SUDS IN THE GREATER DUBLIN AREA

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INTRODUCTION

The author's are employed by Dublin City Council which was appointed as contracting Authority to manage the Greater Dublin Strategic Drainage Study (GDSDS). This was established in 2001 to analyse the existing drainage system in the Greater Dublin Area and to make recommendations on future drainage policies. The study area includes the functional areas of Dublin City Council, Fingal, South Dublin and Dun Laoghaire Rathdown County Councils and parts of Meath, Kildare and Wicklow County Councils. The approximate extent and population involved in this area are 150,000ha and 1.2 million respectively. The Department of the Environment, Heritage and Local Government is funding the main study while the OPW are funding a detailed study of the River Tolka as part of the GDSDS. The Service Provider for the study is a Joint Venture of P.H. McCarthy, Hyder Consulting and MC O'Sullivans with H.R Wallingford as sub-consultants. The current value of the study is just over €10 Million.

The study includes hydraulic modelling of foul and storm drainage networks and of eight rivers in the area. It also involves recommendation of future regional drainage policies for the Greater Dublin Area. This includes policies on New Development, Environmental Management, Climate Change, Infiltration/ Ex-filtration and Basements. The policies on New Development and on Environmental Management will both include recommendations that the use of SuDS (Sustainable Drainage Systems) be greatly increased in the area. This paper will examine the history of SuDS in the region and it's likely future. It will discuss the benefits of using these techniques and the main problems and issues encountered with them.

SuDS

SuDS are defined by CIRIA as "a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques"[1]. The reader will note that the term SuDS is used here rather than SUDS (Sustainable Urban Drainage Systems), as these techniques are as applicable to rural settings as they are to urban areas.

In practice, SuDS can be thought of as a move away from the conventional practice of piping all surface water directly to the nearest watercourse or river. Using SuDS techniques, water is either infiltrated or conveyed more slowly to water courses via ponds, swales, filter drains or other installations. Some of these are described in the Appendix at the back of this report. This more closely mimics natural catchment behaviour where rainfall either infiltrates through the soil or runs off slowly over the ground surface to the nearest ditch or watercourse. Run-off is frequently delayed in natural ponds or hollows. In addition to delaying the rate of runoff, there is more likelihood in the natural situation that pollutants will be filtered through soils or broken down by bacteria. SuDS attempts to mimic this natural behaviour and results in attenuation of stormwater runoff and improved environmental performance.

STORMWATER CONTROL

The need for control of stormwater runoff has long been recognised in Dublin. Rainfall on a green field site is either absorbed into the ground or runs off slowly to the nearest watercourse. When these sites are built on, much of the area becomes impermeable with runoff being piped to the nearest watercourse or storm drain. Thus both the volume and rate of runoff can dramatically increase. This has implications for downstream sewers and rivers. It may lead to flooding or increased overflows from combined sewers, neither of which is acceptable. This is of particular concern in Dublin, where many of the densely built up areas are at the downstream end of rivers and drainage systems and there is increased pressure to allow upstream developments. Excess runoff also causes problems with increased surcharging of pipes and increased costs of wastewater treatment in combined systems.

In recognition of this problem, Dublin City Council introduced it's Stormwater Management Policy in 1998[2]. This limits runoff from developed sites to pre-development levels or, in simple terms, runoff from new development is not permitted to exceed 2l/s/ha with excess runoff being stored on site. This policy is now generally accepted by developers and is also being implemented in a number of the surrounding counties.

In most cases, developers have met their obligations under the Stormwater Policy by installing Hydrobrakes or similar devices to control runoff and underground concrete tanks to store excess water. This leads to problems with future maintenance, with cleaning of underground tanks being a particular health and safety issue. Building these tanks also has cost implications for developers. On bigger sites, the volumes required can be equivalent to a number of olympic sized swimming pools.

Developers are now looking at alternatives to underground tanks. Storage ponds, infiltration devices and permeable pavements are all being considered. The local authorities are very keen to encourage this trend as these devices can all have significant environmental benefits and this is increasingly being recognised as an area where improvement is badly needed. Unfortunately, efforts to date have concentrated solely on hydraulic issues. Ponds are being built in some cases and developers recognise that these can have landscaping benefits and may also act as sources of water for fire fighting. However, the enormous potential for these installations to be used to improve water quality has yet to be recognised. So far, any improvements in water quality, as a result of these ponds, have been more by accident than design. Permeable pavements have been used in a small number of cases though Dublin City Councils Roads Section is still reluctant to accept these in areas that will be taken in charge. This arises from their concerns over long term maintenance issues. There are tentative steps towards re-use of grey water but this is still in the very early stages.

ENVIRONMENTAL ISSUES

Public interest in the quality of our surface water has never been higher, but there are significant problems to be addressed. Dublin Bay currently has only one blue flag beach. While the Ringsend Waste Water Treatment Plant has made great strides to improve this situation, the water quality in the incoming rivers and the whole issue of Combined Storm Overflows (CSOs) also needs to be tackled. The EPA Water Quality Classification for the GDSDS area shows that 70% of water quality stations tested were polluted. Public interest in this issue is now at an all time high and the forthcoming Water Framework Directive will place even more pressure on local authorities to improve water quality.

Stormwater runoff from urban areas has impacts on surface water quality. Firstly, and most obviously, storm runoff can carry pollutants such as oil, anti-freeze, animal and human waste, decaying leaves, grass or other waste matter to our surface waters. This is particularly critical in the case of the first flush, where material may have decayed for several weeks in dry weather before being washed into the watercourse. This is particularly serious when the baseflow in the watercourse is low, which would also be consistent with a long dry period. Secondly, surface water in older areas frequently drains into combined sewers. These were designed to carry dry weather flow and smaller storm events but to overflow to watercourses during more severe storms. In practice, many combined sewers are now carrying considerably more load than they were designed for and overflow in relatively minor rainfall events. The overflow of, admittedly dilute, foul sewage to a watercourse has obvious pollution implications.

The use of SuDS can help address both of the above issues, providing a control on stormwater volume and quality. Volume control reduces the number and severity of overflows from combined sewers. SuDS also have a direct bearing on water quality by mimicking natural processes. Infiltration systems lead to pollutants being filtered out or broken down by bacteria. Swales encourage pollutants to settle out or be broken down naturally. Retention systems such as ponds also allow settlement and natural breakdown of pollutants via aquatic plants and other organisms.

The implementation of SuDS is as much about changing mindsets as it is about drainage systems. Simple ideas like covering rubbish storage areas to prevent contamination of runoff can yield significant improvement at a relatively low cost.

AMENITIES

In addition to providing runoff and pollution control benefits, SuDS can provide amenities to local communities. Ponds or wetlands can be visually attractive and these features have long been encouraged by landscape architects. Many larger SuDS features now include paths or cycleways along the perimeter to encourage their use as local amenities.

Properly constructed wetlands will quickly be colonised by water birds and small animals. Indeed, it has been shown in Scotland that some SuDS features have higher conservation value than natural ponds. The ability to attract wildlife to an urban area is a benefit that should not be underestimated and local authorities should be striving to encourage biodiversity.

It could be argued that many of the green spaces traditionally provided in large housing estates are of little amenity value, require regular grass cutting and can be a focus for anti social behaviour. Surely replacing some of these with ponds or wetlands could be seen as a benefit to the local community. A properly constructed SuDS installation can be as much a public amenity as an item of drainage infrastructure.

COMMON CONCERNS

The ability to provide volume control and environmental benefits whilst potentially providing natural amenities to the local community make SuDS look like the ideal solution to stormwater runoff, yet there is a large amount of scepticism about this. Developers are slow to sign up to full implementation of SuDS and even local authorities are unhappy with certain aspects. People commonly cite concerns about safety, maintenance, cost, land take, site suitability, foundation stability and flooding issues. All of these are legitimate concerns and need to be addressed.

SAFETY

One of the most popular forms of SuDS involves the use of ponds in either industrial or housing areas. A concern frequently expressed is that this leads to a newly created risk of drowning, particularly for small children. The Irish tendency towards litigation makes local authorities all the more nervous in this regard. While these concerns cannot be dismissed out of hand, the risk of a child drowning in a properly constructed pond is considerably less than the risk of a household or traffic accident. We don't ban roads! Ponds can be designed with a relatively shallow perimeter so anyone venturing in would be cold, wet and covered in mud long before they were in danger of drowning. Dense vegetation can also be used to deter access. To operational staff, SuDS can actually reduce Health and Safety problems associated with working in sewers or underground tanks. While risk can never be completely eliminated, it can certainly be reduced to acceptable levels.

SITE SUITABILITY

Concerns are often expressed about filter drains or porous paving being placed in unsuitable locations. It cannot be denied that a filter system will not work if the surrounding soils are impermeable clay. Similarly, infiltration systems may not be advisable close to sensitive aquifers. This still leaves a lot of areas where infiltration systems can be used for stormwater control and may even provide benefits such as ground water recharge. A proper design is required to ensure that the measures implemented are suitable for the given site, but the need for adequate design and planning should not make the implementation of SuDS any more onerous than conventional systems.

MAINTENANCE ISSUES

One of the most strenuously made arguments against the use of SuDS is the perceived need for future maintenance. Porous paving systems will need to be cleaned or possibly even replaced sooner than conventional pavements. Swales will require occasional grass cutting. Having said that, the need for gully or even pipe cleaning is eliminated. Ponds are considerably easier to clean and maintain than

underground tanks. There is a perception that infiltration systems will require more frequent maintenance but these have been used on road schemes for decades without significant maintenance problems. Research in the UK in a number of areas suggests that maintenance of SuDS systems is generally comparable or cheaper than maintenance of conventional drainage systems[1].

The main concern in this area is that responsibility for long-term maintenance needs to be assigned. Local authorities are always reluctant to take on new maintenance responsibilities and developers may not be well placed to offer long term maintenance commitments. Residents groups or management companies could take responsibility for maintenance but this may be problematic. Having said that, these problems are now being encountered with private estates built with conventional drainage methods. The issue of taking in charge is a serious one and needs to be addressed, but like all of these issues, this is a problem that can be overcome.

HOUSING DENSITY

One of the most controversial issues encountered with SuDS installations is that they are perceived as requiring greater land take but this is not necessarily the case. Infiltration systems such as porous paving can be used instead of conventional car parking areas. The areas underneath porous pavements can be used as filter drains for roof drainage or conventional soak pits can be built. Even simple measures such as water butts under down pipes or draining driveways into a garden or soakway can give added SuDS benefits without any loss of building space.

It is undeniable that ponds or similar measures require some degree of land take. This partly explains why we have already seen ponds in business parks or industrial areas but that developers are reluctant to place them in housing developments. The area taken up by a pond could well be another block of apartments and local authorities are now as keen to endorse high densities as developers are. However, properly constructed SuDS systems can add to the amenity value of an area and even increase property values. Research in the US shows that builders can charge significant premiums for sites overlooking SuDS installations[3]. Even in Ireland, developers have been known to put in water features for landscaping purposes and fire fighting requirements without considering their possible water quality benefits. Water features can be more attractive than conventional green space. Local authorities should be ready to accept SuDS installations as part of a development's green space requirements if we are serious about improving our surface water quality.

FLOODING

Concerns have been expressed about the ability of SuDS installations to deal with severe flooding events. If a rainfall event lasts for a number of days, storage features may become full and infiltration systems may become waterlogged, with the result that the system can no longer cope and surface flooding can occur. This is true but it is equally true of conventional drainage systems. It would not be practically possible to design a SuDS system to protect against every possible flood event but we don't design conventional systems to do that in any case. SuDS systems are frequently built with overflows to deal with this issue. Failure of a SuDS system should be more gradual than failure of a conventional system in any case. The focus should thus be on flood routing to ensure that flooding is confined to green spaces or roads rather than properties.

FOUNDATION STABILITY

The focus on infiltration of stormwater causes concern to some engineers. Road designers in particular are used to the concept of keeping ground water as far as possible from their road base. They are thus a little reticent about accepting swales or similar measures to deal with surface water. Having said that, filter drains have been used on roads projects for years without significant problems. What is important is that we ensure filter drains or soakways are far enough from foundations to ensure that stability issues won't arise. Again what we are really highlighting here is the need for proper engineering design. It has been suggested that SuDS may even benefit foundations in so far as SuDS offer a certain amount of groundwater recharge. Foundation damage due to ground shrinkage is often blamed on trees. In reality soils are likely to dry out if we build on them thus eliminating the ability of the soil to regulate its moisture content. Allowing recharge can reduce the risk of ground shrinkage.

Ground water recharge is likely to become an increasingly important issue in the future with climate change experts warning of drier summers and much lower baseflows in watercourses. Increased use of SuDS would help to alleviate these problems.

EXPERIENCE IN OTHER COUNTRIES

People often express reluctance to shift to SuDS due to a lack of research or lack of understanding about their long-term behaviour. The long term nature of engineering work means that conservatism is natural. Nobody wants to be the first to experiment with new ideas or concepts as unforeseen problems may have long term implications.

In fact, SuDS have been in use worldwide for some considerable time. SuDS installations in Sweden go back 15 years and any teething problems have now been overcome there. Swedish authorities point out that SuDS installations are highly regarded there and property supplements regularly stress the fact that particular properties are overlooking a pond. The same has been recorded in the USA, where SuDS are also well established.

There have been some problems in the past with poorly constructed ponds or wetlands but these have been overcome as knowledge in these areas has increased. SuDS are now firmly established in Sweden, the USA, New Zealand and Australia and closer to home, have been used in the UK, and particularly Scotland, for several years. In none of these countries have SuDS been considered to be unsuccessful and I've no knowledge of any moves to revert to more traditional systems.

THE FUTURE

The Greater Dublin Strategic Drainage Study will be recommending that the use of SuDS be greatly increased in the region. These concepts will be incorporated in the New Development Policy and the Environmental Policy. It is hoped to have these adopted in the early part of 2004.

This is expected to offer considerable benefits in terms of stormwater control and prevention of flooding. In addition to this, SuDS will offer enhanced surface water quality. Indeed it has been suggested that Ireland may not be able to meet its obligations under the Water Framework Directive without widespread use of SuDS. Finally, SuDS will offer improved amenities, including the introduction of valuable wildlife habitats to areas where this would otherwise not occur.

SuDS will bring benefits to developers as well as to the public. Now that the need for stormwater control is accepted, these techniques can be adopted at little or no extra cost yet yielding significant additional benefits. SuDS offer developers more tools for meeting their stormwater control obligations in a way that can also enhance the quality and ultimately the price of developments. Research in the US has shown this to be true.

There are reservations over the introduction of SuDS among developers and even the local authorities. We must recognise that people do have legitimate concerns, but all of these issues can be overcome. While we can expect an initial degree of scepticism it is hoped that the successful use of SuDS on a small number of sites will increase confidence in these measures and as experience grows, this process is likely to take on a momentum of it's own. The benefits of using SuDS far outweigh the concerns people have and it is incumbent on all of us to strive to ensure their widespread acceptance.

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The views expressed in this paper are the views of the authors only and do not represent the policies of Dublin City Council or the other local authorities involved in this study.

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APPENDIX

Typical SuDS Installations

Permeable Pavements	Use of porous asphalt, porous paving or similar concepts to reduce imperviousness thus minimising runoff. Runoff infiltrates to a stone reservoir where some breakdown of pollutants occurs before controlled discharge to a drain or watercourse or direct infiltration.
Filter Drains	A gravel filled trench, generally with a perforated pipe at the base which conveys runoff to a drain or watercourse. These provide attenuation and trap sediments.
Infiltration Trenches/ Soakways	Gravel or rock filled pits or trenches designed to store runoff while letting it infiltrate slowly to the ground. Provide treatment of runoff through filtration, absorption and microbial decomposition.
Bio-Retention	These devices are depressions back filled with sand and soil and planted with native vegetation. Provide filtration, settlement and some infiltration. Typically under drained with remaining runoff piped back to the drainage system or watercourse.
Swales	Grass lined channel designed to convey water to infiltration or a watercourse. Delays runoff and traps pollutants via infiltration for filtering effects of vegetation.
Detention Basins	Dry vegetated depressions which impound stormwater during an event and gradually release it. Mostly for volume control but some pollutant removal achieved via settlement of suspended solids and some infiltration.
Retention Ponds	Permanent water bodies which store excess water for long periods allowing particle settlement and biological treatment. Very effective for pollutant removal but limited to larger developments. Have high habitat and aesthetic benefits.
Stormwater Wetlands	Like retention ponds but with more vegetation and less open water area. Excellent for pollutant removal. Also provide aesthetic and habitat benefits.