DPS015

Belfast Local Development Plan

Technical Supplement 9
Flood Risk

August 2018

Belfast City Council

Energising Belfast

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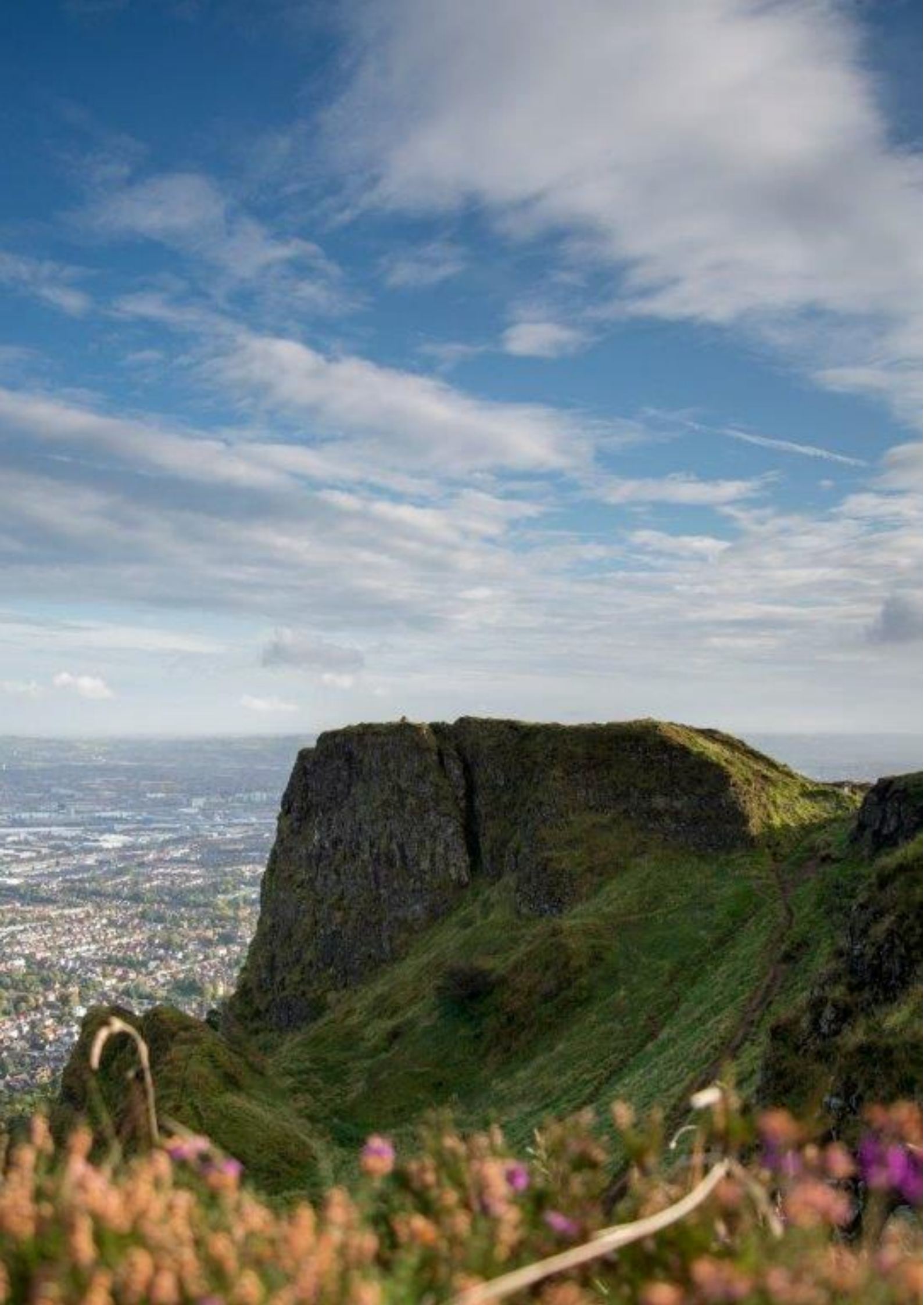

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1.0 Introduction

Purpose of this document

1.1 This technical document has been prepared to draw together the evidence base that has been used to inform the preparation of the Belfast Local Development Plan (LDP) 2035. It is one of a suite of topic-based technical supplements that should be read alongside the LDP to understand the rationale and justification for the policies in the draft Plan Strategy (DPS).

1.2 The document builds upon the suite of 18 thematic topic papers published alongside the LDP Preferred Options Paper (POP), which established the baseline position at that time (January 2017) and identified the key issues to be addressed by the LDP. This technical document therefore updates this baseline position along with the topic paper on flood risk, sets out the evidence base that has informed the relevant policies within the DPS.

1.3 Again, this document forms part of a series of thematic reports to accompany the DPS. Whilst each of the technical supplements can be read separately, there are inevitably important related matters and background evidence within other documents also.

1.4 It should be noted that the evidence base collected to inform the LDP also forms the basis for additional assessments and appraisals required as part of the plan preparation process, most notably the Sustainability Appraisal. By combining the evidence gathering stages for both the Sustainability Appraisal and LDP, we aim to streamline the documentation produced and avoid duplication. It will also help to ensure that sustainable development is embedded in the planning process and that the Sustainability Appraisal is one of the main drivers informing the preparation of the LDP.

Planning and Flood Risk Issues

1.5 The planning system plays an important role in flood risk management insofar as it has a significant bearing on where development takes place and as a consequence can prevent or restrict new development in flood prone areas. This paper provides a review of the policy context around flooding in Belfast, including consideration of current and future flood risk and how this could be managed or mitigated through the promotion of Sustainable Drainage Systems (SuDS). This document should be read in conjunction with Technical Supplement No 16 on Environmental Issues.

1.6 Flooding is a natural process that cannot be entirely prevented. The effects of flooding are wide ranging, and can impact on a wide range of human activities and interests, the most obvious being the health and well-being of people directly caught up in flood events and the damage caused to property by inundation of flood water. The importance of protecting the community from the risk and impact of flooding is at the heart of the European Floods Directive (2007/60/EC). Introduced in 2009, the Floods Directive provides a new approach

to managing flood risk on a catchment wide scale. This is further supported through the aim of the Strategic Planning Policy Statement (SPPS) in relation to flood risk which is to prevent future development that may be at risk from flooding or that may increase the risk of flooding elsewhere. It also seeks to address the future needs of society as well as the present and, in doing so, the planning system must ensure the protection of the environment, including protecting important assets and improving health and wellbeing.

1.7 As well as managing the existing flood risk to people and properties in Belfast it is important that the flood risk is not increased by new development in areas of known flood risk. Northern Ireland's planning policies adopt a precautionary approach to development that aim to prevent future development that may be at risk of flooding or that may increase the risk of flooding elsewhere.

1.8 The planning system can also positively contribute to help address risks associated with environmental change, coastal/fluvial flood risk and measures to help address risks and its harmful impacts associated with surface water, such as SuDS. The LDP can play a key role in helping to mitigate and adapt to the effects of climate change through sustainable approaches to building design, supporting low and zero carbon energy generation, transport, creating and maintaining habitats and open space and addressing and mitigating against flood risk.

1.9 A general approach to flood risk management in the past has largely been based on flood defence and flood warning. With predictions of more intense rainfall and stormier weather in summer months, wetter winters and rising sea levels, we are likely to experience damaging floods more frequently and intensely.

1.10 In preparing the new LDP for Belfast, it is recognised that there are a number of environmental challenges that should be considered and addressed as part of the LDP process. This technical document identified and reviews the key environmental challenges from land use planning perspective. The best available information has been used in compiling this paper. However it may need to be revised in light of the release of any new data. It contains some original data that refers in places to the former BMAP pre-local government reform, when the boundary of Belfast City Council was enlarged. Where possible and relevant, data has also been included which relates to the new Belfast City Council area. In addition, any data used in the previous topic paper (January 2017) has been updated where there is more recent data, so that the overall statistical evidence base is as up to date as possible.

2.0 Policy Context

European / National Policy

European Union Flood Risks Directive

2.1 The European Union Directive on the Management of Flood Risks (the 'Flood Risks Directive'), introduced in 2009, provided a new approach to managing flood risk on a catchment wide scale. The Flood Risks Directive provides the platform to fully implement sustainable flood management within Belfast council area. Such an approach can help deliver cost effective and sustainable solutions, protecting vulnerable homes and businesses from flooding, whilst also benefiting environment and biodiversity within the city.

2.2 The floods directive basically prescribes a three-step procedure:

- First step: Preliminary Flood Risk Assessment
- Second step: Risk Assessment
- Third step: Flood Risk Management Plans

2.3 The Directive highlighted the fundamental importance of preventing or restricting new development in flood prone areas. It also recognized the role of the planning system in regulating new development in existing built up areas so as to afford greater protection to people and property, where this is considered appropriate and commensurate with the flood risk.

The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009.

2.4 The Flood Risks Directive was transposed into local legislation by The Water Environment (Floods Directive) Regulations (Northern Ireland) 2009. Article 4 of the Directive requires that each member state undertakes a Preliminary Flood Risk Assessment (PFRA) for their respective territories.

2.5 Flood Risk Management Plans for Northern Ireland were produced to comply with the requirements of the Directive and the Regulations. The Directive places more emphasis on non-structural flood management measures (soft engineering techniques), such as using natural flood plains and wetlands to store water during floods and makes flood management a key part of river basin management process under the Water Framework Directive.

2.7 The Flood Risk Management Plans highlight the flood hazards and risks in the 20 most Significant Flood Risk Areas in Northern Ireland from flooding from rivers, the sea, surface water and reservoirs. The Plans identify the measures that will be undertaken over a 6 year period and they set out how the relevant authorities will work together and with communities to reduce the flood risks.

Regional Policy

2.9 The **Regional Development Strategy 2035** (RDS) recognises the need to avoid, where possible, the selection of flood prone land for employment and housing growth. It urges the planning system to adopt a precautionary approach to development in areas of flood risk and the use of the latest flood risk information that is available in order to properly manage development. It also promotes a more sustainable approach to the provision of water and sewerage services and flood risk management and to integrate water and land-use planning and encouraging sustainable surface water management.

Strategic Planning Policy Statement (SPPS)

2.10 The aim of the SPPS in relation to flood risk is to prevent future development that may be at risk from flooding or that may increase the risk of flooding elsewhere. It aims to identify, develop and promote opportunities to create a more sustainable society that balances how land can be future developed without increasing the risk of flooding elsewhere. It acknowledges that development can increase the consequences of flooding and identifies the important role of the Local Development Plan in zoning land so as to avoid and reduce the risks of flooding.

2.11 The SPPS requires flood risk to be managed by adopting a precautionary approach to the identification of land for development through the LDP process and the determination of development proposals. This applies in those areas susceptible to flooding, having regard to the precautionary approach where there is a lack of precise information on present day flood risk or future uncertainties associated with flood estimation, climate change predictions and scientific evidence.

2.12 The SPPS also aims to:

- manage development in ways that are appropriate to the four main sources of flood risk in Northern Ireland, i.e. fluvial, coastal, surface water and water impoundment (reservoir) breach or failure;
- seek to protect development that is permitted within flood risk areas by ensuring that adequate and appropriate measures are employed to mitigate and manage the flood risks;
- promote sustainable development through the retention and restoration of natural flood plains and natural watercourses as a form of flood alleviation and an important environmental and social resource;
- promote sustainable development through encouraging the use of sustainable drainage for new development and redevelopment / regeneration schemes;
- promote public awareness of flood risk and the flood risk information that is available and of relevance to undertaking development; and
- promote an integrated and sustainable approach to the management of development and flood risk which contributes to:
  - The safety and well-being of everyone,
  - The prudent and efficient use of economic resources,
  - The conservation and enhancement of biodiversity, and
  - The conservation of archaeology and the built heritage.

2.13 Local Development Plans have to consider:

- Development in river (fluvial) and coastal flood plains
- Development in proximity to reservoirs
- Protection of flood defence and drainage infrastructure
- Artificial modification of watercourses

2.14 Local Development Plan (LDP) preparation must make use of the latest flood risk information produced by the Department for Infrastructure and should work in collaboration with relevant Departments, adjacent councils and agencies. It must take account of the potential risks from flooding over the plan period and beyond, as this is likely to influence decisions on such matters as the zoning of land for development or the designation of land for open space use. The LDP should also promote sustainable drainage within the plan area.

Figure 1: Photo of Belfast Laganside after a flood event

Planning Policy Statement 15 (Revised): Planning and Flood Risk

2.15 Planning Policy Statements have statutory basis and are intended to formulate and co-ordinate policy for securing the orderly and consistent planning of the development of land. Flood planning policy in Northern Ireland is dictated by the requirements of Planning Policy Statement (PPS15), which aims to:

- Prevent development within the fluvial (river) and coastal floodplain;
- Protect existing flood defences;
- Protect developments from flooding from surface water sources; and
- Prevent unnecessary culverting or closing of existing open river channels.

2.16 Development is not permitted within floodplains unless the development satisfies one of a number of exception criteria – such as being classed as strategic infrastructure. The primary aim of the PPS is therefore to, 'prevent future development that may be at risk

from flooding or that may increase the risk of flooding elsewhere'.

2.17 Much of the policy content of PPS15 is incorporated into the SPPS. The PPS also includes a number of annexes that provide additional information and clarification on important issues, such as climate change, SuDS and flood risk assessment. These annexes have been extracted from the PPS and are attached to this technical supplement as they remain valuable and relevant.

The Water and Sewerage Services Act (Northern Ireland) 2016

2.18 The Water and Sewerage Services Act (Northern Ireland) 2016 requires any person proposing to connect a sewer or a lateral drain to a public sewer to obtain written approval on the basis of a mandatory sewer adoption agreement. This will be subject to conditions relating to quality standards, adoption and security.

2.19 Clause 4 of the Act provides a definition of sustainable drainage systems for dealing with surface water from premises and provides the power to adopt specified SuDS structures. It places a requirement for SuDS to be considered and constructed where appropriate and for NI Water to refuse surface water connections to a public sewer.

2.20 The approval for surface water run-off from development will be under the responsibility of the water course management section of the Department of Infrastructure. With the exception of tidal estuaries and coastal waters, green field run-off should be considered as a normal starting point for design of development surface water drainage systems.

2.21 NI Water will accept the design standards based on the CIRIA SuDS Manual C753 published in November 2015. It covers the planning, design, construction and maintenance of Sustainable Drainage Systems (SuDS) to assist with their effective implementation within both new and existing developments.

Sustainable Water – A long Term Strategy for Northern Ireland

2.22 This Strategy presents an overarching approach to help facilitate implementation of a range of initiatives aimed at delivering the long term vision to have a sustainable water sector in Northern Ireland. The document was published on 25th March 2016 and has been endorsed by the NI Executive. One of the key aims and principles of the document is 'Principle 4 – Flood Risk Management', which supports what is said within SPPS, which is that flooding cannot totally be eliminated, but it is important that it is sustainably managed to help protect social, economic and environmental development.

2.23 Part 3 of the document – 'Flood Risk Management and Drainage', makes a number of recommendations to be considered when local development plans are being produced. Key aims in the Strategy are:

- Deliver Sustainable Flood Resilient Development
- Manage the Catchment to Reduce Flood Risk
- Provide Sustainable Integrated Drainage in Rural and Urban Areas
- Improve Flood Resistance and Resilience in high Flood Risk Areas
- Be Prepared for Extreme Weather Events

Local Policy Context

2.24 The current planning policy context at a local level is complex as a result of a successful legal challenge to the adoption of the Belfast Metropolitan Area Plan (BMAP) 2015. There are therefore five existing development plans that relate to parts of the Belfast district, alongside draft BMAP. All of these documents will be superseded at the adoption of the new Belfast LDP 2035.

Belfast Urban Area Plan (BUAP) 2001

2.25 The current development plan for the majority of the Belfast district is the Belfast Urban Area Plan (BUAP) 2001, which was adopted in December 1989. The area covered by the plan included the whole of the administrative area of the former Belfast City Council area, together with the urban parts of the former district council areas of Castlereagh, Lisburn and Newtownabbey as well as Greenisland and Holywood.

2.26 The purpose of the BUAP was to establish physical development policies for this broad urban area up to 2001, clarifying the extent and location of development and providing a framework for public and private agencies in their investment decisions relating to land use. Although alterations were made in 1996, the BUAP is now largely out-of-date and was formally superseded by the BMAP in September 2014. However, BMAP was quashed as a result of a judgement in the court of appeal delivered on 18 May 2017, meaning that the BUAP 2001 remains the statutory development plan for most of the council's area.

The Lisburn Area Plan 2001

2.27 The change in council boundary as a result of the local government reform on 1 April 2015, and the subsequent quashing of BMAP, means that the Lisburn Area Plan 2001 remains the statutory development plan for a small portion of Belfast's district around Dunmurry. Adopted on 4 July 2001, the Lisburn Area Plan sought to establish physical development policies for Lisburn and its surroundings up to 2001. However, as work on the development of BMAP had commenced at the time of adoption, an element of provision had been incorporated so that the area's reasonable housing development needs could continue to be met with some certainty until such time as the successor BMAP was in place.

Lagan Valley Regional Park Local Plan 2005

2.28 The quashing of BMAP also means that the Lagan Valley Regional Park Local Plan (adopted in 1993) was re-instated as the statutory development plan for the Lagan Valley Regional Park (LVRP). It sets out the strategy and policies associated with the protection and enhancement of the natural and man-made heritage of the LVRP. Its main objectives are to conserve the landscape quality and features of the Lagan Valley and to enhance recreational use by the public.

Belfast Harbour Local Area Plan 1990-2005

2.29 The quashing of BMAP also means that the Belfast Harbour Area Local Plan (adopted in 1991) was also re-instated as the statutory development plan for Belfast Lough and its

foreshores, encompassing land east of the Belfast to Larne railway line and west of the Sydenham By-Pass and the Belfast to Bangor road. It was prepared within the strategy set out in the Belfast Urban Area Plan 2001 and underlines the importance of the harbour area to Belfast and to the Northern Ireland economy.

North Down and Ards Area Plan 1984-1995

2.30 A small section of the Belfast District at Knocknagoney was subsumed into Belfast as part of local government reform in 2015. The quashing of BMAP means that this area reverts back to the original North Down and Ards Area Plan 1984-1995 (adopted 1989).

Belfast Metropolitan Area Plan 2015

2.31 Although formally adopted in 2014, this process of final BMAP adoption was declared unlawful as a result of a judgement in the court of appeal delivered on 18 May 2017. This means the Belfast Urban Area Plan (BUAP) 2001 and the other Development Plans provides the statutory plan context for the area. However, BUAP was published in 1990, nearly 30 years ago. The Belfast City Council Plan Area has undergone massive transformation since then, particularly in the city centre. The formal development plans which apply are dated and silent on many of the planning issues pertinent to needs of current planning decision making. In recognition of this unique circumstance and taking account of the short term transitional period in advance of the adoption of the Local Policies Plan it is important to provide clarity in relation to the application of planning policy.

2.32 Draft BMAP, in its most recent, post-examination form remains a significant material consideration in future planning decisions. It was at the most advanced stage possible prior to formal adoption. Draft BMAP referred to throughout the LDP Draft Plan Strategy documentation therefore refers to that version. However, the council has also had regard to the provisions of the draft BMAP which was published in 2004, the objections which were raised as part of the plan process and the Planning Appeals Commission Inquiry report.

2.33 The SPPS's transitional arrangements provide for continuity until such times as a new LDP for the whole of their council area is adopted to ensure continuity in planning policy for taking planning decisions.

2.34 BUAP contains fewer zonings or designations than draft BMAP and delineates a city centre boundary which has expanded significantly since then by virtue of the application of Draft BMAP. The council therefore intends to use a number of the existing designations contained in the draft BMAP, insofar as it relates to the Belfast City Council Plan Area, to form the basis of decision making until the LDP is adopted in its entirety. A list of the existing draft boundaries and designations is contained in Appendix A of the LDP Draft Plan Strategy.

The Belfast Agenda

2.35 The Council assumed responsibility for community planning in 2015 as a result of local government reform. It is a process whereby councils, statutory bodies and communities themselves work together in partnership to develop and implement a shared vision for

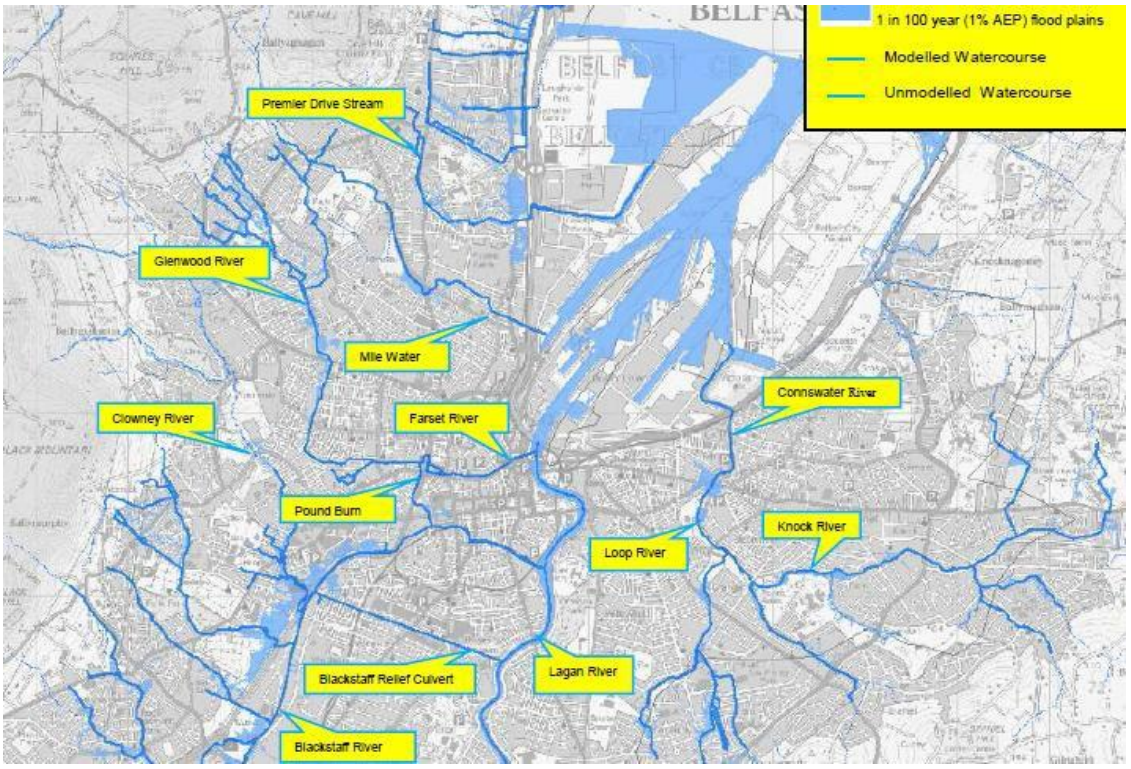
their area, to make sure that public services work together with communities to deliver real improvements for local people. The Belfast Agenda, which is the adopted community plan, sets out a joint vision and long-term ambitions for Belfast's future, as well as outlining priorities for action over the next four years.

2.36 The vision for Belfast in 2035 set out in the Belfast Agenda is:

"Belfast will be a city re-imagined and resurgent. A great place to live and work for everyone. Beautiful, well connected and culturally vibrant, it will be a sustainable city shared and loved by all its citizens, free from the legacy of conflict. A compassionate city offering opportunities for everyone. A confident and successful city energising a dynamic and prosperous city region. A magnet for talent and business and admired around the world. A city people dream to visit."

2.37 Delivery of this vision is based on a number of strategic outcomes, together with four bold ambitions to be achieved by 2035, including an additional 66,000 residents living in the city. The LDP is recognised within the Belfast Agenda as one of the key tools available to shape the physical future of Belfast in a sustainable way. Its development is described as one of several immediate priorities, under the theme of City Development, where it explains that the LDP will be vital to the delivery of the outcomes in the Belfast Agenda. Councils must take account of their current Community Plan when preparing a Local Development Plan (LDP). The LDP will provide a spatial expression to the community plan, thereby linking public and private sector investment through the land use planning system.

Figure 2: Watercourses of Belfast: Source DFI – Rivers Agency Dec 2015



Living with Water Programme – (DfI Rivers and NI Water)

2.38 The aim of the Living with Water Programme is to deliver a drainage plan for Belfast to protect against flooding, enhance the environment and enable the economy to grow. The drainage infrastructure of many towns and cities across NI, including Belfast, is currently inadequate, and this has resulted in:

- Instances of serious flooding occurring with increased frequency
- Belfast Harbour area falling from moderate to bad within the WFD classification
- The main WwTW (Waste water treatment works) serving Belfast is above its theoretical design capacity.

2.39 It recognises the need for cross-sectoral approaches to develop optimum solutions that can be efficiently delivered. DfI and NI Water set up a Strategic Drainage Infrastructure Board in January 2015 with representatives from key stakeholders.

The Reservoirs Act (Northern Ireland) 2015 (the Act)

2.40 This legislation will introduce a risk based approach to the management of the potential flood risk from controlled reservoirs and will have implications for the planning process. The legislation will apply to all reservoirs with a capacity greater than 10 000 cubic metres above the natural level of any part of the surrounding land.

2.41 The control and maintenance of reservoirs now falls under the remit of DfI Rivers. For all development proposals that are located within the potential flood inundation area of a controlled reservoir, DfI Rivers will further consider the application through the appraisal of the accompanying Flood Risk Assessment that will need to demonstrate suitable flood mitigation measures. If it is a new development proposal Rivers Agency will also need the applicant to demonstrate that the condition, management and maintenance regime of the reservoir is appropriate to provide sufficient assurance regarding reservoir safety. Controlled Reservoir Maps for Belfast are detailed in Appendix D

3.0 Flood Risk Profile

Flooding Oversight

3.1 Flooding is a natural process that cannot be entirely prevented. Some areas across the city are already susceptible to intermittent flooding from various sources, principally from;

- Rivers / watercourses, (fluvial)
- Coastal
- Surface water runoff. (pluvial / ponding)

3.2 With regard to flood risk and addressing all phases of flood risk management cycle, there are three main areas to focus upon:

- **Prevention** of damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas or by adapting future developments to the risk of flooding;
- **Protection** by taking measures to reduce the likelihood of floods and/or the impact of floods in a specific location such as restoring flood plains, wetlands, and gullies, and;
- **Preparedness** such as providing instructions to the public on what to do in the event of flooding (flood warnings /community flood action plans, flood evacuation protocols)

Belfast

3.3 Belfast is located within the River Lagan catchment and at the mouth of Belfast Lough. Within the Lagan Catchment there are a number of smaller tributary rivers flowing from the surrounding hills into the city to the River Lagan and Belfast Lough, all of which have the potential to flood during periods of heavy prolonged rainfall. Belfast is also at risk from flash floods caused by storm water unable to drain away quickly into the combined storm and sewerage network. Much of Belfast storm drainage and sewerage network was built in the late 19th and early 20th century. Further expansion of the city may result in additional pressure on the capacity of the network, potentially increasing the risk of flooding.

3.4 Belfast has a history of flood events and major damages are known to have been caused by both fluvial and pluvial events. This has significant potential adverse consequences to human life, property and the wider environment. Coastal and pluvial flood risks are both sensitive to climate change. It is therefore not surprising that Belfast accounts for a large proportion of the total geographical area that is estimated to be at “Significant" risk of flooding in NI.

3.5 As the city has expanded over the centuries, so too has the harbour and today the walls of the various docks and channels, which fringe the extensive harbour area, form a significant the proportion of the Belfast water frontage. Although Belfast has no formal sea defences, the dock walls at the harbour and channel side revetments of the rivers serve as a quasi-coastal defence which protects extensive low lying areas of the city centre from flooding, in all but the more extreme tidal events.

3.6 From a drainage aspect, Belfast is dominated by the River Lagan and its tributaries. The Lagan, which is around 70km long, rises on the western slopes of the Slieve Croob Mountains near Dromara (County Down) and drains an area in excess of 600km2.

Although the river is tidally influenced downstream of the Stranmillis Weir in Belfast, this influence has been limited to extreme high tides only, due to the construction of the Lagan Weir.

3.7 Within the city, various tributaries feed into the River Lagan from the west and the east. The east Belfast catchment covers an area of 26km^2 and the two main watercourses draining this area are the Loop River and Knock River. These combine to form the Connswater, which discharges into the Musgrave Channel in Belfast Harbour. The west Belfast catchment is approximately 55km^2 and the main watercourses draining this area are the Blackstaff and the Farset, which rise in the hills to the north of the city. Within the urban extents of the city, almost all of main watercourses and their tributaries are heavily modified and partially culverted.

3.8 Within the last ten years there have been five significant flood events in Belfast which has caused considerable disruption for property owners. The effects of flooding on human activity are wide ranging, with the potential to cause fatalities and injury, displacement of people, pollution and health risk, damage to buildings, adverse environmental impacts and to severely compromise economic and social activities.

3.10 In Belfast it is estimated that up to 9,800 properties are potentially at significant risk of flooding from rivers. Approximately 6,000 of this number would be at risk of flooding from both rivers and the sea and almost all of these are located within the floodplain of the tidally influenced lower reaches of the River Lagan. Significant portions of the city lie within flood plains.

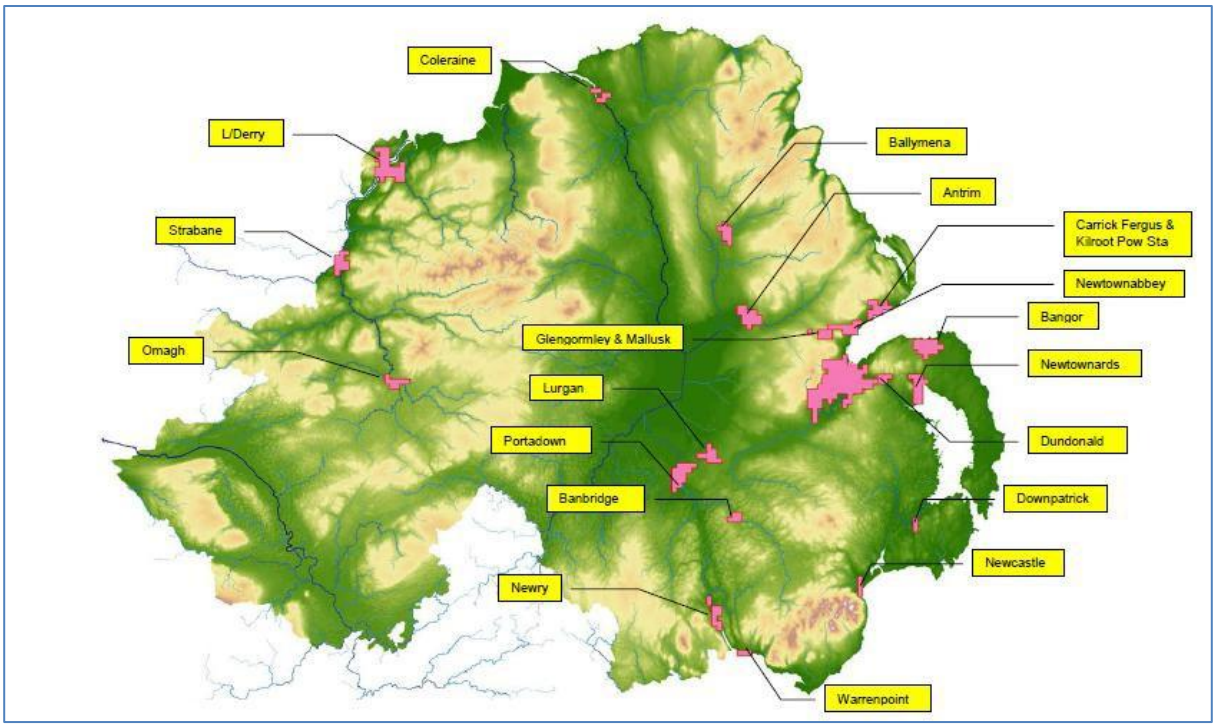
3.11 The Local Development Plan takes account of the potential risks from all sources of flooding over the plan period and beyond as this is likely to influence decisions on such matters as the zoning of land for various uses including residential or economic development. The LDP should avoid zoning sites for development in flood risk areas.

3.12 The SPPS defines a river flood plain as the extent of the areas flooded in a 1 in 100 year return period flood (1 in 200 year return period flood for coastal). It is not uncommon for floods to exceed these return periods. In recent years there have been a number of river floods in Northern Ireland that have been greater than 1:100 years, sometimes by a considerable margin (as was the case in the August 2017 flooding in the North West of NI).

3.13 A review into the North West flooding event of August 2017 concluded in March 2018. This flood event caused damage to approximately 400 homes, numerous businesses and significant areas of agricultural land. There was significant damage to infrastructure, with 210 roads either closed or impacted. Of the 650 bridges affected 89 required remedial action and 5 required total replacement. The review, jointly led by the Department of Infrastructure (DFI), The Executive Office (TEO) and Derry City and Strabane District Council (DCSDC) gathered evidence from a wide range of sources and examined the local tactical response and regional strategic response to the flooding. The review endorsed the effectiveness of the emergency response to this emergency, whilst also identifying 14 recommendations where improvements could be made to potentially mitigate the impact of any future flooding. Furthermore, the DFI's 'North West Flooding Review Report' highlights the importance of having and applying robust planning policies that take appropriate

consideration of flood risk both in terms of preparing new local policy through LDPs and when taking decisions.

Figure 3: Belfast is within the top 20 identified flood risk areas across the region



Flood Mapping

3.15 DfI Rivers) published its Flood Risk Management Plans in December 2015. The documents can be viewed on the DfI website. The maps were produced as a requirement under the EU Floods Directive, with the goal to provide a holistic, structured approach to the management of flood risk and to be used as correlation analysis that can help inform decision regarding future flooding matters.

3.17 A common reference in flood risk is the 100 year flood, also known as the 1% flood. This essentially means that in any given year there is a 1% chance a flood risk area will flood. There are three different kinds of flooding shown on the flood maps (surface water, rivers and the sea). The table below indicates the probability of a flood event from occurring annually.

• 1%	AEP = 1 in 100 year event	Greater rainfall event
• 2%	AEP = 1 in 50 year event	
• 5%	AEP = 1 in 20 year event	
• 10%	AEP = 1 in 10 year event	
• 20%	AEP = 1 in 5 year event	
• 50%	AEP = 1 in 2 year event	
• 100%	AEP = Happens every year	Lesser rainfall event

Flood Resilience Measures

3.18 As Belfast develops further, there risk is that more water runs rapidly into rivers and less filters through soil. This can lead to localised flooding and water pollution. A new approach is required to deal with the overland flow and slow down the speed in which precipitation occurs thus avoiding flash flooding. Sustainable Drainage Schemes (SuDS) provide an alternative approach. Rather than seeing water in the built environment as a threat, we should take the opportunity to develop a green and blue infrastructure network in the city, integrating SUDs that will deliver effective drainage while at the same time avoiding increased flood risk. It will manage rainfall to mimic natural drainage and minimise adverse impacts on water quality. SuDS can contribute to the amenity and aesthetic value of the development, as well as enhancing biodiversity. Permeable paving within developments can also help aid in which water filters through the paved structure rather than running off it.

3.20 Innovative designs to mitigate and adapt to flood risk will need to be considered to as part of the city's flood resilient measures. Retro-fitting existing properties can also help mitigate flooding as well as temporarily retain rainfall i.e. rain gardens and bio-swales, to help address flash flooding. Designs of buildings should also fully recognise flood levels across the city and finished floor levels should be set above the worst case design flood levels to mitigate risk.

3.21 There is a necessity to integrate water and land-use planning to mitigate flood risk. This is important during the preparation of the LDP and, naturally, through its future implementation. Planning policies can promote SuDS at design stage to address flood risk. Examples include, green roofs, permeable paving, soakaways, ponds and wetlands. Scientific evidence from a wide range of sources supports the view that tree-planting in upland and lowland areas can help minimise flood risk as part of a wider solution in sustainable natural flood management measures. Therefore, planning policy can promote this as a natural flood risk mitigation measure.

Coastal area

3.22 The RDS recognises that the Belfast Coastal Area (BCA) needs to be protected from coastal squeeze, to safeguard against loss of distinctive habitats and adapt to climate change. The Strategic Planning Policy Statement (SPPS) aims in regards to the coast reinforce what is stated within the RDS that any development within the coastal area should be highly sensitive the environmental surroundings.

Marine Plan

3.23 The Marine Strategy Framework Directive was formally adopted by the European Union in July 2008. It provides the legislative framework for an ecosystem approach to the sustainable management of the marine environment. The Marine Policy Statement (MPS) was published in 2011 and was prepared and adopted under the Maine and Coastal Access Act 2009. The MPS provides the policy framework for the marine planning system and aids decision making on plans affecting the marine environment.

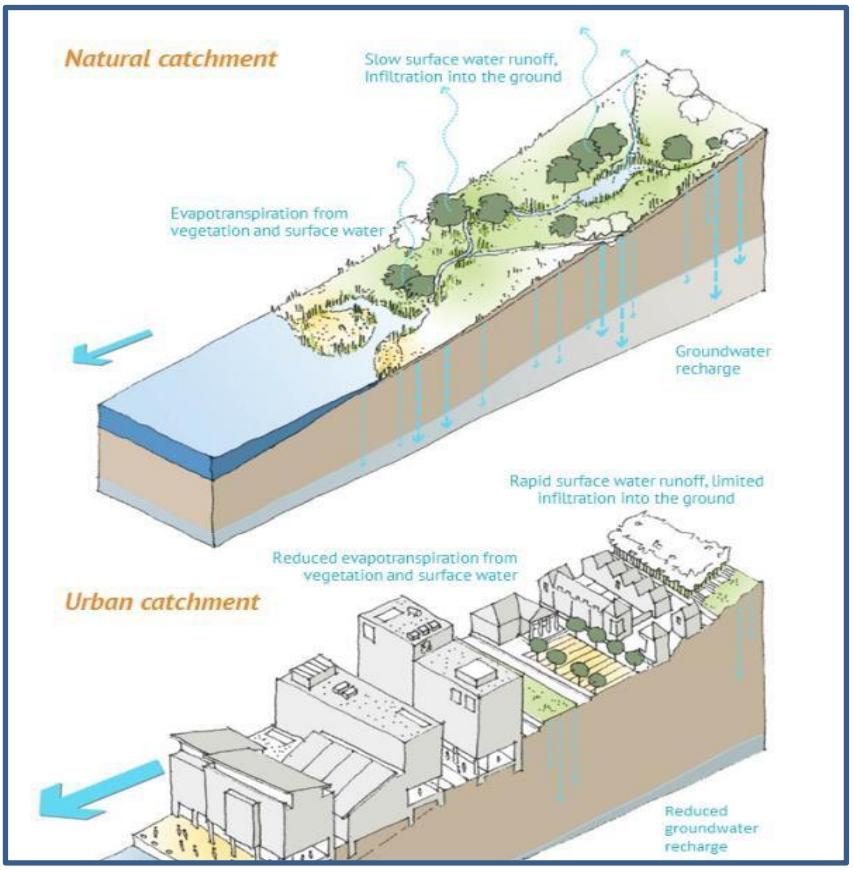


Figure 4: Urban growth adds pressure on surface water run-off outlets
Source: http://www.susdrain.org/images/catchments_resized_png.png

Figure 5: DfI Rivers map of Belfast Council's Coastline

3.24 The Marine and Coastal Access Act 2009 (MCAA) and the Marine Act (Northern Ireland) 2013 (The Marine Act), require the Department of Agriculture, Environment and Rural Affairs (DAERA) to prepare marine plans to facilitate the sustainable development of the marine area. The UK Government has published a 25 year Environment Plan that commits to having UK Marine Plans in place by 2021.

3.25 The Northern Ireland marine area is made up of an inshore and an offshore region. The marine area comprises all marine waters including sea bed, subsoil, sea loughs and tidal rivers, so far as the tide flows at Mean High Water Spring Tide. The inshore region extends from the Mean High Water Spring Tide mark out to, at most, 12 nautical miles (nm) and includes tidal rivers and sea loughs. The offshore region is the area that extends south-eastwardly from the 12nm territorial limit to the outer boundary of the Northern Ireland marine area (31nm at the farthest point).

3.26 The interaction between the land and sea planning systems is important. Terrestrial planning extends to the Mean Low Water Mark while marine planning and licensing extend to the Mean High Water Mark. Therefore, the LDP will have to be cognisant of the emerging Marine Plan for Northern Ireland.

3.27 The draft Marine Plan for Northern Ireland was issued for consultation from 18th April to 15th June 2018 and consultations are now closed. The Marine Plan (when adopted) will be used by public authorities in taking decisions which affect or might affect the marine area, including authorisation or enforcement decisions, and decisions that relate to the exercise of any function capable of affecting the marine area.

3.28 The designated coastal area min Draft BMAP follows the coastline of Belfast Lough and extends to the Low Water Mark, including the narrow strips of coast between the High Water Mark and the Low Water Mark with the exception of the designated urban areas. It contains many environmentally sensitive areas and also listed buildings and scheduled monuments with an industrial heritage value. Any development for employment and port related activities within the harbour area will need to take these factors into account.

3.29 Draft BMAP Policy COU 3 - BMA Coastal Area states that within the BMA Coastal Area, planning permission will only be granted to development proposals which meet the following criteria:

- the proposed development is of such national or regional importance as to outweigh any detrimental impact on the coastal environment; or
- it can be demonstrated that any proposal will not harm the qualities of the coastal landscape, while still protecting nature conservation value.

3.30 It is recognised in the SPPS that some types of development require costal locations, such as ports, marinas, port-related industries and recreational projects. This will require to be considered during the zoning of land at the Local Policies Plan stage. The LDP should also identify areas of the coast that are known to be at risk from flooding, coastal erosion (or land instability) where new development should not be permitted.

4.0 Draft Plan Strategy Policy Approach

4.1 The LDP Preferred Options Paper (POP) set out the proposed vision, key aims and objectives for the new Belfast LDP and the public consultation has indicated wide general support for the proposed approach. The overall structure of the draft Plan Strategy (DPS) generally retains the thematic approach used in the POP, set under an overall vision and development strategy.

4.2 Sustainable and inclusive development is at the heart of the LDP and the LDP is required to strike a balance in meeting the economic, social and environmental needs of the current population, without compromising the ability of future generations to meet their own needs. This includes a presumption in favour of sustainable development to improve and enhance the balance between economic, social and environmental conditions to deliver economic success, and a better quality of life for people living in Belfast.

4.3 The POP identified a series of objectives to help deliver sustainable growth for Belfast. Whilst many of the objectives could ultimately affect our environment, the DPS must ensure that flood risk to people and property is not increased as a result of development. The following two objectives are of particular relevance to this document:

- Adopt the precautionary approach in relation to flooding; and
- Adapt for the potential implications of environmental changes through management of development within areas of risk and designing new development to reduce future risk from flooding by introducing SuDS measures.

4.4 Following on from the POP stage, the DPS includes a number of strategic policies that over-arch the entire plan. These also relate to the overall vision and provide a link to the more detailed operational policies. The most relevant DPS strategic policy to this technical document is Policy SP2 – Sustainable Development – an overarching presumption in favour of sustainable development. Policy SP6 - Environmental resilience also supports development that protects/improves the environment and helps to mitigate and adapt to environmental change.

4.5 These over-arching policies support development that includes measures to adapt to environmental change, including resilience to flood risk and extreme weather conditions and enhancement of the green and blue infrastructure, to ensure sustainable and enduring development and protect public safety. They also provide guidance to developers to aim for the best environmental options and most sustainable design and development strategies.

4.6 Taking the above into account, the DPS has addressed the issues around flood risk through two policies, namely ENV4 Flood Risk and ENV5 SuDS. There are also clear linkages to other policies, including those relating to environmental change (mitigating and adapting) and sewerage and water policies and sustainable design principles. The DPS acknowledges the need to adopt a precautionary approach and to avoid where possible the selection of flood prone land for employment and housing. It also recognises the need to

promote a more sustainable approach to the provision of water and sewerage and flood risk management.

4.7 As previously discussed, there will be the need to consider where best to permit and encourage appropriate development. This includes identifying areas within the city that are of the lowest flood risk and facilitating development that does not increase flood risk elsewhere. There is a need to work collaboratively within a multi-agency framework in order to respond to flooding and associated risks, ensuring that new development is not exposed unnecessarily to flooding. It is intended to provide supplementary guidance on this issue in association with DfI Rivers.

4.8 In bringing forward the DPS, consideration has been given to the promotion and integration of land drainage as a critical element of design. The DPS will require that SuDS measures are incorporated into proposals at design stage to address flood risk and protect water quality. This will also help to ensure a proactive approach towards flood risk. Innovative designs to help address flood risk will be encouraged that will act as part of flood resilient measures.

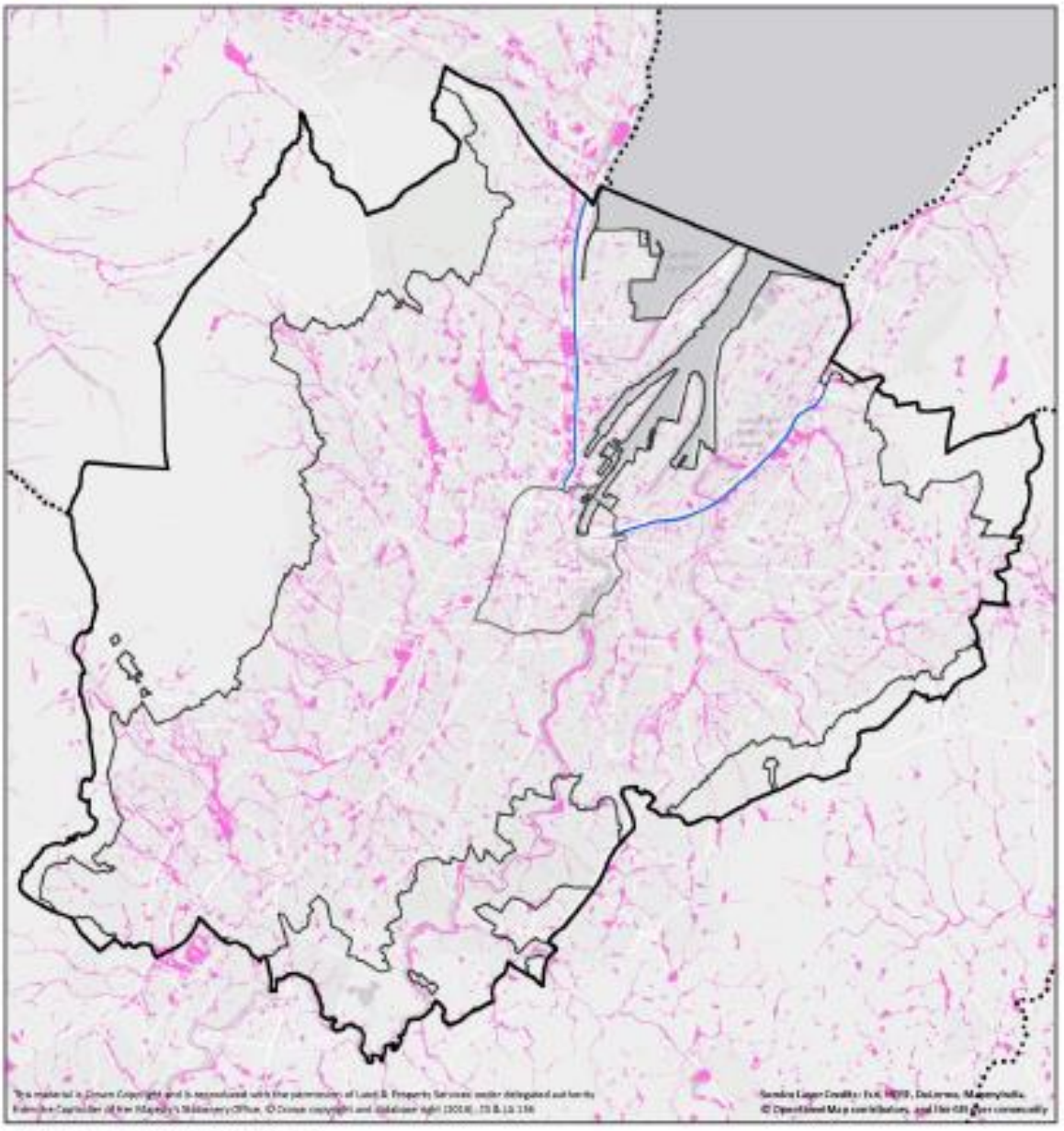
4.9 The DPS will also focus on creating and protecting a citywide green and blue infrastructure network. These green and blue networks and linkages provide a range of benefits, including in relation to environmental resilience, addressing climate change and mitigating flood risks.

4.10 The DPS policy approach is consistent with SPPS and also adopts a precautionary approach to seek to avoid flood risk areas or exacerbate the risk of flooding. The SPPS contains planning policies in relation to flooding and the LDP approach recognises this. The council will work with the relevant statutory bodies to ensure that future development is consistent with policy. The DPS also recognize the value of natural processes to assist in surface water management and it promotes the incorporation of SuDS measures in new development. This approach will also inform the next stage of the LDP, the Local Policies Plan, in the event that there are site-specific land use implications. In the meantime, any development proposals will be assessed against the relevant policy framework set out in the DPS.

Appendix A: Flood Hazard Map- Surface Water

Belfast City Council

FLOOD RISK AND COASTAL DEVELOPMENT



Flood Hazard Mapping - Surface Water

Climate Change - Surface Water:

Surface Water (i2000CC)

Source: Mapping and Modelling Unit, Rivers Agency

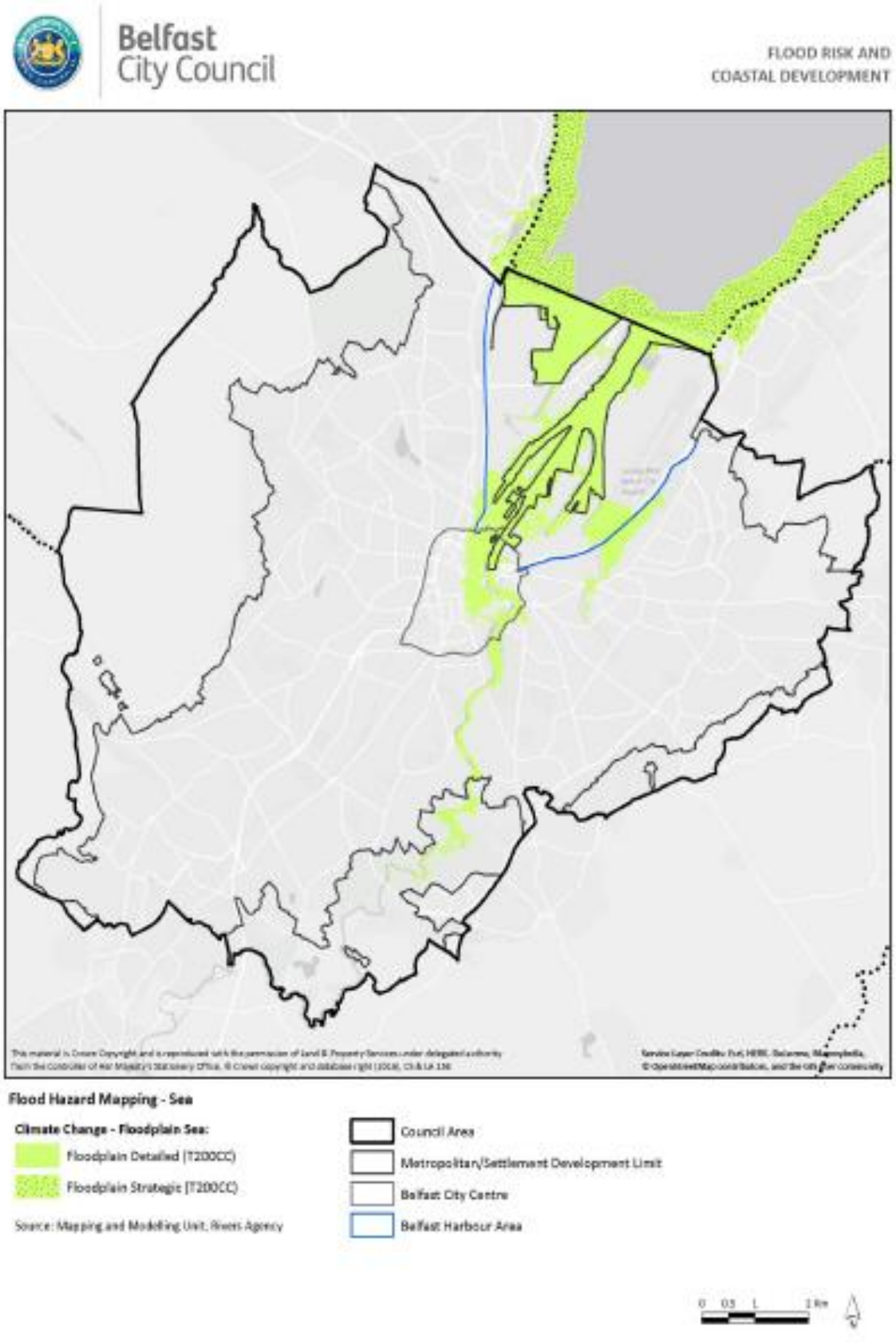
Council Area

Metropolitan/Settlement Development Limit

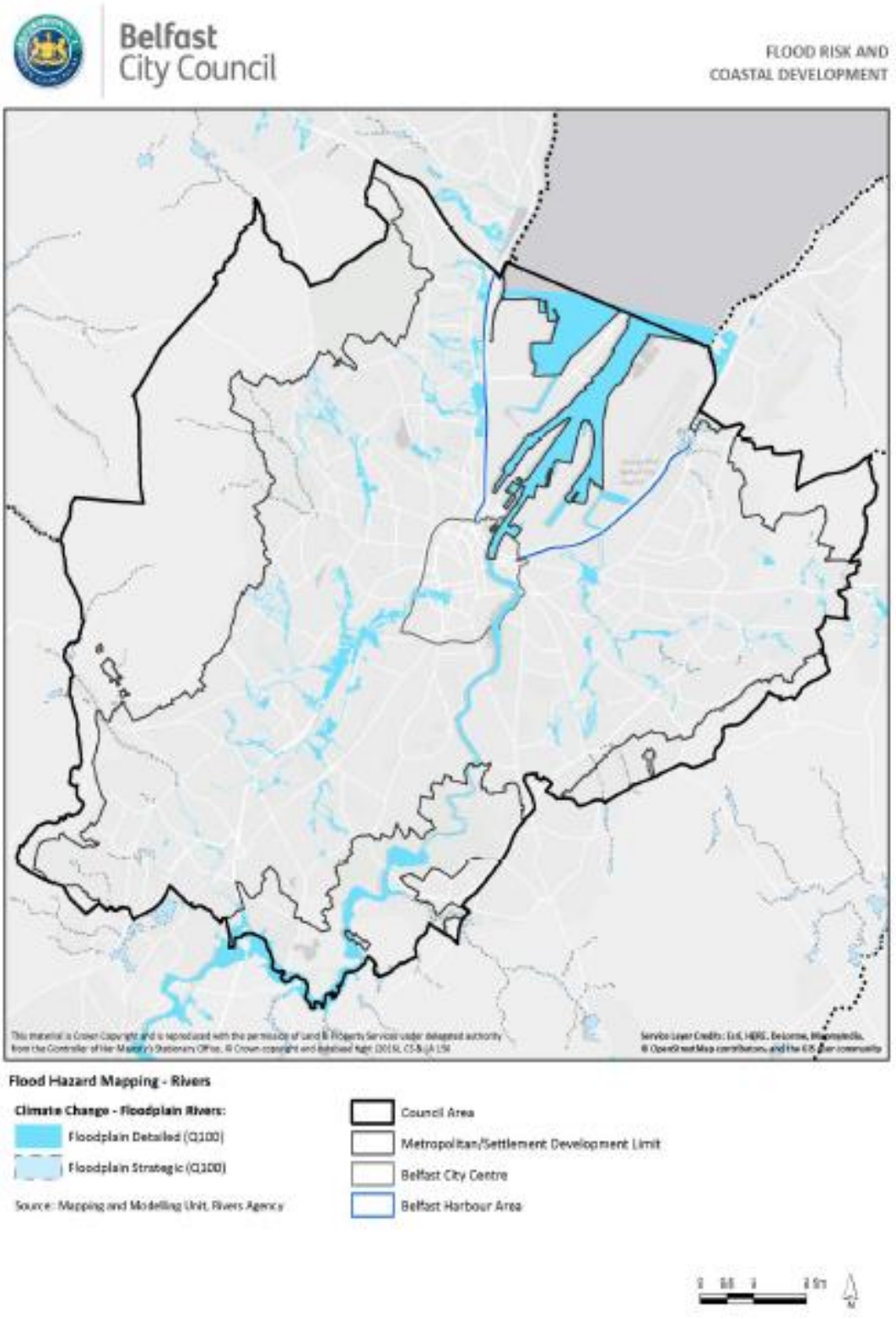
Belfast City Centre

Belfast Harbour Area

Appendix B: Flood Hazard Map- Coastal/ Tidal



Appendix C: Flood Hazard Map- Rivers

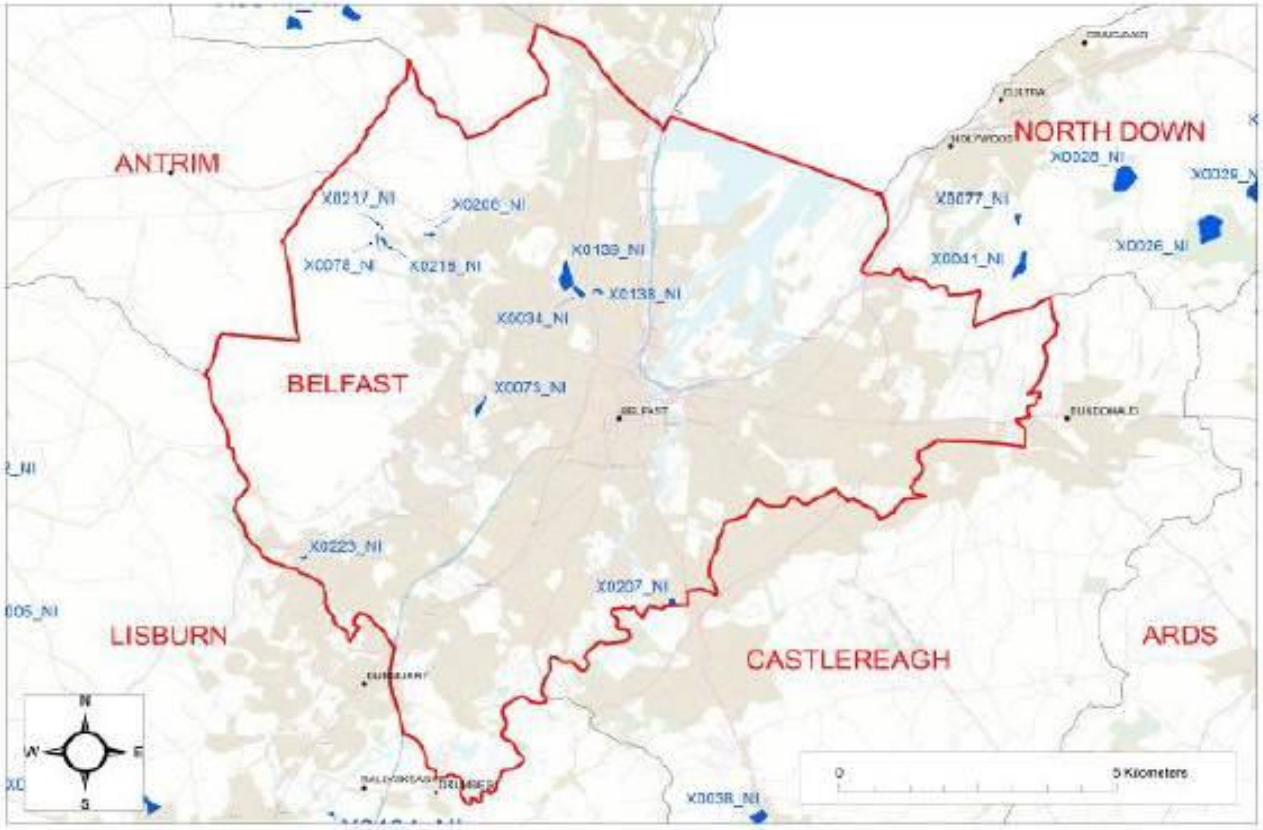


Document Number: 236152
Document Name: Position Paper – Flooding and Coastal Development

Appendix D: Reservoirs Map

Reservoirs in

Belfast City Council Area



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Alexandra Park Pond	X0138
Antrim Road Waterworks (Lower)	X0034
Antrim Road Waterworks (Upper)	X0139
Boodles	X0208
Galwally	X0207
Half Moon Lake	X0223
Springfield (Mackies)	X0073
Wolfhill Lower	X0217
Wolfhill Middle	X0216
Wolfhill Upper	X0078

Appendix E: Extracts from PPS15

Annex A: Impacts of Climate Change

A1 The most recent climate change predictions up to 2100 date from 2009 and have been estimated by the United Kingdom Climate Projections (UKCP 09). These predictions update and replace those of UKCIP 02 and UKCIP 98. They are based on anticipated change to climate variables such as precipitation, temperature, wind speed and sea level rise and take account of different scenarios concerning varying levels of greenhouse gas emissions over the period.

A2 UKCP09 indicates an increased preponderance of hotter drier summers and warmer wetter winters, coupled with increased frequency of extreme weather occurrences such as heatwaves, dry spells, heavy rain and flooding. Some of the key findings from the Climate Change Projections estimate that by the 2050's Northern Ireland will have:

- An increase in winter mean temperature of approximately 1.7 °C;
- An increase in summer mean temperature of approximately 2.2°C;
- Changes in winter mean precipitation of approximately +9%;
- Changes in summer mean precipitation of approximately -12%; and
- Sea level rise for Belfast of 14.5cm above the 1990 sea level.

A3 Whilst flood risk is generally expected to increase in response to climate change, there is uncertainty surrounding the flood risks that particular areas of Northern Ireland face both today and in the future. This uncertainty applies both to the degree of climate change that will occur, and the implications this will have for rainfall patterns, and the permeability of the land.

A4 Flood risk is also driven by non-climate change factors. In this context the ongoing expansion of urban areas will increase flood risk as the loss of natural permeable ground and its replacement with impermeable surfaces leads to faster surface run-off into watercourses in the event of heavy rainfall.

A5 The key challenge for flood risk management is that the effect of these drivers (and more specifically changes in these) on the risk of flooding is not certain, with no clear evidence linking changes in these factors to given changes in flooding levels in particular areas. As a result, there are many potential future levels of flood risk that could be realised, with no clear consensus over which levels of flood risk are more likely than others.

A6 The most recent assessment of the potential local impacts of climate change is the Northern Ireland Climate Change Risk Assessment (CCRA) [1] This identifies, for different sectors such as agriculture, health, transport, business and the natural environment, the risks and opportunities likely to ensue through climate change. The report informed the Northern Ireland Climate Change Adaption Programme,

[1] http://www.doeni.gov.uk/climate_change_risk_assessment_ni_2012.pdf

published in January 2014, which will identifies priorities for action and appropriate sustainable adaptation measures that will be required to minimise risks to the economy, environment and society.

A7 Climate change adaptation is about dealing sustainably with the consequences of a changing climate, adapting to those impacts and reducing exposure to the risk of damage. It is also about developing the capacity to cope with unavoidable damage and taking advantage of any new opportunities that arise. Sustainable adaptation with regard to flood risk will include a combination of a number of the following measures: -

a. Updating climate change flood maps to inform future development proposals.

b. Strengthening planning policy so as to minimise development in flood prone areas

c. Improving the resilience of existing flood defence/drainage infrastructure

d. Upgrading of storm and drainage culverts and managing exceedance

e. Introducing SuDS solutions to complement traditional drainage solutions.

f. Better preparation and flood proofing for those properties that are at increased flood risk including those which may have had no previous flood history.

g. Improved flood warning systems and emergency call out procedures.

Further information is available online:

Nationally:-
http://ukclimateprojections.defra.gov.uk

Local:-
http://www.doeni.gov.uk/index/protect_the_environment/climate_change.htm

Annex B: Impact of Flooding on People and Property

Introduction

B1 The effects of flooding can impact on a wide range of human activities and interests, the most obvious being the health and well-being of people directly caught up in flood events and the damage caused to property by inundation of flood water.

B2 Related socio-economic impacts can also affect the well-being of the wider community. These may range from loss of homes and personal possessions, to the disruption of key infrastructure and services and the local economy, the loss of business confidence and damage to cultural heritage and the environment. Additionally, repeated flooding of properties is likely to impact on property prices, the ability to get a mortgage agreement and the availability of affordable property insurance.

B3 When considering new development in flood risk areas it is important to understand all the impacts that the flooding may bring, direct and indirect impacts, tangible and intangible losses and the immediate and long term damage and disruption.

B4 The multiple impacts of inappropriate development in flood risk areas means that government may be compelled at a later stage to provide hard-engineered flood defences. This invariably involves significant costs which may not be affordable.

The Impact on Health and Well Being

B5 Loss of life from drowning or physical injury arising from being swept away by floodwater is very rare in Northern Ireland. However, there is growing concern about the potential adverse health effects associated with the trauma of a flood event. Living in a damp and dirty environment that such events cause and the anxiety that living in an area liable to flooding can create are increasingly recognized. Table 1 highlights the possible health implications flooding can have.

Table 1: Health Implications of Flooding

Direct Effects

Causes	Health Implications
Stream flow velocity; topographic land features; absence of warning; rapid speed of flood onset; deep floodwaters; landslides; risk behaviour; fast flowing waters carrying debris	Drowning Injuries
Contact with water	Respiratory diseases; shock; hypothermia; cardiac arrest
Contact with polluted waters	Wound infections; dermatitis; conjunctivitis; gastrointestinal illnesses; ear, nose and throat infections; possible serious waterborne disease.
Increase in physical and emotional stress	Increase of susceptibility to psychosocial disturbances and cardiovascular incidences

Indirect Effects

Causes	Health Implications
Damage to water supply systems; sewage and sewage disposal damage; insufficient water supply	Possible waterborne infections (e.g. enterogenic E coli, shigella; hepatitis A; leptosperiosis)
Disruption to transport systems	Food shortages; disruption of emergency services.
Underground services disruption; contamination from waste sites; release of chemicals, oil, petrol storage etc.	Potential acute or chronic effects from chemical pollution.
Standing waters; heavy rainfall, expanded range of vector (disease carrying organism – especially insects) habitats	Vector borne diseases.
Rodent migration	Possible diseases caused by rodents.
Disruption of social networks; loss of property, jobs and family members/ friends	Possible psychosocial disturbance
Post flood clean-up activities	Electrocutions; other injuries
Damage to or disruption of health services	Decreases in standard of or insufficient access to health care

Source: Floods: Climate Change and Adaptation Strategies for Human Health (WHO 2002)

The Impact on Property

B6 The severity of damage to buildings is often dependent on the depth and duration of the flood event. Table 2 illustrates flood damage to a typical residential property. Flood proofing of property is addressed in Annex E

Table 2: Flood Damage to a Typical Residential Property

Depth of Flood	Damage to Building	Damage to Services/ fittings	Loss of Personal Possessions
Below ground level	Minimal damage to main building. Flood water enters basements, cellars and under floor voids. Possible erosion under foundations.	Damage to electrical sockets and other services. Carpets in basements and cellars may need replaced	Possessions and furniture in basements and cellars damaged.
Up to half a metre above ground floor level (GFL)	Damages to internal finishes, plaster, wall coverings etc. Floors and walls become saturated requiring cleaning and drying. Flooring may require replacement. Damage to external and internal doors, skirting, etc	Damage to electricity meter and fuse-box. Damage to gas meter, low level boilers and telephone services. Carpets and floor covering may need replaced. Kitchen units and electrical appliances may need replaced	Damage to furniture and electrical goods. Damage to small personal possessions. Food in low cupboards contaminated
More than half a metre above GFL	Increased damage to walls. Possible structural damage	Damage to higher units, electrical services and appliances	Damage to personal possessions

Source: Preparing for Floods (DLTR, 2002)

Implications on Property Insurance

B7 Flood insurance in Northern Ireland has recently been provided for under the Statement of Principles (SoP) which was a temporary agreement between the insurance industry represented by the Association of British Insurers (ABI) and the Northern Ireland Assembly. The SoP ensured that with certain conditions in place that private flood insurance remained widely available as a standard feature of domestic property insurance and where possible at an affordable price. However the SoP expired in June 2013. The government and the insurance industry are currently working on a new approach which through a financial arrangement will ensure that flood insurance will remain widely available to all. Nevertheless, the accessibility of affordable insurance should be an important consideration for those proposing new development or purchasing property within flood risk areas. Property insurance premiums will be proportionate to the flood risk and the application of flood mitigation measures such as flood proofing of buildings and the establishment of "self help" procedures in preparation for flood emergencies. Developers should always consider alternative site locations outside the flood risk area. However, where the principle of development within a flood risk area has been established, the developer should liaise with the insurance industry at an early stage so as to ascertain if the proposed means of mitigation of the flood risk is sufficient to enable affordable flood insurance to be made available for subsequent property owners and tenants.

Impact on the Environment

B8 River and coastal flood plains are valuable ecological resources which provide habitat for a wide range of plants and animals, many of which are rare. A number of the priority habitats identified in the Northern Ireland Biodiversity Strategy are associated with floodplains. In addition, flood plains are often important landscape assets and the location of features of the archaeological and built heritage. Flood events can damage ecosystems, habitats, archaeological / built heritage assets and landscape features, and development can exacerbate such damage. The natural regulation of floodwater limits ecological damage caused by flooding, while pondage areas provide for the trapping and deposition of sediments and recycling of the nutrients from run-off

Conclusion

B9 Human activity can therefore have a significant impact in increasing flood risk and new development that is constructed without regard to flood risk may serve only to endanger life, increase property and environmental damage and require wasteful expenditure on remedial works.

Annex C: Sustainable Drainage

Development and Drainage

C1 Development inevitably results in hard, impermeable surfaces such as roofs, roads, footpaths and parking areas which traditionally drain surface water to pipes and sewers and thence to rivers. With development, the area of green space decreases and the volume and velocity of drainage water from the development site increases. Our existing engineered drainage network serving Northern Ireland is under considerable capacity pressures. Sustainable drainage offers a solution to support future development while avoiding increased pressure on the existing infrastructure. The use of sustainable drainage (SuDS), particularly for new developments, will provide drainage solutions while not adding more pressure to the existing drainage network.

C2 Taking into consideration the latest research findings on climate change, which predicts more frequent and higher intensity rainfall events, it is imperative that the increased flood risk, particularly in urban and built up areas, is properly managed. Sustainable drainage is a key element in future climate change adaptation planning.

C3 Traditionally, drainage has involved the installation of underground pipes to convey water away as quickly as possible. Although this approach may prevent local flooding it can simply transfer flood risk to other parts of the catchment. Piped drainage systems can become overwhelmed during prolonged periods of high intensity rainfall, particularly where drainage bottle-necks occur in urban centres. Additional water quality problems will occur where surface water and sewage are transported in the same pipes and flooding occurs.

C4 Currently there is an automatic right for developers to connect surface water run-off to a surface or combined public sewer. When accompanied by ongoing urban development and the projected changes to rainfall patterns resulting from climate change, the climate change predictions, if realised, will significantly increase both the volume and flow rate of storm water, thus increasing the risk of flooding in the future. An alternative approach widely used in other parts of the United Kingdom and European Union to address these problems involves the embedding of sustainable drainage measures into new development through the planning system. The current uptake of sustainable drainage solutions for new development within Northern Ireland is estimated to be below 5%.

Sustainable Drainage Systems

C5 Careful design and incorporation of SuDS into new development or redevelopment schemes will deliver effective drainage while at the same time avoiding increased flood risk downstream. Sustainable drainage effectively delivers on the three 'pillars' that define the concept, i.e. water quantity, water quality and amenity / biodiversity, as depicted below:

Water Quantity

Manage rainfall to mimic natural drainage

- Reduce run-off rates
- Reduce additional run-off volumes and frequencies
- Encourage natural groundwater recharge
- Reduce the impact of short duration intense storm events, in particular helping to reduce the impact of 'out of sewer' flood / pollution events

Water Quality

Minimise adverse impacts on water quality

- Reduce pollution and protect the quality of receiving waters
- Prevent direct discharge of spillage - SuDS used at the construction stage for a development is considered as 'best practice'
- Reduce the volume of surface waste runoff to sewers and so reduce storm overflows

Amenity and Biodiversity

- Contribute to the amenity and aesthetic value of the development and the wider environs
- Provide habitat for wildlife and enhance biodiversity

Sustainable Stormwater Management Techniques

C6 There is a wide range of sustainable drainage techniques available to developers[17], which can be applied, individually or in combination. A combination of techniques will deliver the best results – for example, a housing development where downpipes are fitted with water butts, the driveways use permeable paving, all connecting to conveyance swales, which in turn are linked to a pond or wetland area. This combination of drainage techniques is known as a 'treatment train'.

Benefits of Sustainable Drainage

C7 Whilst the focus in PPS 15 is on flood risk management benefits, it should be noted that sustainable drainage offers a wide range of environmental, economic and social benefits.

C8 Flood Risk Management Benefits

With climate change predictions for more extreme rainfall events, sustainable drainage systems will provide more drainage capacity and will incorporate a design capacity considerably greater than traditional pipes. Accordingly, they offer greater flood protection. The main flood risk management benefits are outlined below:

17 **British Standards Institution Publication BS 8582:2013**
Code of practice for surface water management for development sites
Published November 2013.

- SuDS reduce peak flows through the use of appropriate sustainable drainage techniques and will reduce the impact of localised surface water flooding;

- The reduction of peak flows from new development sites incorporating SuDS means that less stormwater will discharge to downstream drainage networks or watercourses, thereby reducing flood risk;

- Effective sustainable drainage systems can reduce the demand for and cost of flood emergency response and preparedness procedures;

- Sustainable drainage promotes a joined up approach to flood risk management as it requires input from a range of responsible bodies (e.g. the flood risk management authority, local councils, the land use planning authority, statutory undertakers) and a wide variety of disciplines (engineers, planners, architects / designers, hydrologists, water quality expertise and ecologists).

C9 Environmental Benefits

While the flood risk element of the disposal of surface water and the impact on human health and safety has long been a material consideration in the determination of planning applications; environmental considerations such as amenity, ecology and water resource issues have historically had limited influence on drainage system design and the determination of development decisions. However, the EC Water Framework Directive now requires urban diffuse pollution to be regulated through the implementation of the Directive. This means that continuing to drain built up areas without taking due account of wider environmental impacts, particularly on water quality, is no longer an option.

C10 Sustainable drainage provides opportunity for the realisation of a number of environmental benefits. These include:

- Improved water quality. This can be delivered in a number of ways, including: (a) natural treatment provided within the SuDS component – for example by filtering drainage thus reducing the level of sediment discharging to watercourses; (b) absorbing of nutrients by plants growing within the SuDS system; and (c) reduced volumes within the combined piped sewerage systems will mean fewer spills of storm sewage to watercourses.
- Increased capacity for water storage through retention of storm water, for example in basins, ponds and water butts provides opportunities for this water to be reused. This in turn creates potential for households and businesses to reduce their consumption of potable water;
- Conservation of biodiversity and ecology will be supported through the incorporation of SuDS features such as ponds and wetlands;
- A well designed SuDS system can connect into and support the existing drains and waterways located beyond the development site, thus extending biodiversity via new nature corridors.

C11 Economic Benefits

Economic benefits likely to accrue from sustainable drainage include the following:

- The increased application of on-site sustainable drainage solutions by the developer will mean that less investment will be required in the provision and maintenance of traditional piped infrastructure. This should reduce costs for infrastructure providers such as DfI Transport NI, DfI Rivers Agency, DAERA and Northern Ireland Water and also the need to seek cost recovery from the developer;
- The removal of storm water from combined sewerage systems will reduce the running costs of sewage treatment works and costs associated with pollution of watercourses;
- Developer savings can accrue through the combination and integration of sustainable drainage with open space provision, particularly on residential sites where the latter is usually required for amenity reasons[2];
- Developer costs associated with designing and installing a sustainable drainage system are invariably less than with a traditional piped system;
- The retention of stormwater as a consequence of sustainable drainage may offer scope for rainwater harvesting and the reuse of this water can result in economic benefits. Considerations such as long term water resource security and improved water supply efficiency are assuming greater economic importance in the face of continually increasing demands upon water resources;
- Buildings overlooking water features generally command higher than average premiums;
- Although difficult to quantify, the benefits to societal health and well-being (see below) associated with sustainable drainage, particularly within urban areas, are likely to reduce public expenditure in such sectors as health and social services.

C12 Social / Amenity Benefits

Sustainable drainage also offers scope for the realisation of significant social, recreational and health / quality of life benefits. Examples include the following:

- The potential of some elements, such as swales, basins, ponds and wetlands to contribute to the provision and integration of 'green infrastructure19' within the urban fabric helps to deliver the quality of life benefits associated with green infrastructure;
- The potential use of some elements, such as ponds, for active and passive recreational purposes and educational purposes;
- Improved water quality generally will benefit public health and enhance the enjoyment of water based recreational activities such as angling;
- The risks to those suffering from respiratory conditions, notably asthma, resulting from air pollution, have been shown to reduce through the chemical effect of certain sustainable drainage systems in trapping pollutants. Such benefits are particularly realised in large urban areas where levels of air pollution are usually highest.

[2] PPS 8 states 10% of the total site area as a normal expectation for open space provision in new residential development with this proportion rising to 15% for developments in excess of 300 units or 15 hectares.

Feasibility and Design Considerations

C13 There are a number of considerations which may influence the choice and design of sustainable drainage solutions for specific sites. These include the following, although the list is not exhaustive:

- The surface structures that may be needed can use more space than conventional systems, although it is usually possible for them to be integrated into the surrounding land use, for example in public open space or road verges;
- Infiltration may not be possible or is likely to be restricted in a number of circumstances; for example, if the permeability of the soil is limited, or the water table is high, or the land is contaminated or where there is ground instability. However, in all such situations, alternative SuDS solutions are usually available;
- Safety and access considerations associated with surface water will always need to be considered as part of the overall design of the development in general and surface water SuDS features in particular, so as to minimise risks.

Sustainable Drainage and the Planning Process

C14 Currently, the option of using sustainable drainage to help offset flooding risk or as a more sustainable option to traditional piped drainage is not integral to the planning process. However, legislation is currently being considered within government which will support the implementation of sustainable drainage.

C15 Notwithstanding the current legislative position, development proposals that facilitate sustainable drainage while meeting broader planning objectives or requirements will usually be considered favourably by the planning authority. It is recognised for example that sustainable drainage offers much potential for providing amenity open space and enhancing quality in residential environments. The planning authority will therefore encourage early engagement with the developer and also between the developer and other relevant agencies and disciplines (e.g. architects, drainage engineers, landscape architects, ecologists). This will inform the planning and design of a sustainable drainage system that is suitable for the particular characteristics of the site and its surroundings. It will also influence the layout of the site and identify the potential for the drainage system to deliver planning and environmental benefits. Other considerations such as safety issues and long term operation and maintenance arrangements are also best addressed at an early stage.

The Future for Sustainable Drainage in Northern Ireland

C16 In regard to the implementation of sustainable drainage, progress in Northern Ireland lags behind the other UK jurisdictions where legislation[3] is in place that makes SuDS a requirement for most new development schemes and designates specific bodies with statutory responsibility for approval and oversight of the SuDS elements.

C17 In Northern Ireland no such legislation is currently in place. However, it is government intention that sustainable drainage practices will ultimately be implemented as an integral part of the development process wherever possible. In September 2011 an inter-departmental / agency working party chaired by the

[3] The Water Environment (Controlled Activities) (Scotland) Regulations 2011
The Flood and Water Management Bill (England and Wales) 2012

Northern Ireland Environment Agency (NIEA) published the final version of "Managing Stormwater – A Strategy for Promoting the Use of Sustainable Drainage Systems (SuDS) within Northern Ireland". This report, which has been endorsed by the Assembly Environment Committee, promotes the use of SuDS as the preferred drainage option for new development. It also advocates the retrofitting of SuDS through joint action by DAERA DfI Rivers Agency, NI Water and DfI Transport NI, on those existing surface water drainage schemes which have a significant adverse effect on the environment, where this is practicable and economically viable.

C18 In June 2011 the Stormwater Management Group (SMG) was set up to implement the recommendations published in the Strategy document. Similar to the initial working party, this group has representation from all relevant government departments and agencies. Key deliverables identified by the SMG to deliver implementation by 2017 are as follows:

- **Implementation strategy** for sustainable drainage in Northern Ireland;
- **Legislation** which will enforce sustainable drainage
- **Technical guidance** for the most effective sustainable drainage systems;
- **|Approval Body** which will assess and approve sustainable drainage proposals for new and retrofit schemes. This body will work closely with the planning authority;
- **New Companies** will be created to service the new sustainable drainage systems, creating new jobs.

C19 It is anticipated that the ultimate delivery of sustainable drainage in Northern Ireland along these lines will enable the planning authority to require the use of such systems as part of most development proposals. From the planning perspective, it is imperative that a responsible approval body is in place, either to facilitate meaningful consultation on the sustainable drainage aspects of development proposals or itself to adjudicate on the merits of submitted proposals. Also important are the intended new service companies, as planning permission will not be granted without appropriate guarantees on the management and maintenance of sustainable drainage arrangements so as to ensure they will function effectively over the life of the proposed development.

Annex D: Assessing Flood Risk and Drainage Impact

Introduction

D1 Proposals that accord with the policies set out in PPS 15 must be accompanied, depending on the sources of flooding, by a Flood Risk Assessment (FRA) and / or a Drainage Assessment (DA). The detail of the Assessment should be proportionate to the scale and nature of the proposed development and the risks involved. The applicant should appoint a suitable qualified and competent professional to carry out the assessment. This Annex provides guidance on relevant considerations and information requirements concerning both types of assessment.

D2 A FRA must consider the flood risk from all sources of flooding where the proposed development is located within or in proximity to the fluvial (river) flood plain, the coastal flood plain or the flood inundation area of a reservoir. It should then identify measures that can be adopted to control and mitigate the flooding to the development or elsewhere as a result of the development. The main sources of flooding[4] (under the implementation of the EU Floods Directive in Northern Ireland) are:

- **Fluvial** – flooding from watercourses, either natural or man-made and either open or culverted. Such flooding is normally caused when channel or culvert capacity is exceeded and water flows out-of-bank onto the natural flood plain.
- **Coastal** – flooding from the sea when water levels exceed the normal tidal range and flood onto low lying areas along the coastline.
- **Pluvial** – flooding which results from excessive rainfall, generating overland flow that overwhelms existing drainage systems and / or collects in low lying areas.
- **Reservoirs** – flooding which occurs to the surrounding area as a result of reservoir failure, overtopping or the controlled release of water via spillways during periods of high flows.

D3 A Drainage Assessment should consider the flood risk mainly from pluvial flooding where the proposed development is located beyond the fluvial and / or coastal flood plain or a reservoir flood inundation area. It should then identify measures that can be adopted to control and mitigate the risk of flooding to the development or elsewhere as a result of it and include for the safe disposal of surface water runoff from the site.

When is a Flood Risk Assessment required?

D4 <u>When a more accurate definition of the Flood Plain and Extents is needed</u>
Due to the nature of the Strategic Flood Map for Northern Ireland the geographical extent of predicted flood areas cannot be precisely defined. In some cases reservoir inundation maps may not be available. A FRA to determine a more accurate extent of flooding is therefore necessary for development proposals located in proximity to the margins of the predicted flood plain, irrespective of whether the site lies just outside or just inside (wholly or partially) the extent as depicted on the Strategic Flood Map. In these circumstances it is sufficient for the FRA to identify the sources

[4] Infrastructure failure should also be considered as a potential source of flooding, which may occur as a result of a blockage or collapse within a watermain, culvert or sewer system.

of flooding and the resulting flood extents. For some sites the applicant may be able to demonstrate through a combination of local knowledge, photographs of historic flood events or a level survey that the site or part of the site lies outside the flood plain and would be suitable for development from a flood risk aspect. For other sites, a more detailed river model may be required. Preliminary discussion with Rivers Agency is advisable to ascertain the type of information required. Should the outcome of this exercise confirm that the development site or part thereof lies within the flood plain, then the applicant should consider a more suitable alternative location.

D5 When the proposed development is within the (fluvial / coastal flood plain / reservoir flood inundation area) and is otherwise acceptable under the policy

In circumstances where the proposed development is acceptable in principle under the policy, for example where it constitutes an exception to policy FLD1; PPS 15 still requires a FRA to be submitted to the planning authority as part of the planning application, so as to ensure the identification of all sources of flooding, the resulting flood extents and the means by which flooding is to be controlled and mitigated. A FRA should not be undertaken when a proposal is clearly unacceptable in principle under the policy as this will invariably result in nugatory work and expense on the part of the developer.

What information should be in a Flood Risk Assessment?

D6 When a more accurate definition of the Flood Plain and Extents is needed

For this purpose, the FRA will typically be required to contain the following information:

- A location plan to a suitable scale, which clearly illustrates geographical features and identifies the catchment, watercourses in the vicinity and the built development;
- A site plan (and where appropriate, cross sections) showing existing levels related to Ordnance Datum Belfast), existing structures, watercourses in or bounding the site, internal site drainage and drainage outfalls;
- Data on historical flooding events, including photographs and media reports, supported by information on rainfall, flood return periods and the probability of storm surge occurrences, where appropriate. Evidence on trends in flood occurrences and changes in the local environment since the last event is particularly valuable;
- A plan of the site showing the extent of the predicted Q100 / Q200 flood plain, and / or in the case of a reservoir, the extent of the predicted flood inundation area. This may require a local hydraulic model based on the topographical information, historical flood events and the assessment of design flow discharges at the site using industry standard methodologies.

D7 When the proposed development is within the fluvial / coastal flood plain[5]

The FRA in these circumstances will typically be required to contain the following information relating to the Assessment of the Flood Risk:

[5] Refer to FLD 5 in PPS15 J&A for guidance on FRA associated with development in proximity to reservoirs

- A location plan as detailed under paragraph 6 above;
- A site plan (and where appropriate, cross sections) showing pre-development and post-development levels related to Ordnance Datum Belfast, existing structures, development proposals, watercourses in or bounding the site, internal site drainage and drainage outfalls;
- Details of any existing or proposed flood alleviation measures or flood defence structures that may influence the site including information on their structural condition, level of protection and maintenance regime;
- The identification of all sources of flooding pre and post- development;
- An assessment of the hydraulic capacity and structural integrity of all drains and sewers within or bounding the site. The methodologies for assessment must be clearly identified;
- Data on historical flooding events accompanied by supporting information as detailed under paragraph 6 above;
- A plan of the site showing the extent of the predicted Q100 / Q200 flood plain and / or in the case of a reservoir, the extent of the predicted flood inundation area. This will involve the production of hydraulic models requiring longitudinal / cross sections of the watercourse and the site, assessment of flood discharges using industry standard methodologies, and the inclusion of information such as finished floor levels, access road and car park levels, estimated flood water levels, flood depths and velocities and associated probability of flooding;
- A plan and description of features which may influence local hydraulics. For example, bridges, pipes or ducts crossing watercourses, culverts, embankments and walls;
- An assessment of the likely speed of potential flooding, the sequence in which various parts of the site may flood, the likely duration of a flood event, the potential consequences of a flood event, the depth and velocity of flood water;
- Where appropriate, the likely impact of any displaced water or increased run-off from the development site should be estimated and the consequences for neighbouring or other locations assessed.

D8 Where the proposed development is located within the fluvial / coastal flood plain (or reservoir flood inundation area), the FRA will also be required to provide details of flood control and mitigation measures as well as safety procedures that will address the flood risks identified. The following considerations may be relevant:

D9 **Flood Control Measures**

- Infrastructure and drainage design where it may be possible to limit the flow and duration of flood water to the proposed development by diversion of flow paths, culvert upgrading and introduction of control structures such as sluices, weirs and sealed manholes;
- Management of residual flood risk through keeping development a safe distance away from flood defence structures and introducing sacrificial flood storage areas at the rear of defences;
- Suitable maintenance and management procedures;
- Ground water control and pumping.

D10 **Flood Mitigation Measures**

- Site design and layout such as siting built development so as to avoid areas of the site liable to flooding and flood flowpaths;
- Raising finished floor levels of new buildings;
- Coastal infilling / land raising;
- Flood resistant and resilient construction (refer to Annex E)

D11 **Safety Procedures**

- Flood and weather warning systems;
- Clear communication lines between those at flood risk and those with flood risk responsibilities;
- Emergency evacuation plans and procedures including safe access and egress for emergency rescue services;
- Capacity and procedures for the rapid movement of furniture and goods to locations outwith of the flood risk area;
- Safe shutdown of electrical supply for domestic and industrial use;
- Pollution control procedures.

Flood Risk Assessment – General Considerations

D12 While it will be necessary to consider all the factors identified above, the detail necessary is likely to vary from case to case, depending on local conditions and the scale and type of development proposed.

D13 Because of the uncertainties inherent in flood estimation and expected climate change impacts, the application of the precautionary approach to hydrological analysis of flood flows and the determination of flood event return periods requires any assessment of flood risk to incorporate the necessary allowances for increased rainfall, storminess and sea level rise specified in current UK research and guidance.

D14 All FRAs should acknowledge that there are no circumstances in which the risk of flooding can be removed entirely. In defended areas therefore consideration should always be given to the potential impacts of extreme events on defences, the residual risks and the minimising of risks to life and property in such events.

When is a Drainage Assessment required?

D15 Policy FLD 3 of PPS 15 requires a Drainage Assessment to be submitted to the planning authority along with the planning application, for development proposals located outside the fluvial and / or coastal flood plain, in any of the following circumstances:

- Where the proposed development exceeds the thresholds specified in the policy, for example 10 or more new dwellings;
- Where run-off from the development may adversely impact upon other development or features of importance to nature conservation, archaeology or the built heritage;
- Where there is evidence of a history of surface water flooding.

D16 The Drainage Assessment, as well as addressing surface water flooding, may also need to identify control measures for storm water discharge from the site. The use of sustainable drainage systems to manage and limit site discharges to pre-

development run-off rates is encouraged.

What information should be in a Drainage Assessment?

D17 A Drainage Assessment will typically be required to contain the following information relating to the assessment of surface water flood risk:

- A location plan as detailed under paragraph D6;
- A site plan as detailed under paragraph D7;
- Confirmation as to whether the proposed development is to be located on previously developed land (that may have minimal impact on the existing drainage network);
- Indication as to whether the local area has past flooding problems, which may limit site discharge to the local drainage and watercourses to pre-development run-off rates;
- Identification of likely overland flow paths including depth, velocities, timing and sequence of inundation;
- An assessment of hydraulic capacity and structural integrity of all drains and sewers within or bounding the site, which may result in out of sewer flooding. The methodologies for assessment must be clearly identified;
- Data on historical flood events accompanied by supporting information as detailed in paragraph D6;
- The likely impact of any displaced water or increased run-off from the development site should be estimated and the consequences for neighbouring or other locations assessed.

Flood Control Measures

- Internal drainage design, including rehabilitation of existing sewers and suitable discharge points to the local drainage and watercourse system that will encourage the safe disposal of storm water run-off away from the site and other neighbouring areas.
- On site SuDS solutions such as flood infiltration and storage that will alleviate the flooding and encourage the slow release of storm water to the local drainage and watercourse system.
- Where the upgrading / use of local drainage networks for additional extreme flows is not possible, designing for exceedence by including sacrificial flood storage areas, such as amenity areas, car parks, roads and pathways into the drainage design.
- Suitable maintenance and management procedures.

Flood Mitigation Measures

- Site design and layout to include infilling, ground re-profiling, raising of finished floor levels (FFL) and landscaping.
- Flood resistance and resilience construction, (Annex E) where raising the building is not possible.
- Ground water control and waterproofing for basement areas.

Safety Procedures

- Safe emergency access and egress routes to safe areas.

Supplementary Information in regard to site discharge to the local drainage network and/or watercourses

D18 In addition to planning requirements, developers will also need to ensure that the following requirements are met:

- An initial application should be made to the local Rivers Agency office for consent to discharge storm water under Schedule 6 of the Drainage (NI) Order 1973. An application form for discharge consent can be obtained at the web address below. https://www.nidirect.gov.uk/articles/rivers-and-watercourses.The completed application form should be sent to the relevant Area Office. If it is proposed to discharge storm water into an NI Water system then a Pre-Development Enquiry should be made and if a simple solution cannot be identified then a Network Capacity Check should be carried out.
- Details of how runoff from the site will be controlled and safely disposed of supported by relevant correspondence from Rivers Agency and/or Northern Ireland Water.
- It is the responsibility of the developer to satisfy the appropriate authorities that the internal site drainage complies with the appropriate legislation and includes for exceedence (refer to CIRIA document C635).

Annex E: Flood Proofing - Resistance & Resilience Construction

E1 The primary aim of planning policy on flood risk is to avoid new development in areas known to be at risk of flooding. However in certain cases, development within areas of flood risk may still proceed, for example where a proposal is deemed to be of overriding regional importance or is accepted as an exception to the policy for development in flood plains. Outside of flood plains, development within areas of surface water flood risk may be permitted subject to a satisfactory drainage assessment. In all such cases, consideration should be given to assessing and managing the flood risk through the adaptation of suitable flood proofing measures. For new development, permanent solutions which incorporate flood proofing into the structure of the building, such as by raised floor levels and impermeable walls will be preferred to other temporary measures. Below ground occupancy and basements should be avoided.

E2 The Building Regulations do not currently impose mandatory requirements for flood resistance or resilience construction for either new or existing buildings in flood risk areas. This position is under review and will be given consideration as part of a proposed Floods Bill for NI. In the interim, practical guidance to developers is available in technical guidance booklet C, which gives some relevant information on safe access and egress at times of flooding, the use of non-return valves for sewer flooding and the intrusion of groundwater through walls and floors.

Flood Proofing

E3 There are a number of routes by which flood water can enter a property. The most common ways are through door openings, patios and windows. Water can also find its way through air bricks on exposed walls, under foundations and through gaps in floors. Less obvious ways are via drains and pipes as the pressure created by flooding can reverse the flow and cause water to back-up and enter the property through sinks, toilets and washing machines etc.

E4 However there are a number of measures available to prevent or limit the damage and disruption caused through flooding. Buildings can be flood proofed through the use of "**flood resistance"** and/or **"flood resilient"** measures**.**

E5 **Flood resistance** is a term that refers to preventing or minimising flood water from entering a building. There are two types of methods available:-

E6 **Passive resistance** is where the flood mitigation is permanently in place. This is generally more feasible in new developments where the property is designed so that flood water is excluded from the building during flood events. Such mitigation methods are usually expensive as they will require structural modifications to the building. Recommended methods are:-

Raised Floor Levels

Finished floor levels of the building are designed to be above the design flood level. The levels will also include an additional height to accommodate a suitable freeboard. Driveways, paths and entrances to allow for access need to be designed accordingly.

Deeper Foundations

This may be appropriate in permeable types of ground, such as sand and gravels, where high ground water and flood water is able, under pressure, to infiltrate into the property from below the foundation level. Cut off trenches and toe walls to deeper impermeable clay / rock ground to block flow paths may also be considered.

Tanking of Internal Floors and Basement Walls

This measure may be used to prevent flood water or high groundwater entering the building. It involves the use of solid concrete walls and floors, which are then sealed with waterproof membranes / sheets. Solid floors have the added advantage that with their extra weight they are able to cope better with the uplift pressures from the flood water.

Water Resistant Walls

The building structure is designed using flood resistant materials that are able to reduce or stop the infiltration of water through the external walls. Solid walls can be constructed instead of cavity walls. Engineering bricks are preferred to concrete / aircrete bricks as they have lower water absorption rates. External joints and rendering can be designed to be more water repellent. Rigid insulation can be applied to cavity walls and internal walls can use cement based renders with a high lime content. Standard gypsum plasterboard which disintegrates when it becomes wet should be avoided.

Sealed Doors and Windows

Entrances and openings can be designed with raised thresholds. Water resistant PVC type material, which can provide better seals can replace traditional wooden frames, which can become warped. Shatterproof / double glazed windows should be considered as these are more liable to remain intact when exposed to a depth of flood water or floating debris.

Non Return Valves and Covers

Flaps can be fitted to the end and junctions of drainage and sewage pipes to stop any water flowing back into the building. Manhole covers can also be sealed by being bolted down and air vents can be fitted with specialised water resistant covers.

E7 **Active resistance** – involves the use of temporary flood mitigation measures and requires an effective flood warning system or a neighbourhood alert scheme to allow for a reasonable lead in time in order to have the mitigation in place. Stand-alone temporary and demountable defences are not normally considered appropriate for new developments due to the likelihood of them not being in place on time, being damaged by flood debris or the potential for being breached or overtopped. The main advantage of these temporary arrangements is that they would normally be less expensive than the more permanent solutions and are more practical and suitable for buildings already within the floodplain. Recommended methods are:-

Demountable Flood Guards

These guards or gates are made of suitable flood resistant material and are fitted across boundary fences, doors and windows by bolting or dropping into pre-prepared slots or channels incorporated into the framework of the structure. They are then removed soon after the flood recedes.

Temporary Flood Defences

This solution is sometimes adopted to provide protection for commercial properties such as shops and restaurants where a service or an ongoing activity may still be required outside the building. They can also be employed as a necessary short term measure that may precede a more permanent flood defence structure.

Sand Bags or Flood Sacks

This is the cheapest form of measure and is more suitable in emergency response situations, such as surface water flooding where there is little to no warning, the water is at a shallow depth and the exact flood path cannot be predicted. The sandbags can be stored in a suitable nearby location or left along previous flood paths on a temporary basis. The flood sacks have the added advantage that they are light and can be easily stored and transported. They expand and fill voids once they come into contact with water.

E8 **Flood Resilience** involves designing or adapting a property so that although flood water is able to enter the building, very little or no permanent damage is caused through the use of water resistant and replaceable sacrificial materials. Structural integrity is also maintained and normal service can resume fairly rapidly after the flood has receded and clean up has taken place. This method is not usually that suitable for new property. Recommended methods are:-

Pipes and Services

Electrical wiring can be dropped down from the first floor / roof level and by ensuring that all fuse boxes and electrical sockets are kept at least 1.5m above the floor level. This would also apply to gas, oil and water supplies so as to avoid pulled joints and leaks, which can lead to contamination and pollution.

Raising Fabrics and Appliances

Televisions, fridges and cookers can be placed on plinths at raised levels. Machinery and office equipment should also be raised. Castor type sofas and the use of movable rugs instead of fixed carpets are better options in regard to flood resilience.

Fixtures and Fittings

Popular methods in kitchens and downstairs bathrooms are to use durable water resistant materials such as stainless steel units and plastic skirting boards. Vinyl and tiled floors are preferred to wooden or chipboard floors.

Valuables and Memorabilia

Any valuables such as ornaments, pictures and photographs can be placed on high mounted shelves. Smaller furniture can be positioned in such a way that it can be easily transferred to upstairs levels.

E9 Guidance and further detail on the use of flood resistance and resilience construction can be found at the following websites:-
http://www.nidirect.gov.uk/flooding-in-your-area Flooding in your area nidirect
http://www.scotland.gov.uk/Publications/2004/08/19805/41597 Scottish Government's publication "Design Guidance on Flood Damage to Buildings"

E10 The applicant will need to demonstrate a sound understanding of these methodologies and their application as proposed mitigation measures within the submitted Flood Risk Assessment / Drainage Assessment.

E11 **Notwithstanding the various flood proofing measures that may be available to manage and mitigate flood risk, it is stressed that the practice of flood avoidance, by locating new buildings and infrastructure outside the flood risk area, is the most effective means of managing the flood risk. Alternative sites should always be considered.**

PPS15 Glossary

AEP	Annual Exceedance Probability – The annual probability of a flood exceeding the peak floodwater level.
Culvert	a structure with integral sides, soffit and invert, including a pipe that contains a watercourse as it passes through a beneath a road, railway, building, embankment etc., or below ground.
Catchment	the area drained, either naturally or with artificial assistance, by a watercourse, including all drainage channels, tributaries, floodplains, estuaries and areas of water storage
Coastal Flooding	flooding from sea water, often arising through storm surge
Drainage Assessment	a statement of the drainage issues relevant to a development proposal and the measures to provide the appropriate standard of drainage. The detail of the assessment will be proportionate to the nature of the proposal. (It may also be called a Drainage Impact Assessment).
Drainage Infrastructure	equipment such as culverts, weirs and sluices provided to facilitate drainage
Flood Defence	a structure or works designed to prevent the inundation of land and property from watercourses and/or the sea. Such defences may take the form of floodwalls or embankments or the management of water levels through drainage works.
Flood Hazard	the features of flooding which have harmful impacts on people, property or the environment (such as the depth of water, speed of flow, rate of onset, duration, water quality etc.).
Floodplain	the generally flat areas adjacent to a watercourse or the sea where water flows in time of flood or would flow but for the presence of flood defences. The limits of the floodplain are defined by the peak water level of an appropriate return period event.
Flood Risk	the statistical probability of an event occurring combined with the scale of the potential consequences of that event.
Flood Risk / Inundation Areas	areas susceptible to flooding from the 4 main sources, i.e. rivers, the sea, surface water and reservoirs

Flood Storage	an area, usually within floodplain where water is stored in time of flood.
Fluvial Flooding	flooding from a river or other watercourse.
Freeboard	a height added to the predicted level of flood to take account of waves or turbulence and the uncertainty in estimating the probability of flooding.
Groundwater	water below the surface of the ground in the saturation zone and in direct contact with the ground or subsoil. non-residential extensions
Minor Development	(Industrial/Commercial/Leisure etc) with a footprint less than 150 sq metres *Alterations*: development that does not increase the size of buildings, eg alterations to external finishes *'Householder' development*: e.g. sheds, garages, games rooms etc. within the curtilage of the existing dwelling in addition to extensions to the existing dwelling. This excludes any proposed development that would create a separate dwelling within the curtilage of the existing dwelling e.g. subdivision of a dwelling house into flats.
Precautionary Approach	the approach to be used in the assessment of flood risk which requires that lack of full scientific certainty, shall not be used to assume flood hazard or risk does not exist, or as a reason for postponing cost-effective measures to avoid or manage flood risk.
Pluvial Flooding	usually associated with convective summer thunderstorms or high intensity rainfall cells within longer duration events, pluvial flooding is a result of rainfall-generated overland flows which arise before run-off enters any watercourse or sewer. The intensity of rainfall can be such that the run-off totally overwhelms surface water and underground drainage systems
Reservoir	reservoirs, dams and other impounding structures, to be defined by the forthcoming Reservoirs legislation
Residual Risk	the risk which remains after all risk avoidance, substitution and mitigation measures have been implemented, on the basis that such measures can only reduce risk, not eliminate it.

Resilience	Sometimes known as 'wet-proofing', resilience relates to how a building is constructed in such a way that, although flood water may enter the building, its impact is minimised, structural integrity is maintained, and repair, drying & cleaning and subsequent re-occupation are facilitated
Resistance	Sometimes known as 'dry-proofing', this relates to how a building is contracted to prevent flood water entering the building or damaging its fabric
River Basin	see *catchment*.
Run-off	that proportion of rainfall which is not absorbed into the ground and finds its way, by surface water drainage systems or overland flow, into watercourses and eventually discharges into the sea.
Storm surge	the increase in sea level caused by the combined effects of low atmospheric pressure, wind and a high tide.
Stormwater	Surface water in abnormal quantities resulting from heavy falls of rain or snow. Stormwater that does not infiltrate into the ground becomes surface runoff.
Sustainable Drainage Systems (SuDS)	a form of drainage that aims to control run-off as close to its source as possible using a sequence of management practices and control structures designed to drain surface water in a more sustainable fashion than some conventional techniques such as stormwater networks.
Watercourse	a river, stream, canal, ditch, culvert and surface water drainage systems. (Water mains and sewers are not included in this definition).

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