

## **Water, Flooding & Landscape**

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This Note helps inform landscape practitioners of some of the context for, and story of, landscape practice in relation to water, and points to other resources that are available.

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# 1 Introduction

In the context of a climate emergency, water as a resource or as a threat will be one of the key challenges across the professions. Water is essential for life – it is a basic need and yet 80% of the world’s population live in areas where there are threats to either water security or aquatic habitats.

Landscape professionals have a role in identifying adaptation and resilience solutions and devising programmes. Inevitably these will be alongside other professionals such as hydrologists and engineers. This is an approach which the profession champions: working with natural processes and taking a landscape-scale approach. The Institute’s Position Statement on Green Infrastructure is an example.

The aim of this Technical Note is to outline the present context and signpost landscape professionals to relevant technical information. As such there are some excellent resources available through a number of organisations, e.g: CIRIA, SEPA, CaBA and the Environment Agency.

## 1.1 Water - a fundamental part of the natural environment

The presence or absence of water determines life. And one of the key challenges facing mankind is linked to its distribution at any one time within the local hydrological cycle (WEF 2014).

Man has for a long time sought to modify this geography of water. The Romans built aqueducts, the Dutch reclaimed land from the sea, and the British created canals. To this list can be added flood defences, reservoirs, and irrigation systems. While such major interventions may have once prompted concern over their landscape and visual impact, and some still do, we owe many of today’s opportunities to the skills of engineers working in the landscape. And some features, such as the reservoir at Lake Vvrywy, Flatford Mill, and the Pontcysyllte aqueduct are now valued as distinctive elements in the landscape.

Some modifications to the geography of water have arisen unintentionally as a by-product of other kinds of landscape change. Earthmoving, forest clearance, urbanisation, and certain agricultural practices have led to local disturbances to the distribution and flow of water. The unintended consequences have sometimes been landslips, erosion of foundations, siltation, and more flooding than would otherwise occur naturally. And where over-abstraction of water has occurred, byproducts include sections of rivers drying up (‘ponding’).

Of all these consequences flooding has had the most immediate impact.

*“considerable damage has been caused in various parts of England by the prevalence of floods during the last winter...such floods have been more frequent and of longer duration in recent times than formerly” Report of the Select Committee, House of Lords, 1887*

Although this was said in 1887, this could have been a quote from 1770, 2001, 2014 or 2020 (or if the Bible is believed, the time of Noah). Flooding is not a new problem. It is one of the most commonly experienced environmental hazards. Its main impact in upland areas may be on the landscape where our understanding has changed about the nature of upland catchments (Whyte, 2009) but in the lowlands it ruins lives. Following various recent catastrophic weather events, the Water Framework Directive, the Flood and Water Management Act, and tensions over continued housebuilding in floodplains (sometimes against Environment Agency advice) it is subject to renewed focus, particularly the handling of surface water.

With surface (storm) water, the traditional approach of getting it into a pipe and away as quickly as possible cannot now always be adopted because downstream capacity in pipes and rivers is constrained. In many if not most places a form of landscape engineering is now required to ensure that water is captured and evaporated, treated, used or infiltrated as close to source and surface as possible. So moves are afoot to ensure that new housing developments accommodate space for sustainable drainage systems (SuDS) or Natural Flood Management (NFM). These new SuDS will help, but they will only ever be part of the solution. A programme of retrofitting SuDS to existing developments would go further but some adaptation to flooding will be needed whether in terms of architecture or land-use.

Drought is another issue. Per capita the UK is one of the 'drier' countries in Europe in terms of water consumption. The water companies, encouraged by OFWAT, are seeking to drive this down – a challenge without the introduction of widespread metering. As one measure, landowners are also being encouraged to capture rainwater. This will provide new opportunities to create ponds and perhaps halt their disappearance from the landscape. But if consumption can be reduced then perhaps we can once again see water back in some of the UK's lost streams and benefit from the other ecosystem services they provide.

Inevitably there will continue to be some water-related civil engineering activities which may well cause concern regarding their impacts, such as flood defence structures, dredging and detention basins associated with major transport infrastructure. Perhaps there may be new reservoirs and structures to enable water transfer. Any negative impact on the landscape needs to be minimised but the bigger challenge is to keep water in the landscape, and within the landscape alone.

The landscape profession has a long history of positive intervention:

*"The English park, perfected in the designs of Capability Brown, was a deliberate composition in complete keeping with its context, shaped by the presence of water features on a major scale. Although often contrived, the whole effect was designed to recreate nature as faithfully as possible and so the sinuous, unpredictable line of lake and stream replaced the geometry of canals and water parterres as the ideal form of water in the garden" (Plumptre, 1993)*

The start of the involvement of the landscape profession with water in the UK is perhaps most famously linked to improving the estates of the 18th century elite. Even Capability Brown could be said to be an early exponent of multifunctionality, since his lakes were designed to allow not just fishing but also boating and visual amenity - and of all things, otter hunting. (Mayer, 2011). But it has evolved well beyond this.

## 1.2 Vision

Drivers for evolving landscape practice include the demands for fresh water and sewers from an increasingly industrialised and urbanised environment. These major civil engineering projects have spurred the profession to speak up for the landscape, sometimes against the forces of change and sometimes for new approaches. The associated growth in the public realm and in the public's right to relate to landscape, most recently best expressed in the European Landscape Convention, have also developed a desire to seek wider benefits.

As long as sixty years ago landscape architects, inspired by the Netherlands, raised concern at the way streams were being turned into sewers rather than providing "wonderful opportunities for interesting

treatment of the town" (Colvin 1947). A similar point was echoed by Tom Turner: "a major reclamation programme is necessary to reclaim our channels, water-courses, culverts and coastal defences" (Turner 1998). Some good examples can now be found, such as at Mayesbrook Park or the River Roch through Rochdale, a much-acclaimed example of delivery of multiple benefits through 'daylighting'. But many streams remain lost.

Insensitive creation of reservoirs has also prompted concern (Hackett, 1971) partly because they sometimes went against a principle that the proper place for large water bodies is 'at the bottom' and also due to the visual impact of the dam wall and the drawdown zone. But the profession has long recognised and promoted the value of "wet solutions" to the restoration of low-level mineral workings. Suitably naturalistically designed (Bell 1999) the legacy of sand and gravel extraction can be opportunities for wildlife and recreation.

A recent thrust is for water sensitive urban design that integrates with green infrastructure and "a comprehensive range of water management techniques" to help deal with flooding (Illman, 2014).

### 1.3 Expertise

Underpinning both campaigns and moments of vision, landscape professionals have developed real expertise relating to water in the environment. At the turn of the 20<sup>th</sup> century Gertrude Jekyll worked with Edwin Lutyens to develop formal water features which still inspire today. That this was then an area of professional strength is evidenced by early textbook coverage of formal ponds, natural water features and roof gardens (Sudell, 1933).

Many skills were acquired by learning from others: architects, engineers and other organisations operating in the environment. As a result, a shared understanding has developed of the potentially damaging effect of water in the wrong place during building construction. Landscape architects have also learnt how to design structures, such as bridges, pontoons or drainage systems. A particular landmark was the publication by the British Trust for Conservation Volunteers of *Waterways and Wetlands* (BTCV 1976) one of a number of valuable handbooks. This equipped landscape managers with a wealth of soft engineering and maintenance techniques. Jeremy Purseglove's seminal work, *Taming the Flood* did much to change our perceptions of managing rivers rather than simply 'engineering' rivers (Purseglove, 1989). Skills have also been developed about dealing with the lack of water. Landscape architects working in the Middle East developed and brought back expertise with irrigation and water conservation (Cochrane & Brown 1978). A number of very dry summers coupled with hosepipe bans encouraged the development of capabilities relating to water detention, irrigation and drought-tolerant species.

Currently landscape expertise is working at the forefront of designing and managing green roofs, and SuDS (Dunnett & Clayden 2007, Landscape Institute, 2014). Landscape professionals understand the infiltration properties of different soils, subsurface geology, topography, plants for different purposes and how to design structures such as swales, detention basins and wetlands that fit with sites and localities. In many cases they can also perform all the necessary calculations to achieve greenfield runoff rates. Water impacts many areas of work relating to the work of landscape professionals:

- Urban design to reduce surface water
- Sustainable Drainage systems: Rainwater harvesting/ green roofs/ rain gardens
- Grey-water recycling/ diffuse urban pollution

- Landscape and catchment management planning
- Designing of greenspace and green-blue infrastructure
- Flood management schemes
- Communication/ working with communities / community resilience
- Recreational development of rivers
- Coastal management
- Wetland restoration
- Horticulture and sports pitch drainage

#### 1.4 Regulation

As well as responding to the needs of clients, Government and its agencies have influenced the work of the landscape professional. The expansion of landscape character assessment in the late nineties, linked to its recognition in planning policy guidance and continued promotion by Natural England, has grown the profession's understanding of the importance of water to the wider landscape, including through history. It has provided a *landscape-based* frame of reference for action that previously might have been limited to arbitrary "corridors" or fragmented patches of wetland habitat. The Environment Agency's imperatives to manage water bodies, coastal erosion and surface water flooding have also drawn on and honed relevant landscape skills and not just in their own landscape staff. As the Environment Agency has opened up its strategic planning processes, in part driven by adoption of the Water Framework Directive, to external contributions through the catchment based approach it has provided opportunities for other landscape professionals to engage. This should grow a capacity in the profession to contribute to future River Basin Management Plans and be engaged in the approval of SuDS.

#### 1.5 Achievement

Throughout there have always been landscape designers who could excel in the construction of large water features, hence the water gardens in Harlow New Town designed by Frederick Gibberd and Geoffrey Jellicoe's Water Gardens in Hemel Hempstead. But with the inspiration given to clients and the confidence given by the Water Park designed by Derek Lovejoy and Partners at the Liverpool International Garden Festival, the body of practitioners developing water-related construction skills has grown.

Substantial resources have been made available for the landscape by the National Lottery Heritage Fund following intensive study by landscape practices and competition between the schemes they are supporting. This competitive process has resulted in a resurgence of landscape skills and understanding related to the restoration of some of these older but iconic water features in parks such as Howard Gardens in Letchworth Garden City, and the Town Centre Gardens in Stevenage.

## 2.0 The case for landscape input: theory and practice

*“There is no question that – certainly in the last few decades – the potential for interesting large scale water landscapes has been in the realm of landscape architecture and no longer in the average private garden” (Plumptre, 1993)*

Based on the opportunity, motive and means, landscape professionals continue to be uniquely placed to provide insight into the management of water at a range of scales and with regard to physical, political and technical processes.

### 2.1 Water sensitive design

Water sensitive design – designing our towns and cities around the water cycle - has gained increasing traction. Such a holistic approach integrates waste water and storm water into urban design includes elements such as green-blue infrastructure, SUDS and green roofs into plans for new development or retrofitting existing residential areas. As such the approach works at a number of scales from the household through to the neighbourhood or city. Designed from the outset within the urban realm, not only can this prevent issues around surface water flooding but, by embracing water in development, create vibrant places.

#### 2.1.1 Blue and Green infrastructure

Since green infrastructure depends on plants and interdependent animals, a supply of environmental water is necessary for its growth. And green infrastructure also forms part of the hydrological cycle itself as the process of evapotranspiration is the means by which much water is returned to the atmosphere.

A notable convergence of green with blue infrastructure occurs along watercourse and river valleys. Water naturally forms into a network of watercourses and rivers. In the timeframe of human lifetimes these tend to follow the same course. This stability means that habitats develop adjacent and the network can potentially support other regular patterns of activity by people and wildlife, providing for associated stable networks. Water also remains a fundamental resource for wildlife and a route and means for species migration (and sometimes species invasion). Water is also attractive for activities such as observing wildlife and recreation. And because of the difficulties of arable farming and construction on periodically waterlogged land, so land adjacent to watercourses has often been left unimproved, much as grassland. In this way the nation’s river valleys have of late consistently become seen as networks of value for both blue and green infrastructure. Whether as countryside management projects, environmental land management schemes, integrated biodiversity delivery areas, nature improvement areas, or Heritage Fund landscape partnership projects, many environmental initiatives have been focussed around a river network. It is perhaps only surprising that river systems are under-represented as SSSIs (Wyatt, 2013).

Severance is one of the big threats to green infrastructure network integrity and this is seen too with blue infrastructure in a number of ways, notably culverting and interruptions to the movement of people and fish caused by structures such as weirs. The fragmentation of ownership and varying approaches to fencing, land use and public access alongside rivers also compounds delivery of some

ecosystem services that rely on continuity. Diffuse and point source pollution are two further challenges.

Landscape professionals are often involved in the planning of green infrastructure and can recommend changes in the way that land is used to promote blue/green networks and prevent their severance. They can also suggest wider landscape measures to reduce runoff, erosion and diffuse pollution, e.g. from upland catchments

### 2.1.2 Sustainable Drainage Systems (SuDS)

SuDS are a collection of measures that seek to make modern drainage work in parallel with natural systems. The SuDS Manual produced by CIRIA is a comprehensive guide to their application with a wide range of case studies including many supplied by landscape professionals.

Rainwater harvesting, the storage and use of rainwater in site, clearly has beneficial impact with respect to surface water flooding. There are a number of techniques working at a variety of scales. SuDS as articulated within the SuDS Manual are a collection of techniques that include green roofs, swales, detention and retention ponds, tree pits and their use within new or existing green space to create networks to direct surface water ('management trains') (CIRIA,2017). Links to technical details can be found in appendix 1.

SuDS have been demonstrated in Scotland to be half the capital cost of traditional systems with annual maintenance costs 20-25% cheaper and to be cost-effective flood control mechanisms. (Duffy et al 2008). They remove pollutants and yet do not collect levels of pollution which would require notified disposal (Heal et al 2006, Napier et al 2009).

The potential for landscape designers to contribute to SuDS is regularly recognised by leading industry bodies such as CIRIA who incorporate leading exponents of soft SuDS solutions in their training offer.

Case studies include the retrofitting of SuDS to highways (Ribblesdale Road) and multifunctional SuDS within a parkland setting (Central Park). These show the art of the possible if there is a political will and the practicalities can be solved, particularly regarding future management responsibility. Highway law does not always help, and the division of responsibilities for drainage matters within and between organisations can sometimes hinder, but Nottinghamshire County Council is just one of a number of highway authorities which has worked through the challenges and is embracing SuDS within the highway.

Springhill Co-housing is an example of a sustainable housing neighbourhood. Using rills to define public/private boundaries, dramatic cascades to deal with level changes, creating play spaces from storage basins and integrating an ornamental pond, this project offers full flood and water quality protection whilst creating an attractive place to live.

As a designer the landscape architect can be expected to specify both hard and soft details that can be both resilient to water but also cope with the drought that is implicit within temporary inundation.

At an urban-scale, new residential development at Upton, Northamptonshire is a good case study of designing swales into a scheme from the outset at a residential scale. In China, the 'sponge-city' concept is the adaption of water sensitive design on a city scale.



Whilst the Landscape Institute alongside other professions including CIWEM and ICE continue to champion SuDS, there is still a long way to go before we can truly have truly integrated water-sensitive urban design such as the schemes identified in the CIRIA guidance (CIRIA, 2017).

### 2.1.3 Green Roofs

Modelling conducted in Manchester found that adding green roofs to all buildings in town centres, retail and high density residential could reduce runoff by 17-19% (Gill et al 2007). They intercept water and reduce peak run-off rate (Mentens et al 2006) Green roofs have also been shown to be effective in reducing diffuse pollution load (Hatt et al 2008).

Redknock School was the winner of the RIBA People's Choice category 2010 and also a local sustainability award. It demonstrates integration of green roofs with a SuDS system to achieve the BREEAM "excellent" standard. Other examples include: [Moorgate Crofts Business Centre](#)

### 2.1.4 Greenspace

Identifying opportunities for retention of water in traditional parks, playing fields or green infrastructure offers opportunities to reconfigure greenspace to allow for temporary inundation of water. There is also a wider movement that considers greenspace in the context of climate change looking at urban pollution and the urban heat island affect. The profession including landscape architects is also looking at how practice can be made both more water-sustainable and encourage biodiversity. Note: the move to establish drought-tolerant perennial planting and wildflower meadows.

### 2.1.5 Natural Flood Management (NFM)

There is a new understanding of working with natural processes that includes natural flood management and identifying space for water. These have been identified within the Environment Agency's 'working with natural processes' evidence-base (Environment Agency, 2017) and are central to the catchment-based approach (Landscape Institute, 2016). Case studies such as the work at Belford or Pickering have inspired a range of interventions at a catchment scale in rural headwaters. These measures can include cross-contour woodland planting, large woody debris dams in water courses or attenuation features.

### 2.1.6 Strategies, plans and policies

Water is a blue thread that continues to flow through the policy work of the Landscape Institute. The Position Statement on Green Infrastructure (Landscape Institute 2013a) describes GI as "the network of natural and semi-natural features, green spaces, rivers and lakes that intersperse and connect villages, towns and cities". It goes on to refer to coastal zones, river valleys, waterways, and wetlands as components of GI, and the contribution that GI can make to water management objectives. It recommends that green infrastructure can often replace grey infrastructure to reduce flood risk and refers to green roofs and SuDS as specific interventions. The Position Statement on Public Health (Landscape Institute 2013b) reinforced this point, embedding water within the first principle for the creation of healthy places.

Defra, its arms-length bodies, SNH, local authorities and NGOs like CIRIA lead on areas of policy related to water. However, with the expanding capabilities outside the public sector LI members are frequently commissioned to contribute to strategic documents, such as the Environment Agency's Landscape & Environmental Design Guidelines and DEFRA's Landscape and Fluvial Design guide. The Institute works with other professional bodies as it promotes a vision for a more integrated approach to water management.

## **2.2 Flood and Coastal Risk Management**

Perhaps one of the most topical instances of the contribution that the landscape profession can make has been its work on flood risk and flood alleviation schemes. The profession seeks solutions that offer wider functionality than just meeting their primary purpose over a few days every few years. More recently there has been an emphasis on working with natural processes.

### 2.2.1 Flood risk management

The Jubilee River is one of the most significant fluvial flood risk management schemes, in terms of scale and investment, in the UK. It incorporates a wide range of aspects including significant areas of wetland and marginal habitats, a national cycle route, bridleways, and a significant length of the Thames long distance footpath. Much of the planning and design work for the project was highly innovative as for the first time the scheme took major water management infrastructure development into the realms of multiple use green infrastructure.

Sutcliffe Park, another scheme undertaken by the Environment Agency further evidences the scope to integrate blue and green infrastructure through a collaborative approach. The Flood Alleviation Scheme at Nottingham shows similar attributes and was led by a private sector landscape practice. Other examples include Boscastle, Coughton Court (National Trust), Caldew & Carlisle & Morpeth.

### 2.2.2 Coastal strategies and projects

As an island nation, our relationship with the sea has seen us seek to protect our coastline. As a profession we have sought to recognise both the importance of 'seascape' and in regenerating seaside towns celebrating our relationship with the sea through restoring esplanades or regenerating docks and harbours.

The impacts of tidal surges have a particular impact. The floods of 1953, where over 300 people were killed along the East coast with 11,000 people left homeless on Canvey Island alone led over time to the development of tidal barrages such as the Thames Barrage (1976-84). Our recognition of the power of tides has created the driver to harness such power such as proposals for the Swansea Tidal Lagoon.

Our response to such catastrophic events has changed over recent years. The Environment Agency working with Lead Local Flood Authorities has sought to create shoreline management plans where investment in sea defences are prioritised and areas with the potential for 'managed retreat' identified. Although controversial, retreat in the face of overriding costs to combat climate change may not just be the most pragmatic solution but has the potential to create new priority habitats such as coastal saltmarsh which have been under threat through 'coastal squeeze' – the loss elsewhere of habitat due to coastal defences.

Managed realignment of the coast is not an everyday occurrence and requires extensive collaboration. Medmerry is an important example of a developing area of coastal green infrastructure planning and design, the development of which requires well co-ordinated inter-disciplinary working, fully incorporating a wide range of the skills of landscape architects and other key water management, access design and ecological disciplines.

In Suffolk, the Touching the Tide Heritage Fund Landscape Partnership sought to take a holistic approach to tidal retreat.

## **2.3 Water resources and supply:**

Even in a country with relatively high rainfall the supply of water for industrial and domestic needs has been paramount. The planning of water resources to support growth – both the economic growth based on water-hungry industry and the development of new towns demanded water resource management. Large new reservoirs were built in times of economic growth. For example, the development of Grafham Water in 1965 and Kielder Water in the 1970s saw water authorities embrace landscape architecture and recreation provision on a grand scale. Of late much new reservoir and lake construction by the profession has been overseas.

Water resource strategies are more associated where water supply is critical but increasingly this applies to parts of the South of England where abstraction has led to significant harm to existing chalk streams. Note the Environment Agency's Water Resources Strategy for Southern England.

### 2.3.1 Reservoirs

In the UK recent work at the 1930s Cheddar Reservoir in West Somerset makes it an amenity destined to become an integral part of the local landscape and history with a positive long-term impact on the landscape and on local people's lives. It has new recreational facilities and includes flood-plain compensation and the creation of a biodiversity area which connects with local and national sites of biodiversity importance. Other examples include: Wenying Lake and Trimpley Reservoir.

### 2.3.2 Water quality

There has been increasing recognition that the focus on improving water quality has to move from identifying point source pollution to a catchment-based approach as articulated within the Water Framework Directive. Targets for Good Ecological Status under the Water Framework Directive focus on the physico-chemistry (pH, temperature, nutrients) and biology (aquatic plants, invertebrates, fish) of our rivers.

### 2.3.3 Biodiversity

In parallel with the climate emergency has been the dramatic loss of biodiversity. Their continuous linear nature make rivers important for migration of wildlife above and beyond the freshwater species that inhabit them. Yet through development we have sought to separate, to break the link between rivers and their floodplain and in the case of urban rivers make them almost unrecognisable. Less than a fifth of our rivers are considered 'healthy' either due to water quality or due to physical obstructions including weirs.

10% of all freshwater species are considered threatened. Charismatic species such as otter, kingfisher, salmon and water voles are well known by they depend on a range of damsel flies that are vulnerable to pollution including excess nitrates as a result of intensive farming practices. The threats to some of our existing water habitats such as our internationally important chalk streams from abstraction and diffuse pollution are critical.

#### 2.3.4 Horticulture

As a profession it is important that we recognise the need to conserve water whether this is drought-tolerant planting or using tree pits to absorb surface water. There are examples of our profession innovating, for example, pioneering solar-powered irrigation in London inspired by Churchman Landscape Architects and designed by Mouchel Parkman (Landscape- July 2006). The London Olympic Park and creation of 23 hectares of species rich grassland and naturalistic planting developed by Professor Nigel Dunnett of Sheffield University and others.

### **2.4 Catchment and River strategies and plans**

Recognising catchments from their source to the sea is implicit within the catchment-based approach (Landscape Institute, 2016). Issues such as water quality, surface water or habitat creation can not be separated out to be dealt with individually is implicit within the Water Framework Directive and action is co-ordinated within the individual River Basin Management Plans and catchment strategies that seek to drive improvements in water quality through a multi-stakeholder approach. For example, initiatives such as Catchment Sensitive Farming administered by Natural England are part of this programme

#### 2.4.1 Upland catchment management

In the wake of significant flood events Sheffield (2007), Carlisle (2015) and the Calder Valley (2015) there has been increasing focus on upland catchments. Where previously water supply has been the main driver; considering managing surface water flow has become a significant factor. This has been driven by the need for evidence through the DEFRA Making Space for Water programme (2012-15) and the Environment Agency's 'Working with Natural Processes' evidence directory (Environment Agency, 2016). On a small scale, working with farmers in Wales, the Pontbren project has yielded impressive results. A report by the Centre for Environment & Hydrology found that infiltration rates for surface water was 67 times greater than in the adjacent pasture (Marshall, M.R, Ballard, C.E, et al 2013)

Targeted woodland buffers along the mid-slope or downslope field edges appear to slow runoff (Nisbet et al). On the other hand intensification of farming such as loss of hedgerows, overgrazing, channelized rivers and winter crops leading to bare and compacted soil increases the rate of runoff (O'Connell et al 2005).

#### 2.4.2 Urban river restoration and 'daylighting'

Porter brook in Sheffield is an easily replicated example of how a culverted section of river, in this case study the headwaters, can be progressively 'daylighted' to provide a variety of benefits. Other examples include: Spinney Hills Park, Leicester, River Wandle, Littlecombe and the Beam Washlands.

The recognition of river's as a valuable part of our urban realm has increased over recent years (although there is also an equal respect for the risks of living and working close to water). The uncovering of urban watercourses or so-called 'daylighting' is a global movement with global cities

such as downtown Seoul re-orientated in the Cheonggyecheon River Urban Design project. Closer to home masterplans implemented for both Bradford City Park and Rochdale have water at the heart of the city. In the case of Rochdale this has meant 'daylighting' the River Roch through the town centre.

### 2.4.3 Floodplains, Wetlands and River Restoration

Wetland habitats have declined by 90% per cent in the UK in the last one hundred years. Such is the risk to wetlands that many are protected by the International Convention on Wetlands or the Ramsar Convention established by UNESCO in 1975. In the UK the work of conservation bodies such as the Wildlife Trusts, Wildfowl & Wetland Trust and RSPB has been key here and together with a number of conservation organisations including Natural England embarked upon a fifty year programme of survey and restoration (Wetland Vision) launched in 2008.

Landscape architects have a role to play. For example, the winning of river gravels has had the opportunity to restore water into floodplains creating new priority habitats. Organisations such as the Wildfowl & Wetland Trust employ landscape architects that have helped create new London Wetland Centre.

Floodplain woodland can slow water velocity and well planned planting has the potential to mitigate flood risk. (Thomas & Nisbet 2007). Wetlands bordering rivers have been shown to prevent diffuse pollutants entering surface water (Gilliam 1994, Gambrell 1994).

Beam Washlands has won a number of awards, including the CIWEM Living Wetlands award. It has been described as "a shining example of how the landscape architecture profession is uniquely placed to consider and balance diverse issues such as safety, flood risk and habitat creation". Apart from its technical merits, one of the important aspects from a landscape management perspective is the way this facility has been taken over by the Land Trust using a sustainable package of funding.

The River Restoration Centre has collected case studies of the restoration of rivers working with natural processes to create backwaters, remove weirs to enable Salmon to migrate upstream or reunite a river with its floodplain. A notable early example is the River Skerne in Darlington creating new green space and reintroducing river meanders.

## **2.5 Cultural Services**

There are cold hard economic reasons for developing our waterspace: a view of water features can raise house prices by 5% (Garrod & Willis, 1992) but we often take for granted the 'cultural services' supplied by being close to water.

### 2.5.1 Health and wellbeing

The physical and mental health benefits of greenspace are well known (Ulrich, 1984) however parallel research by Heriot Watt University reported in the Guardian has looked at our response to water – both positive and negative. The Guardian has reported this under the title Blue Spaces: Why time spent near water is the secret to happiness. Marine and coastal margins were found by some distance to be the happiest locations, with responses approximately six points higher than in a continuous urban environment.

### 2.5.2 Amenity: Formal water features

Millennium Town Park, St Helier is a good example of partnership working with civil engineers. The site is a former gas works and since the States of Jersey has no capacity to deal with contaminated material a restoration solution had to be found on site. The solution involves harvesting all the water that lands on the site before it can penetrate contaminated layers and using it to create attractive water features including fountains and a water curtain. Other examples include: Inwood Park, Hounslow

### 2.5.3 Navigation and recreation

The amenity potential of water has obviously been recognised long before the profession came into existence (Capability Brown and the urban parks movement); however with the interest in countryside recreation in the sixties alongside the need to increase water supply there was a growth in recreational provision. The water authorities took a lead. Today the utility companies still manage these assets under codes of practice, albeit they have had to manage this resource with diminished resources.

Landscape architects, working in utility companies, have been central in designing and planning recreation to reduce conflict with operations, biodiversity and reducing conflicts between recreational users. For example, considering the impact of water-sports on water bodies alongside other users such as anglers.

### 2.5.4 Heritage

The cultural and built heritage of our relationship with water is deeply rooted whether it is the water mills that heralded the industrial age, the piers of Victorian seaside resorts or the industrial heritage of our canals. There can be important conflicts to manage. For example, an area of conflict between conservation and heritage can include the removal of weirs to allow migratory fish.

### 2.5.5 Canals and dockland renaissance

The renaissance of waterways and navigable rivers since the closure of canals in the sixties is down in no small part to passionate and committed individuals (Waterway Recovery Group & Inland Waterways Association). Canals such as the Kennet & Avon restored to full navigation benefitting from some of the largest grants awarded by the Heritage lottery Fund. More recently the Millennium Wheel at Falkirk linking the Forth & Clyde and the Union Canal shows just how far the agenda has come.

We take access to water for granted but it was only the nineteen eighties that there was a move away from seeing these navigations as 'operational' and that the public should be kept out on safety grounds. Access to canals, rivers (note the Thames Path National Trail) and our coastline (England's Coastal Path) have been driven by Natural England and supported by the Environment Agency. The Canal & Rivers Trust estimate 10 million visits per year to the 2000 miles of inland navigation they manage.

Landscape architects and architects have been at the heart of this agenda. Note the production of the Waterway Handbook by landscape architects in British Waterway's and the development of the Etruria marina at the heart of the Stoke on Trent National Garden Festival in 1986.

From London Docklands to Kings Dock, Liverpool re-orientating development to face water has created vibrant new developments— this has been a battle that has been fought and largely won by the profession.

The repurposing of the nation's canal network for recreation has provided many opportunities for imaginative solutions, at least at key access points and basins. The towpath network has also been seen as ripe for upgrading for a wide range of users and the Landscape Interface Studio at Kingston University was active in the EU project, Waterways Forward (Landscape Institute 2012).

*Fort Augustus* is a case in point. A simple but award-winning landscape scheme retaining the integrity of historical elements and carefully using lighting was prepared for this site by landscape architects.

#### 2.5.6 Community engagement & resilience

The profession with an emphasis on 'place-making' and skills in visual representation has always been well positioned to communicate projects. This can particularly be important in communicating flood risk management where mitigation may encompass a variety of options. These are areas where working with other professionals including hydrologists and engineers can help to explain risk through new technology such as augmented reality. For example, in Keswick a Projection Augmented Relief Model is a 3D printed model based on LIDAR and allowing overlays of different flood events to explain the impact of flooding and mitigation approaches.

In the context of a climate emergency there is a recognition that professions have to go far beyond communicating and that professions need to work alongside communities actively engaging communities in developing strategies for resilience. There are examples, of landscape architects working alongside communities. For example, developing SuDS and NFM as part of Slow the Flow Calderdale. On a wider scale, the incremental gains of working with individual households in Oregon on individual plot-scale sustainable drainage has been co-ordinated across the city to reduce the risk of surface water flooding.

The Joseph Rowntree Trust has carried out a review of community resilience to climate change in particular identifying how investment could be targeted at those communities most disadvantaged by flooding (Twigger-Ross.C, Brooks.K, et al,2015).

## **2.6 Professional studies: planning, compliance and standards**

Obviously it is important for the profession to comply with standards and regulations, which are extensive, when dealing with watercourses and flood risk arising from land.

### 2.6.1 Compliance:

Working next to watercourses and altering flow are governed by regulations and licences administered by the various statutory agencies (such as SEPA in Scotland and the Environment Agency). This can lead to confusion. For example, it is usual to apply for an Ordinary Water Consent for an ordinary water course from a local authority but works to the main river are regulated by the Environment Agency through an environmental permit. A landowner needs consent to change or remove a flood defence asset. These may not be altogether obvious to a client.

### 2.6.2 Health and Safety.

Working near water has its own specific risks. As landscape architects there is need to be aware of the code of guidance for working on over or near water. It covers the hazards likely to be met, the legal requirements and the precautions that need to be taken to ensure UK health and safety standards are met.

#### 2.6.3 Standards:

The British Standards Institute is developing a code of practice for surface water flood risk management, BS 8582, alongside existing standards for water reuse and the adoption of rainwater harvesting systems.

#### 2.6.4 Planning Policy:

In England, the National Planning Policy Framework (NPPF) (DCLG, 2012b) was published in March 2012. The rationalised planning policy in England contains much less detail in relation to water cycle management. Within the NPPF, planning and development decisions are to be informed by the delivery of Strategic Flood Risk Assessments (SFRA). The framework focuses on the effect of new development on flood risk and advises that SuDS should be given priority with references to the Flood and Water Management Act 2012. In Scotland the main document is the National Planning Framework with individual guidance such as the production of Surface Water Management Plans (2018) and in Wales by Planning Policy Wales and associated Technical Advice Notes. In Northern Ireland this is known as the Strategic Planning Policy Statement.



### 3. What future for water planning, design and management?

*“Water crises and extreme weather events have been identified by the World Economic Forum community as two of the top 10 global risks. This is hardly surprising, given the devastating impacts of having too little water, or too much. While water’s immediate impacts are often local, water security is now recognized as a systemic global risk... How can the global community respond? The overarching prescription is for a package of investments in information, institutions and infrastructure. But successful water management needs the cooperation of a wide network of water users, public and private institutions.” WEF Global Risks Report 2014*

This Technical Note:

- Sets out the case for improving the integrated management and consideration of water using the momentum which is currently building in the UK – highlighting the fact that water is a resource, providing opportunities as well as problems.
- Highlights the multiple benefits, in terms of achieving a variety of objectives, safer and healthier environments and landscapes and long-term cost savings, of taking an interdisciplinary approach.
- Recognises the overlapping relationship of different sectors and stakeholders when considering water, highlighting the multi-disciplinary requirements.
- Illustrates how landscape architects, through their rounded technical knowledge in all relevant areas, are well-placed to play a central role in leading the realisation of innovative and integrated water management in the UK’s urban and rural landscapes.
- Provides evidence and case studies of how landscape architects can advise on effective integrated water management
- Demonstrates the links between ‘blue infrastructure’ and green infrastructure.

This Note read alongside related documents, such as the Catchment Approach Note, simply helps inform landscape practitioners and others of the context and signpost to other resources that are available. But is more guidance needed? Are there aspects of practice that should be made mandatory for landscape professionals?

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CIWEM (Chartered Institution of Water and Environmental Management) <http://www.ciwem.org>  
DEFRA (Department of Environment Food and Rural Affairs): <http://www.defra.gov.uk/>  
SUDS@defra.gsi.gov.uk  
Environment Agency: <http://www.environment-agency.gov.uk/>  
Highway Authorities (Strategic)  
    Highways Agency (England) <http://www.highways.gov.uk>  
    Transport Scotland <http://www.transportscotland.gov.uk/road>  
    Welsh Government <http://wales.gov.uk/topics/transport/>  
Internal Drainage Boards  
Local Authorities (Noting the distinction between those that are the Lead Local Flood Authority, those that are the SuDS Approval Body and those that are the Local Planning Authority for any particular development)  
Natural England: <http://www.naturalengland.org.uk/>  
Natural Resources Wales: <http://naturalresourceswales.gov.uk/>  
Navigation Authorities  
Canal and River Trust – <http://canalrivertrust.org.uk/>  
Environment Agency – see below  
Broads Authority – <http://www.broads-authority.gov.uk/>  
Scottish Waterways – <http://www.scottishwaterwaystrust.org.uk/>  
Etc.  
Ofwat: <http://www.ofwat.gov.uk/publications>  
Ports & Harbour Authorities  
Scottish Environment Protection Agency (SEPA): <http://sepa.org.uk/>  
SuDS Policy Advisory Network. SUDS@defra.gsi.gov.uk  
Susdrain. The Community for Sustainable Drainage: <http://www.susdrain.org/>  
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**Videos (available on <https://www.youtube.com/>)**

Susdrain. Ever wondered where the rain goes? Sustainable Drainage Animation.  
Susdrain. Water sensitive urban design (WSUD) in the UK  
Environment Agency, SEPA and Institute of Civil Engineers. Designs that hold Water: Sustainable Drainage Systems (SUDS) explained. Pts 1 to 3.  
Water Sensitive Urban Design. Landscape Institute  
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**Key Publications**

***CIRIA***

CIRIA, 1993 Design of flood storage reservoirs (B14)  
CIRIA, 1994 Control of pollution from highway drainage discharge (R142)  
CIRIA, 1996 Infiltration drainage – manual of good practice (R156)  
CIRIA, 1997 Review of the design and management of constructed wetlands (R180)  
CIRIA, 2002 Source control using constructed pervious surfaces. (C582)  
CIRIA, 2004 Drainage of development sites - a guide (X108)  
CIRIA, 2004 Model agreements for sustainable water management systems. (C625)  
CIRIA, 2006 Designing for exceedance in urban drainage: Good practice (C635)  
CIRIA, 2006 Sustainable water management in schools (W012)  
CIRIA, 2007 Building Greener (C644)  
CIRIA, 2007 Planning for SuDS – making it happen (C687)  
CIRIA, 2007 The SUDS manual (C697)  
CIRIA, 2008 Structural designs of modular geocellular drainage tanks (C680)  
CIRIA, 2010 Guidance on water cycle management for new developments (WaND) (C690)  
CIRIA, 2010 Site handbook for the construction of SUDS (C698)  
CIRIA, 2011. Delivering biodiversity benefits through green infrastructure (C711)  
CIRIA, 2012 Retrofitting to manage surface water (C713)  
CIRIA, 2013 Creating water sensitive places – scoping the potential for WSUD in the UK (C724)  
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NHBC Foundation Guidance

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## Appendix #1: Resources and case studies

N.B. This is not intended as an exhaustive list. Many of the case studies referred to are those that were submitted by landscape practitioners to the LI's Water Working Group in 2014. The most recent case studies involving landscape professionals may be better discovered using the case study section on the LI website and examination of annual award winners.

<b>2.1 WATER SENSITIVE DESIGN</b>		
<b>2.1.1 Blue and Green Infrastructure ESIGN</b>		
	Green Infrastructure <a href="#">Landscape Institute Policy Document</a>	Jubilee River, Environment Agency/Chris Blandford Associates Sutcliffe Park, Environment Agency
<b>2.1.2 Sustainable drainage</b>		
<b>Roads and highways</b>	Chapter 9 CIRIA The SuDS manual	
<b>Urban retrofitting SuDS</b>	Retrofitting urban areas to effectively manage surface water, CIRIA C 713 Digman et al, 2010	Ribblesdale Road, Groundwork Gt Nottingham
<b>New Housing</b>		Springhill Housing, Bob Bray Associates Upton, Northamptonshire
<b>Swales and filtration</b>	Chapter 15-17 CIRIA The SuDS manual	
<b>Rain-gardens</b>	Chapter 11.9 CIRIA The SuDS manual pp206-230	
<b>Pervious pavements</b>	Chapter 20 CIRIA The SuDS manual pp386-431	
<b>Trees and tree pits</b>	Chapter 19 CIRIA The SuDS manual pp360-383	solar-powered irrigation in London inspired by Churchman Landscape Architects and designed by Mouchel Parkman (Landscape- July 2006)
<b>Utilities</b>	<a href="#">CIWEM Urban Drainage Group</a>	

2.1.3 Green roofs		
	Chapter 12 CIRIA The SuDS manual pp233-251	Moorgate Crofts Business Park Redknock School, Illman-Young Associates
2.1.4 Greenspace		
<b>Parks and gardens (planting for drought)</b>	<a href="https://www.theparksalliance.org/National-Recreation-&amp;Parks-Association-(USA)">https://www.theparksalliance.org/National Recreation &amp; Parks Association (USA)</a>	Harringey SuDS vegetation types p112 <a href="#">here</a> Refer to the Sheffield School of planting design (Nigel Dunnett) <a href="#">here</a> . Derbyshire Street Pocket Park Central Park, Darlington Manor Fields Park, Sheffield
<b>Sports pitch drainage</b>	<a href="#">NBS specification</a> Useful summary published by a supplier: <a href="#">Shelton's drainage</a>	
<b>Maintenance</b>	Chapter 32 CIRIA The SuDS manual Check list B9	
2.1.5 Natural Flood Management		
	Working with Natural Processes: <a href="https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk">https://www.gov.uk/government/publications/working-with-natural-processes-to-reduce-flood-risk</a>	Belford Pickering Slow the Flow Calderdale <a href="http://slowtheflow.net">http://slowtheflow.net</a>
2.1.6 Strategies, plans and policies		
		Hertfordshire County Council Cambridgeshire Sustainable Drainage Design and Adoption The West Northampton SuDS guide
2.2 FLOOD AND COASTAL RISK MANAGEMENT		
2.2.1 Flood risk management schemes		
<b>Flood attenuation</b>	Detention basins Chapter 22 CIRIA The SuDS manual	Nottingham FAS, Ryder Landscape Boscastle Coughton Court Caldrew



	Ponds and wetlands Chapter 23 CIRIA The SuDS manual	Carlisle Morpeth
	Susdrain technical note on volumes <a href="https://www.susdrain.org/files/resources/fact_sheets/03_14_fact_sheet_attenuation.pdf">https://www.susdrain.org/files/resources/fact_sheets/03_14_fact_sheet_attenuation.pdf</a>	
	Sustainable drainage (Mngt of schemes) Management and maintenance of Sustainable Drainage Systems (SuDS) landscapes Interim Technical Guidance Note 01/2014 March 2014 <a href="#">here</a>	
<b>Master-planning and flood risk</b>	Planning for SuDS – making it happen, CIRIA, C687 Dickie et al, 2010)	City-wide initiative from Portland, Oregon <a href="#">here</a> China’s ‘sponge cities’ <a href="#">here</a>  Overseas: Innovation Park Beijing, Wilder Associates Croydon Urban Blue Corridors <a href="#">here</a>
<b>Urban realm and flood risk</b>	Chapter 10 CIRIA The SuDS manual	Case studies <a href="#">here</a>
<b>2.1.2 Coastal strategies and projects</b>		
		Medmerry Coastal Realignment Touching the Tide Landscape Partnership
<b>2.3 WATER RESOURCES AND SUPPLY</b>		
<b>2.3.1 Reservoirs</b>		
		<b>Case studies</b> <a href="#">here</a> Grafham Water Kielder Water Cheddar Reservoir Wenyng Lake Trimpley Reservoir
<b>2.3.2 Water quality</b>		

<b>2.3.2 Biodiversity</b>		
	Water biodiversity pack <a href="#">here</a>	
<b>2.3.2 Horticulure</b>		
<b>2.4 CATCHMENT STRATEGIES AND PLANS</b>		
<b>Catchment-based approach</b>	<a href="#">Catchment-based approach</a> <a href="#">Landscape Institute Technical Document</a>	Catchment Sensitive Farming <a href="#">Here</a>
<b>2.4.1 Upland catchment management</b>		
	Riparian woodlands Run off	Pontbren
<b>2.4.2 Urban river restoration and 'daylighting'</b>		
		River Wandle Bradford City Park River Roch, Rochdale Spinney Hills Park, Leicester Littlecombe JPorter Brook, Sheffield City Council  Cheonggyecheon <a href="#">here</a>  Rochdale <a href="#">here</a>
<b>2.4.3 Floodplains, wetlands &amp; river restoration</b>		
<b>River restoration</b>	<a href="https://www.therrc.co.uk/">https://www.therrc.co.uk/</a> <a href="#">Environment Agency Working with Natural Processes</a> Wetland Vision	London Wetland Centre Woodberry Wetlands River Skerne Beam Parklands, Environment Agency, Arup
<b>2.5 CULTURAL SERVICES</b>		
<b>2.5.1 Health &amp; wellbeing</b>		
	<a href="https://www.theguardian.com/sustainable-business/impact-sea-lakes-rivers-peoples-health">https://www.theguardian.com/sustainable-business/impact-sea-lakes-rivers-peoples-health</a>	

	<a href="https://www.theguardian.com/lifeandstyle/2019/nov/03/blue-space-living-near-water-good-secret-of-happiness">https://www.theguardian.com/lifeandstyle/2019/nov/03/blue-space-living-near-water-good-secret-of-happiness</a>	
<b>2.5.2 Amenity: Formal water features</b>		
	<a href="#">Landscape Institute Technical Note</a>	Harlow New Town Water Garden, Hemel Hempstead Liverpool International Garden Festival Howard Gardens, Letchworth Town Centre Gardens, Stevenage Millennium Town Park, Burns & Nice, St Hellier Inwood Park, Hounslow
<b>2.5.3 Navigation and recreation</b>		
<b>Canals &amp; dockland renaissance</b>		Chichester Canal basin Worcester Canal basin Islington Canal basin Millennium Wheel, Falkirk Stoke on Trent National Garden Festival Kings Dock, Liverpool Fort Augustus, Richard Glen Associates
<b>Access to rivers</b>	Outdoor Recreation Network: <a href="#">here</a> Access to water: <a href="https://www.outdoorrecreation.org.uk/wp-content/uploads/2017/02/CRN-WORKSHOP-1997-ACCESS-TO-WATER.compressed.pdf">https://www.outdoorrecreation.org.uk/wp-content/uploads/2017/02/CRN-WORKSHOP-1997-ACCESS-TO-WATER.compressed.pdf</a>  University of Brighton, Water-based sport & recreation: the facts	Thames Path National Trail England's Coastal Path
<b>Recreation strategy:</b>		Yorkshire Water Case study: <a href="#">here</a>
<b>2.5.4 Heritage</b>		

<b>2.5.5 Canals and dockland renaissance</b>		
<b>2.5.6 Community engagement and resilience</b>		
	Evidence review on community resilience. Joseph Rowntree Report <a href="#">here</a> SuDS community engagement Chapter 34 CIRIA The SuDS manual SuDS design and stakeholder engagement P99 CIRIA The SuDS manual	<a href="https://www.jbatrust.org/how-we-help/physical-models/">https://www.jbatrust.org/how-we-help/physical-models/</a> ( <a href="http://slowtheflow.net">http://slowtheflow.net</a> ) Oregon
<b>2.6 PROFESSIONAL STUDIES: Planning, compliance and standards Horiculture</b>		
<b>Legal obligations</b>	England: <a href="#">here</a> Living on the edge (2007). No longer on <a href="http://www.gov.uk">www.gov.uk</a> website. <a href="#">Here</a> Scotland: <a href="#">here</a>	
	Ordinary Watercourse Consents	Example from Calderdale Council <a href="#">here</a> – each local authority has its own.
<b>Planning issues</b>	Scotland <a href="#">here</a> CIRIA The SuDS manual pp96-99	
<b>Health &amp; safety</b>	Chapter 36 CIRIA The SuDS manual	



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