA and planning authorities are one and the same; apart from the national parks, LAs are unitary authorities in Wales.

Although the work remit and responsibilities of the LLFAs have been set out in detail (Local Government Association, 2012), there have been no formal guidance as to their composition, apart from statements which stress the need for partnership arrangements between the statutory consultee stakeholder organisations shown in Figure 1. Other additional stakeholder groups (shown by dashed circles in Figure 1; e.g. Highways Authority, Internal Drainage Boards (IDBs), Non-Governmental Organisations (NGOs), Canal and River Trust, Network Rail etc.) are to be encouraged to “buy-in” to the partnership arrangements as necessary. Upper level unitary authorities have the advantage that the Local Planning Authority (LPA) and LLFA teams are located within the same council, which is not the case for the lower two-tier authorities. However, planning and SUDS are frequently dealt with in different departments within unitary authorities and by different LAs in two-tier settings with drainage and planning departments also having different and often incompatible software systems for administering and processing development applications. They will therefore need to develop and nurture close collaborative arrangements and processes to ensure effective SUDS delivery and management (Ashley *et al.*, 2015). Some LLFAs may also choose to simply provide flood risk advice whilst others may deal with a full review of applications and SUDS designs, and not all authorities will necessarily use the same procedure to approve - or reject – the use of SUDS within a development application. This inevitably must result in a variety of approaches and processes depending on local policy, resources and organisational relationships, as well as being dependent on opportunistic circumstances for SUDS implementation arising within the respective authority planning portfolios. The unfolding of such a scenario in practice would represent a real ‘watering down’ of the recommendations of the Pitt review (Pitt, 2008) and a failure of the FWMA (2010) to lead to a systematic and consistent implementation of SUDS as initially foreseen.

With regard to funding LLFA activities, the DEFRA (2012) LLFA guidance document to the Localism Act (2011) suggests that this latter legislation may offer a source of bespoke local funding to support the work remit of the LLFA (including emerging SUDS needs). This same DEFRA (2012) document however, acknowledges the difficulties which will be faced by the LLFAs to secure sufficient funding sources and to achieve effective partnership arrangements and so the “burden” associated with implementing LFRM strategies remains to be satisfactorily resolved. As part of a response to addressing this ‘funding gap’, many Welsh LLFAs, as well as some English LLFAs, are reviewing their charges for “ordinary watercourse” consents to take into consideration the real costs of implementing flood control and defence activities as a basis to relieve some of the regulatory monetary burdens. However, it is not clear if such increased charges are allowable, given that such fees appear to be only exercisable under statutory governmental instruments. New burden Section 23 assessment (NAO, 2015) has resulted in the consent fee being raised from £50 to £184 but this still does not cover full local cost-recovery, particularly as such consenting represents a growing function given the increases in development pressure. The government has also agreed to provide the 152 LLFAs in England and Wales with an average fund of about £13,000 per year from April 2016 which will help to alleviate some of the financial burden.

Some LLFAs have established a hierarchy of separate governance groups to deal with collaborative partnership and operational delivery of their LFRM strategy with cross-membership between the groups. In the case of Cumbria County Council in Northern

England for example, the operational LLFA Working Group is supported by further district groupings which provide input on localised “hotspot” flooding events. In addition, to these formal governance structures, some LLFAs have made collaborative arrangements with various local flood and community action groups, many of which were initiated by the EA as communication forums prior to 2010, and which primarily focus on local fluvial overbank flood issues. Other LLFAs have set up local flood resilience forums, risk management technical groups etc., within their formal governance structures to provide more focussed local knowledge, communications and awareness-raising to address specific needs identified locally. The relationships between the local planning system, water resource and flood risk management and wider catchment management strategies are fully detailed in Bide and Cranston (2014). It is clear that LPA policy and planning for surface water management and flood risk assessment will have a direct influence on SUDS design and adoption, and so it is critical that LPAs and LLFAs develop a good working relationship. Such liaisons will be difficult if the LPA lacks in-house drainage experience and competency (Green, 2016). LLFAs on the other hand may well lack knowledge and experience of the planning application processes, both generally and specifically in relation to SUDS. An improved knowledge and awareness of SUDS within key LA staff, especially those having planning committee responsibilities, is vital for future implementation, particularly for complex or contentious planning cases involving SUDS (or indeed the lack of them). A key area of concern relates to checks on the accuracy of SUDS construction against approved SUDS plans and the adoption and maintenance of SUDS. The long term implications of poor or no-ongoing maintenance of existing SUDS are yet to be experienced by most authorities, although concerns over SUDS failure (whether perceived or actual) continue to persist, despite an increasing evidence base on the long-term performance of a range of operating types and condition e.g. the Dunfermline Eastern Expansion and Lamb Drove, Cambourne (Susdrain, undated). Moreover, the working differences between Section 106 agreements and a planning “condition” outcome for SUDS long term performance are still to be evaluated (Morrow, 2008).

A layering of the various governance structures for urban surface water management seems to be emerging in the organisational framework with a lower level of partnership structures focussing on local issues and communication linkages with local community action and interest groups, typically operating in relation to immediate to short-term timelines. These local level partnerships support the development and implementation of district-based SWMPs and associated drainage controls. The core of the upper governance level comprises the statutory consultee cross-organisational partnerships in which the strategic (and therefore presumably longer term) overview and lead responsibility for flood risk management and drainage infrastructure approval is vested. There still remains within the organisational framework a separate autonomy between LAs, highways authorities and water companies in respect of SUDS drainage for housing developments, public highways and land drainage. Highway authorities can still refuse to accept surface water drainage from housing developments but highway authorities (through development of a reciprocal agreement under Section 115 of the Water Industry Act 1991) and property developers (under the FWMA, 2010) have the right to connect their infrastructure to water company owned combined and surface water drainage systems. This issue remains contentious; figures on the contribution of stormwater to combined system flows are estimated to be in the region of 30-70%. Water and sewerage companies see stormwater inputs as an uncontrolled demand and a dominating cause of hydraulic incapacity with impacts on standards of service to customers and the environment. Water companies together with professional organisations and NGO groups are currently lobbying the House of Lords to amend the Housing & Planning Bill to restrict this automatic “right to connect” new housing to existing drainage systems and compel

developers to integrate SUDS as a statutory compensation for additional impermeable surface flows (House of Lords, 2016).

### *3.2 The planning application process*

The planning application process now in place in England under the regulatory and legislative framework for new major development proposals and associated SUDS drainage is complex as illustrated in Figure S1 (Supplementary Material). Pre-application discussions between the local planning authority (LPA) and the developer are intended to identify early design and adoption issues and to encourage consultation with the formal statutory consultees shown in Figure 1. It has been alleged that this process could extend the application and approval time frame for development as well as potentially engendering too close a relationship between the developer and LPA. However, the statutory consultation and approval in the application process is subject to a 21 day time-limited period. The NPPF legislation framework also limits consultation to major development only and excludes developments less than 0.5 hectares (<10 properties). However, as in the case with the paving over of front gardens to provide parking spaces (sometimes referred to as ‘urban creep’), smaller developments, particularly infill development within metropolitan areas, can comprise a significant cumulative flood risk. Housebuilders and LPAs are generally not “geared-up” for small development sites with drainage designs frequently being dealt with by reference to “conditions” rather than under the full consent planning procedure. On such small sites, the developer is reluctant to “make space for water”. It is left to the LA to reference any advice that might be given by the LLFA on what might constitute such potential development impacts. However, with new developments only accounting for about 1% per year of housing stock, there is a clear need for effective strategies to implement SUDS retrofitting into existing and infill development.

As indicated from Figure S1, it is possible for Section 106 agreements (a mechanism to make a development acceptable when it would not otherwise be i.e. a planning obligation which must be legally complied with) to be tied to an outline application which may not carry any housing layout or SUDS design. Such matters then become “reserved” and subject to “conditions” which could result in inadequate SUDS solutions and requirements. In addition, without a detailed layout and drainage design, the LA may find it difficult to quantify a reasonable commuted sum for SUDS adoption and maintenance. The legislation is currently constructed to leave the developer and not the LPA to fully demonstrate how SUDS components will be maintained.

Producing a detailed SUDS design however, requires a knowledge of the housing layout and if this is held over as a “reserved” matter, then SUDS cannot be considered in the outline application and early consultation stage. Such considerations also apply to staged development proposals on large sites where the full proposed drainage system needs to be discussed and agreed at an early stage and not left for piecemeal agreement at each later stage. Such discrete accumulative drainage design is unlikely to meet a holistic surface water management strategy or sustainability criteria. Developers would also prefer to learn what commuted sums in respect of future operation and maintenance (O&M) might be required at the early pre-application stage so that they can be taken into account in land pricing negotiations or house sales, rather than being left as “reserved” matters at a much later stage. SUDS commuted sums also carry uncertainties associated with unexpected lifetime maintenance costs, life expectancy, interest rates and inflation levels which can inhibit future large scale development, although experience in agreeing commuted sums for such purposes is accruing (e.g. see the guidance developed by Rhondda Cynon Taf, 2014).

Some of the working confusion and uncertainty arising from the emerging regulatory

frameworks can be illustrated by reference to whether, and if so how, LAs/LLFAs should record an adopted SUDS asset on the drainage register. As Schedule 3 was not implemented there is no legal duty on authorities to include development SUDS in the register. On the other hand, under Section 21 of the FWMA, it is left to individual LLFAs to decide whether they will define SUDS as a significantly large enough drainage asset to be declared. However, queries to LAs in relation to property conveyancing (CON29DW) search requests, may well result in some obfuscation. Whilst SUDS may be recorded on LA drainage registers, the authority may not wish to take the potential risks that might arise from declaring these on the “public” drainage register. This is not just reflecting an aversion to possible later litigation, but also arises from a genuine caution resulting from their limited knowledge of, and confidence in, the “as-built” SUDS design. Some LAs such as Bracknell and Central Bedfordshire consider that as Schedule 3 remains unenforced, they are not required to retain such SUDS records.

There is some evidence that LLFA objections to and refusals to approve received development drainage applications involving SUDS are very high reaching 50% to 90% in the case of Thames Region (TRFCC, 2015), even where developers argue they have submitted proposals in line with the DEFRA national technical standards. Much of this issue relates to insufficient information on the proposed SUDS design and operation being produced at the detailed/full planning stage. There are also potential issues arising from differing interpretations of the available technical SUDS guidance. For example, whilst the CIRIA SUDS Manual argues for a 1:30 event design for soakaways and permeable surfacing, Garvin (2010) states that it is only “good practice” to go higher than 1:10. In addition, reference to British Standards EN752 (BSI, 2008) for drainage design will give a significantly different approach to that identified in Part H of the Building Regulations covering drainage and waste disposal (DCLG, 2010). There is also some LA/LPA uncertainty regarding what climate change percent increase should be factored into flood risk assessment to satisfy the requirement that a range of flood extents and depths should be evaluated in new housing development proposals. This can vary between an upper value of 40% down to a 20% allowance, but with most developers opting for a lower 20% - 30% standard; this clearly has implications for required SUDS storage volumes as well as for the future vulnerability of the proposal under extreme storm conditions.

There is therefore some uncertainty amongst developers, LLPAs and LPAs of what constitutes essential information that needs to be submitted at both outline and full application stages. Insufficient information at the outline stage makes it difficult for the LLFA to assess and verify the functionality of the design; this is particularly the case in respect of ground investigations and winter soil infiltration testing as well as water quality. Weak or insufficient information at the outline stage poses potential difficulties in terms of viability of space or inclusion of alternative design approaches at the later stage should this be required. In England, some LLFAs are looking at the more substantial guidance and criteria provided in the Welsh Government standards as well as those developed within the LASOO best practice guidance.

There is little written in the regulatory framework of the relative roles of the LPA, LLFA, LA or water companies etc in the assumption of responsibility for adoption and maintenance. This could lead to overlap of remits and organisational misunderstandings. In addition, other issues such as the future designation of SUDS under possible protected species status might well conflict with earlier agreed maintenance requirements. All these uncertainties can undermine confidence that consistent, high quality procedures and practice will widely emerge to simplify and stimulate future SUDS uptake.

#### 4. Planning, development and permeable paving

The term SUDS applies to a diversity of drainage systems which can be grouped into four broad categories: storage systems (e.g. retention and detention ponds), infiltration systems (infiltration basins and soakaways), conveyance systems (e.g. swales and filter strips) and permeable surfaces with storage (e.g. porous paving). These categories are not always discrete, with SUDS in each category facilitating the occurrence of a range of water quantity and quality mitigation mechanisms, from settlement and infiltration to volatilisation and microbial degradation. In terms of water quantity management, infiltration is prioritised in various national working manuals (e.g. Anglian Water Services Ltd., 2011; BSI, 2013; Woods-Ballard et al., 2015) as the preferred first source disposal option for surface water runoff following any considerations for rainwater harvesting. Despite this stated preference and the existence of successful demonstration sites (Forterra, 2015; Interpave, 2015), concern amongst LAs about the sustainability of infiltration systems and especially permeable paving continues to persist. As such SUDS controls are not generally on public open space, their operation and maintenance is very much down to local residents and/or private management companies. Under the FWMA, LLFAs can designate features of the drainage system which may cause adverse receiving water impacts and thus can exert a veto power in assessing what is adoptable. However the designation process needs to be undertaken long before individual property sales take place and should be discussed during the pre-application stage in order to be fair to both developer and resident.

Local planning authorities (LPAs) have been receiving increasing applications for permeable paving (as well as attenuation tanks) as proposed SUDS source controls at development site-scale, with some developers requesting direct discharge of roof waters to porous paving storage volumes (as opposed to managing directly received volumes of rainfall only). However, many LAs have become somewhat cautious and risk-averse about approving permeable paving as a viable sustainable drainage option. There are many reasons that are given for this reticence:

- limited in-house technical knowledge to properly evaluate the design efficiency, construction and performance
- limited time and finance to independently outsource, check and discuss the drainage design and ensure it accords with national technical criteria
- no independent site supervision to ensure that actual in-ground construction is in full accordance with the approved drainage design and performance specifications
- no independent check on post-installation compliance, operation and maintenance
- likelihood of post-installation disturbance

This uncertainty leaves LAs with a perceived residual risk of performance deterioration and uncertain financial liabilities over the medium to long term. Some LAs consider that the introduction of formally licensed paving contractors to undertake initial installation and reinstatement if disturbed at a later date, would alleviate their concerns. The uncertainty also means that some LAs resort to Section 38 legislation on adoption and right to connect to existing drainage systems as a deterrent to try to persuade developers to seek an alternative drainage option rather than as a positive tool for adoption.

Increases in impermeable cover of between 10% - 24% have been recorded for front garden conversion to car park hardstanding in many UK urban areas (Warhurst *et al*, 2014) with more than 60% contribution to increases in impermeable surfaces estimates for parts of the metropolitan London area (Smith, 2010). Planning permission is not required for new or

replacement driveways (of any size) using permeable (or porous) surfacing; planning permission is required for the use of impermeable materials on surface areas  $>5\text{m}^2$  (Planning Portal, 2015). However this requirement rarely appears to be enforced and the conversion of front gardens to impermeable surfaces continues apace. There is hence an increasing diversion of roof drainage to ground with many such arrangements having an overflow to roadside (highway) gutter and drains. Where permeable surfaces are used to receive roof drainage, many initial designs will have been based on calculated areal infiltration rates rather than any additional point-loading inflow rates and volumes expected from roofwater down-pipe. Planning consent needs to limit such rooftop discharge rates to no more than 5 l/s in order to avoid overloading and overflows to the adjacent highway surface.

Although there is official guidance on front garden conversion (DCLG, 2008), formal applications often incorporate a “geotextile-wrapped” diffuser pipe to the basal sub-layer. Issues arise here from potential dangers of long term blockage and through-passage of surface-derived pollutants. Exceedance of the localised sub-surface storage capacity could also lead to wash-out of the finer particulate leading to void spaces and an early collapse of the surface pavers. Softening and collapse of the basal layers, experience of poor installation, flood exceedance onto adjacent highways collectively can only make LAs cautious of approving such designs for permeable paving.

Subject to Section 106 of the Water Industry Act (1991) owners/occupiers of any premises have the right to discharge foul water and surface water from those premises to the public sewer. Generally, LAs do not permit “private” connections such as rooftop discharges to highway drainage systems but some LAs such as Peterborough City Council in the East of England, Swansea in South Wales and Kirklees Council in W. Yorkshire, have permitted private connections and roof discharges via sub-base connection of a permeable driveway or car park to a porous highway surface or to a SUDS control such as a roadside swale or infiltration trench. This raises the issue of liability should the highway drainage fail as a result of such surface water connections, particularly in respect of against whom any enforcement could be taken in the event of failure. If residents do not maintain the permeable paving drainage properly or are deemed by the highway authority to contribute to surface water flooding as a result of the design, redress might be sought under Section 106 planning obligations (Howe and White, 2011). Section 163 of the 1980 Highways Act also enables LAs to require householders to prevent such surface water discharges to the highway. However, there is a need to ensure that the LPA consults with their drainage engineers and the LLFA on such “connections” rather than assume that the drainage proposal is acceptable simply because it constitutes an LA asset.

## **5. Conclusions**

It is evident from the many organisations and legislative references associated with SUDS for future urban development that a complexity of structures, processes and procedures persists. This situation is in sharp contrast to the system overhaul and simplification of surface water management recommended by the Pitt Review (Pitt, 2008), requirements which implementation of the FWMA (2010) was meant to deliver. In England, given the lack of clarity regarding organisational arrangements and legislative structures, SUDS design and approval agreements should be predicated such that higher maintenance components be located on controllable land and ensuring that SUDS always complements rather than interferes with the wider practical use of public open space and amenity/biodiversity objectives. Many of the administrative functions and responsibilities of the stakeholder

organisations have potentially overlapping work remits. The emerging regulatory regime might result in SUDS design and standards becoming only “material considerations” within the planning approval process and lacking clear enforcement procedures. Given the differing objectives, constraints and resources of the various stakeholder organisations, it is not at all certain that the surface water management goal of wider SUDS implementation or integrated urban drainage can be readily achieved. Opportunities for cross-sectoral benefits to be realised – such as that accrued by reducing stormwater flows within combined sewer systems for water companies, property developers and environmental protection - may also be lost. Irrespective of this, it is certainly the case that objectives can and should be aligned as best as possible with common visions established from shared and supportive collaborative relationships. This however, requires commitment at all organisational levels, rather than just being treated as a technical and/or administrative issue to be dealt with at the negotiating level between the LPA/LLFA and the developer; this will not secure trust or consistency of practice. There is evidence that LAs and LLFAs are developing good working linkages with statutory consultees and are becoming more professionally and technically knowledgeable about SUDS. This is evidenced by the many workshops and training days on SUDS design and delivery which are on offer to stakeholders e.g. DEFRA/EA, CIRIA, CIWEM Urban Drainage Group and private consulting groups such as Arup, DHI, CH2M Hill etc. However, clarity of objectives, standards and practice as well as certainty regarding funding and related adoption issues need to be established if SUDS implementation is to become the “norm” for future urban surface water management in England and Wales. These are national strategic issues which must first be addressed at central government level before they can be translated and delivered by local authorities, developers and practitioners.

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