SUBMISSION BY SAVE CORK CITY
www.savecorkcity.org

By e-mail to: npf@housing.gov.ie

Submission to: *Draft* of Ireland 2040 – Our Plan

Dear Sir/Madam,

Save Cork City is a voluntary group. We formed in January 2017 because we were concerned by the impact on Cork of the Lower Lee Flood Relief Scheme, and the fact that the vast majority of people in the city knew little or nothing about the proposals.

We welcome the level of communication and public and stakeholder engagement in the development of Draft Ireland 2040 – Our Plan. We have read the Public Consultation Document and are pleased to note that this draws upon lessons learned from the National Spatial Strategy.

We concur on the need for better management of Dublin's growth while at the same time supporting ambitious growth targets to enable all four cities of Cork, Limerick, Galway and Waterford to enhance their significant potential to become cities of scale and drive regional development.

We welcome balanced development, increased urbanisation and making better use of under-utilised land, including 'infill' and 'brownfield' sites better serviced by existing facilities and public transport.

In particular we note the vision for Cork city and the reference to the need for flood management to be addressed as part of any future growth strategy for Cork and its hinterland. We also note the reference to Strategic Flood Risk Assessment and the focus on integration of environmental considerations into the planning system.

It is important to state that the Lower Lee Flood Relief Scheme (LLFRS), referenced on pg. 55 is currently at Public Exhibition stage. We have been assured by the OPW that the 1200+ submissions received as part of the statutory process are being considered, that this will take some time, and that these will be responded to as part of the statutory process.

Our research has established that the LLFRS, which is primarily defensive in its implementation, is not in fact compatible with planning legislation as it refers to conservation and landscape character.

Nor does it comply with the national flood policy, which advocates focus on

- Managing flood risk, rather than relying only on flood protection measures aimed at reducing flooding
- Taking a catchment based approach to assess and manage risks within the whole catchment context

Furthermore the LLFRS does not adequately respond to the recommendation from the Dutch Peer Review Report that the OPW take up a role in drafting standards and providing coherent supervision of dams and reservoirs related to flood risk. Large constructions upstream induce risks to those who live below stream, especially when not operated or maintained properly. We note that Cork city is particularly at risk from Iniscarra dam.

We contend that the LLFRS as proposed is counterproductive when measured against the ambitions and strategies outlined in Ireland 2040 Our Plan. **It does not comply with the stated policie**s particularly under the following headings:

4 *ensure the creation of attractive liveable well designed high quality urban places*

The LLFRS threatens one of the key assets of Cork City, its historic landscape character. It singularly fails to capitalise on the potential to implement a strategic design review of the banks of the Lee and a revitalisation of the complex network of waterways that shape the city, inform Cork's identity and sense of place. An integrated design process can realise creative solutions that work in terms of high quality urban space, tectonics, heritage and hydrology.

Equally important is the lost potential to engage the community as active partners in a process of urban regeneration and resilience, rather than passive consumers of piecemeal interventions imposed by private developers and state agencies.

5 *develop cities and towns of sufficient scale and quality to compete internationally*

Cork is Irelands second city, and its greater urban area has a population larger in size than the 3 other second tier cities combined. Cork City Docks is a 160 hectare site which could be of national significance that is unequalled in Munster and only equalled by Dublin Docklands in Ireland.

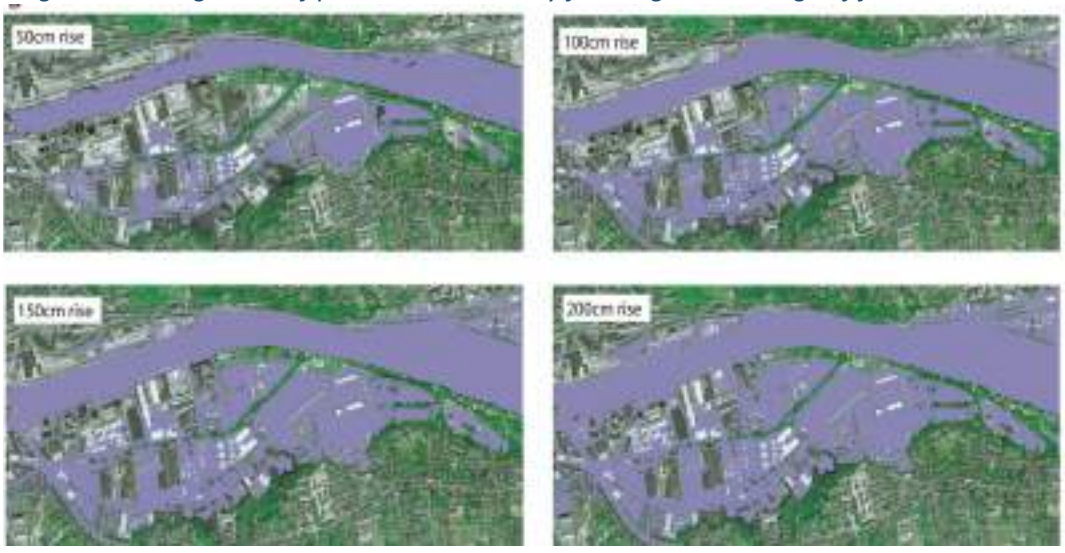
Yet its 4 km long waterfront remains completely unprotected by the LLFRS and it is thus likely to remain undeveloped until the issue of flood risk has been addressed.

8 *realising our sustainable future*

The scheme fails to address the major risk, tidal flooding, at its source and consequently fails to protect the north and south docklands and harbour area. The LLFRS is a short term solution for Cork city centre that does not future proof against the effects of climate change as the walls cannot realistically be increased in height. Demountable barriers for the length of walls proposed completely impracticable.

The currently projected regional (Ireland - NW Europe) and global rates of sea-level rises over the next 10-40 years are for >0.4m. But, most likely, based on current climate warming rates, regional sea-level rise for Ireland will be >1.0m and very probably with even higher values of 5-6m rise by c.2100. Given these fundamental hydraulic sea-level rise base level values, coupled with greater storm magnitudes and significant increased fluvial run-off rates (probably twice present levels resulting from climate warming), then a storm surge barrier for Cork will be needed sooner rather than later.

Diagram showing areas of permanent Cork City flooding with a range of future sea level rise:



10 *assessing environmental impact*

The proposed LLFRS would have significant negative impact on the historic and potentially the prehistoric heritage of Cork City. The fundamental principles of national and international practice and regulations in relation to protection of cultural heritage - avoidance and adequate mitigation - do not seem to be adhered to.

The EIS, that is meant to guide decision making by scoping the potential of the impact of the works on the heritage of the city, under-estimates the extent of destructive impact, both in terms of works to be undertaken as well as presence and value of heritage, the extent and means of adequate mitigation and thus cost to the public and developer.

One of the city's most valuable assets, its cultural heritage is - in line with international standards - protected by a number of legislative means. Many of the city's quays are included in Architectural Conservation Areas and the majority of Quay Walls included in the National Inventory of Architectural Heritage. The fact that these mechanisms, devised to protect the city and its valuable cultural resource are proposed to be overridden in the proposed scheme is greatly worrying and detrimental to Cork's past and future.

In contrast we wish to draw your attention to our document Potential Cork, copy attached. This details our 3 point plan including a tidal barrier. It would have hugely significant implications in enabling the quality sustainable development of Cork and particularly Cork Docklands since it;

- Will enable the provision of a continuous linear waterfront amenity corridor extending from the Lee Fields to the Lower Harbour by removing the threat of flooding without having to use negative localised measures such as walls or embankments.
- Would be a far better use of resources than the proposed OPW Lower Lee Flood Defence scheme, which will cost €140m+, will take 7 -10 years (or more) to deliver, would have a huge negative impact on city centre trade and tourism and will not provide any flood protection for Docklands or areas outside the city centre.
- Will allow the ground plane to be lowered well below that set out in the South Docks LAP, which will enable phased delivery of high quality urban regeneration and significantly reduce the cost of infrastructure delivery.
- Will give the opportunity for Finished Floor Levels (FFL) to be set at a level that make sense for incremental phasing, reduced development costs, and the insurance industry.
- Provides for the conservation of the historic city quays, a significant heritage asset, which will enhance and complement the new Docklands development and celebrate the identity of the city, making it a stronger urban place.
- Is an innovative and holistic solution with a combination of measures reflecting best international practice, a multi-disciplinary design approach and a community engagement process, and which, very significantly, takes account of climate change.
- Provides flood protection not just for Docklands and Tivoli Docks but also the entire city centre and a much larger hinterland including Little Island and Mahon.

We noted with interest in the section on Coastal Environment and Planning for Climate Change that forty per cent of Ireland's population lives within 5km of the coast, and also that our coastal areas are a key driver for Ireland's tourism sector.

We agree that as a result of climate change, sea levels and erosion and accretion patterns are key issues for planning and flood risk assessment, especially in managing the ongoing development of our cities and towns.

However we strongly disagree that such measures should be pushed out to the long term, to 2040 and beyond for climate change adaptation responses which may entail the consideration of barrage or similar technologies to prevent inundation of more low-lying city centre areas during extreme weather events. Cork City, for example, has already suffered severe flooding related to extreme weather and water management in 2009 and cannot wait to 2040 and beyond for a solution to climate change.

Please see attached the independent Report and Estimate for Cork City Tidal Barrier prepared by HR Wallingford, which gives the estimated cost of a tidal barrier for Cork as €140 million at 2017 prices. It also notes the major benefit of not requiring the construction of walls along the quays in the city and that it would avoid the scenario of overtopping or failure of flood walls in the city which could cause a serious risk to life as well as damage to the city.

The proposed Cork City Tidal Barrier would be a far safer, more effective and better long term investment of public funds than the proposed OPW Lower Lee Flood Defence scheme, also budgeted to cost €140 million (though likely to run far above that based on their track record of much less complex schemes which have all run significantly over budget).

We note the stated Policy Objective 21, to facilitate the development of the rural economy through supporting a sustainable and economically efficient agricultural and food sector, together with forestry, fishing and aquaculture and diversification into alternative on-farm and off-farm activities, while at the same time noting the importance of maintaining and protecting the natural landscape and built heritage which are vital to rural tourism.

There is an opportunity for farmers to play a crucial role in water management, containment, soil improvement and reduction of carbon emissions in conjunction with sustainable flood management, and we believe that this is a planning issue which should not be neglected.

The Draft River Basin Management Plan states that the Irish River Basin District has a population of around 4.76 million, with 62% of these living in cities and towns. These key statistics illustrates the very close connection which most Irish people have with our rivers and lakes.

Our modern river landscape is very different from what nature intended. We have lost water storage in wetlands, created hard surfaces that water rushes off, and changed our river channels so they move water very quickly. Our rivers are less able to cope with the rain we expect in the future, making flooding more likely to impact communities.

Flooding is natural and floods are important for healthy rivers. Flooding creates habitats for wildlife, moves nutrients to help plants grow and cleans gravel, which is important for fish and insects. However, it can also be devastating for people and communities.

In our busy landscape, we can’t make all rivers completely wild again, but we can restore some of the features that store water, or restore natural processes which slow water down. This could mean that a flood could develop slower, and be less damaging to property, and less risky to people.

This has other benefits too. A landscape which stores more water, can be less likely to run out of water in a drought. Wetlands which store water, can also remove pollution. Restored rivers, with more bends, clean gravel, vegetation, and trees, provide more habitat for fish and insects.

The OPW’s budget for flood relief has been doubled in 2017. Yet their approach to flood risk to date has been typically symptom driven, dealt with on a project-by-project basis, and resulting in

extensive concrete barricades. Lengthy concrete engineering systems are costly to build and maintain, and their effectiveness is questionable and will inevitably deteriorate over time. There are also negative environmental, social and economic side-effects.

A truly sustainable approach to flood management is very cost effective and enables communities to adapt to the realities of climate change. Restoring a river's natural defences against flooding brings social, economic and environmental benefits to the whole community and improves water quality.

Our water infrastructure is also intrinsically linked with our built heritage since almost every Irish town and city and many of our villages have developed from an initial point of connection between land and water. The Granada Convention must be carefully considered in developing flood management solutions which protect our valuable heritage and also its relationship with the waterside setting.

The Irish approach to flood risk mitigation is in contrast to current thinking in other countries in Europe. In the Netherlands, massive interventionist engineering projects such as the delta works (1950s) have been critically assessed in recent years to achieve a new dialogue between flood protection and nature, with the issue of cost effectiveness being a significant factor in the discussion. Key to this change is the wider realisation that the effectiveness of engineering-only approaches has its limits. A more holistic approach was adopted, in which working with natural dynamics could yield multiple benefits while continuing to retain water security.

When Scotland transposed the European Water Framework Directive into domestic legislation in 2003 the Scottish Parliament took the opportunity to add a statutory duty for sustainable flood management. It ensures integrated working across government bodies to promote sustainable flood management. In the same year Scotland launched the River Devon Natural Flood Management demonstration site, working in the whole river catchment. They have also formed a National Technical Advisory Group on flooding to provide guidance on sustainable flood management strategy. Almost all local authorities in Scotland have now set up Flood Liaison Advisory Groups which meet regularly to discuss policy on drainage and flood prevention and to share information and technical expertise on managing the catchment area.

There are plenty of useful examples of sustainable flood management schemes across Europe at a variety of scales from the integrated catchment management of the Rhine River to the Belford Catchment Solutions Project in the UK.

Save Cork City submits that the quest for sustainable solutions for river water management should play a role in the current process of flood protection. To sustainably manage flood risk and optimise the outcomes and benefits, a long term, holistic and design-led strategy must be developed. Reframing the context of flood protection in the long term will lead to different insights and proposals for flood protection. Multi-sectoral thinking develops integrated solutions with added benefits.

An all-encompassing nationwide vision for the future of Irish rivers is needed. This ambition statement should be included in the National Planning Framework and underline the amenity, ecological, cultural and touristic benefits and the vital role that Irish rivers play at the heart of Ireland's cities, towns and villages. Rivers need to be treated as central, publicly oriented spaces and integrated as the framework for blue/green amenity and ecological infrastructure in the country. This should be a long-term objective which all the relevant organisations can work towards.

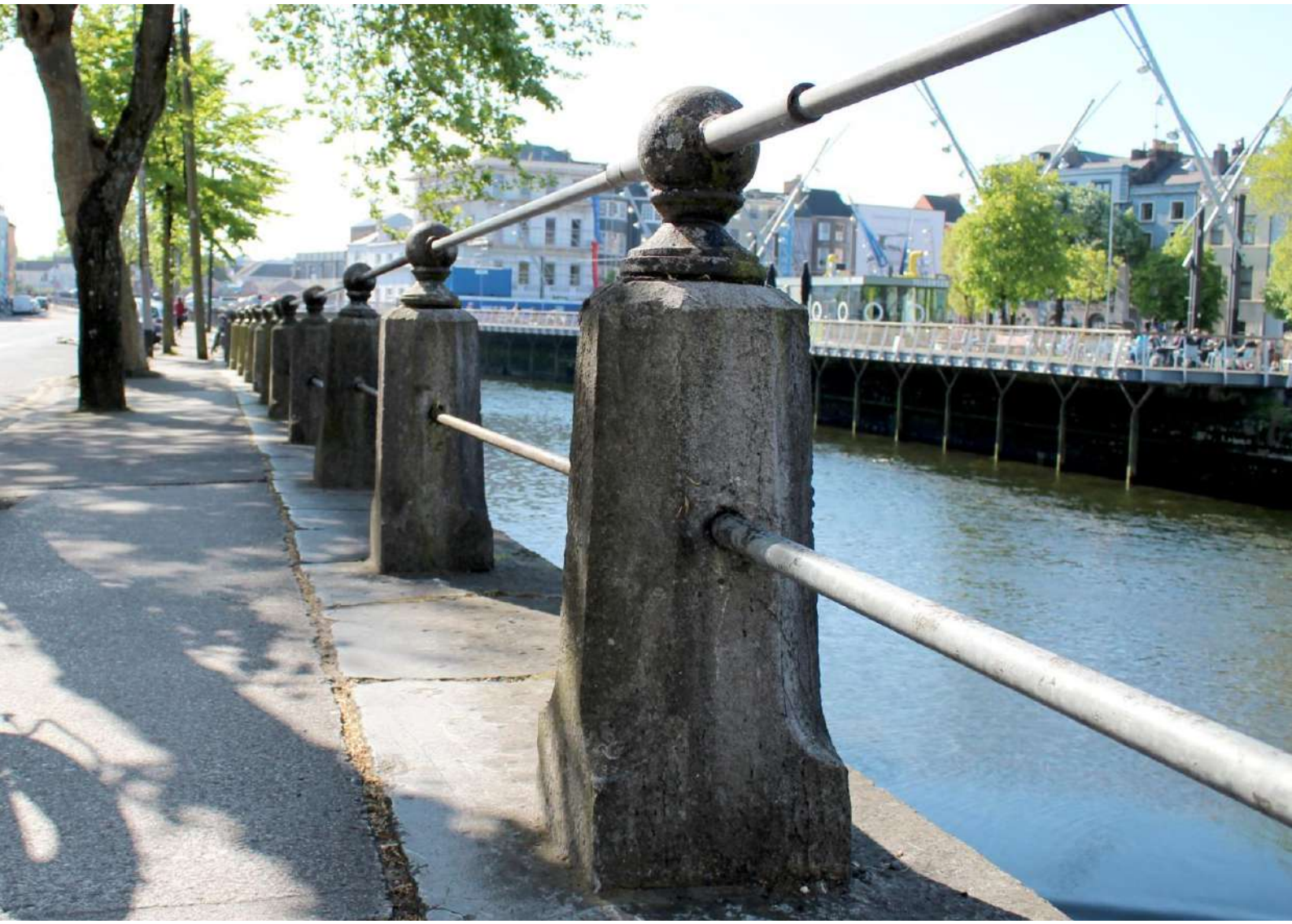
Yours faithfully,
Save Cork City
savecorkcity@gmail.com

9th November 2017

References:

Please see the Bibliography attached to the Save Cork City policy document 'Potential Cork',
And also:
HR Wallingford. *'Cork City Tidal Barrier Cost estimate.'* October 2017.
DRR Peer Review Report 'Irish Flood Risk Management' October 2015
Intergovernmental Panel of Climate Change (IPCC), 2014 (Vol 2)
Devoy, R.J.N., 2015, 2017
Nolan, P. 2015
www.climateireland.ie 2017
Anja Murray. '*Natural Flood Management Adapting ecosystem approaches to managing flood risk*.' Report for Friends of the Earth, January 2017.
Eco Eye episode broadcast Wed 02 Aug 2017 on RTE 1: Anja Murray and Duncan Stewart investigate how Ireland can adapt to the increasing intensity of storms and floods
REDscape Landscape & Urbanism. *Irish Rivers 2040, Designing Irelands 'next generation' flood defences,* Flumina Hiberniae
www.theflowpartnership.org

Potential Cork



The Save Cork City Solution

A Progressive and Economical Flood Management Solution for Cork

May 2017

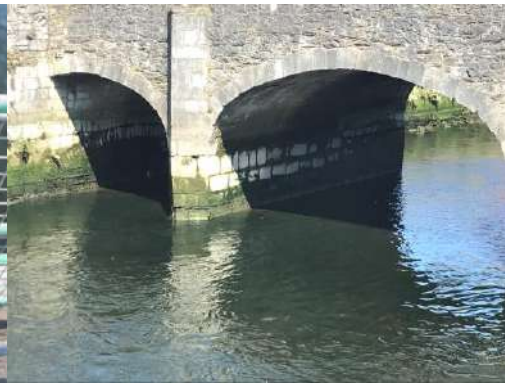
www.savecorkcity.org











Contents

A Three Point Plan 2

The Save Cork City Solution in Detail 4

Introduction
The Tidal Barrier
The Quayside Landscape
The Flow of the River

Why the Save Cork City Solution is Right for Cork 9

Summary
Economic Impact
No Traffic Impact
The River Lee is 95 Kilometres Long
International Best Practice
Ready for Climate Change
A Highly Considerate Design Solution
Full Reference to the Development Plan
Heritage Gain
Opportunity for Betterment
Consideration for Civic Life
Economic Gain from Protection of Heritage
Increased Tourism and Tourism Potential
City Centre Trade Boost
Improvement Starts Now
Docklands and Tivoli Protection
Insurance Cover at Last
More Cost Certainty
Avoid Costly Litigation

Conclusion 21

Notes
Glossary
Bibliography
Acknowledgements

Appendices

Comparison of Walls Scheme & Save Cork City Solution A
Images B
Drawings C
Comments on the Walls Scheme D
The Save Cork City Campaign E

'A city's conserved historic core can differentiate that city from competing locations, branding it nationally and internationally, thus helping the city to attract investment and talented people.'

'Heritage anchors people to their roots, builds self-esteem and restores dignity.'

from *The Economics of Uniqueness* by the World Bank

'Urban heritage is of vital importance for our cities – now and in the future. Tangible and intangible heritage are sources of social cohesion, factors of diversity and drivers of creativity, innovation and urban regeneration - we must do more to harness this power.'

Irina Bokova, Director-General of UNESCO[1]

'If you think good design is expensive you should look at the real cost of bad design'

Dr Ralf Speth

The Save Cork City Solution: A Three Point Plan

Our proposal is to control flooding using a downstream tidal barrier supported by the repair of the historic quay walls and a combination of upstream catchment management measures.

1. Building a tidal barrier

We propose a tidal barrier at Little Island, to protect the city from major flooding threat. The barrier would have a gate that can be closed as necessary to protect the city from tidal surge for generations. The chosen location allows for required water storage and the protection of and development of the city and docklands. A tidal barrier causes no disturbance to the current river landscape in the city or to the city economy during construction. The benefits of choosing a tidal barrier would start now, and would grow in time.

2. Repair of the quayside landscape

Our proposal includes the repair of all quay walls and walkways of the historic river channels of the city, giving particular attention to national and international guidelines for design in historic places. We propose to reveal the historic diversity of the landscape through conservation, restoration and restrained design intervention, leading to an upgraded civic experience and improved river access.

3. Slowing the flow of the river

Management of the entire River Lee catchment would include tree planting,[2] wetland restoration, water diversion, attenuation,[3] reinstatement of ditches and alteration of land drainage methods in cooperation with landowners who may have a vital role to play and in addition to optimal dam management.[4] Below the dam the repair of weirs[5], tree planting and diversion of water can be considered. The solution aims to reduce the flow of the river into the city centre and improve the city environment. With the implementation of river catchment management measures, sustained or high intensity rainfall in the catchment should not lead automatically to fast water flow in the city.[6]

The Save Cork City Solution in Detail

Introduction

Cork City was founded at the highest point on the River Lee that is navigable from the harbour. Cork has traded with other European cities for hundreds of years and this has formed much of its rich and diverse character.[7] The visual identity of the city and the River Lee is defined by the diversity of the buildings and the historic quay walls set against the background of an 18th and 19th century city landscape. This was the *Age of Enlightenment*[8] in European history and Cork embraced this time with ingenious and unexpected results.

The Save Cork City solution has come about from the recognition that what makes Cork special is extremely fragile. Proposals for flood relief walls may represent a final tipping point in Cork's future that would see much of the city's character and potential lost forever. Save Cork City believes that now is the time to reassess how we treat the extraordinary asset that is the historic landscape, and in particular the quayside landscape, of Cork City before it is too late to do so.

We believe that works to Cork City should reveal the city's history, improve amenity and provide betterment of the city environment, opening up development potential and making Cork an attractive place to live and invest.

The authenticity of the historic centre of Cork City and the quayside landscape is visible on the ground and in many historic images.[9] It bears testament to the optimistic values of generations of people who lived and worked in the city and whose abilities created a European city to rival any in historic significance and uniqueness.

It is our experience that most people who are aware of it are unhappy with the Walls Scheme for flood defence and would prefer a tidal barrier, which they see as inevitable in years to come.

The Save Cork City solution of a tidal barrier at Little Island, repair and restoration of the quayside landscape and slowing the flow of water from upstream is by far the best overall option both for now and for the future. It is also the best economic solution.

The Tidal Barrier

Previous opposition to a tidal barrier has been based on cost, however, the Save Cork City solution for a tidal barrier is estimated to cost €135 m for the barrier structure,[10] and would protect more of the city and more homes and businesses now and in the future, when compared to alternatives. Proportionally, the cost of protecting individual properties would reduce significantly when future protection is considered. The barrier is a technically viable solution and can be economically built in the location proposed, where the water is relatively shallow.[11]

A tidal barrier has been investigated at the existing tunnel location in the Lee CFRAMS Report[12] but was found to have *"insufficient storage volume behind the barrier."*[13] Two other options; a barrier at Roche's Point and two barriers located on either side of Great Island, were also considered by the report but were not found to be economic. The Save Cork City solution of a tidal barrier at Little Island is a new proposal. It represents a lower environmental impact solution in comparison to the Great Island barriers.[14] Crucially, it allows for ample water storage from upstream behind the barrier. The Save Cork City tidal barrier is a solution for Cork flooding that allows us to move forward now and not have to wait. This is a crucial advantage to the growth and wellbeing of the city.

We propose the tidal barrier at Little Island to be constructed using simple, economic and tried and tested technology.[15] Its construction timing would align with the move of the Port of Cork to Ringaskiddy. It would be open to recreational and commercial craft except in times of tidal surge when it would be closed for a short period of hours. It would allow for the full protection of docklands and extensive additional areas of the city. There is easily accessible public land on both sides of the river between Little Island to the north and Horse Head to the south. Water between 1 and 8 meters deep at the Little Island location means that simple, causeways (earthen/sand embankments protected from erosion by rock armour) can be constructed to form the barrier which would accommodate a navigation channel and tidal gate 60 metres wide. This proposal allows for sea level rise and can allow for a one metre or more rise in sea level on construction.

The Save Cork City Solution. Proposed location for the tidal barrier at Little Island.

The projected cost of €135 m is based on construction cost and maintenance costs for fifty years (a figure of €27.5 m). Other features of the proposed barrier are as follows:

- a total barrier length of 910m
- a 60m navigation channel with tidal gate
- 6 sluice gate complexes
- 850m of embankment dams
- 910 linear metres of sheet piling
- an 850m long wave wall
- a double sector gate with a flushing gate structure to prevent silting
- flow control measures for the channel north of Little Island

The Save Cork City solution also creates a new amenity in Lough Mahon and Tivoli as it protects these areas from flooding and maintains a more gentle and serviceable river environment behind the barrier.[16] Save Cork City's Little Island barrier proposal is a viable and sustainable proposal. It allows for upstream catchment management measures to be introduced and established over time and represents a significantly faster flood relief result for the whole city than any other proposal.[17] The effect would be to boost the city's economy and maintenance of the barrier would be significantly lower and more manageable than other options.

The Quayside Landscape

The tidal barrier means a better city now, not in ten years time. Once we decide to build the barrier, we can begin to sensitively repair the quays and to design the gentle intervention that will reveal and reinforce our historic city environment. We can plan for development now, based on the impact of the tidal barrier to create flood prevention for a greater area over a long period of time. The Save Cork City solution for a tidal barrier in the right location has the power to unlock the potential of Cork from the minute we adopt it as the best way forward. From that point on Cork, Ireland's 'Second City', will begin to heal and to grow, freed from both the uncertainty of flooding and of damaging flood defence proposals. We can begin the process to improve the city now and not after ten years of construction.[18] Our solution proposes €25m for repair, restoration and betterment of the quayside landscape.

The repair of the quayside landscape would increase amenity, encourage city life and tourism and reinforce the city as a place to live, visit and invest. There is significant evidence that the repair of the historic areas of cities can lead to substantial economic gain through tourism, increased trade and increased investment. Improved amenity and authenticity of the landscape has become a commodity in the fight for significance between cities.[19]

The Flow of the River

Building the Little Island barrier means that there is less need for upstream works in the short term and that we can concentrate on slowing the flow of rainwater into the river over the medium term

The Waterford Greenway is a useful comparator on the achievability of a project involving many stakeholders and landowners over a relatively short period of time.[20]

If appropriately grant-aided, farmers could play a vital and cost-effective role in the management of the river in accordance with good practice and as part of an integrated climate change policy environment[21]. Upriver storage of water, via the restoration of wetlands and native woodlands, for which there is already a grant scheme, in addition to other methods that attenuate water and slow the flow of the river, has many advantages. A tidal barrier at Little Island would work in conjunction with these softer and sustainable methods of river management. Methods to slow the flow of rivers and store water upstream are becoming widespread and are being used on small and larger catchment areas in the UK and in the rest of Europe.[22] Some methods can be designed and achieved through grant-aided relief for individual landowners or by altering land drainage methods and improving tree plantation in existing and new areas. Many low cost methods could be put in place relatively quickly.[23] All of these methods lead to slower flowing rivers, environmental improvements and could form a valuable part of an integrated national climate policy. We propose €30m for upstream catchment management works and works may be grant aided also.

In addition to flow reduction measures we advocate utilising the existing dams in the optimum way for flood management. Since the flood of 2009 the local authorities and the ESB have put in place improved communication and flood management protocols. They control the alteration of the water levels in time of increased rainfall and any condition or warning of a condition that may cause flooding. Optimal dam management is currently the first line of river flood defences on the River Lee until better catchment management measures can help reduce the burden.[24]

Why the Save Cork City Solution is Right for Cork

Save Cork City wants timely and effective, long term flood relief for Cork, protecting as much of the city as possible. We want to promote the development of the city in terms of amenity, tourism, business and investment potential for the short, medium and long term.

Save Cork City Three Point Plan

We propose a tidal barrier for Cork, the repair of the quays including urban improvement, and upstream attenuation and storage of flood waters, in conjunction with optimal dam management.[25] A tidal barrier is inevitable for Cork due to climate change.[26] Instead of delaying its deployment to a later date, we want the tidal barrier to happen now, and the resulting growth and development of the city to start now too.

Economic Impact page 12

The Save Cork City solution is construction light in the city centre. The proposal to repair and restore the quays would allow for immediate improvement to the local environment, boosting tourism and the local economy with no negative effect on local business.

No Traffic Impact page 12

Save Cork City's flood relief proposals would have minimal to no effect on traffic in the city centre.

The River Lee is 95 Kilometres Long page 12

Save Cork City proposes flood relief solutions to manage flooding outside the busy and built up city centre.

International Best Practice page 13

Our proposal for upstream attenuation and catchment management is based on current best practice in river flood relief. Our city centre 'repair the quays' programme is based on the best economic advice of the World Bank. Walls Schemes are ineffective and outdated. Our tidal barrier proposal looks to the future.

Ready for Climate Change page 14

The Save Cork City tidal barrier allows for predicted sea level rise due to climate change and protects much more of the city than any other solution.

A Highly Considerate Design Solution page 14

The Save Cork City solution improves the city and protects the city's economy now and in the future by improving the whole river landscape in an expanded area, and by slowing the flow of the river.

Full Reference to the Development Plan page 15

The Save Cork City solution pays close attention to the aims of the City Development Plan. It reinforces the legitimate expectations of citizens and investors to rely on the City Council Development Plan to guide development and protect investment.

Heritage Gain page 16

What we have in Cork is internationally important. Cork's river landscape is the most significant Georgian water landscape in the world and it has survived remarkably well over the past three centuries. Save Cork City aims to protect and reinforce Cork's heritage.

Opportunity for Betterment page 17

The Save Cork City solution to protect the city with a tidal barrier allows for unhindered opportunities for betterment of the city to begin now as it removes the uncertainty of lengthy and destructive city centre works.

Consideration for Civic Life page 17

Save Cork City proposes to protect and restore the significance of our relationship with the river in Cork City and County in consideration of the importance of civic life for good health, safety and the economy.

Economic Gain from Protection of Heritage page 17

Heritage has an intrinsic value but economists also value the 'cultural capital' of heritage for locals, for tourists, for businesses and for investors. Save Cork City aims to protect this asset for future generations.

Increased Tourism and Tourism Potential page 18

The tourism value to a city that values and protects its heritage is universally accepted. Tourism was worth over €700 million in the Cork Region in 2016 and could grow significantly if we repair the historic river landscape.

City Centre Trade Boost page 19

Cork people do not have to come into the city centre. They can spend their money elsewhere. If coming into town is an improved experience, local people will value it, use it and the city will thrive.

Improvement Starts Now page 19

Improvement to the city centre can start when we decide to build the tidal barrier. If we make the decision now we can immediately start long term improvement of the city centre through small projects initially, leading to extensive improvement to environment and economy over the next ten years.

Docklands and Tivoli Protection page 19

The Save Cork City tidal barrier will protect vast areas of Cork that can provide development opportunity in the future. The decision to build the tidal barrier means that development of the docklands becomes more feasible, cost effective and attractive as a prospective location for development from the moment that decision is made.

Insurance Cover page 19

By reducing flood risk in a real way, Save Cork City's proposals can lead to increased availability of insurance cover in previously flood prone areas.

More Cost Certainty page 20

Save Cork City's proposal for a tidal barrier is a proven technology, unlikely to create major unforeseen circumstances in construction and may be cost predicted with a level of accuracy difficult to achieve with other schemes, particularly those that involve large amounts of construction work in the centre of a busy historic city.

Avoid Costly Litigation page 20

The Save Cork City barrier could be built within four years and would protect the historic city from that point without affecting ground conditions or water tables and the significant costs that such changes would bring.

Economic impact

Everyone in Cork wants flood relief. People have told us about the terrible pain and difficulty that flooding causes. Yet, many people who have been flooded support Save Cork City.

Our proposal is the least construction intensive plan for flood relief in Cork. We will be able to repair the city's quay walls and enhance the river landscape of the city because we propose to maintain, and ultimately slow the speed at which the river flows. The Save Cork City solution means very little construction in the city centre apart from repair and reinstatement of the quays.[27] Our proposals would mean that business could welcome city improvements now that would reinforce the economic recovery of the city centre and avoid the fear that they may not survive a prolonged construction project based on building walls for flood defence. Traders in the city still remember the effects of the Cork Main Drainage Scheme.

We believe in the unlimited economic potential of the city as a historic place to attract investment, tourism and local trade. We are convinced that the repair and improvement of our quay walls and landscape as well as the speedy elimination of flood risk would increase and cement good business opportunities for now and for future generations. Any flood relief projects in the city centre are likely to go well over budget based on precedent elsewhere.[28] It is more economic and environmentally beneficial to prevent flooding outside the major centre of population. In addition, the Save Cork City solution permits the development of the docklands, and opens up whole new areas of the city for development and investment.

Traffic impact

Save Cork City's flood relief proposals would have minimal to no effect on traffic in contrast to a Walls Scheme that would involve large scale construction in the city centre for a prolonged period.

An article in the *Sunday Independent* in 2015 describes businesses in Dublin being pushed to 'breaking point' by construction works for the new Luas tram lines.[29] More recently (on Thursday 11th May 2017), RTE Radio 1 programme '*Today with Seán O'Rourke'* explored the topic further. A large scale city centre construction project like a Walls Scheme is a frightening prospect for Cork's remaining small businesses, many of whom barely survived the last recession.

The River Lee is 95 kilometres long

The River Lee is 95 kilometres long which gives great opportunity for flood relief measures to be located outside the built up and highly populated historic city of Cork. Save Cork City's proposals are in line with current international best practice. The proposal to build a tidal barrier not only can prevent flooding related to tidal surges, but its location at Little Island also provides the space needed during a flood event to allow consistent river flow through the city. Our upstream proposals to slow the rate of water transfer from the land into the river mean that flash rainfall does not have to mean flash flooding. The attenuation of water and even its diversion or storage in manageable quantities could be carried out over time and help to improve the quality of the river and the city centre river landscape.

As tidal pressure increases on the barrier as a result of climate change, inland river pressure would reduce. The intervention of the barrier is the single most important long term solution to flooding in Cork and allows us the time and space to begin to manage the landscape and the historic city in a more gentle and considerate

manner. It would mean a bright future for the 'Second City' and that bright future could begin the minute we decide to choose a tidal barrier as the solution for the City

International best practice

Save Cork City's proposal for upstream attenuation is based on current best practice in river flood relief. Our city centre 'repair the quays' programme is based on the best economic advice of the World Bank. It is also in compliance with the Granada Convention.[30]

Our tidal barrier proposal protects more of the city and is an inevitable necessity according to Cork engineering Professor Philip O'Kane, a world expert on hydrology, river modelling and flood protection, who supports the Save Cork City solution.[31]

The Dutch principles of flood management state that when considering walls for flood protection the longer the walls, the more expensive they are to maintain and the more likely they are to fail. When relying on walls for flood protection it must be accepted that they will eventually fail and it is simply a matter of when and how. With sea levels rising we believe the best solution for Cork is a *No Walls* solution.

The optimum method of flood relief for any urban area slows the flow of the river and lowers water levels during a flood event. This is a far safer solution for the citizens as they are not, over time, increasingly living under water. Walls Schemes that allow river levels to be kept higher than city streets are dangerous and would lead to unprecedented damage in the event of a wall breach.[32] A tidal barrier based on worldwide tried and tested technology is a much safer option.

Cork City is built on a marsh which sits on a deep gravel based aquifer (see glossary on page 27). At present, flooding occurs in the city when water levels in the river rise higher than the city streets. Flood waters also enter buildings by rising from the ground. The Save Cork City solution proposes a tidal barrier that would work to maintain lower water levels in times of flooding thereby eliminating the flood risk. Apart from those times, the city's water levels would continue as normal and a tidal barrier would be closed infrequently and for short periods only, in order to protect citizens and properties. The tidal barrier solution has the smallest impact on existing ground water levels in the city centre. These water levels currently act to protect thousands of buildings in the city and should only be tampered with as a last resort and only then by proven experts, after extensive research on the likely effects. The potential to cause widespread subsidence by tampering with ground water levels is real and could lead to catastrophic damage to the built fabric of the city. Any significant tampering with ground water combined with attempting to make quay walls and drains impervious to water may also lead to more focused, unpredictable and severe flooding from beneath buildings.[33]

The EU Floods Directive of 2007 relating to upriver flooding[34] advises moving away from walls towards methods like slowing the flow of rivers, restoration of wetlands and the management of flood waters. Save Cork City believes that a tidal barrier in conjunction with improvements in dam management would allow time to implement better upriver management of the Lee, much of which could be grant aided or relate to tax relief measures. Improved forestry management and draining the land along valley contours could significantly reduce water flow into rivers. Flash or continuous rainfall does not have to mean flooding. There are many options upriver. The Save Cork City solution gives us the time needed to develop our city sensitively and slow the flow of our river in times of flood. Up-river attenuation of water also means improved water quality.[35]

'Nature is a key ally in meeting the challenges of climate change mitigation and adaptation. Working with nature can provide sustainable cost-effective solutions to many of the impacts of climate change. 'Natural flood management' is when a whole catchment approach is taken to managing flood waters, through managing soil, wetlands, woodlands and floodplains to retain water strategically at times of flood risk.'

Anja Murray, Environmental Policy Analyst and Ecologist

'Findings demonstrated that the combined effects of enhanced wet canopy evaporation, infiltration and surface roughness associated with the addition of deciduous trees to key locations in the landscape produced significant reductions to flood peaks'

The Rivers Trust

Ready for climate change

The tidal barrier proposed by Save Cork City takes into account predicted rises in sea levels due to climate change and protects much more of the city than any other solution. Professor Robert Devoy, who was lead author, member and reviewer in the Nobel Prize winning *Intergovernmental Panel on Climate Change's (IPCC) Fourth Assessment Report* has said that the Save Cork City solution addresses the certainty of climate change and that a Walls Scheme for Cork does not do so.[36]

If sea levels rise (as they are expected to do), a tidal barrier can be designed to cope with the change with relative ease from day one and is the only solution considered practical for Cork based on extensive studies.[37] Initially a tidal barrier would be required to be closed only for a few hours on the infrequent occasion that tidal flooding or combined tidal and fluvial (upriver) flooding may occur (i.e. once every two years). Over time, the amount of times the barrier would come into use may increase but it would still be an open river channel for the vast majority of the time, allowing the free passage of boats to continue in and out of the city.

In addition, Save Cork City's proposals for upriver Natural Flood Management could prove to be a vital tool in an integrated climate change response to the issue of agricultural emissions, which currently account for 32% of the State's entire greenhouse gas emissions.[38] At present, opportunities for climate change abatement in the agricultural area are extremely limited, short of large scale culling of the national herd, which is not an option. Save Cork City believes that Natural Flood Management can open up abatement opportunities for the economically vital agri-sector. Natural Flood Management could form part of GLAS (the Green, Low-Carbon Agri-Environment Scheme, part of the Rural Development Programme 2014-2020).

A highly considerate design solution

The Save Cork City solution creates a new certainty for the future of Cork. We propose to maintain the current rate of flow of water on the river with reduction of flow over time. If we do not increase the flow rates of the river (the Walls Scheme proposes a significant increase in flow rates), we can then repair our city and our quay walls and enhance our relationship with the river.

The removal of historic quay walls and replacement with extensive concrete walls under the Walls Scheme is intended to support a higher rate of water flow and higher water levels in the river. The current accepted flow rate from the Dam is between 150 and 200 cubic meters per second. The Walls Scheme proposes to increase the speed of the flow rate to 350 cubic metres per second. Alarmingly, this is almost double the current speed. It is this increase in speed that necessitates the Walls Scheme.[39] However, once this method is chosen it is not

easily adaptable to future sea level rise without even greater expenditure, increasing wall heights and further sacrifice to the local economy. The Save Cork City solution proposes the restoration of what should be a gently flowing urban river within a historic river landscape and the retention of over five kilometres of historic Georgian quay walls. A gently flowing river is a much safer river. Lower river levels mean that there is no chance of a wall breach that could threaten citizens' lives.[40]

Once constructed, the Little Island tidal barrier would require a limited and defined maintenance programme. Maintaining current water levels below the streets and quays in the city centre would mean retaining a passively drained city centre which requires a relatively low level of defined maintenance and management. Any flood relief scheme involving increases in water flow will require extensive construction of 46 pump chambers[41] and maintenance programmes that would be ongoing and involve increasing dependence into the future.[42] A Walls Scheme dependent on pump chambers increases the vulnerability of the city if one or more of the elements were to fail due to inadequate maintenance or mechanical failure.

Good design is design that considers all the influences that may inform a design concept. In the case of flood relief for Cork, the Save Cork City solution represents good design as it includes consideration of the many influences of a populated and vibrant city. Bad design settles too quickly on singular, flawed solutions. A bad design solution is one that fails to take into account all the considerations that would lead to design success. It is not enough to propose minor alterations to a bad design as this only compounds the initial failure.[43] The Save Cork City solution favourably considers the local economy, civic life, heritage benefits, tourism potential, future adaptability, and the economy, trade and the inward investment potential of Ireland's 'Second City'.

'Good design is good business.'

Thomas J Watson Jr.

'Questions about whether design is necessary or affordable are beside the point: design is inevitable. The alternative to good design is bad design, not no design at all.'

Douglas Martin

Full reference to the Development Plan

Cork City Council has a sophisticated plan that protects the city and guides development within it. The plan represents an understanding between the City Council and investors in the city. Ignoring its guidance on issues of planning and development works against those who have already invested in the city centre. In addition, a Walls Scheme would destroy one of the main attractions of Cork for investors: the city's relationship with the river.

The Save Cork City solution pays close attention to the aims of the Cork City Development Plan. It reinforces the legitimate expectations of citizens and investors to rely on the City Council's Development Plan to guide investment and protect their investment, which can be a once in a lifetime spend for many.[44]

Heritage gain

As an emerging merchant city in the 17th 18th and 19th centuries, Cork produced exceptional and ingenious design. The city is defined by the river and by its proud trading history with other European cities. The plan of the city and its general arrangement and material quality may be compared with any other European city and is based on design precedent dating back to ancient Greece and Rome.

Our city was born of the river and we have an opportunity to recognise and reinforce the relationship. The connection with the river is exceptional and the antiquity of the city's bridges and quay walls and railings is remarkably preserved. The river landscapes of the city are firmly rooted in the hearts and minds of Corkonians.

The green space of Fitzgerald Park is inextricably combined with the gently flowing river and has formed part of the civic experience for generations in the city. The proximity of the river in the city acts as the setting to a great part of our civic life and should be protected for future generations.

We Corkonians know that Cork is a significant city. When you consider the exceptional beauty of the city and the people of great ability and achievement who have come from Cork or have contributed to the city, everyone agrees that Cork is an extraordinary place. What we have in Cork is internationally important. Our river landscape is the most significant Georgian water landscape in the world, and it has survived remarkably well over the past three centuries.

Pope's Quay. Photo: Anthony Barry Collection

Opportunity for betterment

Save Cork City's proposal to protect the city with a tidal barrier allows for unhindered opportunities for betterment of the city. The design of new footpaths, lighting and surfaces in an historic setting and the repair of historic stonework[45] can enhance opportunities for economic growth and improve amenity, leading to increased civic pride, increased tourism and inward investment.

This proposal aims to preserve the diverse character of the city quays. We aim to reinforce the rich material and design history that has developed in relation to trade and engagement with the river over hundreds of years. We propose sensitive repair and sensitive design additions to improve our city as a place to live, work, visit and in which to invest. We propose to learn from the many significant historic images of the city and to be guided by the principals of understanding of and design within historic places as set down by ICOMOS[46] (The International Council on Monuments and Sites) at the *World Urban Forum 6* in Naples in 2012.

'Tangible and intangible heritage are sources of social cohesion, factors of diversity and drivers of creativity, innovation and urban regeneration; we must do more to harness this power.'

Irina Bokova, Director General of UNESCO

Consideration for civic life

A properly conceived flood protection scheme would facilitate the repair of the city and its economic prosperity. This would also ensure the quayside landscape is maintained as a gentle and safe place to be.

Access to the river for boating could be enhanced and promoted by our proposals. Corkonians would retain a vital visual connection with the river which was historically the source of its main trading income. A restored river landscape would make sense of our history and bring new life and opportunities to civic life and the city centre and would reinforce the connection between citizens and the river, already evident in popular events such as the Lee Swim and Ocean to City.

Economic gain from protection of heritage

Heritage has an intrinsic value for all of us, but it also has an economic value. Economists know the value of cultural and heritage capital, for cities that are lucky enough to have historic landscapes and buildings.

Save Cork City believes that the potential for the development of Cork is infinite if the historic city is repaired and restored in addition to providing flood relief. We believe that the two are not incompatible as many other cities have shown. There is great potential for the regeneration of the quays of Cork City. The waterside spaces could be vibrant and lively places as they once were. Imagine a waterside space with restaurants and cafes at street level, people sitting out and perhaps a linear pontoon allowing small boats to dock on the edge of a restored historic quay landscape where people may engage with the river.

There are many instances of precedent for the repair of historic places carried out sensitively throughout Europe and we have not fully tapped this potential here in Cork. Save Cork City proposes this to be the next logical step to increase economic activity, raise inward investment, retain current investment and enhance and restore the dignity of citizens.

Save Cork City is concerned that a Walls Scheme would result in a degraded city centre experience for workers, shoppers, tourists, residents and investors. UCC economist Dr. Declan Jordan, who supports Save Cork City's proposals for a tidal barrier, says:

'It is now widely accepted in academic literature on urban and regional development and planning that cities are the engines of economic growth. One of the key sources of advantage for cities is the quality of its human capital. This refers to the skills, abilities, education, and creativity of the people living in a location that are available to businesses. The risk is that flood walls undermine the attractiveness of the city for social engagement and, instead, the centre of the city becomes a location that workers simply commute to in the mornings with any social buzz that is important for creative life. Richard Florida, author of 'The Rise of the Creative Class', has stressed the importance of highly innovative workers as a source of economic growth. The implications for cities in an increasingly competitive, globalised, and global-driven world, is that they must accommodate and attract these workers to succeed. An important consideration for innovative, creative people is the availability of amenities and an attractive lifestyle.'

The World Bank agrees:

'The benefits of investing in heritage for liveability, job creation, and local economic development have been increasingly studied and debated over the last few decades, with the economic theory underpinning investment becoming substantially more robust. A city's conserved historic core can also differentiate that city from competing locations - branding it nationally and internationally - thus helping the city attract investment and talented people. Cities that are the most successful at attracting investment and businesses to meet the aspirations of their citizens, while alleviating poverty and promoting inclusion are those that harness all of their resources, including their heritage. In addition, heritage anchors people to their roots, builds self-esteem, and restores dignity.'

From 'The Economics of Uniqueness: Investing in Historic City Cores and Cultural Heritage Assets for Sustainable Development', published by the World Bank in 2012

Increased tourism and tourism potential

The tourism value to a city that values and protects its unique heritage is universally accepted. This is what geographer Dr Denis Linehan from UCC calls 'the golden goose argument'. Tourism was worth over €700 million in the Cork Region in 2016 and is expected to grow. That growth could be very significant if we repair our historic river landscape. The repair of the antique parts of the city and the retention of historic monuments and historic assets could be a major attraction for tourists and would mean exploiting something that we already have rather than destroying it.[47]

'If you suddenly feel as if you are walking on water, don't be so surprised. Cork is a city built on water, its heart set on an island between two arms of the River Lee.'

Ireland's Ancient East Website 'Cork - the Merchant City'[48]

City centre trade boost

Save Cork City wants to repair and improve the city centre and in particular to reveal the history behind the Georgian river landscape which is one of our greatest assets. While this would directly benefit citizens on a day to day basis we believe it is the key to unlocking unlimited growth potential for city centre trade and amenity. In addition, we believe that sensitive repair of the historic river landscape would be a significant help in attracting inward investment. This is an exciting prospect for all stakeholders in business, in trade, in heritage, in tourism and in development.[49]

Improvement starts now

Improvement to the city centre could begin as soon as we decide to build a tidal barrier at Little Island. We can immediately start long term improvement of the city centre leading to great and extensive improvement to the environment and the economy over the next ten years. An architectural competition could help to gather ideas for the future development of the city. Because of the predictability and stability of the scheme, the Save Cork City solution would ensure that this process of increased trade and economic investment will start the moment we decide to build the tidal barrier and protect the city from flooding.

Docklands and Tivoli protection

The Save Cork City tidal barrier will protect vast areas of Cork that can provide development opportunity in the future. A protected docklands area means more immediately viable development including related and subsequent job creation. More housing may be built immediately as more land will become protected in the low lying area of the docklands. Building the tidal barrier now means a bright and certain future for Cork, including the docklands and Tivoli areas. Development in the docklands area would make Cork a competitive place to invest in relation to other Irish and European cities. The Save Cork City solution allows for the full development of the docklands and Little Island, the protection of the Douglas estuary, and for the protection of further areas within an expanded city boundary.

Insurance cover

Save Cork City propose a definite solution to flooding in the city that can withstand the test of time and protect generations. The proposal could solve the insurance problem by increasing the probability of insurance cover by significantly reducing risk of the possibility of flooding. By repairing the city and by creating flood defences outside the vulnerable historic centre, our proposal will create genuine risk reduction, thereby potentially permitting insurance cover in current flood zones. In addition, our proposal will not create any new subsidence issues as a Walls Scheme would, by tampering with the city's water table.[50]

Lack of insurance cover is a genuine source of difficulty for residents, businesses, civil servants and politicians, and there is little data available from as to the reasons for a continuing lack of cover.[51]

More cost certainty

The Save Cork City solution proposes a tidal barrier to protect the city which has a predictable cost outcome and a certain result. The positive benefits of flood protection (increased tourism, trade and investment), may all be considered in a cost benefit analysis that is truly reflective of the real benefit of an infrastructural project providing widespread benefit to society on a grand scale for comparatively little investment. The benefits of providing flood relief outside the historic centre and facilitating the repair of the historic river landscape may be quantified on their own merits as well as being compared to the negative effects on the local economy inherent in other proposals requiring heavy construction in the city centre.[52]

Avoid costly litigation

The Save Cork City tidal barrier could be built within four years. It would protect the city from that point without affecting the city's ground conditions or water table. This would avoid the possibility of unending litigation and compensation as a result of significant city centre works in a highly populated and built up historic area.[53]

View of Cork John Butts (1728 – 1765)

Conclusion

The Save Cork City solution would ensure a bright future for our city and the greater Cork area, fully protected from climate change and whatever storms may come; where the river and the harbour would be seen not as a problem but would be restored once again, as in centuries gone by, to being our greatest asset. Revisiting and repairing the quay walls and landscape of the city is the best economic solution for Cork. We believe it would greatly increase the development potential of the city, significantly improve city amenity and promote business activity on many levels. The plan would mean instant improvement as it would remove uncertainty. The Save Cork City solution would secure the economic future of Cork and the well-being of its citizens for generations.

Notes

[1] see UNESCO New Life for Historic Cities, The historic Urban Landscape Approach Explained pg 5 (2013).

[2] Trees can be demonstrated to allow rainwater to penetrate ground much faster than grassland and allow the water to slowly enter waterways in a sustainable and manageable way.(JBA Consulting for Lancaster University, The Rivers Trust Life-IP Natural Course Project: Strategic Investigation of Natural Flood Management in Cumbria Technical Report Dec 2016). As our understanding of landscape scale hydrological processes has improved in recent decades, good practice for managing flood risk has also evolved to incorporate catchment wide land use and management which slows down the flow of water through the catchment and thus reduces flood peak. To develop an evidence base to help predict the impacts of land management change on flood generation, four experimental sites were established on improved grassland used for sheep grazing at the Pontbren catchment in upland Wales, UK. At each site, three plots were established where surface runoff was measured, supplemented by measurements of soil infiltration rates and soil and vegetation physical properties. Following baseline monitoring, treatments were applied to two of the plots: exclusion of sheep (ungrazed) and exclusion of sheep and planting with native broadleaf tree species (tree planted), with the third plot acting as a control (grazed pasture). On average, post-treatment runoff volumes were reduced by 48% and 78% in ungrazed and tree-planted plots relative to the control, although all results varied greatly over the sites.

[3] Attenuation is the process of water retention on site and slowly releasing it in a controlled discharge to a surface water or combined drain or watercourse. The amount of discharge will vary depending whether it is a brown or green field site.

[4] In addition to flow reduction measures we advocate utilising the existing dams in the optimum way for flood management and avoiding any proposed increase in allowable peak discharges. It is noted that these dams are designed to cope with water runoff from the upper Lee catchment up to a 1 in 10,000 year storm event (which would be extremely rare).

[5] Weirs to be upgraded to allow for appropriate fish passes as per the Fisheries (Consolidation) Act, 1959

[6] Lower Lee (Cork City) Drainage Scheme Flood Risk Management Options Report (hereafter 'Options Report'), Arup, JBA, March 2017, Table 5 Flood States, Actions and Frequencies Page 42 and 43. Flow rates proposed to go from 150-200m^3/sec to up to 400m^3/sec (an increase in allowable river flow rates of up to or over 100% or twice the current maximum discharge rate.)

[7] Study of the city reveals a layout that is based strongly on the classical traditions of Greek and Roman civilisations that were renewed in Renaissance times and adopted with great skill in Cork in the 17th and 18th centuries.

[8] The Enlightenment (also known as the Age of Enlightenment or the Age of Reason; in French: le Siècle des Lumières, (the Century of Lights); and in German: Aufklärung, 'Enlightenment' was an intellectual and philosophical movement which dominated the world of ideas in Europe during the 18th century.

[9] Such as the Lawrence Collection of Photographs (available through the National Library of Ireland) and Anthony Barry collection (courtesy Barry family) and Crawford Gallery Collection.

[10] Note that this is not a base cost for the barrier but a total life cost (capital and operational cost) for a 50 year period (discounted to 2017) and is made with reference to various documents and studies, and is in line with OPW methods for comparing options costs. (We have allowed €25m for repair, restoration and betterment of the quayside landscape and €30m for upstream catchment management works with a total cost estimate for the Save Cork City Solution of €190m)

[11] Depth of water (at low tide) in the River Lee Estuary / Cork Harbour varies from:

1. 6 metres below Ordnance Datum (O.D.) between Custom House Quay and Tivoli
2. 10 metres below O.D. at exit of Lough Mahon (near Marino Point)
3. 18 metres below O.D. at Monkstown
4. 15m at exist of Cork Harbour

Note: the Little Island tidal barrier location is between points 1 and 2.

[12] Lee Catchment Flood Risk Assessment and Management Study Report (hereafter 'CFRAMS Report'), Halcrow / Barry & Partners / Brady Shipman Martin, January 2014, Section 16.6.33 page 224

[13] The Lower Lee (Cork City) Drainage Scheme Flood Risk Management Options Report (section 4.2.4.4, pg 33):

"A tidal Barrage to protect Cork City from tidal flooding would involve providing a tidal barrier downstream of Cork City. One potential location would be immediately upstream of the Jack Lynch Tunnel"

Preliminary assessment undertaken as part of the Lower Lee FRS (LEE CFRAMS REPORT Lee Catchment Flood Risk Assessment and Management Study Final Report page 190 - 192) *confirmed that this option is unlikely to be technically viable as there would likely be insufficient storage volume behind the barrier to store fluvial flows impounded by the barrier during the time the barrier would be closed.*

An alternative location for a tidal barrage would be in the lower harbour to the west and east of great island (this requires two barriers one at Monkstown / Rushbrook and one at Marlogue / East Ferry).

The Lee CFRAMS concluded that whilst a barrage would likely be technically viable, it was not economically viable in the current scenario and would likely have significant environmental impacts." *Page 33 42.44 Tidal Barrage* The Lower Lee (Cork City) Drainage Scheme Flood Risk Management Options Report:

[14] Little Island also has a minor waterway to the north which is controlled at present. It can also represent an opportunity for promotion and support of wildlife and further amenity.

[15] For example, traditional, rock armour protected sea wall embankments with gates which would remain open outside of tidal surges. (Gates to be closed once every two years, according to CFRAMS Report, pg 192).

[16] The Little Island barrier is proposed within a Special Area of Conservation (SAC) and would require an environmental assessment (SEA) to ensure that environmental impact on the area is kept to the absolute minimum necessary. Any environmental impact may be offset by the creation of a new wetland amenity area abutting the inlet to the north of Little Island. Save Cork City budgets €5m for these wetland enhancement works. Taken together with Save Cork City's upstream proposals, the overall environmental impact of the Save Cork City three point plan can be positive. In addition, the environmental footprint of the Little Island Barrier is far lower than the invasive 8.6km Walls Scheme, where the impact of pouring huge quantities of concrete and concrete grout - apart from the inevitable spillages - in the vicinity of the delicate city river ecosystem, would be severe.

[17] A tidal barrier could be in place within 4 years following the appointment of a designer. That would equate to 2 years of design and procurement and 2 years of construction. This is much faster than the proposed Walls Scheme which cannot achieve a result until the entire 8km of wall is completed. Note that the Save Cork City solution proposes a barrier of only 0.9 km in length.

[18] Save Cork City propose a competition to design the sensitive repair of and intervention to the historic quayside landscape.

[19] This is elaborated further in the World Bank's publication 'The Economics of Uniqueness' (see bibliography).

[20] The Greenway, a 46km long off-road walking and cycling route along a disused railway line, opened in March this year. The work was complex, and on a difficult and narrow site with very few access points: 46km of new walkways, 48km of sheep-fencing, a new bridge and 2 large underpasses on the N25, 6 car parks, 3 access bridges, 50 farm machinery crossing points, 12 farm underpasses, restoration of a metal viaduct and the drainage and clearance of the Durrow tunnel. An arbitration mechanism (comprising a council employee, a member of the IFA and a farmer) was put in place to deal with farmers' concerns on an individual basis. The entire project took only four years from the formation of the Déise Greenway Group in 2013 to the completion of works in 2017.

[21] An Integrated Catchment Management approach is increasingly seen internationally as essential to successful water management. To achieve the Water Framework Directive objectives and the sustainable use of our water and land resources it needs to be adapted to Irish conditions. EPA Environmental Protection Agency (Ireland) (epa.ie)

[22] The NWRM EU study of Polder management near Altenheim Germany demonstrates how catchment management measures can be applied to large catchment areas. The study demonstrates that creating an ecological area to act as a storage area can be done on a large scale (17.6 Mio m^3) and can be used to protect large cities (Karlsruhe, Speyer, Mannheim in this instance). The extent of the proposal is not suggested for Cork but there is much to learn here. The proposal employed tree planting, floodplain restoration and management, restoration and reconnection of seasonal streams, reconnection of oxbow lakes and similar features and forest riparian buffers.

[23] 'Natural Flood Management: Methods and Evidence,' paper presented by Paul Quinn, School of Engineering and Geosciences and Alex Nicholson ARUP Water Group, Newcastle at Engineer's Ireland Conference, May 2017. See also http://research.ncl.ac.uk/proactive/ and https://www.theflowpartnership.org/Belford/

[24] It should be noted that these dams are designed to store water runoff from the upper Lee catchment for 1/10,000 year storm events (2009 event was c. 1/100 -1/250 year event). Optimal management can keep the city safe from a solely upriver based flood easily based on a 100 year event. This can be improved further with catchment management and includes great improvement to water quality and can help to carbon emissions depending on method (tree planting).

[25] *The High Court Record No. 2012/129p Between: University College Cork (Plaintiff) And The Electricity Supply Board (Defendant): "Page74 Article 86. Part I ("Regulations for Flood Management"). In general, the Lee Reservoirs "are treated as being independent of each other". (Lee Regs, para. 1.1). Spilling instructions at the Dams have been modified to deal with extreme floods. (Lee Regs, para. 1.1). The Lee Regulations have as their objective that Carrigadrohid and Inniscarra shall be capable of passing floods with an expected annual occurrence of 1:10,000 [an annual probability of 0.01%]…. Up to these levels, the Hydro Manager on the advice of the Hydrometric Officer has the option of spilling in order to increase storage and/or to reduce flooding at a later stage.

Page 75 Art 88 ""It is known that, to date, flooding of houses has not occurred downstream of Inniscarra for discharges from Inniscarra of up to 250m3 /s."

Options Report page 38 "Continuous monitoring and simulation of predicted rainfall using the new flood forecasting system (FFS) will allow potentially significant flood events to be detected further in advance."

Options Report Pg 44 "There are two primary roles involved in implementing the revised operational rules, during flood conditions, as follows:· 1) Flood (Advisory) Body, the OPW through its agents* fulfilling the role required under the Lower Lee (Cork City) Drainage Scheme. 2) · Reservoir Operator – Electricity Supply Board (ESB) (*It is envisaged that Cork City Council will act as agents for the OPW in carrying out the functions of the Flood (Advisory) Body)

The Save Cork City solution has 2 main differences to that of the present OPW proposals

It prioritises flood risk alleviation over hydropower generation i.e. safety first with less emphasis on false alarms avoidance

It proposes no increase in peak discharges from the dam except in the event of an extreme event i.e. 1/10,000 year flood.

[26] In chapter 18 of the Lee CFRAMS report (Jan 2014) the following is noted: "proposed tidal defences in Cork City, designed to protect against current levels of flood risk [2017 walls proposal], would be overtopped in years 2070 (MRFS, Mid Range Future Scenario) and 2049 (HEFS, High End Future Scenario) for the 0.5% AEP [1/200year] event." And "the tidal barriers at Monkstown and Marloag Point receive a positive MCA [Cost benefit Analysis] score in 2050 for the HEFS and 2072 for the MRFS".

It should be noted that the Save Cork City solution includes a tidal barrier at a more suitable location than that of Monkstown / Marloague (Great Island) with significant associated total cost reductions which will thereby bring forward the date at which barriers are cost competitive with direct tidal defences even under the most conservative Cost Benefit Analysis scoring (i.e. omitting heritage, tourism and business disruption losses).

[27] The Cork Business Association estimated business loss to Cork due to recent bus strikes as "somewhere north of €50 million" (*see Roche*). This was over a period of twenty days. That would be €75 million loss per month. If you take the minimum projection of 6 years for OPW construction (it could be up to 10 years or more) and conservatively give only 4 years of construction for walls and pump chamber construction in the city, the time equates to 48 months. If the construction impact on the local business community is conservatively estimated at one third of the impact of the bus strike that equates to a conservative €25 million per month. So a conservative estimate of loss to business due to the construction of walls is €1.2 billion lost to the local economy by construction disruption alone. It is worth noting that in chapter 6 of the Lee CFRAMS document there is a detailed description of damage assessment from flooding in Cork City. The Lee CFRAMS final report of 2014 estimated on page 50 that the damages were of the order of €175 million and that proposals to repair the quay walls are estimated to be between €10 and €20 million depending on the approach taken. Save Cork City estimates that its quay repair and conservation programme would cost €25m.

[28] The initial budget for the OPW Walls Scheme started at €20 million and has now reached up to €200 million. The similar (but smaller) OPW Walls Scheme for the River Nore began at €13 million and rose to a real contract figure of €47 million, as noted in Chapter 4 of the Comptroller and Auditor General's *Report on the Accounts of the Public Services*, 2013. An increase to 360% is an alarming prospect for a Walls Scheme that could severely reduce the economic potential of Cork City. Although the OPW may have since then improved their budget management, it is noted that they have not yet embarked on a wall project of such complexity or scale, involving the challenging ground conditions and water regimes that are present in Cork and therefore it would be prudent to expect that significant cost overruns are not only possible, but probable.

[29] (see McCabe).

[30] The Granada Convention for the Protection of the Architectural Heritage of Europe, created in 1985, was ratified by Ireland in 1997.

[31] An extract from Professor O' Kane's research on the best location for a tidal barrier validates the location of the Save Cork City Solution Tidal Barrier:

"I took the design flow at Waterworks Weir as a max flow of 350m/s, for a duration of 6 hrs 12 minutes from low to high water which gives a required barrage storage of 7,800,000 m^3. Placing the barrage on the roof of the tunnel gives an available storage of 5,600,000 m^3, a shortfall of 2,200,000 m^3."

Note: 350m^3 at waterworks weir = 150-200m^3/s at Inniscarra outflow + downstream tributaries flows.

Placing the barrage at the exit from Lough Mahon gives an available storage of 27,000,000 m^3 i.e. between 3 and 4 times what is required. The Save Cork City solution for a tidal barrier at Little Island would give the city full protection for up to a 24 hour period (only a 6 hour period is required in practice due to the duration of high tide).

[32] While the OPW Walls Scheme mentions new parapet walls up to 1.2 metres above footpath level, it is worth noting that because they are also proposing to raise footpaths, the rise in levels above the existing quays is up to 1.8 meters. As this could cause ground levels on the quays to slope down away from the quays, directing rainwater towards the existing buildings, this is supported by the need for mechanical pumps to pump water from the streets and drains. This move away from a natural water drainage regime to a mechanical one leaves the risk of residential flooding.

[33] It is estimated that up to 10,400 tonnes per kilometre of concrete grout would be required to be pumped into the ground behind the quay walls in the Walls Scheme that is 83,200 tonnes over the proposed length of 8km. Grout may run off and often travels underground to unknown destinations. It could be environmentally disastrous for the river as well as polluting ground water.

The current quay walls are generally constructed on river gravels. These gravels are also found extensively within the medieval city and to a lesser extend in the easterly reclaimed areas of the city. The gravels are highly permeable, to the extent that tidal oscillations in groundwater have been measured in bore holes within the city. Dr Allen confirmed that groundwater fluctuations greater than 2 metres in normal tidal conditions occur every day and that there is a lag or delay ranging from only 30 minutes to one hour for the groundwater to fluctuate in response to the changing tidal levels dependent on location within the city (*see Allen*).

Proposed grouting of the quay walls may have the effect of preventing the water equalisation process that now exists in the city and may force water into limited and stronger streams of movement. Raising water levels in the river may also add additional pressure to the ground water table which may push upwards into the city at higher levels than ever before and increasing, not reducing, city centre flooding. In addition lower ground water levels caused by grouting may expose building piles and cause serious cracking to buildings in addition to the force of upward lift. This could cause further devastation to the city centre in terms of widespread building subsidence.

[34] The EU Directive on the assessment and management of flood risks [2007/60/EC], often referred to as the '*Floods Directive,'* came into force late in 2007. It is a framework directive that requires member states to follow a certain process, namely:

Undertake a Preliminary Flood Risk Assessment (PFRA) by 22 December 2011.

Prepare flood hazard and risk maps for the Areas for Further Assessment (AFA) by 22 December 2013.

Prepare flood risk management plans by 22 December 2015.

The 'Floods' Directive was transposed into Irish law with the *European Communities (Assessment and Management of Flood Risks) Regulations 2010* (SI 122/2010). The Regulations set out the responsibilities of the OPW and other public bodies in the implementation of the Directive, on consultation, and details the process for implementation of the measures set out in the flood risk management plans.

Implementation of the Directive is monitored by DG Environment in the European Commission.

[35] 'Natural Flood Management' (NFM) is defined by Anja Murray for Friends of the Earth as an approach to managing flooding which works with natural hydrological processes throughout the catchment to store flood water temporarily during flood events. NFM involves managing the pathways of water and enhancing the capacity of features throughout a catchment to store floodwater.

Natural Flood Management measures include: peat land restoration for flood; woodland creation to impede the flow of water and increase infiltration; managing wetlands to store flood water; re-connecting rivers with their floodplain; reinstatement or creation of water storage features in floodplains; creation of new features to temporarily store water; opening up land to flooding; Sustainable Urban Drainage Systems (SUDS); Managed coastal realignment with salt marsh and mudflat restoration.

[36] Robert Devoy is Professor in Physical Geography and Emeritus Professor in Geography, University College Cork (UCC). He was a lead member of the Intergovernmental Panel on Climate Change Working Group with an international academic career spanning some 40 years. He currently continues to work as senior scientist and technical advisor at the Centre for Marine and Energy-based Research, Environmental Research Institute, UCC; as member of the Irish Maritime and Energy Resource Cluster (IMERC) for UCC & the NMCI and is an external scientific assessor and member of the governance group for Science Foundation Ireland's (SFI) virtual Centre for Marine and Renewable Energy Ireland (MaREI). He continues to be involved within MaREI in a range of EU Framework, EPA and other nationally funded research projects, dealing particularly with issues of coastal science and management, together with aspects of climate, energy and linked environmental changes. He was a lead author in the Intergovernmental Panel on Climate Change's Nobel Prize (2007) winning Fourth Assessment Report.

[37] It is worth noting that the OPW's only proposal to allow for rising sea levels under the Walls Scheme is to allow for the height of the walls to be increased at a later date. The walls would be made even higher than the 1.2m above ground level proposed now. Options Report Pg 165 "it is proposed that all new defence walls within the fluvially dominated reach will be designed to be able to be extendable in the future to resist a total hydrostatic load of 2.2m above dry side ground level. (In practice, this would likely be a 1.2m high permanent defence wall supporting a further 1m height in demountable defences)"

It is worth contrasting the above statement with the Lee CFRAMS Report Chapter 16 page 230 "Cork City Option 4 receives a negative technical score as this option [demountable defences] is heavily reliant on human/mechanical intervention to install defences before onset of flooding. Long lengths of demountable defences will be challenging to erect in time."

[38] 32% agricultural emissions figure provided by Dr Brendan Flynn of NUI Galway at the Law and Environment Conference at UCC on 27th April 2017.

[39] At present the dam management allows for 150 to 200 cubic meters per second of water to be released into the city. The Walls Scheme proposes this to be increased to up to 400 cubic meters per second. This is the main reason that concrete walls are proposed in conjunction with higher water levels. It would create a more dangerous river environment.

[40] This is a grave new precedent for Cork and a new and dangerous scenario that could easily be avoided with more considerate design solutions.

[41] Pump chambers are expected to be of a depth between 3 and 8 metres and with a plan area of 4 by 4 metres or more.

[42] Extensive systems of walls for flood relief and underground pump chambers and motors would all require constant and vigilant maintenance as is the case for any mechanically dependent flood defence system. If maintenance is not regular and thorough, the city could become dangerously at risk very quickly due to the proposal to allow higher levels of water in the river than in the city centre streets. This is a new and dangerous design precedent for Cork that could increase the risk of serious flood based catastrophe in the city. Save Cork City believes that this fact is still not known by many of the citizens of Cork.

[43] Alterations to the proposed Walls Scheme to try to improve it can make little difference as the fundamental design conclusion and assumptions that settled upon a walled solution for the city are flawed. It should be noted that walls in the city centre can be avoided with a tidal barrier and optimum use of the ESB dams, however, in the preferred solution identified by the OPW, they chose to increase extreme flows from the dams, thereby necessitating walls in the city centre. It is that fundamental decision and process that needs to be examined and accepted as requiring change, leading to a more globally considerate solution for the city.

[44] The Walls scheme disregards the expectations of all, including the council employees and councillors who prepared and approved the City Development Plan, and the citizens and investors who rely on it. Cork City Council is in the process of reviewing the current City Development Plan and preparing a new City Development Plan. This new plan will replace the current City Development Plan which was adopted in 2015.The new plan will set out the overall strategy for the future development of Cork City.

[45] Save Cork City could find no specific Conservation Report carried out as part of the Walls scheme.

[46] ICOMOS the International Council on Monuments and Sites is the accepted international body for defining the considerations of heritage landscape protection and has formulated internationally accepted guidelines for the specific repair and design intervention to historic cities, landscapes, buildings and structures.

[47] In the most recent survey of the annual value of tourism to the county of Cork issued by Research & Evaluation Fáilte Ireland in October 2016, the value of tourism to the county of Cork in 2015 was €729m.

[48] www.irelandsancienteast.com/discover/stories/featured-stories/merchants-city

[49] Currently coming into the city centre for Cork people is a rewarding and enjoyable experience. In a 2014 *Irish Examiner* article (dated 23rd Sep.), Eoin English wrote, 'Concrete flood barriers could damage city's river potential.' In the article, Cork Chamber outlined that they had 'concerns about the visual impact of installing mass concrete walls along the river,' and that 'It could potentially damage the ability of the city to realise its obvious riverside potential and negatively impact on the attractiveness of the city as a location for inward investment and tourism.'

[50] What is being proposed by the OPW will not solve the insurance problem. In fact, it could get far worse. People in flood risk areas could be faced with an added problem of subsidence. The proposal attempts to carry out works that may alter the water table, allow foundations to dry out and cause subsidence in what is currently a highly balanced system that has reached equilibrium over a long period of time. Any tampering with the water table in Cork city centre could have catastrophic and far reaching effects. In addition Walls Schemes have been built in recent years in Fermoy (€38m), Mallow (€36m) and Clonmel (€40m). Despite this state investment, and the fact that the walls seem to have worked to date, the insurance climate remains unchanged, and flood insurance remains unavailable in these towns. It is a truism in the insurance business that 'if the risk goes down, you will get insurance'. Has the risk gone down in Fermoy, Mallow and Clonmel? It has been suggested by some that the continuing absence of insurance cover is down to the 'human factor' necessitated by demountable defences, and the potential for error inherent in such systems. It seems to us however that, while failure to comply with the required procedure of a demountable system might justify a refusal to indemnify in the event of an error or systems' failure, it does not justify the wholesale refusal of cover, as is the situation at present. Insurance is an international business and may not consider that walls and demountable barriers actually reduce flood risk as they don't deal with the source of the issue.

[51] Policy paper May 2017 by Swenja Surminski 'Fit for the future? The reform of flood insurance in Ireland: resolving the data controversy and supporting climate change adaptation' (published by the Grathan Research Institute on Climate Change and the Environment (LSE) and the Centre for Climate Change Economics and Policy (UCC)).

[52] Chapter 7 of the Lee CFRAMS Report (Pg56-63) details how their Cost Benefit Analysis is conducted. The tables in this chapter outline how the CFRAMS scores options. Factors considered are limited definitions of technical, economic, social and environmental impact. Crucially there is no consideration for tourism impact, business disruption, economic disruption or heritage impact. In the Netherlands there is a legal requirement placed on the Dutch government to protect areas subjected to flooding and protection is subsequently provided. In Ireland, for a scheme to proceed it must have a demonstrable cost benefit ratio relating to the circumstances generally, i.e. the cost of the scheme should be equal or less than the benefits that would result from putting it in place. In the Netherlands, tourism, business and heritage are carefully considered and protected in designing flood relief measures whereas in Ireland factors considered are mainly technical. "Where there is a flood protection need we provide a solution (mandated by law). Once the requirement for a solution is determined then the Dutch negotiate the best solution with affected stakeholders including extensive consultation"

[53] If the scheme went ahead as planned there would be major and unprecedented disruption to Cork. The city centre could be a building site for up to ten years. Precedent shows that neither of the schemes carried out in the significantly smaller Mallow scheme were completed within the contract programme (the programme over-ran by between 50 and 80%). Roads would be dug up, concrete grout would be pumped into the ground to try to create a complete solid mass. What this would do is change the current ground conditions and lead to differential settlement and cause damage to buildings, interfering with property rights and creating an extensive litigation nightmare for the Government. The potential for litigation in Cork is even greater than in any other OPW flood scheme due to the complexity of the city landscape and the size of the project.


Mick Barry

Glossary

Attenuation	Attenuation is the process of water retention on site and slowly releasing it in a controlled discharge to a surface water or combined drain or watercourse. The amount of discharge will vary depending whether it is a brown or green field site.
Conservation	To protect something (especially something of environmental or cultural importance) from harm or destruction.
Catchment Management	The management of a catchment simply defined as an area contributing water to a river and its tributaries, with all the water ultimately running off to a single outlet.
Downstream	Situated or moving in the direction in which a stream or river flows.
Economy	Careful and considerate management of available resources to best use.
Ecosystem	A biological community of interacting organisms and their physical environment.
Flood Mitigation	The action of reducing the severity of flooding through intervention.
Historic Monument	The concept of a historic monument embraces not only the single architectural work but also the urban or rural setting in which is found the evidence of a particular civilization, a significant development or a historic event. This applies not only to great works of art but also to more modest works of the past which have acquired cultural significance with the passing of time. Venice Charter, 1964.
Integrated Wetland	Wetlands “areas of marsh, fen, peat land or water, whether natural or artificial, permanent or temporary, with water that is static or fl owing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres”.
Land Drainage	The purpose of a land drain is to allow water in wet or swampy ground to rapidly drain away or to relieve hydrostatic pressure. Land drains running against the contours or with the slope of the land allow for the fastest runoff of water and help to cause flooding.
Natural Flood Management	Natural flood management (NFM) means working with or restoring natural landscape processes with the aim of reducing flood risk and delivering other benefits. Measures can provide additional benefits such as reducing diffuse pollution, improving biodiversity and providing opportunities for recreation. NFM can be more cost effective and sustainable over the long term compared to hard engineering solutions to flooding.
Polder	A piece of low lying land reclaimed from the sea or a river.
Regeneration	The action or process of regenerating including renewal of something that existed before.

Restoration	The action of returning something to a former condition. The process of restoration is a highly specialized operation. Its aim is to preserve and reveal the aesthetic and historic value of the monument and is based on respect for original material and authentic documents. It must stop at the point where conjecture begins, and in this case moreover any extra work which is indispensable must be distinct from the architectural composition and must bear a contemporary stamp. Venice Charter 1964.
Slowing the Flow	Measures to reduce the flow rate and levels of a river through methods designed to store water or absorb water into the landscape or create landscape features that may slow water flow and increase water absorption.
Spring Tide	A tide just after a new or full moon, when there is the greatest difference between high and low water.
Sustainability	The avoidance of the depletion of natural resources in order to maintain an ecological balance.
Tidal Surge	Coastal flood phenomenon of rising water commonly associated with low pressure weather systems the severity of which is affected by the shallowness and orientation of the water body relative to storm path, and the timing of tides.
Upstream	Situated in the opposite direction from that in which a stream or river flows; nearer to the source and on higher ground usually.

Select Bibliography

Allen, Alistair. “Urban Groundwater Problems in Cork City, Southwest Ireland.” *Urban Groundwater, Meeting the Challenge*, 2006, pp. 41-54.

Amirtahmasebi, Rana, et al. *Regenerating Urban Land: A Practitioner’s Guide to Leveraging Private Investment*. The World Bank, 2016.

Bandarin, Francesco, and Ron van Oers. *Reconnecting the City: The Historic Urban Landscape Approach and the Future of Urban Heritage*. Wiley Blackwell, 2015.

The Burra Charter: The Australia ICOMOS Charter for Places of Cultural Significance. Australia ICOMOS, 2013.

Charter for the Conservation of Historic Towns and Urban Areas (Washington Charter 1987). ICOMOS, 1987.

Cork Tourism Strategy Taskforce. *Growing Tourism in Cork: A Collective Strategy*. Visit Cork, 2016.

Devoy R., *Submission to the OPW in Response to the Lower Lee Flood Relief Scheme.* 30th Mar. 2017.

English, Eoin. “Concrete Flood Barriers ‘Could Damage City’s River Potential.” *Irish Examiner* 23 Sep. 2014.

The Florence Declaration on Heritage and Landscape as Human Values (2014). ICOMOS, 2014.

Florida, Richard. *The Rise of the Creative Class*. Basic Books, 2002.

Halcrow Group Ireland. *Lee Catchment Flood Risk Assessment and Management Study*. Office of Public Works, 2014.

Hankin, Barry et al. *Natural Course Project: Strategic Investigation of Natural Flood Management in Cumbria*. The Rivers Trust, 2016.

Historic Gardens (The Florence Charter 1981). ICOMOS, 1981.

ICOMOS Charter – Principles for the Analysis, Conservation and Structural Restoration of Architectural Heritage. ICOMOS, 2003.

International Charter for the Conservation and Restoration of Monuments and Sites (The Venice Charter 1964). ICOMOS, 1964.

Ireland. Comptroller and Auditor General. *Report on the Accounts of the Public Services 2013*. The Stationery Office, 2014.

Ireland. Department of Environment, Heritage and Local Government. *Architectural Heritage Protection Guidelines for Planning Authorities*, The Stationary Office, 2011.

Ireland. Fáilte Ireland. *Regional Tourism Performance in 2015*. Fáilte Ireland, 2016.

JBA Consulting. *Strategic Investigation of Natural Flood Management in Cumbria*. The Rivers Trust, 2016.

Licciardi, Guido, and Rana Amirtahamasebi. *The Economics of Uniqueness: Investing in Historic City Cores and Cultural Heritage Assets for Sustainable Development*. The World Bank, 2012.

Loeber, Rolf, et al. *Art and Architecture of Ireland Volume IV: Architecture 1600-2000*. Royal Irish Academy, 2015.

McCabe, Sarah. “Traffic Gridlock and Luas Works Push Dublin Businesses to Breaking Point.” *Sunday Independent* 6 Dec. 2015.

Marshall, M.R., et al. “The Impact of Rural Land Management Changes on Soil Hydraulic Properties and Runoff Processes: Results from Experimental Plots in Upland UK.” *Hydrological Processes*, vol. 28, no. 4, 2013, pp. 2617-29.

Murray, Anja. *Natural Flood Management: Adopting Ecosystem Approaches to Managing Flood Risk*. Friends of the Earth, 2017.

The Nara Document on Authenticity (1994). ICOMOS, 1994.

Roche, Barry. “Bus Strike: Cork Businesses ‘Losing €50m in Revenue’.” *Irish Times* 12 Apr. 2017:

Rosa, Fortuna De, and Maria Di Palma. “Historic Urban Landscape Approach and Port Cities Regeneration: Naples between Identity and Outlook.” *Sustainability*, vol. 5, no. 10, 2013, pp. 4268-87.

Springate-Baginski, Oliver, et al. *An Integrated Wetland Assessment Toolkit: A Guide to Good Practice*. Gland, Switzerland, IUCN, 2009.

Stamp, Gavin. “The Art of Keeping One Jump Ahead: Conservation Societies in the Twentieth Century.” *Preserving the Past*, edited by Michael Hunter, Sutton, 1996, 77-8.

Strosser, Pierre, et al. *A Guide to Support the Selection, Design and Implementation of Natural Water Retention Measures in Europe*. European Commission, 2014.

UNESCO. *New Life for Historic Cities: The Historic Urban Landscape Approach Explained*. UNESCO, 2013.

UNESCO. *Recommendation on the Historic Urban Landscape*. UNESCO, 2011.

UNESCO World Heritage Centre and Istituto Universitario di Architettura di Venezia. “Partnerships for World Heritage Cities: Culture as a Vector for Sustainable Urban Development.” *World Heritage Papers*, No. 9, UNESCO World Heritage Centre, 2003.

UNESCO World Heritage Centre. “Managing Historic Cities.” *World Heritage Papers*, No. 27, UNESCO World Heritage Centre, 2010.

Veirier, Laure. *Historic Districts for All: A Social and Human Approach for Sustainable Revitalisation: Manual for City Professionals*. UNESCO, 2008.

Wilkinson, M.E., and P.F. Quinn. Belford Catchment Proactive Flood Solutions: A Toolkit for Managing Runoff in the Rural Landscape. Newcastle University, 2010.

WWF Scotland. *Slowing the Flow: A Natural Solution to Flooding Problems*. WWF Scotland, 2016.

Xi’an Declaration on the Conservation of the Setting of Heritage Structures, Sites and Areas. ICOMOS, 2005.

Acknowledgements

Local business owners and individuals who have supported our efforts and taken time to talk with us.

Public bodies and Local Government officials and councillors who have given us time.

All individuals and businesses who have been part of our ‘Humans of Cork’ campaign.

All of our followers on social media, and all local and national media.

All who have provided research assistance including The Flow Partnership (UK), Dr Declan Jordan from the School of Economics at UCC, Dr Denis Linehan from the School of Geography at UCC, Erik Kraaij, Programme Director of the Dutch Flood Protection Programme, hydrologist Professor Philip O’Kane, climatologist Professor Robert Devoy and Dr Simon Harrison from the School of Biology Earth and Environment Science (BEES) at UCC.

Everyone who has listened to us as we have presented our ideas and who has helped us in any way.

A: Comparison of Walls Scheme & Save Cork City Solution

	Walls Scheme	Save Cork City Solution
Number of properties Protected	1400 to 2000	Increase
Area of city protected	City centre	City and docklands
Cost per property protected	Up to €75,000*	Significant reduction*[1]
Build cost of scheme	Up to €200m*	€190m*
Losses during construction	Significant*	None*
Tourism losses	Significant*	None*
Litigation costs	Significant*	None*
Inward investment losses	Significant and ongoing*	None*
Heritage loss	Significant*	None*
Traffic disruption	Significant*	Negligible*
Insurance cover	Reduction*	Normalised*
Certainty of outcome	Uncertain	Secure outcome
Public support	Lack of support	Growing support
Protected Structures impacted	1000	None
Development Plan consideration	Ignores plan	Full consideration
Amenity value	Greatly reduced	Greatly increased[2]
Archaeological cost	Significant	Minor
Length of proposed walls	8.9km concrete walls	0.9km barrier length
Historic walls to be altered	5.3km removed or altered	Repair only
Pump chambers to maintain	46	None
City centre pump chambers	22	None
City centre sheet piling	2.16km	None
Embankments	6.9km	0.8km

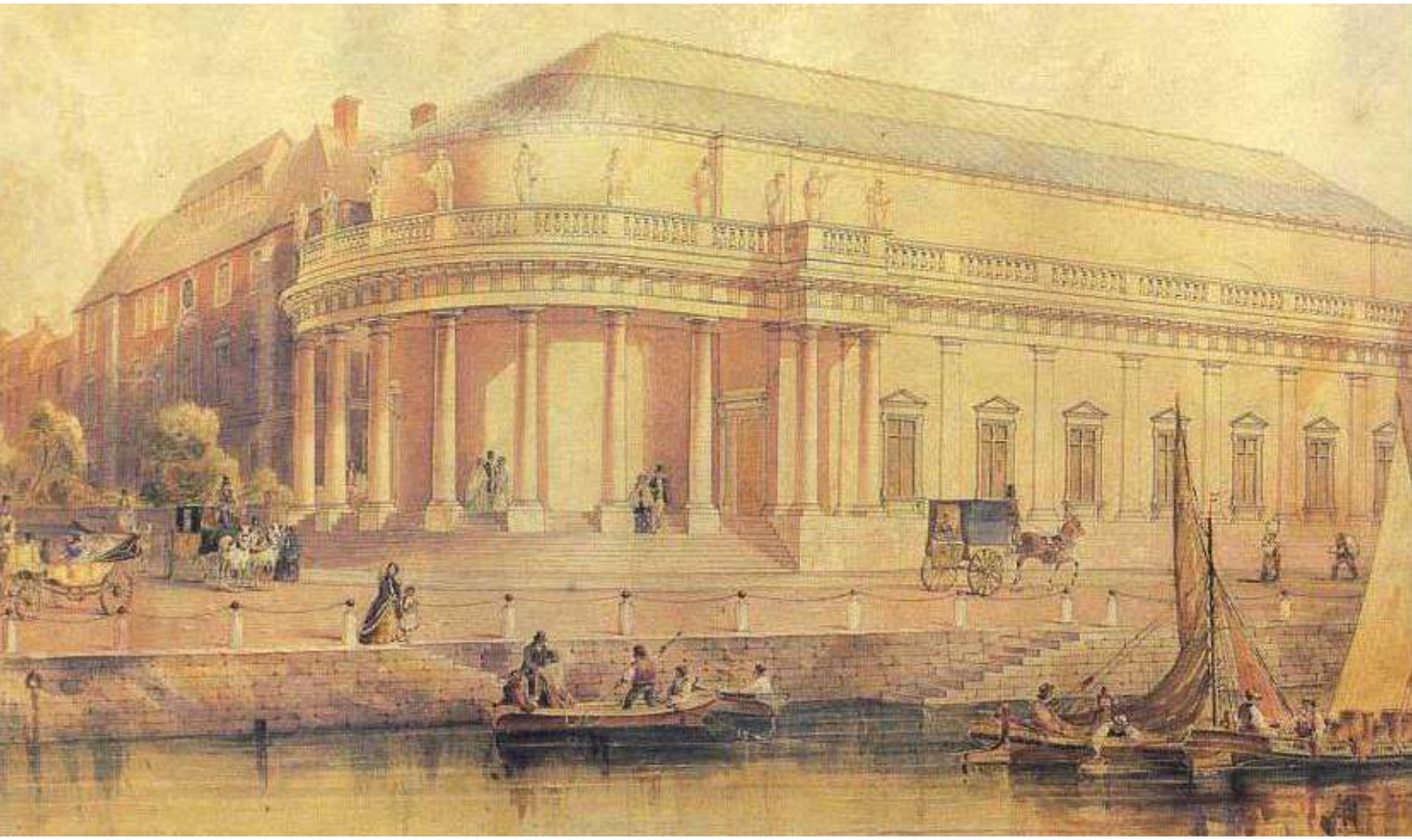
Notes:

Tourism alone for the Cork region was worth €729m to the economy in 2015.

** Items directly affecting the local economy and investment potential.*

1. *Areas protected and numbers of properties will increase as sea levels rise.*
2. *The Save Cork City solution would create increased amenity throughout the river landscape.*

B: Images



Opera House Lavitts Quay 19th Century

Lavitt's Quay, Cork Lawrence Collection


Trinity Church, Cork under construction & Church of San Giovanni Novo, Venice


Crawford Art Gallery (Custom House), Cork & Capitoline Hill, Rome


Parliament Bridge, Cork & Pedestrian Bridge, Venice

Historic Photographs from the Lawrence Collection and Anthony Barry Collection









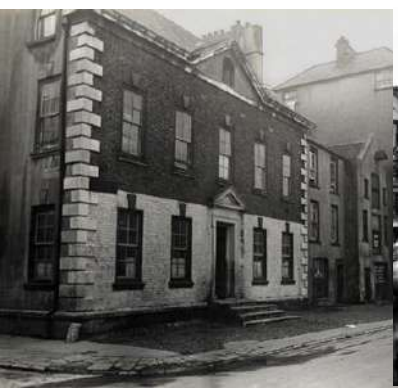










Studies of the Historic Quays of Cork, 2017



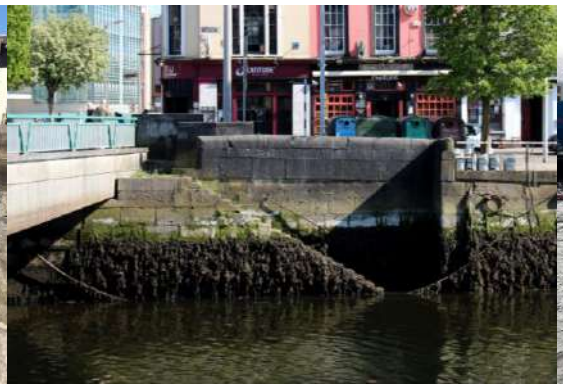
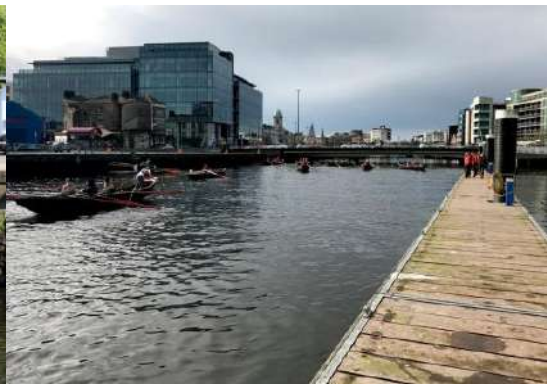










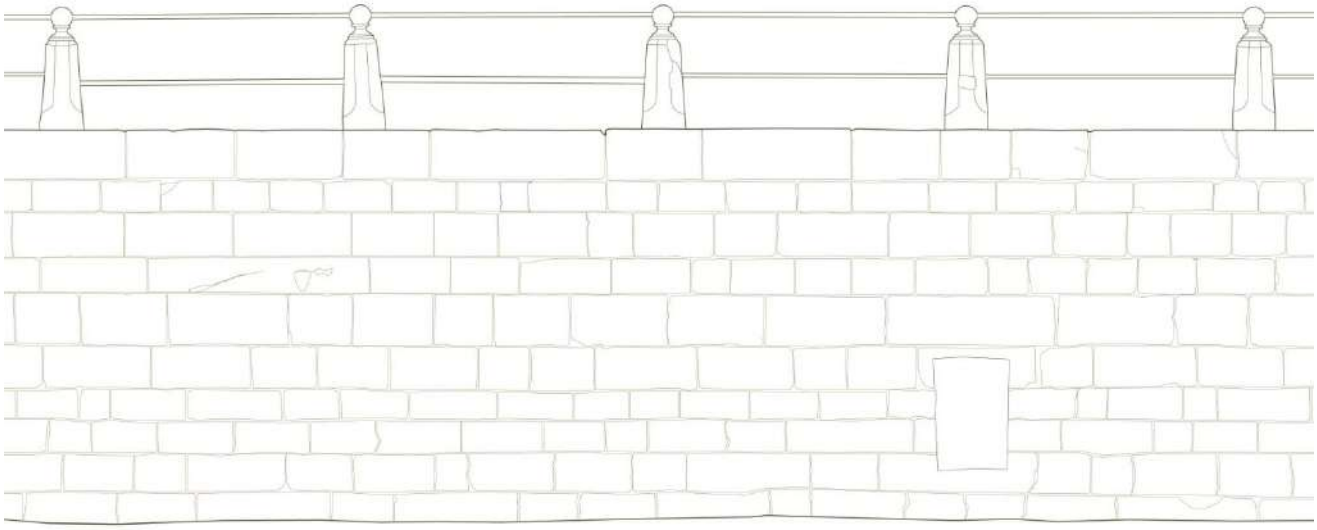




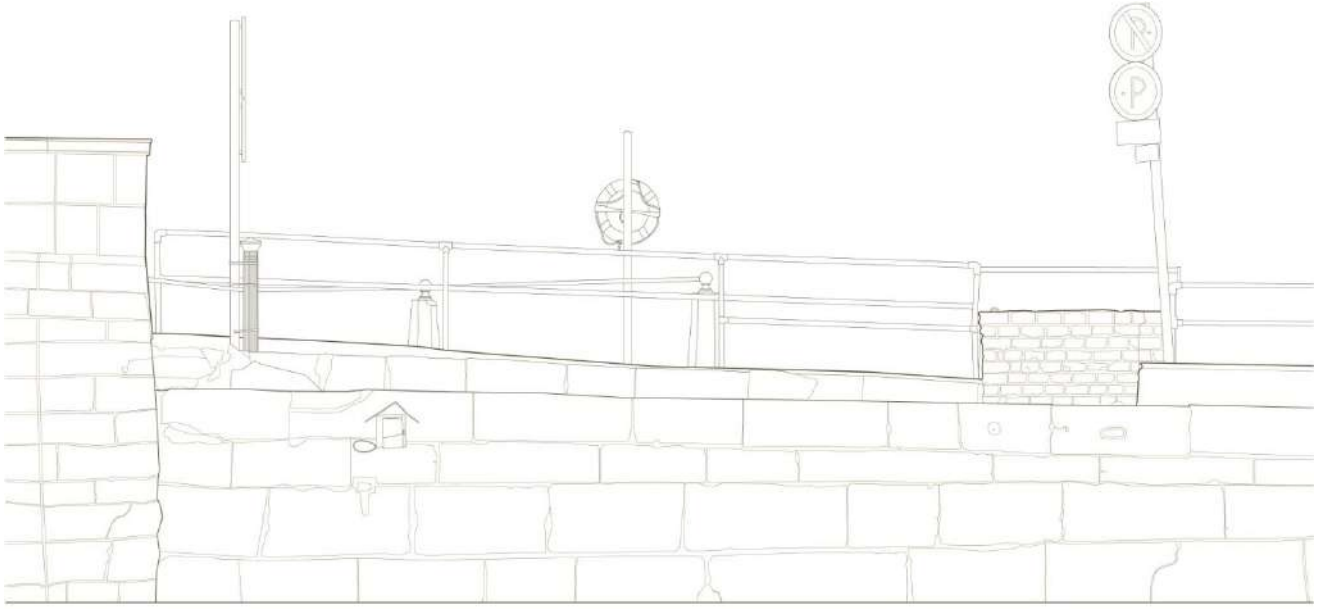



C: Drawings

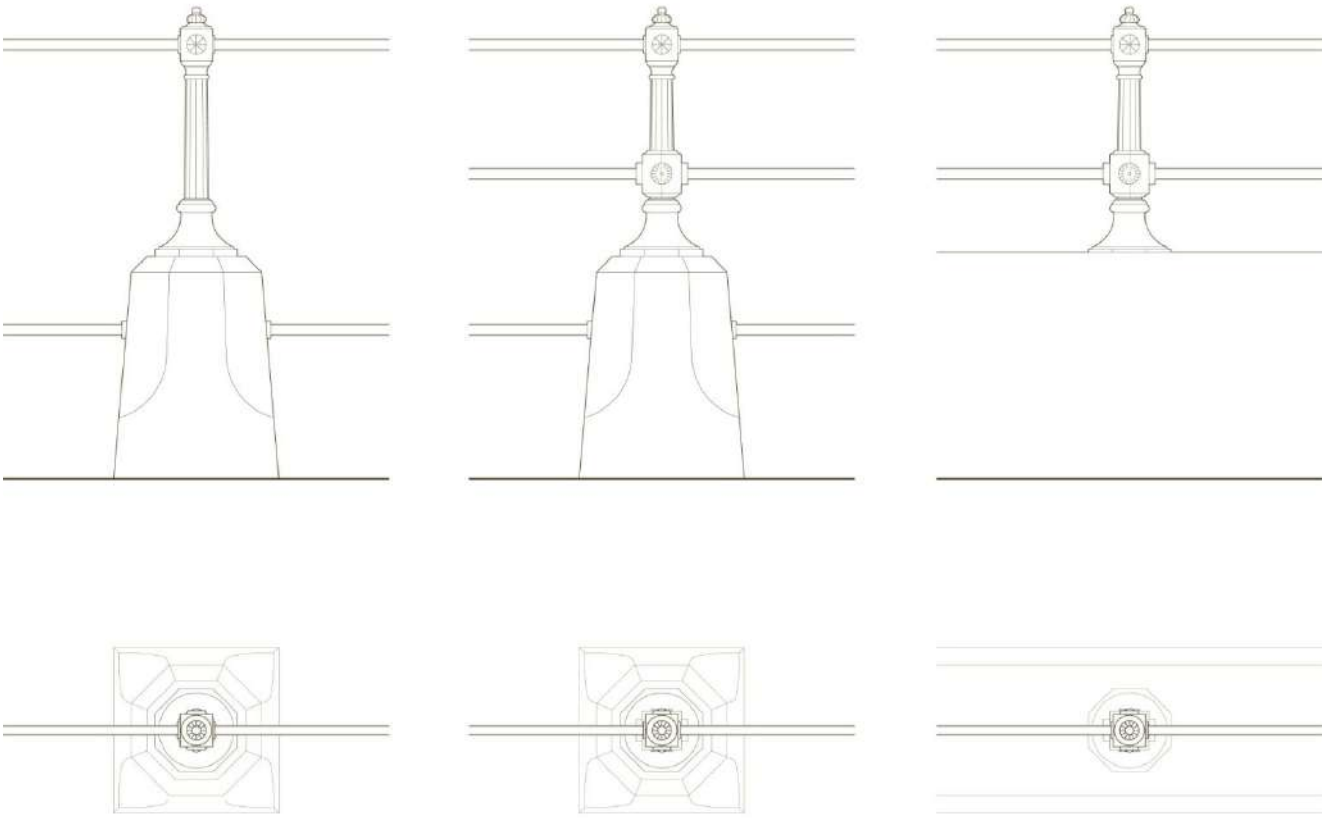
Studies of the Historic Quays of Cork



Sullivan's Quay (Elevation)

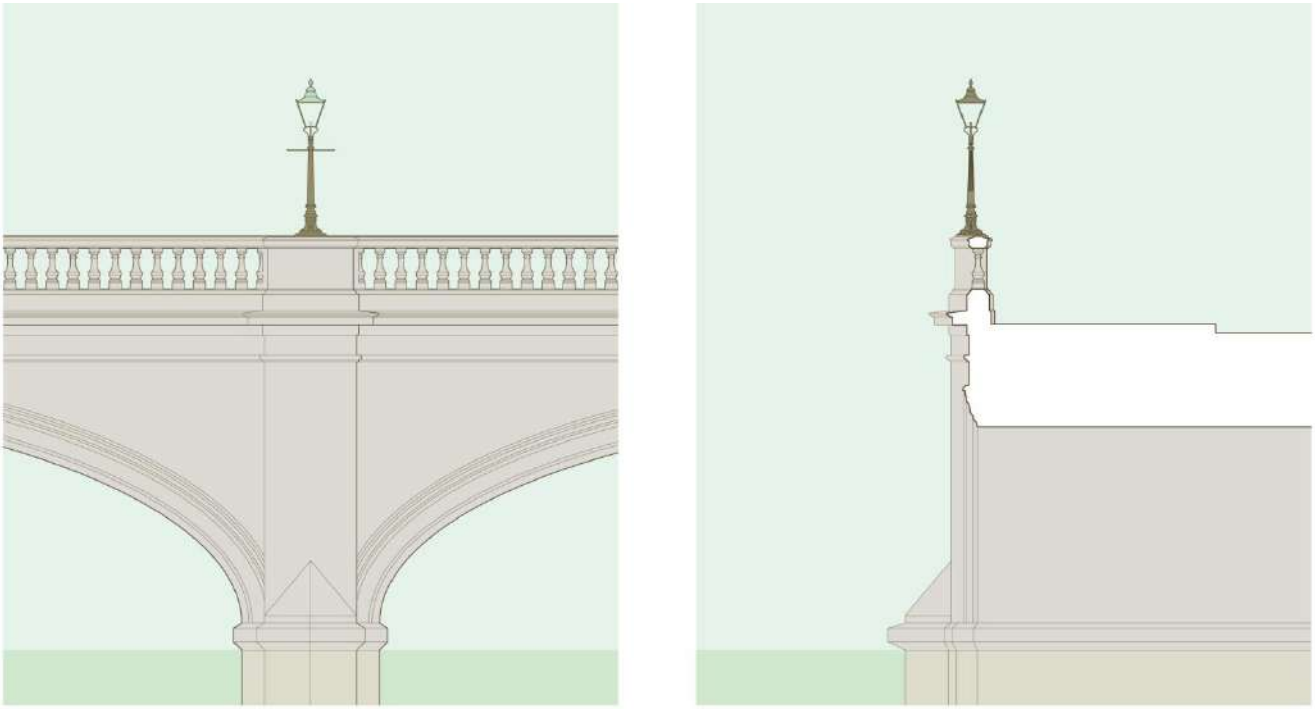


Father Mathew Quay (Elevation)

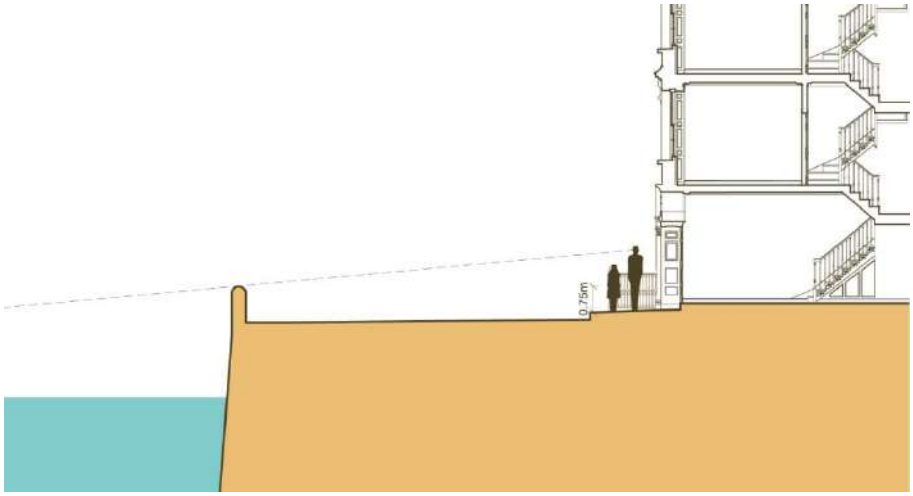


Original *Addition* *2006*

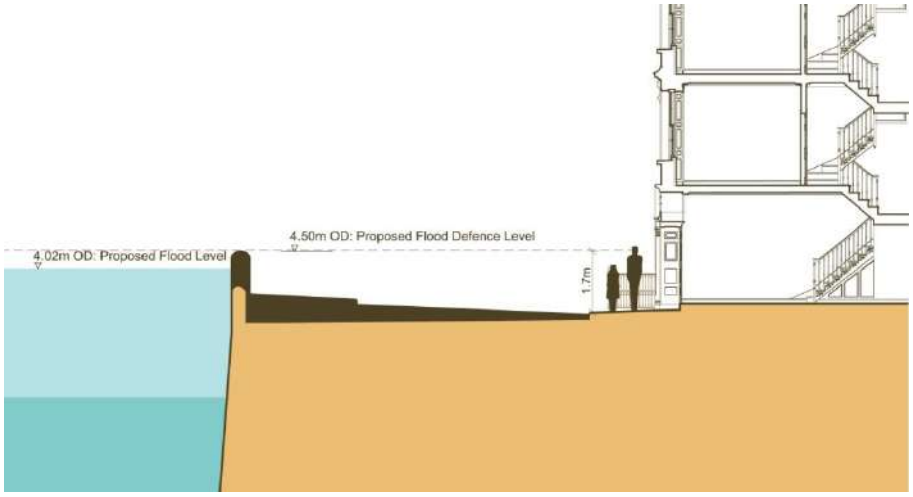
Bollard, Grand Parade



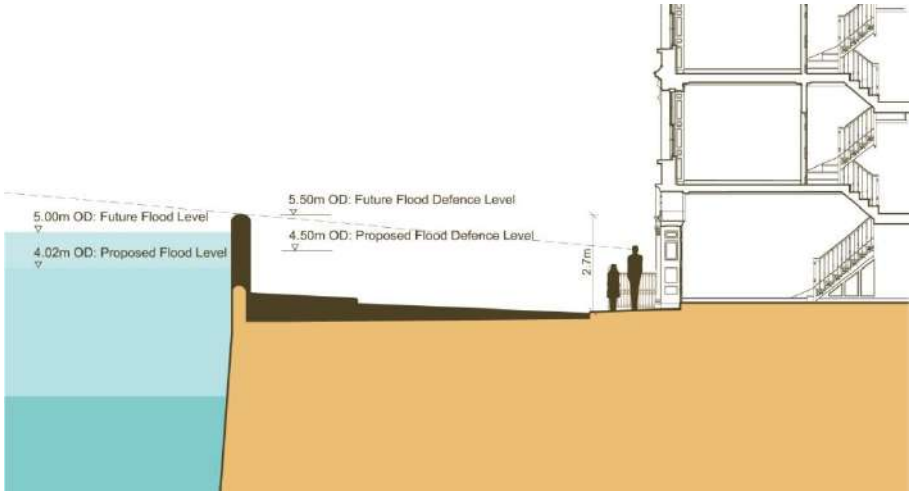
Restoration Detail, St. Patrick's Bridge



Grenville Place now



Grenville Place with proposed flood relief walls



Grenville Place with future flood relief walls allowing for climate change

**Water and flood defence levels are taken from drawings and documentation published by the OPW in relation to the Lower Lee (Cork City) Flood Relief Scheme, December 2016.*

D: Comments on the Walls Scheme

An Unworkable and Costly, Mechanically Based System

Drainage in the city centre is now mainly passive and flows into the river easily. In many cases the Walls Scheme raises quay ground levels and slopes drainage back towards property, creating a new, more vulnerable scenario. Giant hydraulic pumps are proposed to drain water from the city centre and in the event of pump failure, the city may be easily and frequently flooded.

The OPW are proposing to protect the city centre by constructing reinforced concrete walls of varying height on top of the existing historic quay walls as part of the Walls Scheme. Extensive excavations are proposed throughout the city centre quays of almost unimaginable scale. The Walls Scheme proposes to pump (thousands of tonnes of) concrete grout behind the existing quay walls in an attempt to prevent water from the river seeping into the ground. But this proposal cannot achieve its goal. There would be spaces left in the grout, and those spaces would provide paths for water to travel. And where would it go? We do not know where it could end up – nobody can predict that. What we do know is that, if the path of water is blocked in one place, it would be forced to surface somewhere else and the more it is blocked the more force it will have when it ultimately emerges.

Works to a pump chamber in Mallow

The extent of the works involved in constructing an urban walls based flood relief scheme can be difficult to imagine. Proposed construction means extensive excavation and the use of large scale plant and machinery. In addition to all the other construction involved in building walls there are 46 pump chambers proposed for the historic centre of Cork. Each pump chamber is underground and requires noisy sheet piling to contain it. They can be very large at a minimum size of 4m x 4m and up to 8 metres in some cases. They would be filled with stagnant water. Each of the forty six chambers would have a pump to get rainwater from the city into the river. None of this would be required if a simpler and more economic form of flood relief was pursued. In addition to the forty six pump chambers proposed are over 3.5 km of concrete quay walls proposed to replace or cover the 17th, 18th and 19th century historic quay walls. Over 5km of concrete flood wall are proposed above the quay walls. 2.15km of sheet piling is proposed by the Walls Scheme (a staggering amount of such a noisy construction method). The Walls Scheme proposes 6.9 km of embankments, and over 10km of concrete

motorway footpath kerbs and slabs. Make no mistake, construction would be noisy, extensive and leave behind an unrecognisable and degraded city following years of torture to business and residents.

Many kilometres of concrete walls cannot protect the city. Flooding in the city centre is directly linked to groundwater. The city centre is underlain by the Lee Buried Valley gravel aquifer and the groundwater in the aquifer is hydraulically connected to the River Lee and as a result it is also connected to the tide. The system is extremely complex and to get an accurate understanding of the interactions between individual components you need to build a detailed model, which has to be calibrated and verified. We do not believe that this has been carried out to the necessary level or even if it is possible to do so. The only real solution for Cork that can be demonstrated to work and has real and continued precedent is to maintain manageable and sustainable water levels within the city. Given the conditions within Cork, the tide, the geology and the aquifers a wall will not protect against sustained flooding. In fact a wall of many kilometres in length would be almost certain to fail in its aims. The OPW proposal would represent an extensive waste of public funding in addition to the wasted opportunities for the City on many different levels, some of which would be found to be irreversible when it was too late.

Minimal public consultation

The OPW have directly informed only 475 people out of a population of 125,000. One Millennium Hall information day was attended by just 53 people. This represents a major information deficit.

The Arterial Drainage Act

The 1945 Arterial Drainage Act is being used to carry out works in Cork City for flood relief. The irony is that it was devised to drain farmland; the policy of which has led to much upstream flooding due to certain methods. The act is inappropriate for use in an urban area.

Severe economic impact during construction

The Walls Scheme is the most construction intensive plan that could have been chosen. City businesses are justifiably afraid that they will not survive another prolonged construction project.

Traffic issues

The traffic problems caused by the Walls Scheme may be as bad as or worse than anything Cork has ever seen.

No docklands or Tivoli protection

Under the Walls Scheme the docklands would not be protected and if it is to be covered in the future further significant spending will have to be allocated and further time. This is disastrous for a city that should be allowed to grow now in certainty of flood protection.

The River Lee is 95 kilometres long

The OPW is concentrating all their flood relief construction work within the highly populated, historic city centre when many choices exist that could locate intervention elsewhere.

Inconsiderate use of resources

The Walls Scheme does not propose use of available funding or help to mitigate climate change. It does not recognise available funding on an EU level and national level for elements of upstream catchment management or slowing the flow techniques. It does not include the use of trees for influencing the speed of drainage of rainwater or reductions in carbon emissions. It ignores the vital role farmers could play in upstream management. This represents a non-integrated approach to problem solving and is a waste of resources.

The Walls Scheme also represents a massive lost opportunity for Climate Policy Integration. Ireland is facing massive fines of between 600 million and 6 billion euro for not meeting its targets on reducing carbon emissions. Combined methods of catchment management and slowing the flow of rivers could help to mitigate carbon emissions. Reduced fines would also pay for a tidal barrier many times over.

The Walls Scheme is outdated and will not work

Engineering professor Philip O' Kane, a world expert on hydrology, has said that the Walls Scheme is fifty years out of date and that the walls will not work. Increasing the speed of the river and building walls is unsustainable and increases the possibility of major flood damage.

The Walls Scheme does not deal with climate change

Professor Robert Devoy, who was Lead Author, member and reviewer in the Nobel Prize winning Intergovernmental Panel on Climate Change's (IPCC Fourth Assessment Report has said that the OPW Scheme does not adequately address the certainty of climate change. The OPW's only proposed solution to climate change under the scheme is to make their walls even higher. What would 2.2m high walls mean for the river landscape? Does the OPW plan to rebuild and replace every bridge in the City?

Insurance cover is not guaranteed for businesses or property

The Walls Scheme will not solve the insurance problem. In fact, it could get far worse if the Walls Scheme causes subsidence due to ground water alteration. Building walls as a flood relief solution has not thus far been accepted by the insurance industry as allowing for insurance cover. Clearly, a different approach is needed to reduce the risks.

Flawed design

Cork is defined by the river and by its proud trading history with other European cities. The Walls Scheme, such as the plan to turn the north channel of the Lee into an open drain, seems both astonishing and inexplicable as a design solution and this is recognised by the thousands of people who oppose it.

Heritage loss

What we have in Cork is internationally important. Cork's river landscape, the most significant Georgian water landscape in the world, would be irretrievably lost.

Disregard for the Development Plan

The Walls Scheme ignores the legitimate expectations of citizens and investors to rely on the City Council Development Plan

Disregard for civic life

If the Walls Scheme was to be constructed, the connection with the river would be broken. You could not be able to see the river from Fitzgerald Park. What is proposed is something more suited to wartime defences than civic life.

Economic loss & loss of heritage

Heritage has an intrinsic economic value. Economists know the value of cultural capital, for locals, for tourists, for businesses and for investors. The Walls Scheme does not give adequate weight to heritage loss.

City centre trade loss

Cork people do not have to come into town to eat or shop; they can spend their money elsewhere or on something else. If coming into town is a degraded experience, local people will not value it and we believe that they will vote with their feet.

Litigation & construction

If the Scheme goes ahead, the City would be a building site, roads will be dug up, and vast quantities of concrete grout would be pumped behind the quay walls. This would change the current ground conditions and lead to differential settlement, causing damage to buildings, interfering with property rights and creating a litigation nightmare.

Cost and time overruns

It is inevitable that there would be delays and huge cost over-runs based on precedent. The Walls Scheme means economic uncertainty for between 6 and 10 years as that is how long it would take to complete. The projected time may also be unrealistic as precedent shows such projects tend to increase in timescale.

E: The Save Cork City Campaign

Support for the Save Cork City Solution

It is hard to find any one person on the ground in the city who isn't concerned by the impact the Walls Scheme would have on the local economy and on the quality of the city environment. Concerns about loss of heritage, combine with business concerns. Many people are surprised and upset by the poor consultation. Almost universally, people say to us that there has to be a better way. We have also spoken to many people devastated by flooding and many of them form part of our support. We believe that there are much more considerate options for all.

Public Awareness

Many people in Cork still know little to nothing about flood mitigation proposals for the city. Key bodies and stakeholders within the city do not know what the options are. Save Cork City has run an awareness campaign on the issues yet there is still much to be done in giving people adequate information and a choice on the future of their city.

Our Campaign So Far

We came together as a voluntary group in January 2017 as we were concerned for the heritage and landscape of Cork and how it would be affected by the Walls Scheme. Following our analysis of the options for flood relief and development of the city, our concern began to focus on the local economy and how it might be affected. We began to investigate current practice in flood relief in the European Union and beyond as well as examining Irish government legislation and independent research. We have a deep concern for the maintenance of civic life by heritage protection which leads to a growth in self esteem and the reinforced dignity of citizens. We began to see the deep connection between our concerns and the development of the local economy and the potential of the city.

We began a campaign to inform people about the flood relief proposal and the options available and about their legal right to make submissions to the government about flood relief. In addition we set up a discussion forum through lectures and two symposium, one in UCC and one in The School of Music. We were invited by the Lord Mayor to present our views at a public meeting on Friday 10th March 2017 and to present to City Council in the council chamber on 27th March 2017. Our 'Love the Lee' weekend on 10th to 12th March was well attended. On social media the level of engagement in such a short time has been exceptional.

Our social media posts have reached almost 28,000 hits on a single post. According to Facebook figures, we regularly reach over 50,000 people in a week. We have a lot of public support from people from all walks of life. Our *Humans of Cork* social media campaign has received tens of thousands of hits and represents real people living in Cork or in business (including flood victims) who are willing to be recorded as supporting our solution for the city. Support for Save Cork City is growing daily. End.

www.savecorkcity.org
2017