

01 – Rehabilitation of the Camac River under the water framework directive: New opportunities to engage local communities and to manage flood risk

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Abstract

Dramatic flood events in recent years have reminded the Irish Public that their relationship with water is ever changing and despite advances in modern engineering, water's ebbing and flowing still has the power to impact and perhaps threaten our lives. People now want to know where their local rivers are and in many cases these are rivers that might have been concealed underground for years. The popularity of the recently revised second edition of the Rivers of Dublin Book (Sweeney and O'Connell *et al.*, 2017) is testament to this.

In the Water Framework Directive (WFD) Office of Dublin City Council (DCC), this interest affords us an opportunity in our overall goal of restoring water bodies to "Good Status" by the European deadlines. The Camac River is one key river in Dublin that needs restoration and alongside the regular gathering of engineering and scientific data that informs the day to day business of DCC, the move towards a full and holistic plan for this river is gaining momentum.

The Camac River has a rich industrial history. Its historical significance in shaping the westerly growth of the city, and its importance to industry going back as far as the 1600's, is somewhat in contrast to its current condition, hidden underground in concrete culverts for long sections, squeezed into concrete channels between palisade fences, difficult for the public to access, inhospitable to wildlife, a history of flooding and with water of questionable cleanliness. This water body is currently classed as being of 'poor status' in the City Area.

With the significant emphasis on community involvement and multidisciplinary co-operation enshrined in the legislation, DCC has begun an exciting project together with local people, local historians, local nature lovers, local business, property owners and community groups. The engineering and science of the river does not define it. To successfully restore the river's health and connection with its community and environment, DCC knows it must continue to be open to learning about its other often hidden attributes. DCC might be in possession of the technical and operational data but the residents know the story of the river best and their futures are entwined.

In acknowledgement of this, DCC has been inviting local residents in the Camac Catchment to share their knowledge about the river's heritage and past glories. Local school children have been brought on expeditions exploring the built and natural heritage that is unique to this River. And in keeping with the long-established tradition of rivers representing a source of inspiration to artists, and to engage the established and aspiring poets in the community, DCC has been initiating and facilitating literary workshops and poetry competitions with the Camac River as the subject. The idea is simple: they are encouraging people to consider the river, people who walk or drive past the river every day and

scarcely know it's even there and people who know it intimately and understand it's past importance to the city.

If people are writing and talking about the Camac they are thinking about it and clarifying their views on it. This is essential even if their feelings might be negative. People who know how they feel about it will be ready to enter into a dialogue about what kind of river they want to work towards. This is a long-term project, but as was said at a DCC Camac Heritage Evening in Inchicore Library, 'the river is patient'ⁱ. In truth it could take a lifetime before the river reaches its full potential in the way it contributes to the communities.

Despite 400 buildings flooding in October 2011, in Dublin City and South Dublin County Council Areas, no viable flood alleviation scenario was found. New contract documents are currently being compiled to revisit this study and to look at individual flood cells for possible local flood alleviation measures. New synergies may exist between flood alleviation aims and the WFD measures that might be considered appropriate for the Camac at a local level e.g. opening up culverts and restoring millraces to a heritage standard. Further public and statutory consultations will be required on any proposed scenarios to ensure that environmental and heritage considerations are addressed and by this stage, DCC should be in a position to build on earlier efforts and broaden the scope of existing dialogues with interested members of the community.

1. INTRODUCTION

It is increasingly believed that meeting EU Water Framework Directive obligations in relation to rivers, and attaining good status, is substantially dependent on our ability to reconnect them with their floodplains (Grizetti *et. al.*, 2017). These are the views of the 'Ecological Status' experts who have an interest in flood management. On the other hand, the socio-economists and urban planners remind us that river catchment systems are complex systems and that while the pure science and engineering interventions are vital to our untangling and tackling of the challenges and pressures, the social and economic dimensions to a river's rehabilitation make this a political exercise requiring a partnership with the people (Prescott & Ninsalam, 2015), providing insights and guiding value-based decisions: a task more usually associated with a town planner. The socio-ecologists might say that there is a conflict of interest between what's good for the river's creatures (and the "Good Ecological Status" we strive for) and the future human recreational users of the rehabilitated river spaces (Zingraff-Hamed *et. al.*, 2018). A river means a lot of different things to different people. Rehabilitating a river successfully so that these needs and entitlements can be balanced requires that certain values be communicated, adopted and shared between all of the stakeholders within the river catchment: **meaningful community engagement is critical.**

One such complex river system is that of the Camac, a flashy river and very urban in its lower catchment within the Dublin City Area. Together with locals both in the city and the county, Dublin City Council has been taking steps to understand this river with a view to putting a plan together to make it a safe and healthy river for all its users and close neighbours in the future, in accordance with its responsibilities under the Water Framework Directive.

2. THE CHALLENGE OF ACHIEVING GOOD ECOLOGICAL STATUS

The story of humans is thoroughly intertwined with the story of rivers, although they were, of course, here before us. Our dependencies have changed since that story began. It's less about needing rivers for power, food, navigation, a means of carrying away wastes although we are still largely dependent on rivers and lakes for drinking water. Nowadays when people consider rivers, they think more of recreation, sport and of course, nature and wildlife. There is a conflict there, unfortunately, between the legacy issues of past uses and these visions of what rivers can be. In many cases, rivers were modified to enhance the qualities that made them most valuable to the local inhabitants in the past when their needs were most basic. Their presence attracted agriculture, industry, growing human populations and the earliest roads were often built alongside rivers, where the land was flattest. In the meantime, human activities have resulted in multiple pressures on waters: nutrient pollution, modifications of river morphology, alterations of water flow regime, and the introduction of alien species (Grizzetti, *et. al.*, 2017).

The varying and contrasting natural conditions and processes of rivers along their course from source to mouth are considered to constitute some of the most species-rich environments known. Large numbers of rivers, especially in urban areas have become "managed" by humans with artificial interventions such as:

1. Flow alterations, including weirs, bridges and bifurcations
2. Channelisation, including bridges
3. Dredging and
4. River bank stabilisation.

Such interference is now considered to reduce connectivity in the riverine landscape and alter natural fluvial characteristics. Both have the effect of diminishing habitat variety and thereby, biodiversity (Ward *et. al.*, 1999). These hydromorphological alterations are often present together with water pollution from human activities, over-fishing, and an increasing number of alien species, acting together on the same river. Freshwater ecosystems are typically subject to multiple pressures that undermine their biodiversity and ecological functioning (Grizzetti *et. al.*, 2017).

In order to rise to the challenge of The Water Framework Directive and achieve 'good ecological status', we are required to untangle these pressures and quantify the cause and effect relationship between them and the ecological functioning of the system. To further complicate the task, the combined impact of particular pressures as well as the impact of the time taken for the current circumstances of the river and its catchment to come about are not well understood (Grizzetti *et. al.* 2017).

Achieving 'good ecological status' for some urban rivers will prove difficult as the complexities identified in the paragraphs above require an approach that is beyond what most technical professionals consider typical. Multidisciplinary co-ordination is not optional. The challenge even goes beyond this, as articulated by Tourbier *et al.* in a paper published in 2005:

'Urban river rehabilitation has been found to be extremely context specific relating to existing ecological framework conditions, cultural understanding, financial constraints, professional abilities and preferences of stakeholders and decision makers and the public in general.'

Especially in the urban context, this is an undertaking that extends beyond the realm of the purely technical and it will be directed by societal values (and decisions regarding quality of life) making the

process similar to urban planning (Tourbier *et. al.*, 2005). This makes it a political exercise that demands collaboration with the community.

It is not a coincidence that it was as a result of campaigning by European citizens and environmental groups for healthier rivers and lakes that the Commission made water protection one of the priorities of its work. This process and approach culminated in the EU Water Framework Directive which was adopted and came into force in 2002 (European Commission Websiteⁱⁱ). The Directive recognises that the role of citizens and their groups is crucial. The overall aim of this legislation is that polluted waters will be made clean again and kept clean and in many cases this means river restoration or rehabilitation.

The Water Framework Directive has been in force for almost 16 years. The terms associated with it e.g., Good Ecological Status, are familiar to most of us. Still up to recent years, there has been little consensus on how to get there.

In 2017, a high-level pan-European study was carried out to quantify multiple human pressures and their relationship with the ecological status for all European rivers. It did so by examining ecological data gathered and pressures (including pollution and hydrological and hydromorphological alterations) assessed by various means (models etc.). They (Grizzetti *et. al.*, 2017) found that:

1. urbanisation and nutrient pollution were found to be key predictors of ecological degradation;
2. better ecological status was associated with the presence of **natural** areas in floodplains.

In the past, urban river rehabilitation tended to focus on aesthetic improvements and the reconfiguration of the river channel. There is little evidence available to suggest that interventions that focus exclusively on the river channel are having a positive impact on the river ecology (Bernhardt & Palmer, 2011). More recently, the development of catchment-scale river rehabilitation programmes demonstrates a shift from the application of channel-based engineering principles towards an ‘adoption of ecosystem-centred, adaptive and participatory approaches’ to river management (Hillman & Brierley, 2005).

If successful rehabilitation of rivers and streams (with the desired and necessary improvements in the ecological status of the water body) requires us to look beyond the river channel and consider the wider river catchment and the interplay between them, then this demands that traditional methods of flood management be re-examined. These approaches typically required that rivers were artificially isolated from their floodplains, where it was decided that other uses of the land were more desirable, e.g. agriculture, housing, industry etc..

Accepted strategy elements for the successful rehabilitation of urban rivers would be considered to be as follows:

1. Reinstatement of floodplains and connectivity with rivers (including a re-naturalisation of the river channel)
2. Introduce, enhance, widen, or maintain riparian corridors with appropriate planting
3. Intercept urban run-off from impervious areas using Green Infrastructure.

Natural Water Retention Measures (NWRM) could constitute a thread common to each element and offer something in the development of actual designs for of these approaches, designs that have the potential to address both ecological status and flood management. These NWRM measures on the larger rivers to date have not been found to reduce the 100-year flood substantially but can have a significant effect on the 5 to 20 year flood events. However, each river catchment is unique.

3. MANAGING FLOODING WHILE WORKING TOWARDS GOOD ECOLOGICAL STATUS

3.1 Trends in Flood Control Management in Europe

During the past 20 years, catastrophic flood events both in Europe and Worldwide have shown that human activities and traditional river engineering works may result in an increased frequency of floods and, most importantly, in negative economic consequences (Kiedrzyńska *et. al.*, 2015). Flood events expect to become even more frequent with climate change and in parallel, Europe's biodiversity is under severe pressure from many forms of human activities while other issues such as water scarcity and droughts are becoming more pronounced. It is increasingly believed that flood risk management must integrate with sustainable water management. Measures which work with nature are now considered to be of particular importance, as they 'contribute to the strengthening of the resilience of nature and society to extreme weather events' (EC Directorate-General Environment, 2011).

The 2011 guidance from the European Commission highlights the need for better environmental solutions to flooding challenges. Solving one problem but causing another is not sustainable. Links between historical flood control and the deterioration of the status of rivers have been documented in mainland Europe. It has since been established that these types of interventions have reduced the connectivity in the river landscape and 'undermined the fluvial dynamics that support biodiversity' (Ward *et al.*, 1999) and it appears that in the interests of the both Floods and Water Framework Directives this reduced connectivity between the river and its floodplains will have to be examined.

Referring back to the key findings of the paper by Grizzetti *et. al.* (2017) supports this view as the results indicate that maintaining natural floodplains and limiting nitrogen pollution can be key measures to improve the ecological status of rivers and can, together, produce synergetic effects. They also suggest that preserving natural land cover as opposed to urban sprawling, which 'erodes the capacity of the ecosystem to buffer pressures, should be seen as an investment in ecosystem resilience'.

This ties into a wider drive for integrated green approaches, as detailed on DG Environment official webpage, "*Natural Water Retention Measures (NWRM) support Green Infrastructure by contributing to integrated goals dealing with nature and biodiversity conservation and restoration, landscaping, etc.*"ⁱⁱⁱ

As described in the 'EU policy document on natural water retention measures', NWRM include a wide range of measures that range from small-scale ponds, soil conservation practices, green roofs in urban areas, to large scale floodplain and wetland restoration and aquifer recharge. They can be divided in two broad types:

1. Measures that modify and restore ecosystems, and;
2. Measures that adapt and change land-use and water management practices.

Both types are described in the table below.

Table 1: Illustrating the diversity of measures classified as Natural Water Retention Measures (EC D-GE, 2014)

| Type | Class | Non-exhaustive list of examples |
|---|---|--|
| Direct modification in ecosystems | Hydro-morphology (Rivers, Lakes, Aquifers, connected wetlands) | Restoration and maintenance of rivers, lakes, aquifers and connected wetlands; Reconnection and restoration of floodplains and disconnected meanders, elimination of riverbank protection... |
| | Agriculture | Restoration and maintenance of meadows, pastures, buffer strips and shelter belts; soil conservation practices (crop rotation, intercropping, conservation tillage...), green cover, mulching... |
| Change & adaptation in land-use & water management practice | Forestry and Pastures | Afforestation of upstream catchments; targeted planting for "catching" precipitation; Continuous cover forestry; maintenance of riparian buffers; urban forests; Land-use conversion for water quality improvements... |
| | Urban development | Green roofs, rainwater harvesting, permeable paving, swales, soakaways, infiltration trenches, rain gardens, detention basins, retention ponds, urban channel restoration... |

NWRM is principally used as a new overarching flooding term that groups measures that retain water using natural means and processes. At the same time, they have the potential to provide multiple benefits to other sectors, e.g. WFD and ecology. The concepts, however, are not new: they are largely in line with existing concepts and objectives such as Room for the River, Ecosystem-based Adaptation, Natural Flood Risk Management or Green Infrastructure.

‘The application of NWRM supports green infrastructure, improves or preserves the quantitative status of surface water and groundwater bodies and can positively affect the chemical and ecological status of water bodies by restoring or enhancing natural functioning of ecosystems and the services they provide. The preserved or restored ecosystems can contribute both to climate change adaptation and mitigation’ (EC Directorate-General Environment, 2014).

In terms of their use as part of the flood manager’s toolbox, NWRM are considered to be complementary to grey infrastructure such as dikes or concrete structures. In addition, grey infrastructure may support the implementation of NWRM, if the natural water retention process cannot be guaranteed by natural processes alone. Even though it is expected that NWRM can mitigate the extent and intensity of the negative impacts of grey infrastructure on ecosystems, NWRM cannot always be considered as cure-all measures. While NWRM cannot fully replace grey infrastructure, NWRM can reduce the need for grey infrastructure and in addition reduce, to some extent, the negative impact of grey infrastructure. (EC Directorate-General Environment, 2014).

Another benefit of such natural flood management measures is that such measures, when appropriate have the capacity to be very cost-effective (EC Directorate-General Environment, 2011).

The ‘EU policy document on natural water retention measures’ highlights the need for solutions to integrate with land use planning as part of an overall green infrastructure strategy to address habitat fragmentation and lack of connectivity that are major drivers for the loss of biodiversity. It also makes recommendations as to what steps should be considered to improve coordination of water management and spatial planning. These are:

- *‘Early involvement of land-use planners in river basin and floods risk management planning. Expanding from the traditional “water stakeholders” to land use and spatial planning stakeholders such as private owners of land.*
- *Coordinate the development of RBMPs and FRMPs with spatial or land-use planning.*

- *Systematically consider the role of green infrastructure in the planning and authorisation of new urban developments.*
- *Greater involvement of local communities?'*

In many circumstances, river engineering carried out in the past, typically in response to urban development, has ‘removed the connectivity of flows, sediment movements and organisms between the river and floodplain and has severely constrained river channel dynamics’ (Gurnell *et. al.*, 2007). In short, urban development changes all key processes that ‘drive river corridor form, dynamics and bio complexity’ (Gurnell *et. al.*, 2007). Some of this damage will need to be undone but first and foremost, if we can avoid further unnecessary damage, we should.

Increasing the water retention capacity throughout the whole area of the river catchment by the following activities: ‘forestation, agro technology activities, river restoration, restoration of wetlands and creation of new ones and the use of water harvesting devices in rural areas, as well as by building cascade systems of flood reservoirs preceded by sequential bio filtering systems’ in urban areas are all options that are considered relevant for a catchment-floodplain-river system strategy (Kiedrzyńska, *et. al.*, 2015).

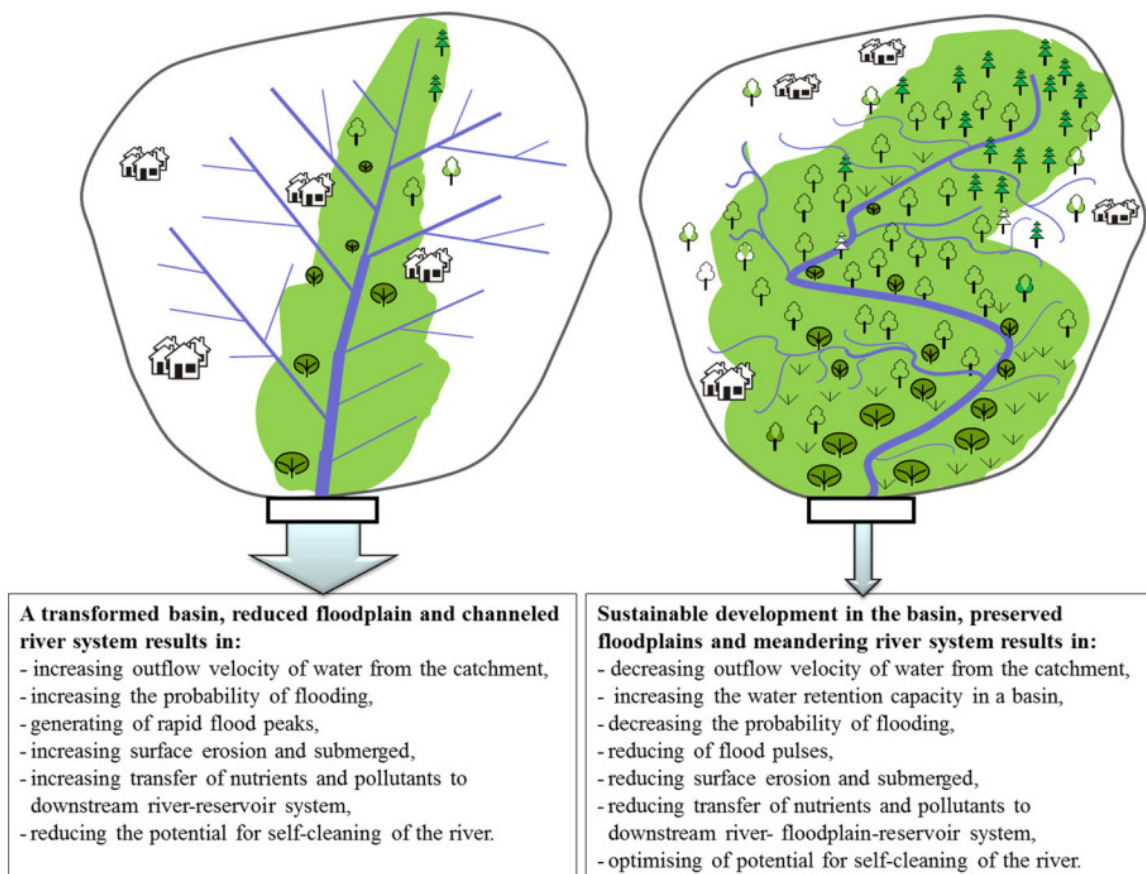


Figure 1: *The role of the character of the catchment-floodplain-river system in the probability of flooding, water quality improvement and good ecological status of the basin (Kiedrzyńska et al., 2015)*

The 2011 guidance from the European Commission highlights the need for better environmental solutions to flooding challenges. Solving one problem but causing another is not sustainable. Links between historical flood control and the deterioration of the status of rivers have been documented in mainland Europe. As discussed in a previous section, it has since been established that these types of interventions have reduced the connectivity in the river landscape and diminished the fluvial processes that support biodiversity (Ward et al., 1999) and it appears that in the interests of the both Floods and Water Framework Directives this reduced connectivity between the river and its floodplains will have to be examined.

Severe flood events in Europe have prompted new interest in floodplain areas, partly in working towards increasing and optimising their flood retention capacities. Several countries in Europe with a history of extensive traditional flood alleviation measures, such as The Netherlands and Germany, have been working to make their existing flood control mechanisms more environmentally friendly and multifunctional with programmes such as Room for the River (Schindler *et. al.*, 2016). Austria has examples of similar programmes that also employ the concepts of natural water retention measures (EC Directorate-General Environment, 2014). A 10m riparian strip provides the joint function providing environmental benefits for the river and reducing flood levels though allowing more space for floodwaters. Hopefully in Ireland, we can avoid making some of their mistakes in the first instance.

3.2 Snapshot of the River in Full Flood

During a significant flood event the river changes colour normally to a light brown with the amount of soil and silt being carried on it, sand, pebbles and stones can be dragged along the bottom. Flood can last from a few hours to several days on the bigger rivers. Underwater plant life has little choice but to endure these harsh conditions. Fish and other fauna have some choice and the maintenance of such stable areas with low currents for their survival during a flood is essential.

Many rivers have large lakes on them which provide a minimum flow essential for their flora and fauna.

These river dynamics and the responses of flora and fauna to them must be understood and factored into designs that involve river engineering, including flood management projects.

3.3 Flood Management and Freshwater Ecological Status in Ireland

The management of floodplains in Ireland is still focused on flood alleviation, with the building of embankments and other flood defences being a common approach (Schindler et al., 2016) but it is largely the case that traditional flood protection measures will continue to be appropriate in the centres of larger and established urban centres. It will be impossible to reconnect rivers with their floodplains in certain areas but for urban regeneration projects and flood management elements designed for less intensively developed urban centres and suburban locations, serious thought should be given to using existing public open spaces (as well as creating new ones over time) located in what might once have the river's natural floodplain to facilitate the natural flooding processes of the river. It might be possible to achieve improved connection to groundwater, which also has the capacity to improve conditions for biodiversity, (Kurth, et al., 2015) and the development of wetlands and riparian forests (Gurnell *et. al.*, 2007)... not to restore the river environment to what it would have been after the last ice age, devoid of human influence as this may well be impossible but... to work towards the reinstatement of river floodplain features where and when possible and an increased number and complexity of habitats for enhanced biodiversity. **The capacity for flood managers to accommodate ecological considerations**

into flood management strategies and designs will have a significant bearing on the ability of individual rivers to achieve good ecological status as required by the Water Framework Directive. Equally, with careful community awareness and engagement, existing public open space could become multifunctional spaces constituting hotspots for biodiversity and riverine features that are understood, protected and valued by river catchment residents.

Additional and catchment-based sustainable flood management techniques, such as those referred to in the above section, will become increasingly important in the face of climate change and also to prevent the existing traditional flood protections in densely populated areas from becoming obsolete. It is clear that significant synergies exist between the Floods and the Water Framework Directives e.g. Room for the River, opening up or ‘daylighting’ culverts.

Planning and Development in Ireland has already started moving in this direction. Across the country, large number of river flood plains were effectively zoned in response to the publication of The Planning System and Flood Risk Management - Guidelines for Planning Authorities (Department of the Environment, Heritage and Local Government and Office of Public Works, 2009). In many areas, lands that had been zoned for residential development was 'de-zoned' where ‘vulnerable uses’ such as Housing were no longer considered appropriate where a significant frequency of flooding was anticipated. This has strengthened the policy to maintain and enhance riparian corridors, as enshrined in the Great Dublin Region Strategic Drainage Study, 2005 and is in keeping with recommendations from the Grizzetti report that recommends limiting the further advancement of urbanisation into riparian corridors and floodplains and to preserve natural areas along water courses to protect the ecological quality of rivers and ensure future benefits for humans (Grizzetti *et. al.*, 2017).

Dramatic flood events in recent years have reminded the Irish Public that their relationship with water is ever changing and despite advances in modern engineering, water’s ebbing and flowing still has the power to impact and perhaps threaten our lives. People now want to know where their local rivers are and in many cases, these are rivers that might have been concealed underground for years. The popularity of the recently revised second edition of the Rivers of Dublin Book (Sweeney, O’Connell *et al.*, 2017) is testament to this.

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4. PUBLIC ENGAGEMENT IN THE REHABILITATION OF RIVER CATCHMENTS

4.1 Appropriate approaches for beneficial public engagement

The role of citizens in getting water onto the main agenda of the European Commission is reflected in the Directive that was finally adopted. It is acknowledged that river catchment systems are complex in nature, as are the pressures and demands that are put on them by their users, and the inherent characteristics of the landscape and climate. The principals that guide urban river rehabilitation are necessarily in keeping with the principals of sustainable development. And ‘[p]olicies and strategies for sustainable development at the local level are strongly influenced by quality of life considerations’ (Mahon *et. al.*, 2012).

A paper by Prescott and Ninsalam published in 2015 emphasises this:

‘Over the last two decades, as a result of environmental consequences, a major paradigm shift has occurred globally. Catchments and water systems are now acknowledged as socially constructed

entities (Ison et al., 2007), and a shift has taken place wherein humans are acknowledged as components of ecosystems (Palmer et al., 2004). This has led to emphasis in the literature on 'effective governance based on principles of equity, efficiency and diverse knowledge integration', which are now seen as similarly important to technological solutions (GWP, 2000).'

If humans are considered components of the ecosystem, a rehabilitated river must also meet the requirements of these inhabitants within the catchment. The challenge is in striking the balance between these needs and desires and those of the more sensitive species. It is the case, though, that through education and awareness the needs and desires of humans can evolve. This takes time and requires that a trusting partnership be established with the community from the outset to achieve better outcomes for all.

Rittel and Webber in their well-known paper, 'Dilemma in a general theory of planning' published in 1973, propose a model of planning that seems appropriate for the river-basin catchment situation. They assert that interactions with locals 'should be based on an argumentative process in the course of which an image of the problem and the solution emerges gradually among the participants, as a product of incessant judgement, subjected to critical argument' (pp. 162). Participatory approaches should aim to 'facilitate this argumentative process by bringing together a wide variety of people with different interests and opinions and supporting them in identifying their own positions and those of others, leading them to learn from one another and develop a deeper understanding of the issues' (Carr, 2015).

Three forms of public participation with an increasing level of involvement are mentioned in the Water Framework Directive:

- Information supply,
- Consultation, and,
- Active involvement (PPG, 2003).

Moreover, all at different stages and in varying amounts are usually useful for collaborating with the various stakeholders. Active involvement could be set up to embrace the argumentative process described above. It can also be developed to include the handing over of certain powers and influence to locals in the manner that Rivers Trusts have been moving towards in the UK.

One accepted definition of Citizen Science is as follows: 'volunteer collection of biodiversity and environmental information which contributes to expanding our knowledge of the natural environment, including biological monitoring and the collection or interpretation of environmental observations'. This is taken from Understanding Citizen Science & Environmental Monitoring: a report written on behalf of UK-Environmental Observation Framework, NERC Centre for Ecology & Hydrology and Natural History Museum. This report goes on to define different levels of citizen science where people participate in both scientific thinking and data collection (Roy *et. al.*, 2012):

- Contributory projects – designed by professional scientists; members of the public primarily contribute data.
- Collaborative projects - designed by professional scientists; members of the public contribute data and inform the way in which the questions are addressed, analyze data and disseminate findings.
- Co-created projects - designed by professional scientists and members of the public working together and for which some of the volunteer participants are involved in most or all steps of the scientific process.

It is claimed by some that technological advances have increased the accessibility of citizen science and, hence, the number of volunteers contributing to a wide variety of citizen science initiatives has also increased (Roy *et. al.*, 2012).

Currently there are over 60 official River Trusts across the UK and Ireland. The Rivers Trust is the umbrella body of the Rivers Trust movement. It has the stated aim of protecting, promoting and enhancing freshwater ecosystems for both people and wildlife^{iv}.

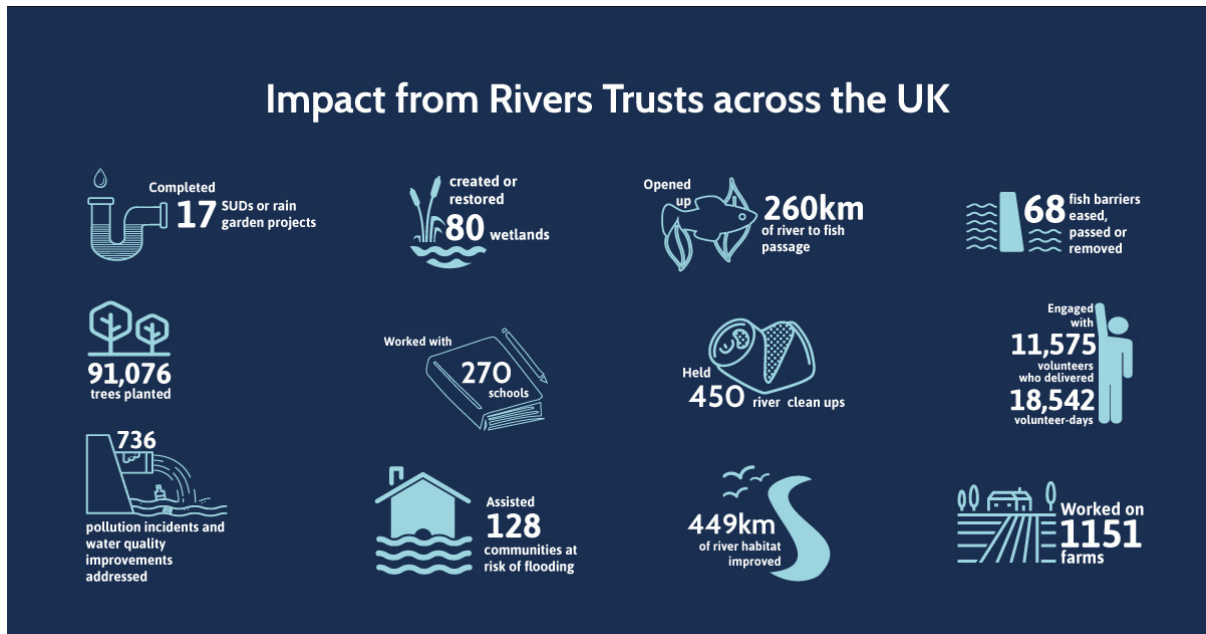


Figure 2: Image to illustrate work undertaken by Rivers Trusts (From the Rivers Trust Website)^v

The Rivers Trust is the administrator of the Catchment Based Approach.

The Catchment Based Approach (CaBA) is a community-led approach that engages people and groups from across society to help improve our precious water environments^{vi}.

The objectives for the Catchment Based Approach are (DEFRA, 2013):

- To deliver positive and sustained outcomes for the water environment by promoting a better understanding of the environment at a local level; and
- To encourage local collaboration and more transparent decision-making when both planning and delivering activities to improve the water environment.

4.2 Public Engagement and the Water Framework Directive in Ireland

Public consultation, partnership and participation are not new terms and but in relation to initiatives undertaken in response to the Water Framework Directive, it is not something that Ireland has been considered to be particularly good at. Ireland is considered to be peculiar in that it has only marginally increased public participation in the planning process for water resource management (since the adoption of the Water Framework Directive), despite its relatively low starting point (Jager *et. al.*, 2016). The wider reforms the country undertook in the late 1990s in anticipation of the WFD are acknowledged, however.

The practical business of river rehabilitation requires action and “boots on the ground”. While desktop studies are useful to a point, the issues individual issues must be assessed and monitored by people on the ground. While much of this must be undertaken by professionals initially, there is also a role for interested lay-people in the rehabilitation of their local river. It is common knowledge that citizens

working together can collect much more scientific data than scientists working alone (EPA Website^{vii} Section on Citizen Science). Support must be provided to interested parties in relation to the part they can potentially play. This can take the form of training and awareness, access to information and funding. Local knowledge of the river is also very important as this can highlight information about the river not documented elsewhere. Land ownership is often another key consideration in river restoration and the willingness of these landowners to participate.

The Local Authority Water and Communities Office was set up in Ireland in response to the European Union (Water Policy) Regulations 2014 (S.I. 350 of 2014) which also clarified the roles and responsibilities of local authorities in coordinating the catchment management and public participation aspects of the Water Framework Directive (LAWCO, 2017).

The Waters and Communities Office it has a key role in forging connections with local communities and it also assists with the integration of waterbody interventions between different local authorities acting within the one catchment.

It operates as a shared service on behalf of all Local Authorities, with two key objectives:

- To coordinate the water quality work of Local Authorities through agreed regional structures, thereby providing a collaborative approach to river catchment management.
- To engage local communities and promote public participation in the management of our water environment (LAWCO, 2017).

In their direct work with local communities and community groups, they can provide technical assistance and support on water based initiatives, such as^{viii}:

- Invasive species removal and control
- Riverbank improvement works/halting erosion
- In stream works – stream crossings
- Community engagement around water
- Citizen science and monitoring of local rivers – Nature detectives
- Restoration of wildlife habitats
- “Solution to pollution” – advice on problems identified
- Animal access to waters – advice on best practice
- River heritage and walks signage and leaflets

The Water and Communities Office has played an important role in getting the Water Framework Directive on the agenda for interested community groups across the country. They also administer funding through The Community Water Development Fund.

Table 2: Extract from Water and Communities Office Website on the Community Water Development Fund (Water and Communities Office, 2018)

[It] aims to support communities in progressing water related projects and initiatives, delivering benefits locally whilst also helping to meet the objectives of the River Basin Management Plan for Ireland and the wider EU Water Framework Directive. This fund is open to all community and voluntary groups to assist in the protection and management of water quality, both locally and in the wider catchment. This can include the development of a catchment partnership or River/Lake Trust, and delivery of local projects to protect and improve water quality in a local waterbody. This fund will enable communities to get more involved in the management of their local water environment, delivering multiple benefits for present and future generations. The fund is administered by the Waters and Communities Office on behalf of the Department of Housing, Planning and Local Government.

Types of projects considered will include:

- Capital projects such as restoration/habitat conservation/natural flood mitigation measures.*
- Projects that promote public awareness/education and events such as biodiversity days, surveys, training workshops, surveys and plans, etc.*
- General amenity such as beach clean, improving amenity areas, bird watching facilities, etc.*

Grants awarded will range from up to €5,000 up to €10,000 and up to €25,000. The fund is capped at €180,000 for 2018.

2018 was the first year of this money has been made available. The number of applications for funding far exceeded expectations.

104 applications totalling an amount of €371,825.75 were made for this first funding call in 2018. Funding was approved for 69 applications and a total €185,800 was made available to different community groups around Ireland for water related projects and initiatives (Figures provided by Local Authority Water Programme, 2018 (unpublished)). In many cases, local groups were offering to put up their own funds in order to undertake more meaningful projects and perhaps to demonstrate their commitment to the endeavour. Several grant applications included proposals for “instream works”.

These figures show us how engaged community and environmental groups are and the extent to which they are willing to take an active part in the management of rivers and water resources. Many of this are the beginnings of “co-created projects” as referred to in a previous section and show the impact that the Water and Communities Office are having nationally in a short space of time.

5. THE WATER FRAMEWORK DIRECTIVE AND THE CAMAC RIVER

WFD Camac Project in infancy

The Camac River has a rich industrial history. Its historical significance in shaping the westerly growth of the city, and its importance to industry going back as far as the 1600’s, is somewhat in contrast to its current condition... hidden underground in concrete culverts for long sections, squeezed into concrete channels between palisade fences, difficult for the public to access, inhospitable to wildlife, a history

of flooding and with water of questionable cleanliness. This water body in the City Area is currently classed as being of ‘poor status’.

With the significant and necessary emphasis on community involvement and multidisciplinary co-operation enshrined in the legislation, Dublin City Council has begun an exciting project together with local people, local historians, local nature lovers, local business, property owners and community groups. The engineering and science of the river does not define it. To successfully restore the river’s health and connection with its community and environment, Dublin City Council knows it must continue to be open to learning about its other often hidden attributes. Dublin City Council might be in possession of the technical and operational data but the residents know the story of the river best and their futures are entwined.

In acknowledgement of this, the Water Framework Office of Dublin City Council devised and developed a Camac Cultural and Heritage Programme for 2018. It sought and co-ordinated input from key individuals in the community, including artists, poets, built heritage enthusiasts/experts as well as high-profile media personalities, academics, the Historian in Residence for the South Central Area (DCC), the DCC Heritage Officer, the South Central Area Office, as well as the Water and Communities Office.

The Water and Communities Office, through their links with local environmental groups in the South Dublin County Council Area, gave many of the Camac Cultural and Heritage Programme Events a catchment-wide context that extended beyond the City Boundary as Camac enthusiasts from Clondalkin and Saggart attended events and contributed to the content with their information and insights.

The programme to date has involved local residents in the Camac Catchment sharing their knowledge about the river’s heritage and past glories both with technical staff and with each other. Interested adults and local school children have been brought on expeditions exploring the built and natural heritage that is unique to this River. And in keeping with the long-established tradition of rivers representing a source of inspiration to artists, and to engage the established and aspiring poets in the community, Dublin City Council has been initiating and facilitating literary workshops and poetry competitions with the Camac River as the subject. The idea is simple: they are encouraging people to consider the river... people who walk or drive past the river every day and scarcely know it’s even there... and people who know it intimately and understand it’s past importance to the city.

If people are writing and talking about the Camac they are thinking about it and clarifying their views on it. And this is essential... even if their feelings, for now, are negative. People who know how they feel about it will be ready to enter into a dialogue about what kind of river they want to work towards, ready to articulate the values most important to them that will guide this rehabilitation project. This is in keeping with the Rittel and Webber model of planning discussed in the previous section.

This is a long-term project... but as was said at one of the Camac Heritage Evenings in Inchicore Library, ‘the river is patient’^{ix}. And in truth it could take a lifetime before the river reaches its full potential in the way it contributes to the communities. The older members of the community who have lived through various evolutions of the river and its role in the locality already know this.

The many members of the communities are also aware of the flooding challenges associated with this river. Despite 400 buildings flooding in October 2011, in Dublin City and South Dublin County Council Areas, no one viable flood alleviation scenario was found. New contract documents are currently being compiled to revisit this study and to look at individual flood cells for possible local flood management measures. New synergies exist between flood management aims and the WFD measures that will be

considered appropriate for the Camac at a local level e.g. opening up culverts and restoring millraces to a heritage standard, and multifunctional green spaces, 'Room for the River' type approaches. Further public and statutory consultations will be required on any proposed scenarios to ensure that environmental and heritage considerations are addressed and by this stage, Dublin City Council should be in a position to build on earlier efforts and broaden the scope of existing dialogues with interested members of the community.

5.1 Better understanding of the River and what it represents

In the case of the Camac, this river was used for power starting hundreds of years ago. The earliest maps show numerous mills along its banks. A diversion from a tributary of the River Liffey (the Brittas River) carried out in the 18th century along with the channelization of some of the upper reaches made this river more powerful and a more reliable source of power for the industries that needed. The number of mills on the Camac increased until the early part of the last century until technologies changed and the river was then seen by many to have served its purpose. It is much polluted state (according the many sources it is much cleaner now than in the recent past) must have encouraged landowners and planners and transport planners to believe it should be hidden from view and even culverted to make way for the new ways, new land uses and the new expectations of a modern society.

This is a complex river with a long industrial history. We have the legacy issues that accompany that, not only in terms of contaminated land and diminished water quality but also in relation to its flood regime after the river has been modified over time to power a large number of mills with improved efficiency.

The old maps and more recent technical data tell part of the story but local historians, anglers and other interested locals have been studying the Camac for many years, some for their whole lives. Their insights are invaluable to us as we come to appreciate the past hydrological, historical, cultural and social dimensions of the river.

5.2 The Flooding Legacy of the Camac

One of the principal challenges facing Dublin City Council and local residents in the restoration of the River Camac back to good ecological status is due to the many diversions and modifications the river has been subject to for hundreds of years. The Camac is one river where historical river engineering has resulted in a suite of unintended environmental consequences: not only have these modifications deemed necessary to "enhance" this industrial water-body made the river less hospitable to flora and fauna but they have contributed to modern flooding issues throughout the catchment...

From studying historic maps and old photos together with interviews with local people, it would appear that:

1. Within the city area land was built up along certain stretches and at these high points, mill ponds were constructed together with weirs to create a head of water upstream to drive mill-wheels more efficiently downstream
2. Upland reaches of the river were effectively channelized to again increase the power of the river to drive mill-wheels
3. Diversions from the Liffey Catchment were constructed at source
4. Channelization was implemented for the benefit of the mills
5. Former millponds became wetlands prior to being filled in for other uses

Nowadays the mills are gone and the mill-ponds have been filled in but we are left with a powerful channelized river with a complicated (and unpredictable) flooding regime. In the past, the river's power was harnessed by industry. Today this same power exists (potentially to become more powerful as a result of Climate Change) is no longer harnessed and constitutes a flood risk, a danger to its human neighbours.

In parallel with physical changes to the river itself and its evolving role in the generation of power for industry, the thirst for residential and commercial development within the city was increasing, which resulted in buildings being constructed right up to river walls at many locations, leaving us with limited options for environmental enhancement or flood level reductions today.

5.3 Environmental Legacy of the Camac

Evidence of the environmental legacy issues are gathered from numerous sources. Clues from local historians, residents, anglers and local business owners are invaluable in guiding the research and detailed investigations in this highly complex river system.

1. This is an urban river in an historic urban centre and all the pressures that entails (Urban settlements dating back before the Vikings: housing, industries, transport etc. encroaching on the river over 100's of years)
2. Industry sprang up on the banks of river originally to harness its power
3. As the nature of industry changed, river water was still used for cleaning, cooling and to carry away wastes.
4. Dredging was undertaken by various parties at different times in the past
5. Even non-water dependent industry located along the banks of the river and their activities in many cases polluted the soil adjoining the river
6. Quarries were established where in the river catchment where sands, gravels and outcropping bedrock was identified. Many of these would have formed part of the hydrogeological system of the Camac and her tributaries. Dumping is then known to have taken place in at least some of these locations.
7. The modified river channels that are a feature of the Camac River in the City Area, with artificially stabilised banks and underground culverts disconnect the river from many of her natural floodplains makes the river's hydrological and hydrogeological regimes more inhibited. They limit the ways in which the river can interact with and support the natural riverine habitats and biodiversity. They also make the identification of sources of pollution more difficult and obscure an assessment of the degree stretches of the river are in communication with surrounding groundwater.
8. Long-formed angling clubs have kept records of fish kills (dating back at least 50 years) and the reasons for them, giving us an appreciation of historical pollution patterns, droughts, disease, etc.
9. Assistance from locals in the identification of prohibited misconnections

5.4 Modern Insights and Necessary Next Steps

Interested members of the community also give us insight into the aspects of the river that currently contribute to society in a positive way (even for a river with 'Poor Status'), characteristics and existing ecology we must protect, as well as facets that might not be immediately obvious to outsiders. An appreciation of these features can change people's attitude to the river, meaning that the journey towards 'Good Status' starts before a single sod of earth is turned. A sharing of these perspectives is something Dublin City Council has promoted since the Camac Culture and Heritage Programme commenced in the summer of 2018. People have memories of the Camac, of experiences on and in the river that were transformative. Rivers can have that effect on people. These people would love their grandchildren to

come to know this river in a similar way and share some of these experiences. Dublin City Council wants to work with them in achieving this reality.

6. REHABILITATION OF THE CAMAC RIVER: THE JOURNEY TOWARDS ACHIEVING GOOD ECOLOGICAL STATUS

The next steps for the DCC Engineering Department centres around the Camac River Basin Management Project, aimed at addressing both flooding and WFD concerns together. The following steps are in train:

- Define individual “flood cells”
- Characterisation of physical condition of river channel and flood plain in each flood cell
- Biological assessment of each flood cell
- Investigation as to feasibility of re-naturalising the river channel and immediate floodplain
- Identification of appropriate instream measures
- Identification of extent of surface water network contributing to each “flood cell”
- Investigation into the possible use of NWRM’s in contributing sub-catchments: selected according to the identified pressures in each
- Selection of complementary grey infrastructure where necessary
- Design complimentary and ongoing monitoring programme for each flood cell to document improvements or unintended or unrelated deteriorations.
- Linking up one flood cell with the next to provide local joined up thinking
- Consider the overall catchment, flood cells and areas between to generate a unified and coherent environmental/ecological and flood plan for the river.

As discussed in detail in earlier sections, the successful rehabilitation of an urban river requires, not just a meaningful partnership with the local people in the catchment, but a multidisciplinary approach that involves collaboration with other technical professionals, other Local Authority Departments, other Local Authorities that share the river catchment, and national bodies, as well as private interests... all of whom have plans for the river. Joined-up thinking and a coherent approach to river planning will be vital to the success of the aims of the Water Framework Directive.

6.1 Land Use Planning: Planning Department

Where land (near the river, in particular but also in key locations within the wider catchment) is in private ownership, the redevelopment of sites subject to planning permission provides unique opportunities. The Planning Authority can request that certain river rehabilitation measures be incorporated into the development e.g. enhance or extend riparian corridors, green infrastructure, or in some cases simply that land adjacent to the river is preserved in a wild state. The policy statements included in the Greater Dublin Strategic Drainage Study (2005) will be sufficient in some instances but an approved river rehabilitation plan for the Camac would provide a stronger basis for such stipulations.

New Local Area Plans must highlight the existence of piped streams that residents of newer estates in Cherry Orchard and Park West may not even be aware of. These streams may in time be daylighted and may once again become defining features of this landscape.

6.2 Transport Planning: Camac Greenway and Transport Infrastructure in the Catchment

The concept of a Camac Greenway has been in existence for at least 10 years in Dublin City Council and a notional route is shown on the National Transport Authority’s Cycle Network Plan (2013) for the

Greater Dublin Area. Finding a balance between the more sensitive members of the river's ecosystem and the need for residents by locating walkway or cycleway infrastructure in the less vulnerable areas within the river valley will be critical in achieving 'good ecological status' while meeting the expectations of local people. The intensively developed urban nature of the Camac River Valley in the Dublin City Area, especially in certain stretches in the Inchicore and Kilmainham localities, limits opportunities for the desired enhancement and expansion of the riparian corridor. DCC aims to protect the riparian ecology that exists currently. Where sufficient space exists to potentially reconnect the river with its floodplain, this must be seriously considered as such grand gestures may prove necessary in order to facilitate some of those fluvial dynamics that are currently absent.

Kick-starting some of these river processes is considered to be a top priority by those who seek 'good status' for rivers, such as the Camac that are in need of attention. This does not mean that walkways or cycleways are incompatible with river rehabilitation schemes but in the Camac, for the reasons outlined above, such a greenway might cross the river at specified points, even join the river for short stretches but will at all times be respectful of the river and the needs of its natural dynamics and ecosystem. Breath-taking viewing points could be a feature of such a greenway, especially for a river with such notable tourist attractions such as Kilmainham Gaol, Royal Hospital Kilmainham including the Irish Museum of Modern Art (IMMA), the lesser known Drimnagh Castle and potentially the recently purchased Kilmainham Mills within her river valley. The Camac would be revealed in glimpses and stages and this could tie into the tourist trail but will largely retain her mystery for her own flora and fauna. Such a vision would be representative of the most current thinking. The residents, naturally will have their own views and through discourse, debate, the sharing of memories, knowledge and insights, we will chart a course towards 'good status'.

Road run-off can also constitute a negative pressure on rivers. New roads in new developments and in upcoming urban regeneration projects are likely to be designed in conjunction with green infrastructure that will have the effect of cleaning contaminants from road run-off. This trend has already commenced within the city, not quite falling within the Camac Catchment but very close by, in nearby Crumlin.

Within its catchment, the Camac River (both directly and from its tributaries) receives road drainage from several nationally and regionally important roads, e.g. the M50, the Naas Road and the Long Mile Road.

An agreed plan to treat road run-off developed by the DCC Water Framework Directive Office and the Transportation Department may prove to be important in enhancing freshwater ecology in the Camac River. The use of green infrastructure may include Natural Water Retention Measures (NWRM) which would have the added benefit of slowing the flow to the river thus helping with flood alleviation for certain storm events.

6.3 Protecting Existing Ecology and future enhancements: Working in Tandem with The Parks and Landscape Division (DCC)

As part of the Camac Cultural and Heritage Programme 2018, Dublin City Council engaged the services of bird expert, Eric Dempsey. Initially, he was selected as one of the natural heritage guides for the Camac Programme for Schools. Several interesting species of bird were identified by Mr Dempsey on the river heritage walks and from the need for baseline bird survey data was established. Preliminary bird surveys have been carried out by Mr Dempsey in certain areas and the results of these were presented at the Camac Heritage Event for Heritage Week in August 2018.

One of the birds already identified by Mr Dempsey in the urban environment of the Camac was the Sand Martin. The Sand Martin is one bird of which the importance and vulnerability has been recently highlighted by Maryann Harris of the Parks and Landscape Division of Dublin City Council. In a recent internal memo (October 2018), she brought attention to the susceptibility of the Sand Martin to threats from Climate Change and emphasised the importance of healthy waterbodies to this bird species.

Design details are currently being put together by Ms Harris (email to DCC WFD Office, October 2018) in relation to protecting and enhancing the natural habitat of the Sand Martin which will guide Camac River management endeavours and may also, in the future form part of Planning and Development Management policies and requirements.

6.4 Working with Irish Water for Better Water Quality

The presence of sewage to a greater or lesser extent is a feature of urban rivers, unfortunately. There are currently no wastewater treatment plants located within the Camac Catchment since the closure of the Saggart Wastewater Treatment Works in the early 2000's. There is an important trunk sewer, the 9b, that drains foul water from the river catchment (and additional areas) as far as the Grand Canal and ultimately to the Ringsend Wastewater Treatment Plant.

The past importance of the Camac as a means of taking away waste is evident from the location of some of the drainage infrastructure in place today. In certain sections of the river, we see that foul sewers are located in bed of the river. It also tells us that in the past, engineers intercepted foul drainage on its way to the waters of the Camac and contained the effluent in a pipe, to bring about environmental improvements (although it might have taken place largely due to complaints about odours). These 'features' are visible from Kern's Place Bridge on the Camac where the metal sewer manholes protrude from the river bed, rising up out of the water in the middle of the river channel. These metal manholes now appear to be in a corroded state and need to be replaced both from environmental and flooding points of view.

A large number of combined sewer overflows (CSO's) exist within the Camac Catchment. They have been in place for many years to act as a pressure release when a foul sewer is overloaded by significant rainwater. The role of these CSO's in the health assessment of the Camac River as one of the sources of environmental pressures will be investigated and dealt with together with Irish Water.

6.5 Green Infrastructure

As discussed earlier, green infrastructure, including many of the measures listed as Natural Water Retention Measures for Urban Areas, has the capacity to ease many of the environmental pressures that act on urban rivers and to play a direct role in the management of flooding as well as offsetting some of the environmental costs of the complementary grey flooding infrastructure.

The retrofitting of Green Infrastructure is sometimes a controversial topic as it is substantially more expensive than the its inclusion in a new development. The Bluebell/Drimnagh Area, traditionally an industrial area, is likely to undergo significant redevelopment in the short to medium term so there will be an opportunity to introduce green infrastructure or sustainable drainage systems (SuDS) to these areas as they are evolving. Some large sites also exist within the older areas of the catchment, such as St. Michael's Estate so it will be important that SuDS be included her also. A possibility exists here to link a green space and green infrastructure with the nearby riverside park at Turvey Avenue (on the opposite side of Emmet Road). Pluvial flooding is a feature of a section of Emmet Road between the two green areas so perhaps a flooding solution might be incorporated into the design.

Green infrastructure may be useful in eliminating surface water from combined sewers that are typical of older urban areas of the city and may be useful in limiting the activity of CSO's as mentioned above.

6.6 What role will the community play in the project to rehabilitate the Camac?

The next step for the Camac Community is likely to be a high-level visioning process. This will be undertaken with the guidance of the Water and Communities Office, The Rivers Trust (UK and Ireland) and Dublin City Council. It is thought that some key aspirations for the river could be agreed upon between local people and DCC: e.g. to manage flooding in an environmentally responsible way; to improve water quality; to promote biodiversity; to provide new public spaces; etc. While there is likely to be some differing opinions and priorities, this is to be expected and creating a unified vision for the Camac River will take time. Even starting this process together with the communities and the other departments within DCC and also South Dublin County Council will allow us to create a lens through which we can identify river projects which are desirable and also compatible with the aims of the Water Framework Directive and those that are not.

It is expected that many of the existing community groups along the Camac River may join together to form a Camac Rivers Trust. A River Trust is typically a registered charity and once officially designated as such, can apply for funding from a wider variety of sources, e.g. the EU.

The pressures must be identified, monitored and resolved using a combination of technical and non-technical means. There is room for everybody at the table. The citizen science approaches can be applied here and there is a wealth of data related to the Catchment Based Approach (CaBA) and other resources available from the UK.

One citizen science tool that would appear to be relevant for a small urban and significantly modified river, such as the Camac is MoRPh: A citizen science tool for monitoring and appraising physical habitat changes in rivers. It is a method also endorsed by CaBA and training for local groups can be organised through them. Training for two different methods of ecological assessment for citizens (with varying levels of accuracy and detail) have been arranged for members of the Camac Community in both the DCC Area and the South Dublin County Council Area (Pers comm, S Hurson, LAWCO). The combination of the results from physical assessment of the river environments together with the ecological assessment is considered to provide valuable information. Community groups may also play a role in the monitoring of changes after river rehabilitation works are completed to assess the impact.

Another aspect to consider in the creation of a partnership with the community will be in formalising a structure to facilitate the sharing of information e.g. the results of monitoring data commissioned by Dublin City Council, in a timely manner. In this day and age, "open disclosure" will be necessary to establish a strong working relationship between the local authorities and the communities. Providing supports and information through which the data can be viewed and understood will be important also.

Also management of expectations through education and awareness will be vital: the humans are one component of the ecosystem (as discussed above) but 'Good Status' depends on striking a balance between all the needs and expectations of the users of the river and various statutory departments.

7. CONCLUSIONS

Across the world, city populations are growing. The importance for urban people to have access to nature cannot be overstated and yet their needs must be balanced against the needs of the more sensitive species of the riverine environment. And yet, river systems are vulnerable systems. By their very nature, rivers are found at the lowest point in their landscapes and as a result of this are at the receiving end of everything that happens on the land in their catchments. Officially, under the Water Framework Directive the status of the Camac in the City Area is currently ‘poor’. The challenges are complex and entangled so the full cause and effect relationships with the river, are as of yet, not fully understood. The measures necessary to put the Camac on the path to ‘good ecological status’ are likely to be equally complex.

Also, people in urban areas need to be safe from the impacts of flooding. Increasingly and as Climate Change alters our perception of what flood management should look like, we consider that a healthy river is a natural river and that a floodplain wetland may be of a value greater than its development potential or intensive agricultural potential. The solutions to ecological challenges are starting to look very like the solutions to flooding and quality of life challenges and as a result, there are a lot more people taking a seat at the decision-maker’s table. That is the first step to finding sustainable, publically acceptable and lasting solutions.

Values and questions of quality of life require a partnership with the communities connected to the river. Input from technical professionals from many different fields of expertise will be necessary. The project team is likely to consist of residents and professionals who will each view the project from entirely different viewpoints between all of which a balance must be struck. A collaborative and adaptive approach will be crucial.

The responsibility of the rehabilitation of an urban river is a great one. Rivers are symbols of life, of rebirth. They have played important role in spirituality down through history. They have been regarded as vital sources of inspiration, of magic. People who work towards the successful rehabilitation of urban rivers are pursuing that magic. ‘Good ecological status’ for a re-naturalised river benefiting from improved flood control would be a valuable gift for future generations of humans, mayfly, crayfish, sand martins etc..

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ⁱ Comment made by Author and Historian Pat Liddy on the 28th May 2018. Pat's books include *Dublin be Proud*, 1987 and *Dublin A Celebration*, 2000 among others.

ⁱⁱ http://ec.europa.eu/environment/water/water-framework/info/intro_en.htm

ⁱⁱⁱ <http://ec.europa.eu/environment/archives/water/adaptation/ecosystemstorage.htm>

^{iv} <http://www.theriverstrust.org/who-we-are/about-us/>

^v Ibid.

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^{viii} <http://watersandcommunities.ie/about/>

^{ix} Comment made by Author and Historian Pat Liddy on 28th May 2018. Liddy's books include *Dublin be Proud*, 1987 and *Dublin A Celebration*, 2000 among others.