

SuDS

Sustainable Drainage Systems



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Government commits to reducing flood risk

IN JANUARY, Prime Minister Theresa May launched the government's 25 Year Environmental Plan. Hailed as Britain's answer to the environmental problems facing this country and the world, Mrs May promised that her government would 'leave the country in a better state than [they] found it'. The plan focuses on a number of solutions which can be employed to mitigate any environmental drawbacks. Central to Mrs May's commitment to the country is her promise to solve the housing crisis by getting Britain building more homes. However, with more homes come more issues, and on the back of record flooding

experienced in the UK, natural flood management solutions and property-level flood protection all feature in the 25 Year Environment Plan. The 25 Year Environment Plan outlines the government's commitment to reducing flooding and coastal erosion while also advocating the use of natural flood management, SuDS and improved property-level flood resilience. The government has already made a massive commitment to improving flood defences across the country, with £2.6Bn due to be invested between 2015 and 2021. The Environmental Plan outlines a number of other measures the government wants to implement. By making changes within

the National Planning Policy Framework (NPPF), the government intends to encourage the use of natural flood management solutions and tackle surface water flooding. Guidance for developers will clarify construction and ongoing maintenance arrangements for SuDS in new developments and existing arrangements for managing surface water flooding will be improved and made more collaborative. The flooding measure within the plan comes in response to comments made by ADA chairman Henry Cator. Last year, Mr Cator identified a lack of government SuDS strategy, and highlighted this as one of the three main threats to effective water level and flood risk management.





Wales stems flood risk through SuDS

THE WELSH GOVERNMENT has released a water strategy for Wales highlighting the importance of introducing sustainable drainage methods. In launching the strategy, Minister for the Environment Hannah Blythyn highlighted how Wales has moved towards more sustainable methods of dealing with rainwater, thus reducing the risk of flooding, protecting water quality and contributing to communities' sense of place. The Welsh Government's Water Strategy for Wales sets out its aspiration for sewerage and drainage infrastructure so that both waste water and surface water can be well managed and maintained in an integrated way. In order to achieve this, the Welsh Government wants all new developments to incorporate effective sustainable drainage systems (SuDS). The Welsh Government believes SuDS projects not only help with flooding, but provide a range of benefits for society and should be incorporated into all projects. Between 2010 and 2015, the Welsh Government supported Dŵr Cymru Welsh Water, developed a series of SuDS projects, known collectively as 'Rainscape'. One of the largest of these is at Stebonheath Primary School, Llanelli, which uses a range of SuDS methods to divert or reduce the flow of rainwater to the sewerage network. These include permeable paving, water butts, planters, increased numbers of

trees, grass and plant, and a large swale. Stebonheath Primary is the first school in Wales to have a surface water removal scheme retrofitted into its grounds. The scheme has been used as an educational opportunity to enable pupils to understand more about water resource management. Speaking during a visit to Stebonheath Primary, Hannah Blythyn said: "Surface water flooding is a serious problem and a major cause of flooding. The Rainscape project, which I have seen today is an innovative and sustainable approach to dealing with rainwater, which reduces the risk of flooding and water pollution, while also providing a wide range of community benefits. "It was great to hear how the pupils get involved in the design and ongoing maintenance of the Rainscape features. I was particularly interested to hear how they have been educating their parents on the benefits of the project. This, in turn, has led to a better understanding in the community about the subject of drainage, which, I think it's fair to say, is not usually a conversation starter. "Sustainable drainage schemes help to reduce surface water flood risk, protect water quality and improve the local environment. We want to make them a requirement across Wales for all new developments and I am grateful to everybody that responded to our recent consultations."

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UKIS 2018 : KEYNOTE SPEAKERS ANNOUNCED

UKIS 2018, the UK's Leading Infrastructure, Housing & Supply Chain Event, has announced the keynote speakers for this year's event.



Infrastructure is the foundation upon which our economy is built; with the government committing billions to delivering better infrastructure, the infrastructure industry represents a significant opportunity for businesses of all sizes.

The National Infrastructure Pipeline showcases some £600Bn in projects to be completed over the next ten years. Released at the end of 2017, the pipeline is backed by the Transforming Infrastructure Plan, which is aimed at revolutionising British infrastructure and boosting the construction sector's productivity.

Government investment is supporting some 40% of projects included in the pipeline, which is the largest and most comprehensive ever, with private finance making up more than half of the pipeline to 2020/21. The pipeline will help deliver important local projects across the country including transport, broadband, flood defence, and housing.

Major projects featured in the pipeline include Thames Tideway Tunnel, the rollout of smart meters, and the upgrading of the A14.

KEYNOTE ARENA

The Keynote Arena at the UK Infrastructure Show 2018 will showcase presentations from some of the organisations charged with setting the strategy of future infrastructure plans as well as some of the major projects currently under way across the UK.



Bob Sleight OBE
Deputy Mayor of the
West Midlands



Henri Murison
Director, Northern Powerhouse
Partnership



Roger Bailey
Asset Management Director,
Tideway



Keith Waller
Commercial Advisor,
Infrastructure and Projects
Authority



Lorna Pimlott
Director of Phase Two
Policy & Sponsorship
[Phase Two] HS2 Ltd

Through the pipeline, UK infrastructure investment is set to reach a record high. The investment fund includes infrastructure investments of over £2.6Bn to improve transport networks; a multimillion-pound package to accelerate the future of broadband, and £72Bn to support the construction of new homes. Over 720 projects and programmes across transport, housing and digital to fire up the nation's infrastructure are featured within the pipeline, with around 20 new schemes added to the pipeline since March 2016, including the Oxford to Cambridge Expressway.

Investing in better infrastructure is at the heart of the government's ambitious plans to close the UK's productivity gap, and the Northern Powerhouse Investment Fund (NPIF) is designed to boost productivity in the long term. If the UK raised



UKIS 2018 is a must-attend event for those working in all areas of infrastructure, and celebrates major ongoing and future infrastructure projects, including HS2, Tideway and Crossrail.

CONSORTIUM PROCUREMENT is the national procurement service of the Northern Housing Consortium, providing a wide range of framework agreements covering compliance management, asset management, telecare and financial inclusion including insurance and electronic payments. We currently represent over 300 members who between them manage over three million social housing tenancies across the UK.

£70,000 Rainwater Garden complete at Clandeboy Primary School

NI WATER, the Department for Infrastructure, Education Authority and the Department of Education have completed an innovative new rainwater garden at Clandeboy Primary School. Some £70,000 has been invested in the garden, which is an innovative flagship project for NI Water and the Department for Infrastructure, and is the first of its kind in Northern Ireland. The garden demonstrates how sustainable design can reduce the risk of flooding, whilst also enhancing the environment and providing a valuable educational resource. NI Water previously invested £1.7M on a new Pumping Station within the grounds of Clandeboy Primary School. This was part of the overall ongoing £10M investment to improve the infrastructure, reduce the risk of flooding and improve bathing water quality in the Bangor area. On completion of this project, the Rainwater Garden was constructed utilising funding of £70,000 from the Department for Infrastructure. The rainwater garden is a simple concept, which collects water run-off from the school roof and playground area, which is collected in an underground storage tank disguised as a turtle. When the water within the storage tank builds up to a certain level, a valve opens and allows the water to run down a channel, which will be used by the school children as a "duck run" play facility. The rainwater then travels into two split-level ponds within the rainwater garden area, which provides further storage. This process reduces the rate at which the storm water reaches the local watercourse – Clandeboy Stream – lowering the risk of flooding in this area of Clandeboy. Sara Venning, NI Water's Chief Executive, said: "Our customers are at the heart of everything we do and one of our customer promises is to protect and enhance the natural environment – which this scheme undoubtedly delivers. "This is a great example of how we can encourage the engineers of the future to think outside the box and create sustainable drainage solutions, which help to manage storm water and reduce flood risk for our customers in an innovative way. "I would like to thank Clandeboy Primary School, the Department for Infrastructure, Education Authority and the Department of Education, as well as all our stakeholders and elected representatives in the local community for their support throughout this project." Linda MacHugh, Director of Water and Drainage, Department for Infrastructure, added: "There

have been many significant flood events during the last ten years, which have had a severe impact on homes and businesses throughout Northern Ireland, highlighting the vulnerability of many communities to flooding and the need to improve our critical drainage infrastructure. "The Rainwater Garden is an excellent example of an innovative sustainable solution to flood risk and demonstrates joined up government working together, and we plan to adopt this approach in future projects." Roger Sayers, the Education Authority's Assistant Director for Infrastructure and Capital Development, said: "The Education Authority is delighted to have been able to work in partnership with NI Water, the Department for Infrastructure and the pupils and staff of Clandeboy PS to delivery this sustainable and educational drainage solution, which is a first for the education estate in Northern Ireland. As well as reducing the potential for flooding in both the school and the wider area, it also offers fantastic learning opportunities that can be applied across a wide range of subject areas." Julie Thomas, Principal of Clandeboy Primary School, commented: "Clandeboy Primary School is delighted with the Rainwater Garden, which is a great asset to the school. The children have a great opportunity here to safely learn in a practical way about living with water in familiar surroundings, as well as the importance of biodiversity. We are looking forward to seeing the many plants and wildlife blooming in the garden in the spring and summer months."





susdrain

Celebrating SuDS

- susdrain SuDS Awards 2018

CIRIA is delighted to announce that its first susdrain SuDS Awards are open for entries. The Awards invite leaders from across the construction industry to showcase outstanding and innovative SuDS schemes, with a focus on projects that deliver multiple benefits beyond drainage alone. SuDS are becoming an increasingly visible and functioning part of our landscapes and with support from government to increase the uptake and delivery of SuDS – as seen in the 25 Year Environment Plan released in January – this trend is likely to continue. With increased implementation comes increased acceptance and improvements to their design and construction. susdrain's inaugural SuDS Awards has been established to encourage high-quality planning, design, construction and maintenance of sustainable drainage and will showcase the best SuDS that are being or have been implemented over recent years. Suzanne Simmons, Project Manager, CIRIA, says: "We are seeing SuDS mainstreamed in many scenarios, accepted as an effective and attractive means of delivering multiple benefits to society and the environment. It seems only natural now,

with so many truly great SuDS out there that we seek to celebrate these schemes and the people who champion and deliver them. The susdrain SuDS Awards is our way of continuing to champion good practice whilst helping to promote SuDS and their multiple benefits across the wider community; as well as saying a 'big thanks' to the community for their perseverance, innovation and patience in achieving excellence." The 2018 Awards will feature three award categories covering both retrofit and new-build SuDS as well as a SuDS Champion and overall winner. Submitting your SuDS scheme is easy and it's free to enter. You have until Friday 30 March 2018 to submit! For more information or to enter your case study please go to:

https://www.ciria.org/News/CIRIA_news2/Celebrating_SuDS_-_susdrain_SuDS_Awards_2018.aspx

The winners will be announced at an Awards ceremony which will take place on Wednesday, 18 July 2018 at City Hall, (kindly hosted by GLA) in London.



£10M flood storage basin for Salford

A £10M flood prevention scheme was opened in Salford, coinciding with World Wetlands Day, on 2 February. The new flood defence includes an urban wetland and is designed to help protect 2,000 properties from flooding. The Salford Flood Improvement Scheme delivers a long-held vision to create a flood storage basin in Salford, reducing the risk of flooding from the River Irwell. The scheme also allows local wildlife populations to take advantage of the development, by including a high quality urban wetland habitat. Wetlands provide many benefits to society and help us to be more resilient to the effects of our changing climate. They provide multiple benefits such as slowing the flow of water, reducing flood risk, filtering water and capturing

carbon. Their importance is increasing as a result of climate and land use change. The Salford scheme can hold more than 250 Olympic-sized swimming pools of water during a flood and includes more than five hectares of urban wetland habitat. The scheme protects homes and businesses across Lower Broughton and Lower Kersal, which were badly affected by the devastating floods that struck the city on Boxing Day in 2015. Emma Howard Boyd, Chair of the Environment Agency, said: "The £10M Salford flood scheme will reduce flood risk to almost 2,000 homes and businesses. In addition, we have created more than five hectares of urban wetland, bringing attractive landscapes for people and wildlife.

"People in the area can also enjoy a new footpath around the site and links to existing footpaths that now provide a green route to and from the centre of Manchester. This excellent partnership project is a fine example of the multiple benefits our work brings to the local community." Floods Minister Thérèse Coffey said: "How fitting that, on World Wetlands Day, a new scheme in Salford is opening that will reduce flood risk to thousands of homes and businesses and deliver a lasting legacy for wildlife in this area with five hectares of new urban wetland habitat. "I am pleased the government has been able to support this scheme as part of the £39.5M we are investing in Greater Manchester by 2021."



SuDS – latest guidance

STEP-BY-STEP ROUTE MAPS for implementing effective surface water management measures in an urban environment.

The ICE SuDS Task Group has produced a set of detailed, easy-to-follow visual route maps, sponsored by surface water drainage experts ACO Technologies.

All plans and designs for new housing or commercial developments should address the issue of Sustainable Drainage Systems (SuDS) from the earliest stages. This enables the best SuDS to be delivered to mitigate flooding risk, avoid overloading the drainage network and provide water quality, biodiversity and public amenity benefits. However, regulations and

custom and practice vary across the UK nations and between different local authorities, making the processes of SuDS delivery sometimes confusing. The purpose of these new route maps is to provide an overview of the main stages of delivering SuDS, with numerous relevant hyperlinks at the appropriate point. This will help both existing SuDS practitioners and built environment professionals new to SuDS to understand the main processes and available resources. Although not a fixed legal requirement in England and Northern Ireland, SuDS are a legal obligation in Scotland and soon in Wales.

Water UK, the water industry body, is also developing more rigorous standards. The ICE/ACO route maps cover key delivery stages: from pre-planning, design and construction, to adoption and maintenance. There are also numerous links to further detailed information online.

Specifically for:

- Architects
- Planners
- Developers
- Construction contractors
- Water engineers
- Chartered environmentalists



What are SuDS?

Dr David Smoker, Chair of the ICE SuDS Task Group and Business Development Director at ACO Water Management

SUSTAINABLE DRAINAGE SYSTEMS (SuDS)

(SuDS) are surface water management measures which mimic natural hydrological processes, offering benefits to water quality, biodiversity, public amenity and flood risk management. With urban development, impermeable surfaces disrupt the natural hydrological pattern of evaporation from vegetated areas and permeation into the soil. This leads to localised flooding and water quality issues in receiving water courses. SuDS mimic nature and typically manage rainfall close to where it falls. SuDS can be designed to transport (convey) surface water, slow runoff down (attenuate) before it enters watercourses, provide areas to store water in natural contours and can be used to allow water to soak (infiltrate) into the ground or evaporated from surface water and lost or transpired from vegetation (known as evapotranspiration). Local flood risk management plans should consider all impacts of urban developments and, although they are often considered in isolation, SuDS should be considered as part of the response to increased impact of more frequent and larger rainfall events, along with catchment management and river flooding mitigation.

Policy, Procedures and Barriers

It is a requirement of most new developments in England, Scotland, Wales and Northern Ireland to consider and deliver SuDS as part of proposed surface water management measures. Across the four countries, the delivery mechanisms for SuDS and technical capabilities for SuDS are varied:

- **Schedule 3 of the Flood & Water Management Act (2010), which would have provided established SuDS Approval Bodies (SABs) in each Lead Local Authority (LLFA), was not implemented in England**
- **Plans to implement schedule 3 of the Flood & Water Management Act (2010) in Wales are well advanced**
- **In Scotland, the Water Environment (Controlled Activities) Regulations have required SuDS for new developments since 2006, and SuDS are routinely installed in new developments**
- **Non-statutory SuDS technical guidance was developed in England, Northern Ireland and Wales**

- **LLFAs made statutory consultee on surface water management, including SuDS, in major developments in England and Wales**
- **In Northern Ireland, there is no automatic right to connect to the public sewer network (Sewerage Services Act, 2016) and some SuDS components can be adopted by Northern Ireland Water**
- **Water UK, the UK water industry body, is considering embedding a SuDS standard for components that sewerage undertakers can adopt within the unifying adoption document 'Sewers for Adoption 8'**

The variation in policy and legislation surrounding SuDS delivery, in combination with differing national and local governmental organisational structures, funding and skills, is often cited as a challenge to the delivery of successful SuDS (for example: as found in the Chartered Institute of Water and Environmental Management (CIWEM)'s report, *A Place for SuDS*, 2017). In England, policies and laws concerning SuDS have continued to develop, with variable levels of implementation following the introduction of the Flood and Water Management Act

(2010). Evidence from the CIWEM Big SuDS Survey (2017) states that the vast majority of respondents involved in SuDS delivery consider current SuDS policy ineffective and that the full benefits of SuDS are not being realised. However, the greatest barrier to SuDS delivery – commonly reported by housebuilders, practitioners and authorities alike – is the lack of a single adopting body or clear route for adoption of SuDS in new developments. In some cases, these challenges are being overcome by early and effective engagement from stakeholders that desire SuDS.

SuDS in the planning process

The Government's housing ambition of one million homes delivered over the course of this Parliament, as outlined in the Housing and Planning Act (2016), will increase pressure on potable water supplies, urbanisation (and the associated risk of surface water flooding) and could lead to the increased fragmentation of habitats in our urban centres.

Consideration of SuDS early on in the masterplanning process, prior to any outline design, potentially as part of pre-application discussions can be extremely effective in combatting such pressures. By working collaboratively and engaging early in the development planning process, developers, local planning authorities, LLFAs, Internal Drainage Boards (IDBs), highways authorities, Water and Sewer Companies

(WaSCs), other utilities providers, landowners and the public, can integrate effective water management techniques into new and existing communities. This principle is enshrined in and expanded on in the CIRIA C753 SuDS Manual (Part B). In order to gain all the benefits that SuDS provide, SuDS design must be considered at the very start of the feasibility stages of a project and must also be factored in prior to land purchase. If SuDS are integrated into the vision and layout for the development, they will provide many opportunities to add value, character and desirability to a development. If the layout of a proposed SuDS scheme can be agreed at the conceptual masterplanning stage, then iterative design processes can exploit opportunities and overcome constraints by refining the design to make the best use of available space within a development to deliver a high-quality integrated water management solution. SuDS can also play a part in mitigating the requirements for future infrastructure improvements (eg: reducing the quantity of surface water entering public drainage networks, hence reducing the risk of foul water flooding to homes and property and removing, or reducing, the need for network capacity enhancements). Good outcomes are underpinned by due consideration to the layout, function and land-take from the outset, to avoid designers having to effectively squeeze and retrofit lesser quality measures into the drainage design.

The ICE / ACO SuDS Task Group

The SuDS Task Group, sponsored by ACO Technologies, brought together SuDS practitioners, engineering consultants and academics to ascertain what the barriers to SuDS implementation are and how they may be overcome. A survey of over 400 SuDS professionals identified the need for 'route maps' to link to the most up-to-date information and guidance. One of the core outputs of the task group has therefore been the development of a suite of SuDS route maps. There is a wealth of high-quality resources and information relating to SuDS design and delivery – notably the CIRIA C753 SuDS Manual and the supportive community susdrain. The ICE SuDS Task Group wanted to draw together all relevant resources into one single place, to provide professionals and stakeholders involved in SuDS delivery a clear, easy to follow process for the delivery of SuDS and signposting to relevant resources.

The route maps serve two functions:

1. Outlining the processes and stages involved in SuDS delivery (Outline Design, Detailed Design, Adoption, Maintenance and Retrofitting).
2. Providing links to other sources of information and resources to enable professionals to design, deliver, adopt and maintain SuDS.

The downloadable pdf version is available on the ICE website at www.ice.org.uk/sudsroutemaps.



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The hard and soft of SuDS

TRADITIONALLY, DRAINAGE

TECHNIQUES were developed to direct surface water away from specific areas (such as dwellings) and keep spaces safe, clean and easy to manage. However, as we continue to develop over open green land, there are fewer places for water to go. In addition, we are experiencing more extreme weather events (it's raining more intensely, for longer, and more frequently). These factors combine to create the devastating flooding events which we see on an increasingly regular basis. Sustainable Drainage Systems (SuDS) are a series of design methods and philosophies which aim to emulate natural drainage processes. The principle is that rainwater should be collected where it lands and, instead of channelling it away as quickly as possible, it should be held back and released at a controlled rate. This reduces the peak flows that occur during a storm event, meaning that existing sewers and watercourses are better able to cope with the demand. Another key advantage SuDS have over traditional drainage techniques is their ability to improve water quality. As surface water travels over roads or pathways, it frequently picks up a variety of both chemical and biological pollutants. In a traditional drainage system this dirty water then needs to be transported to a different location to be treated; however, in a Sustainable system, many

of the pollutants are removed and the water is cleansed as it flows through the system. Broadly, SuDS fall into two categories – hard and soft. The integration of a variety of different techniques usually provides the best solution; a practical, useable space that invites water in and manages it efficiently while also providing an attractive area that people want to spend time in. In many ways, soft SuDS are the ideal. These include attenuation ponds, rills and swales that have been carved into the landscape to collect volumes of water in a storm event and let it soak naturally down into the ground where it replenishes the water table. These are frequently planted with hardy, perennial, drought-resistant vegetation which is selected to survive regardless of the weather conditions. These provide a number of benefits. The vegetation not only slows down the flow of water by creating a 'leaky dam', but also maximises the cleansing potential of the system. They can create screens which hide less attractive, functional elements of the landscape, or they can be designed to be an attractive feature in their own right. As well as creating pleasant features for people to enjoy, well-planted SuDS also create environments for wildlife and insects which help to maintain healthy ecosystems. However, soft SuDS can take up



significant areas of land. This may be simply unavailable, or developers may be unwilling to give over expensive land for such purposes. In these circumstances, 'hard SuDS' provide an effective, pragmatic compromise. An example of hard SuDS is permeable paving. There are various different type of permeable paving systems, but all varieties follow the same principle: a hardstanding surface which accepts heavy loads and looks the same as either macadam, concrete or block paving, but also allows rainwater to soak through the surface into the ground below or specially designed storage. Although this kind of system doesn't provide the biodiversity and amenity benefits of a well-designed soft SuDS, it does provide a dual-purpose drainage solution that links an attractive, loadbearing landscaping product with a drainage system which cleans

and stores large volumes of water. Permeable block paving is one of the most popular forms of permeable surfacing. It comprises concrete units which fit together to create an attractive paved surface that looks and performs just like ordinary block paving. However, special nibs on the side of the blocks create joints through which rainwater flows directly into a specially prepared sub-base. Once there, the water can either infiltrate directly into the ground at source, or, if that's not possible, be channelled away to a receiving watercourse at a controlled rate. In addition to removing large volumes of runoff from entering our already overburdened sewers, a combination of mechanical filtering and chemical biodegradation that occurs naturally in the sub-base ensures that pollutants are largely removed from the water in the sub-base before it is released. This combination of reducing

water quantity and improving water quality makes permeable block pavements an excellent example of good SuDS. Greater understanding of SuDS, along with the increasingly wide range of products available, mean that landscapers are now changing their approach to water management. Instead of designing water out of their projects, burying it underground and out of site, enlightened landscape designers are now inviting water into their designs – creating shared spaces which make a feature of the fresh, clean water that flows through them. The ability to blend hard and soft landscaping techniques results in easy to maintain places which are as functional as they are beautiful.

Chris Griffiths is SuDS Development Manager for the UK's largest landscaping company, Marshalls plc.



The added landscape and wellbeing value of SuDS

Dr Phil Aldous, Director of Water, Thomson Ecology

TRADITIONALLY, SUSTAINABLE DRAINAGE Systems (SuDS) have been and remain drainage solutions. They provide rainfall and runoff, source control and storage facilities to control and mitigate normal and peak flows depending on the situation. They are essentially rainfall event controllers. However, with advances in SuDS design and options, maturity in the SuDS implementation marketplace and more rigorous requirements and scrutiny at the planning approval stage, the wider landscape and

wellbeing values of SuDS are becoming increasingly important in ensuring that developments receive approval from both planners and the wider community. It has long been recognised that SuDS ponds can, at their best, support rich wildlife communities. But they are largely dominated by common species, and therefore do not fulfil their full ecological potential. There are many simple design features which could easily be added to new SuDS schemes, or be retro-fitted into existing schemes,

to improve their ecological value without compromising their function. Examples of simple and effective measures would include: creating SuDS ponds near to, but not as a replacement for, existing natural ponds. Plants and animals will colonise these new ponds and potentially recolonise after a pollution event; create riffle and pool structures along channels to provide a variety of water depths and check planting schemes after one or two years to ensure that the scheme is performing as expected. Small





changes and alterations like this are well worthwhile. Build and walk away is not an option if benefits are to be maximised. One of the key risks associated with this type of habitat enhancement is the number of non-native plant species that may be either directly or indirectly introduced into SuDS sites. This may include failure to meet specifications for providing native species of local provenance, or the accidental introduction of invasive aliens via seeds in contaminated soil from other bought-in plants, such as the introduction of the highly invasive New Zealand swamp stonecrop (*Crassula helmsii*). But ecology is only part of the landscape and wellbeing story – whether a swale, pond or green roof. To really contribute to wellness and wellbeing, SuDS need to be an integral part of the main design, not an

outside building design extra. Sustainable drainage systems must integrate with the overall design and be firmly embedded into the overall landscape design of the project – walkways, cycle routes, sitting and exercise areas. We can see how good landscape design can enhance wellbeing if we look at the creation of the original garden cities like Letchworth. These cities were designed with large green spaces interlinking urban residences and work locations together with domestic retail. Garden cities followed what could be called the first green revolution, following the trail blazed by famous green architect Le Corbusier. We can measure the impact that these green spaces have on local populations by conducting Health Impact Assessments (HIAs). These assess the positive outcomes for health using specific indices

which are broadly classified as:

- Opportunity and encouragement of physical activity (running, walking, and cycling)
- Improving air quality in and around developments (combustion engines are kept away, plants absorb contaminants, and water features produce air movement through differential warming and cooling)
- The tranquillity and relaxation created by the space eg: reduction in stress and improvement in mental wellbeing

In recent years the health and wellbeing associated with open spaces has slipped down the priority list. Green spaces in our urban neighbourhoods have all too frequently been perceived as a liability due to the net cost in terms of management and maintenance. Because of the planning drive for SuDS, we now have a great opportunity to realise their full potential not only for sustainable drainage, but as ecological havens, and in the creation of wellbeing landscapes. For widespread gain of these benefits, it is essential that we break the management and maintenance funding barrier that has existed for many years. SuDS are different site by site, scheme by scheme with different levels and degrees of integration. What we do know is that these schemes need maintenance to function in the longer term and they need other forms of maintenance to maintain landscape and wellbeing value as well. If we don't maintain the value of creation then over the longer term it will be lost and we will have failed the next generation.

For more information about the work of Dr Phil Aldous and Thomson Ecology, please visit www.thomsonecology.com



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