The background is a vibrant red color. It features several abstract geometric shapes: a large teal semi-circle in the top-left corner, a blue semi-circle in the top-right corner containing a white circle, a dark blue horizontal bar in the top-right corner, a teal semi-circle in the bottom-right corner, and a blue semi-circle in the bottom-left corner containing a white circle. There are also smaller white circles and shapes in the bottom-left and bottom-right corners.

Appendix N

Flood Risk Assessment

National Transport Authority
**Belfield / Blackrock to City Centre
Core Bus Corridor Scheme**
Stage 1 Flood Risk Assessment

Issue | 17 December 2021

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 268401-00

Ove Arup & Partners Ireland Ltd

Arup
50 Ringsend Road
Dublin 4
D04 T6X0
Ireland
www.arup.com

ARUP

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Appendix A

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Executive Summary

Arup was commissioned by the National Transport Authority (NTA) to prepare a Flood Risk Assessment (FRA) as part of the planning application process for the Core Bus Corridor (CBC) BusConnects Dublin Programme. The 'Belfield/Blackrock to City Centre Scheme' is identified as forming part of the radial Core Bus Network.

This report details the Flood Risk Assessment carried out as part of the planning application. It has been undertaken in accordance with the Guidelines for Planning Authorities on 'The Planning System and Flood Risk Management' published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG).

The Proposed Scheme consists of five main sections, as follows:

- Section 1: Stradbroke Road to Booterstown Avenue;
- Section 2: Booterstown Avenue to Nutley Lane;
- Section 3: Merrion Road (Nutley Lane to Ballsbridge);
- Section 4: Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street); and
- Section 5: Nutley Lane (R138 to Merrion Road).

A Plan-Making Justification test formed part of the Strategic Flood Risk Assessment. The Strategic Development Zone (SDZ) Planning Scheme as approved notes that all proposed developments must include a site-specific flood risk assessment (SSFRA). It is further confirmed that the SSFRA is not required to carry out a Plan-Making Justification test, given that this exercise has already been carried out as part of the adopted SDZ Planning Scheme.

Sections 1 and 2

There are two areas along the proposed scheme where there is medium risk of fluvial flooding. The two areas consist of area 1 at Merrion Road and area 2 at Frascati Road which lies within Flood Zone B.

An area along the proposed scheme is at high risk of tidal flooding as identified in Section 4.2. Area 3 at Merrion Strand falls within Flood Zone A. This risk of pluvial flooding along the proposed route is medium, however, this risk will be reduced as a result of the scheme proposals and improved drainage. The risk of groundwater flooding along the proposed route could be medium to high, with no evidence of historic flooding associated with groundwater.

There are areas of the scheme identified as being within Flood Zone A and Flood Zone B, therefore, a Justification Test is required. The Plan-Making Justification Test and Development Management Justification Test 2(i) have been assessed and passed, therefore, further investigation of the flood risk in the form of a Stage 2 FRA does not need to be carried out.

Sections 3, 4 and 5

There are two areas along the proposed Route where there is a risk of fluvial flooding. The two areas consist of Area 1 at Ballsbridge which lies within Flood Zone A and Area 2 at Merrion Road which lies in Flood Zone B. This risk of pluvial flooding along the proposed route is medium to high and it will be partly mitigated via upgrades to the surface water drainage system. The risk of ground water flooding along the proposed route is low to moderate.

As areas of the scheme are within Flood Zone A and Flood Zone B, a Justification Test is required. The Plan-Making Justification and Development Management Justification Tests has been assessed and passed, therefore, further investigation of the flood risk in the form of a Stage 2 FRA does not need to be carried out.

1 Introduction

1.1 Project Background

Arup has been appointed by the National Transport Authority (NTA) to undertake a Stage 1 Flood Risk Assessment (FRA) as part of the planning application process for the Core Bus Corridor (CBC) BusConnects Dublin Programme. This FRA will assess the flood risk for the Belfield / Blackrock to City Centre Scheme.

The Stage 1 FRA is a high-level study of the scheme to identify flood risks to the project and any potential flooding issues arising due to the project. This report will inform the planning process and identify whether a further Stage 2 FRA is required.

The BusConnects Dublin Programme is a plan to transform Dublin's bus system, with the CBC project providing 230km of dedicated bus lanes and 200km of cycle tracks on sixteen of the busiest bus corridors in and out of the city centre. This project is fundamental to addressing the congestion issues in the Dublin region with the population due to grow by 25% by 2040, bringing it to almost 1.55million.

In June 2018 the NTA published the Core Bus Corridors Project Report. The report was a discussion document outlining proposals for the delivery of a CBC network across Dublin. The aim of the Proposed Project is to transform the bus system to provide better services to more people.

The 'Belfield / Blackrock to City Centre Scheme' is identified as forming part of the radial Core Bus Network. The BusConnects radial CBC network is shown in Figure 1.

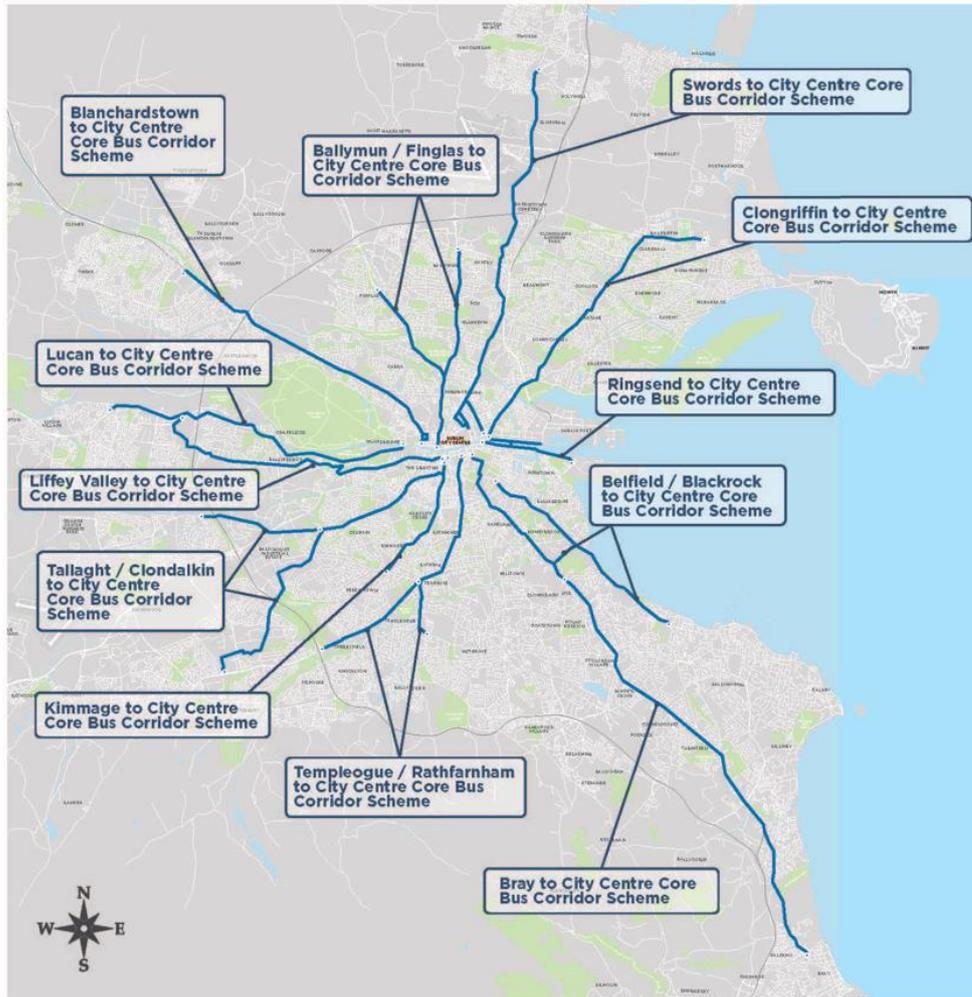


Figure 1: BusConnects CBC Network

The FRA has been undertaken in accordance with the ‘The Planning System and Flood Risk Management Guidelines for Planning Authorities’ published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DoEHLG), herein referred to as ‘The Guidelines’.

1.2 Scope of Assessment

The FRA will include the following:

- Confirmation of the sources of flooding which may affect the site;
- A qualitative assessment of the risk of flooding to the site and to adjacent sites as a result of construction of the proposed development,
- Review of the availability and adequacy of existing information,
- Identification of possible measures which could mitigate the flood risk to acceptable levels, and;
- Areas for further investigation (Stage 2 FRA) if required.

1.3 Summary of Data Used

Data regarding flood risk relevant to the proposed development and surrounding area has been obtained from the following sources;

- Review of Dún Laoghaire-Rathdown County Council Development Plan 2016-2022 (<https://www.dlrcoco.ie/en/planning/county-development-plan/county-development-plan-2016-2022>);
- Review of Dublin City Development Plan (<http://www.dublincity.ie/main-menu/services/planning-city-development-plan/dublin-city-development-plan-2016-2022>);
- Dodder Catchment Flood Risk Assessment and Management Study and associated flood maps (OPW);
- Dodder Catchment Flood Risk Management Plan (OPW);
- Irish Coastal Protection Strategy Study (ICPSS);
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW;
- Dublin City Council EU Interreg IVB Flood Resilience City Project;
- Flood history of the site from the OPW National Flood Hazard Mapping website (www.floodinfo.ie);
- Guidelines for Planning Authorities on ‘The Planning System and Flood Risk Management’ published in November 2009, jointly by the Office of Public Works (OPW) and the then Department of Environment, Heritage and Local Government (DEHLG); and
- Topographical information received for site surveys.

All Ordnance Datum (OD) levels referred to in this report are to Malin Head Ordnance Datum unless otherwise stated.

1.4 The Proposed Scheme – Belfield / Blackrock to City Centre Core Bus Corridor Scheme

The Proposed Scheme consists of two main alignments and runs primarily from Blackrock to the City Centre, with Nutley Lane forming a secondary alignment in a southwest-to-northeast direction.

The Blackrock to City Centre alignment of the Proposed Scheme commences at the R113 Temple Hill, to the north of the R827 Stradbroke Road, travels along the N31 Frascati Road, the R118 Rock Road / Merrion Road / Pembroke Road, turns at the Lansdowne Road junction onto the R816 Pembroke Road / Baggot Street Upper / Baggot Street Lower, turns onto Fitzwilliam Street Lower and terminates at the junction of Mount Street Upper / Merrion Square South / Merrion Square East.

The Nutley Lane alignment of the Proposed Scheme commences at the junction with the R138 Stillorgan Road, travels along Nutley Lane and terminates at the junction with the R118 Merrion Road.

The Proposed Scheme is split into five main sections, as follows:

- Section 1: Stradbroke Road to Booterstown Avenue;
- Section 2: Booterstown Avenue to Nutley Lane;
- Section 3: Merrion Road (Nutley Lane to Ballsbridge);
- Section 4: Ballsbridge to Merrion Square (Pembroke Road, Baggot Street and Fitzwilliam Street); and
- Section 5: Nutley Lane (R138 to Merrion Road).

The Proposed Scheme includes the construction of a new retaining wall near Blackrock Park and the widening and upgrading of the existing road infrastructure.

The Proposed Scheme is shown in Figure 2.

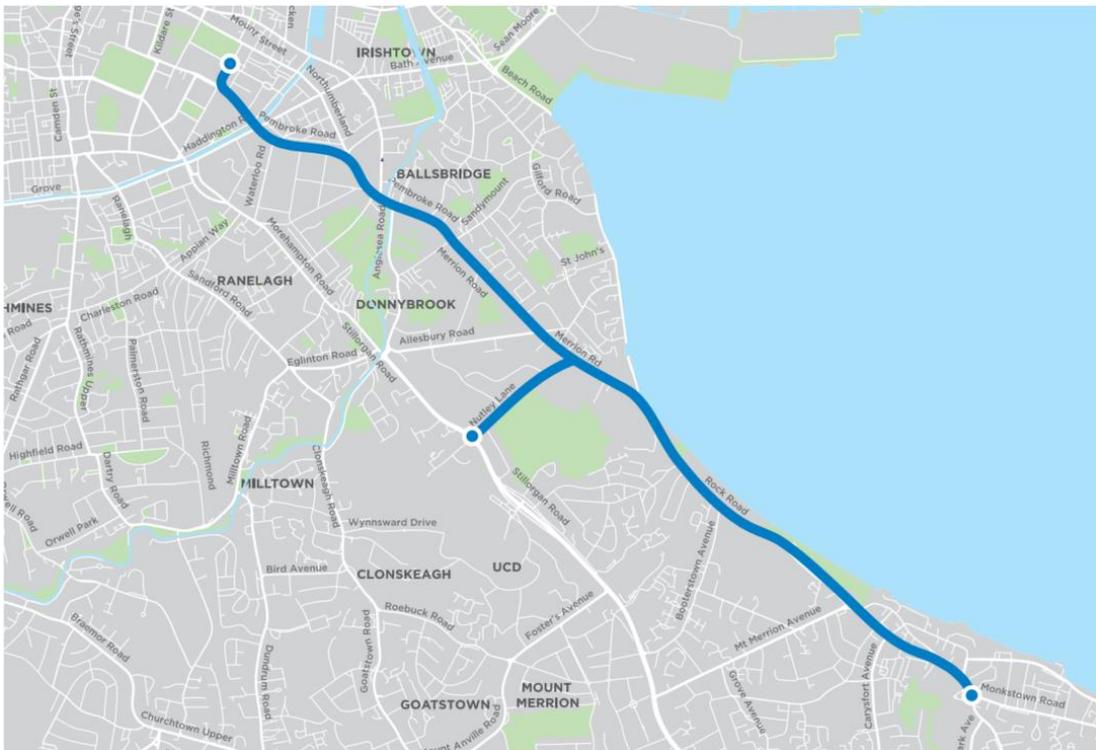


Figure 2: Belfield / Blackrock to City Centre CBC Scheme Alignments

2 The Planning Context

The following policy documents are relevant to the assessment of the proposed development:

- The National Planning Guidelines, referred herein as ‘the Guidelines’, published by the OPW and the Department of the Environment, Heritage and Local Government in November 2009 entitled ‘The Planning System and Flood Risk Management: Guidelines for Planning Authorities’ are particularly pertinent and are discussed in section 2.1.
- In terms of planning policy context, the provisions contained in the Dublin City Development 2016 - 2022 are relevant.
- Dún Laoghaire-Rathdown County Development Plan 2016-2022.

2.1 The Planning System and Flood Risk Management Guidelines for Planning Authorities

In November 2009, the Department of Environment, Heritage and Local Government and the Office of Public works jointly published a Guidance Document for Planning Authorities entitled “The Planning System and Flood Risk Management”.

The Guidelines are issued under Section 28 of the Planning and Development Act 2000 and Planning Authorities. Therefore, An Bord Pleanála are required to implement these Guidelines in carrying out their functions under the Planning Acts.

The aim of the guidelines is to ensure that flood risk is neither created nor increased by inappropriate development.

The guidelines require the planning system to avoid development in areas at risk of flooding, unless they can be justified on wider sustainability grounds, where the risk can be reduced or managed to an acceptable level.

They require the adoption of a Sequential Approach to Flood Risk Management following the steps of Avoidance of flood risk, Substitution with less vulnerable uses, Justification and Mitigation of flood risk. The Guidelines require the incorporation of Flood Risk Assessment into the process of making decisions on planning applications and planning appeals.

Fundamental to The Guidelines, is the introduction of flood risk zoning and the classifications of different types of development having regard to their vulnerability to flooding.

The management of flood risk is now a key element of any development proposal in an area of potential flood risk and should therefore be addressed as early as possible in the site masterplanning stage.

2.1.1 Definition of Flood Zones

Flood zones are geographical areas within which the likelihood of flooding is in a particular range.

There are three types of flood zones defined in the Guidelines as follows:

Table 1: Definition of Flood Zone Categories

Zone Category	Description
Flood Zone A	Probability of flooding from rivers and the sea is highest (greater than 1% or 1 in 100 for river flooding or 0.5% or 1 in 200 for coastal flooding).
Flood Zone B	Probability of flooding from rivers and the sea is moderate (between 0.1% or 1 in 1000 and 1% or 1 in 100 for river flooding and between 0.1% or 1 in 1000 and 0.5% or 1 in 200 for coastal flooding); and
Flood Zone C	Probability of flooding from rivers and the sea is low (less than 0.1% or 1 in 1000 for both river and coastal flooding). Flood Zone C covers all areas of the plan which are not in zones A or B.

2.1.2 Definition of Vulnerability Classification to Flooding

The Guidelines classify different land uses and types of development as highly vulnerable, less vulnerable and water-compatible to flooding. The vulnerability classification is influenced primarily by the ability to manage the safety of people in flood events and the long-term implications for recovery of the function and structure of buildings. The following Table 2 summarises the Vulnerability Classes defined in the Guidelines and provides a sample of the most common type of development applicable to each class.

The project will be providing primary transport and is therefore considered essential infrastructure. It is therefore classed as Highly Vulnerable Development.

Table 2: Definition of Vulnerability Classes

Vulnerability Class	Land uses and types of development which include;
Highly Vulnerable Development	Includes Garda, ambulance and fire stations, hospitals, schools, residential dwellings, residential institutions, essential infrastructure, such as primary transport and utilities distribution and SEVESO and IPPC sites, etc.
Less Vulnerable Development	Includes retail, leisure, warehousing, commercial, industrial and non-residential institutions, etc.
Water Compatible Development	Includes Flood Control Infrastructure, docks, marinas, wharves, navigation facilities, water-based recreation facilities, amenity open spaces and outdoor sport and recreation facilities

2.1.3 Sequential Approach and Justification Test

The Guidelines outline the sequential approach that is to be applied to all levels of the planning process. This approach should also be used in the design and layout of a development and the broad philosophy is shown in Figure 3. In general, development in areas with a high risk of flooding should be avoided as per the sequential approach.

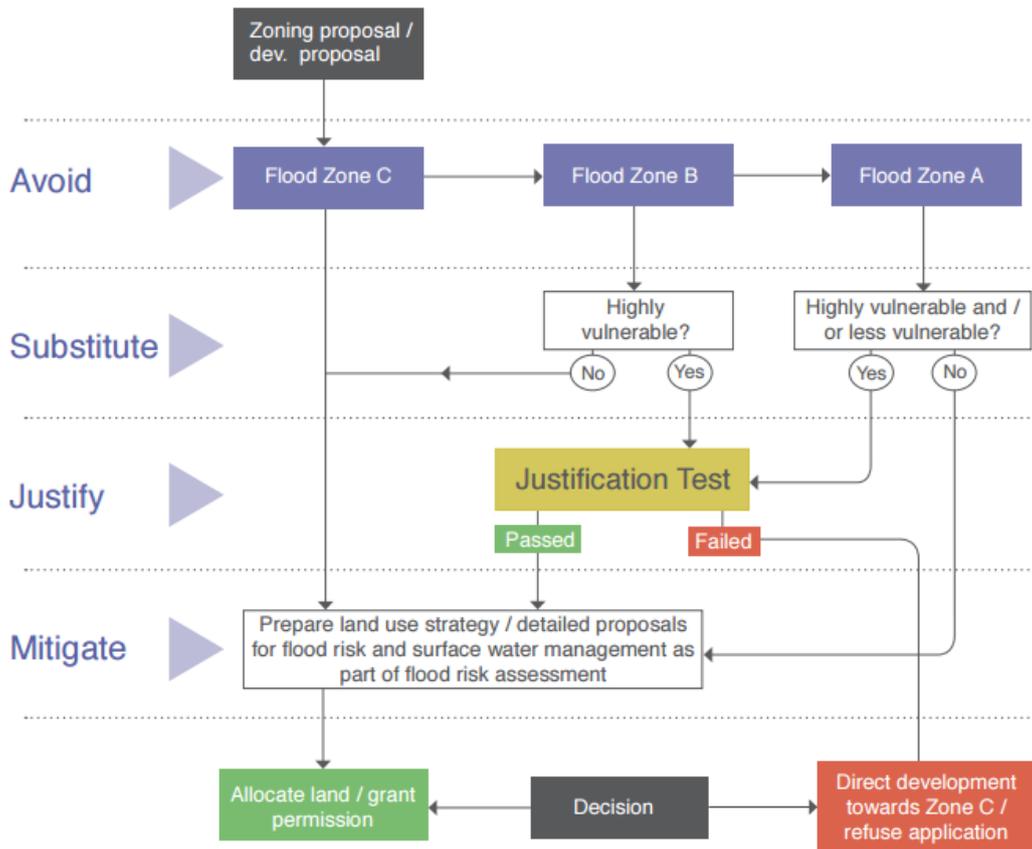


Figure 3: Sequential approach (reproduced from the Guidelines)

The Justification Test has been designed to rigorously assess the appropriateness, or otherwise, of developments that are being considered in areas of moderate or high flood risk. The test comprises the following two processes.

- The first is the Plan-Making Justification Test and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
- The second is the Development Management Justification Test and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

Table 3 illustrates the different types of Vulnerability Class appropriate to each zone and indicates where the Justification Test is required.

Table 3: Vulnerability Class per Zone (reproduced from the Guidelines)

	Flood Zone A	Flood Zone B	Flood Zone C
Highly Vulnerable	Justification Test	Justification Test	Appropriate
Less Vulnerable	Justification Test	Appropriate	Appropriate
Water Compatible	Appropriate	Appropriate	Appropriate

2.2 Dublin City Development Plan 2016-2022

The Dublin City Development Plan 2016-2022 was adopted by Dublin City Council on 23rd September 2016 and came into effect on 21st October 2016. The Plan sets out policies and objectives to create a sustainable and vibrant city at the heart of the Greater Dublin Region and guides how and where development will take place in the city over the next 6 years.

Section 9.5.3 of the plan deals with Flood Management and outlines the key policies and objectives of Dublin City Council in relation to flood risk. The plan presents a number of Dublin City Council ‘Strategic Infrastructure’ (SI) policies that state that it is their policy to:

- **SI8:** To mitigate the effects of floods and droughts, subject to Environmental Assessment.
- **SI9:** To assist the Office of Public Works in developing catchment-based Flood Risk Management Plans for rivers, coastlines and estuaries in the Dublin city area and have regard to their provisions/recommendations.
- **SI10:** To have regard to the Guidelines for Planning Authorities on the Planning System and Flood Risk Management and Technical Appendices, November 2009, published by the Department of the Environment, Community, and Local Government as may be revised/updated when assessing planning applications and in the preparation of plans both statutory and non-statutory.
- **SI11:** To put in place adequate measures to protect the integrity of the existing Flood Defence Infrastructure in Dublin City Council’s ownership and identified in the Strategic Flood Risk Assessment and to ensure that the new developments do not have the effect of reducing the effectiveness or integrity of any existing or new flood defence infrastructure and that flood defence infrastructure has regard also to nature conservation and amenity issues.
- **SI12:** To implement and comply fully with the recommendations of the Strategic Flood Risk Assessment prepared as part of the Dublin City Development Plan.
- **SI13:** Development of basements or any above ground buildings for residential use below the estimated flood levels for Zone A or Zone B will not be permitted.

- **SI14:** To protect the Dublin City coastline from flooding as far as reasonably practicable, by implementing the recommendations of the Dublin Coastal Flood Protection Project and the Dublin Safer Project.
- **SI15:** To minimise the risk of pluvial (intense rainfall) flooding in the city as far as is reasonably practicable and not to allow any development which would increase this risk.
- **SI16:** To minimise the flood risk in Dublin City from all other sources of flooding, including fluvial, reservoirs and dams and the piped water system.
- **SI17:** To require an environmental assessment of all proposed flood protection or flood alleviation works

Section 9.5.3 of the development plan also outlines the following objectives in relation to Flood Risk Management. The plan presents a number of Dublin City Council ‘Strategic Infrastructure Objectives’ (SIO) that state:

- **SIO8:** All development proposals shall carry out, to an appropriate level of detail, a Site-Specific Flood Risk Assessment (SSFRA) that shall demonstrate compliance with:
 - The Planning System and Flood Risk Management, Guidelines for Planning Authorities, Department of the Environment, Community and Local Government, November 2009, as may be revised/updated and the Strategic Flood Risk Assessment (SFRA) as prepared by this Development Plan.
 - The site-specific flood risk assessment (SSFRA) shall pay particular emphasis to residual flood risks, site-specific mitigation measures, flood-resilient design and construction, and any necessary management measures (the SFRA and Appendix B4 of the above-mentioned national guidelines refer). Attention shall be given in the site-specific flood risk assessment to building design and creating a successful interface with the public realm through good design that addresses flood concerns but also maintains appealing functional streetscapes. All potential sources of flood risk must be addressed in the SSFRA.
- **SIO9:** Proposals which may be classed as ‘minor development’, for example small-scale infill, small extensions to houses or the rebuilding of houses or paving of front gardens to existing houses, most changes of use and small-scale extensions to existing commercial and industrial enterprises in Flood Zone A or B, should be assessed in accordance with the Guidelines for Planning Authorities on the Planning System and Flood Risk Management & Technical Appendices, November 2009 as may be revised/updated, with specific reference to Section 5.28 and in relation to the specific requirements of the Strategic Flood Risk Assessment. The policy shall be not to increase the risk of flooding and to ensure risk to the development is managed.
- **SIO10:** That recommendations and flood maps arising from the Fingal-East Meath CFRAM Study, the Dodder CFRAM Study and the Eastern CFRAM Study are taken into account in relation to the preparation of statutory plans and development proposals.

This will include undertaking a review of the Strategic Flood Risk Assessment for Dublin City following the publication of the Final Eastern CFRAM Study, currently being produced by the OPW.

- **SIO11:** To work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross-boundary development.
- **SIO12:** To ensure each flood risk management activity is examined to determine actions required to embed and provide for effective climate change adaptation as set out in the Dublin City Council climate change adaptation policy and in the OPW Climate Change Sectorial Adaptation Plan Flood Risk Management applicable at the time.

2.3 Dublin Strategic Flood Risk Assessment

A Regional Flood Risk Assessment (RFRA) was carried out for the Regional Planning Guidelines (RPG) for the Greater Dublin Area 2010-2022. Chapter 9 of the RFRA sets out the key policy with regards to avoiding and managing flood risk within the Greater Dublin Area (GDA). The Guidelines set out a number of strategic recommendations including:

- **FR1:** New development should be avoided in areas at risk of significant flooding. Alongside this, the Regional Flood Risk Appraisal recognises the need for continuing investment and development within the urban centres of flood vulnerable designated growth towns and the City and for this to take place in tandem with the completion of CFRAM Studies and investment in comprehensive flood protection and management.
- **FR2:** Development and Local Area Plans should include a Strategic Flood Risk Assessment and all future zoning of land for development in areas at risk of flooding should follow the sequential approach set out in the Departmental Guidance on Flood Risk Management. All Flood Risk Assessments and CFRAM studies should take place in coordination and consultation with adjoining local authorities and regions and in coordination with the relevant River Basin Management Plans.
- **FR3:** Local authorities should take the opportunities presented to optimise improvements in biodiversity and amenity when including policies and actions in development plans/local area plans (such as flood plain protection and SuDS) for existing and future developments.
- **FR4:** Plans and projects associated with flood risk management that have the potential to negatively impact on Natura 2000 sites will be subject to a Habitats Directive Assessment (HDA) according to Article 6 of the habitats directive and in accordance with best practice and guidance.

2.4 Dún Laoghaire-Rathdown County Development Plan 2016-2022

The Dún Laoghaire-Rathdown County Development Plan 2016-2022 was adopted by the Council on 16th March 2016.

The Plan sets out policies and objectives to create a sustainable and vibrant city at the heart of the Dún Laoghaire-Rathdown Region and guides how and where development will take place in the city over the next 6 years.

Section 5.2 of the plan deals with Flood Management and outlines the key policies and objectives of Dún Laoghaire-Rathdown County Council in relation to flood risk. The plan presents a number of Dún Laoghaire-Rathdown County Council 'Strategic Infrastructure' (SI) policies that state that it is their policy to:

- **Policy CC14:** Assist the Office of Public Works Flood Risk Assessment and Management (CFRAM) Study being carried out for the Eastern District. Any recommendations and outputs arising from the CFRAM study for the Eastern District that are relevant for Dún Laoghaire-Rathdown will require to be incorporated into the Development Plans.
- **Policy CC15:** Support, in cooperation with the OPW, the implementation of the EU Flood Risk Directive (2007/60/EC) on the assessment and management of flood risks, the Flood Risk Regulations (SI No 122 of 2010) and the Department of the Environment, Heritage and Local Government and the Office of Public Works Guidelines on 'The Planning System and Flood Risk Management, (2009)' and relevant outputs of the Eastern District Catchment and Flood Risk Assessment and Management Study (ECFRAMS Study).
- **Policy CC16:** Work with neighbouring Local Authorities when developing cross-boundary flood management work programmes and when considering cross boundary development.
- **Policy CC17:** Implement and have regard to the recommendations of the Coastal Defence Strategy (2010) for the County where feasible. The Council will endeavour to obtain funding from the Office of Public Works in order to undertake defence measures for specific areas as prioritised in the Strategy.

3 Flood Mechanisms and Historic Flooding at the Site

3.1 Potential Flood Risk Sources to the Site

The potential sources of flooding to the subject site can be categorised as follows:

- Fluvial (river) Flooding of a watercourse occurs when the capacity of a river is exceeded during periods of intense rainfall;
- Tidal Flooding is the temporary inundation of low-lying areas, during exceptionally high tidal events;
- Pluvial Flooding/Urban Drainage occurs when the capacity of the local urban drainage network is exceeded during periods of intense rainfall. At these times, water can collect at depressions in the topography and cause flooding; and
- Groundwater Flooding can occur during lengthy periods of heavy rainfall, typically during late winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause long periods of flooding.

3.2 Historic Flood Data

Reports and maps from the OPW's Flood Hazard Mapping website (www.floodmaps.ie) have been examined as part of this flood risk assessment.

3.2.1 Historic Flood Data at Sections 1 and 2

Figure 4 presents the flood record for the site and its immediate vicinity. It can be seen there are a number of historical flood events recorded along the proposed route. Table 4 shows a summary of the flood events that have occurred along the proposed route.

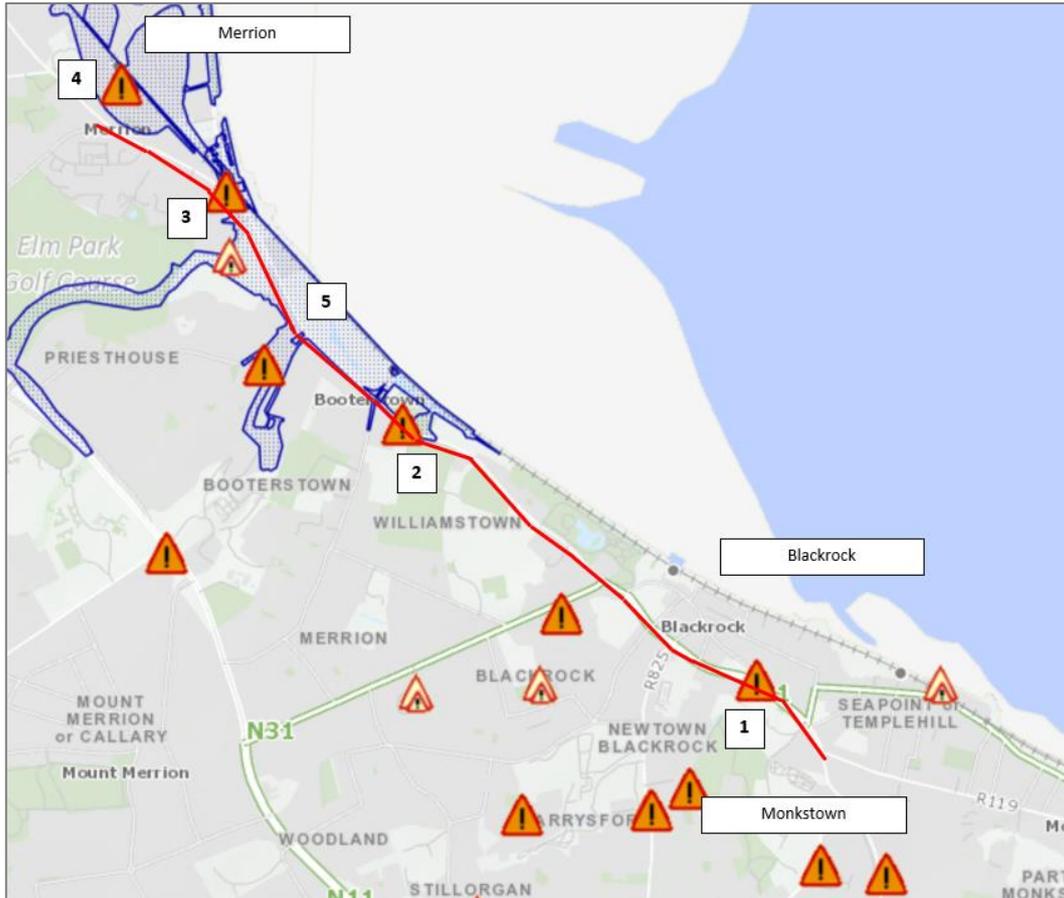


Figure 4: Blackrock to Merrion Historic Flood Events

Table 4: Historic Flood Events; Blackrock to Merrion

Flood Point No.	Date	Catchment	Flood Source	Details
1	October 2011	-	-	Flooding at Barclay Road and Temple Road, Blackrock
4	February 2002	Liffey	Coastal/Estuarine Waters	Dublin City Tidal
2	October 2002	Coastal (Sruffaunree River)	Pluvial Runoff	Rock Road
3	November 2000	Liffey	-	Rock Road, Merrion Gates
4	November 1965	Coastal (Malin Head)	Coastal/Estuarine Waters	Booterstown/Ailesbury Park
5 (Flood extent)	June 1963	Coastal (Bunratty)	Coastal / River	Nutley Elm Park Streams

There have been a number of flood defence assets put in place since one or more of the noted flood events took place.

3.2.2 Historic Flood Data at Sections 3, 4 and 5

Figure 5 presents the flood record for the site and its immediate vicinity. It can be seen there are a number of historical flood events recorded along the proposed route and these are summarised in Table 5.

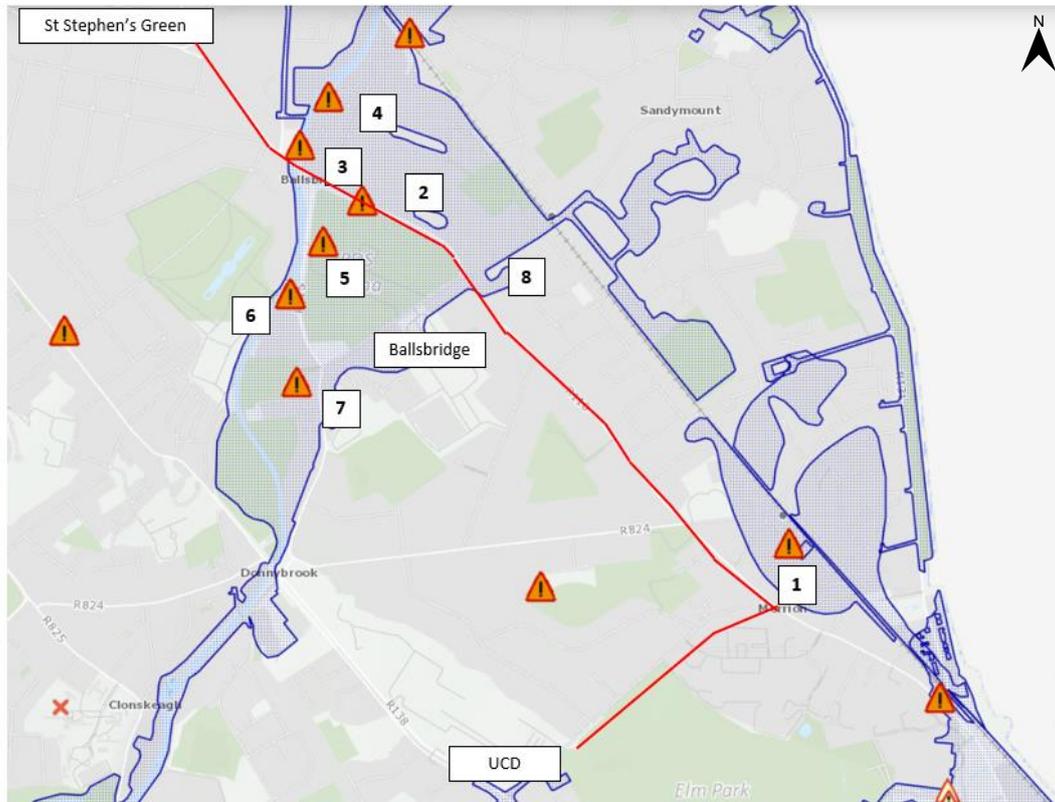


Figure 5: UCD Ballsbridge to City Centre Historic Flood Event Locations

Table 5: Summary of recorded flood events along proposed route

Flood Point No.	Date	Catchment	Flood Source	Flood Event
1	November 1965	Coastal (Malin Head)	Coastal/Estuarine Waters	Boosterstown/Ailesbury Park
2	September 1931	Liffey	Fluvial	Dodder Ballsbridge
3	October 1987	Liffey	Fluvial	Dodder
4	October 2011	-	-	Herbert Cottages, Ballsbridge
5	October 2011	-	-	Railway Cottages, Ballsbridge
6	October 2011	-	-	RDS, Ballsbridge
7	October 2011	-	-	Anglesea Road, Ballsbridge
8	August 1986	Liffey	Fluvial	Dodder August 1986 - Hurricane Charlie

During flooding caused by Hurricane Charlie on 25th August 1986, both Rathfarnham (Pearse) Bridge and Ballsbridge Bridge on the River Dodder were closed during the peak of the flood and required certification for structural stability after the event before traffic was allowed to cross.

While not noted in the historic flood record, there have been a number of flood defence assets put in place since one or more of the noted flood events.

Although flood points 4-7 are not directly along the route, they are in the surrounding area; in October 2011 the area of Ballsbridge experienced large amount of flooding. The River Dodder Flood Alleviation Scheme and upgrades to the local drainage network have since been carried out, therefore, reducing the risk of flooding in this area.

4 Existing Flood Risk at Sections 1 and 2

4.1 Fluvial Flooding

4.1.1 Dodder and Eastern CFRAM Studies

Fluvial flood extent maps from the Dodder and Eastern CFRAMS are displayed in Figure 6, Figure 7 and Figure 8. The predicted fluvial flood extents for three return period events are presented on the map for the 1 in 10, 200 and 1000-year fluvial flood extents).

As shown in Figure 6, a section of the proposed route falls within Flood Zone B. This area is benefitting from flood defences (marked in hatched polygon) and the risk of flooding to this area is, therefore, considered low.

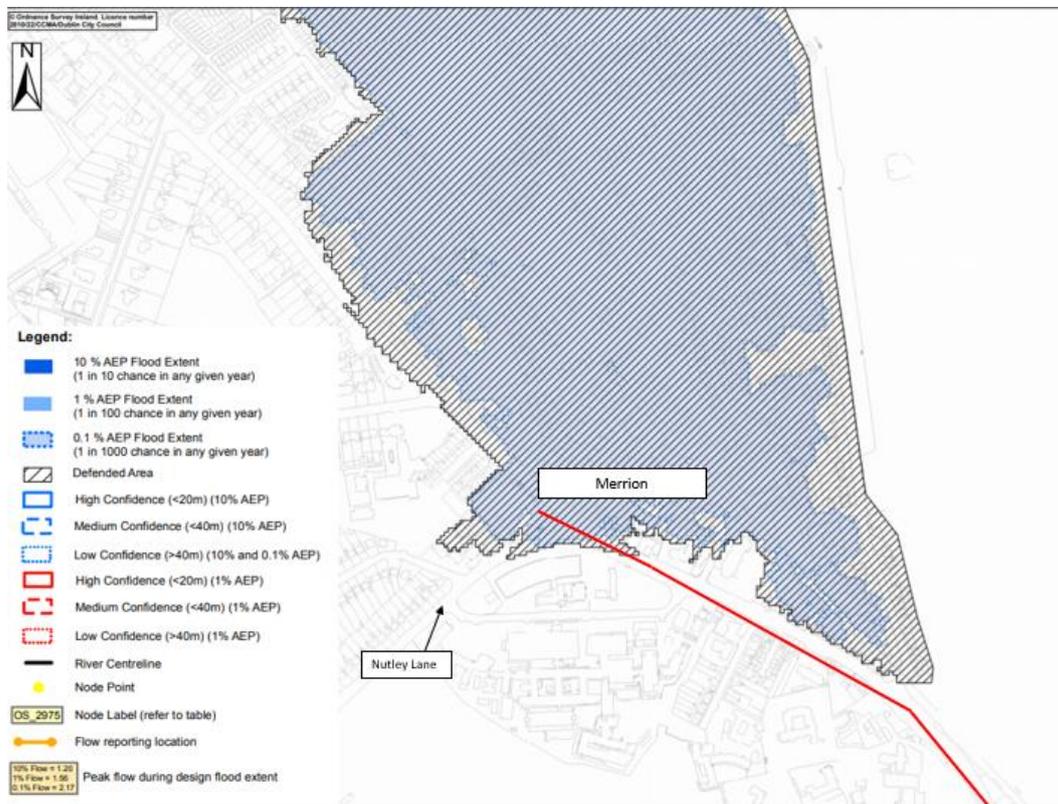


Figure 6: Merrion Fluvial flood risk (CFRAM studies)

As shown in Figure 7, the section of the proposed route from Blackrock through Merrion does not fall within the CFRAM study as it does not cross any watercourses through this extent. It can, therefore, be assumed that the risk of fluvial flooding in this area is low.

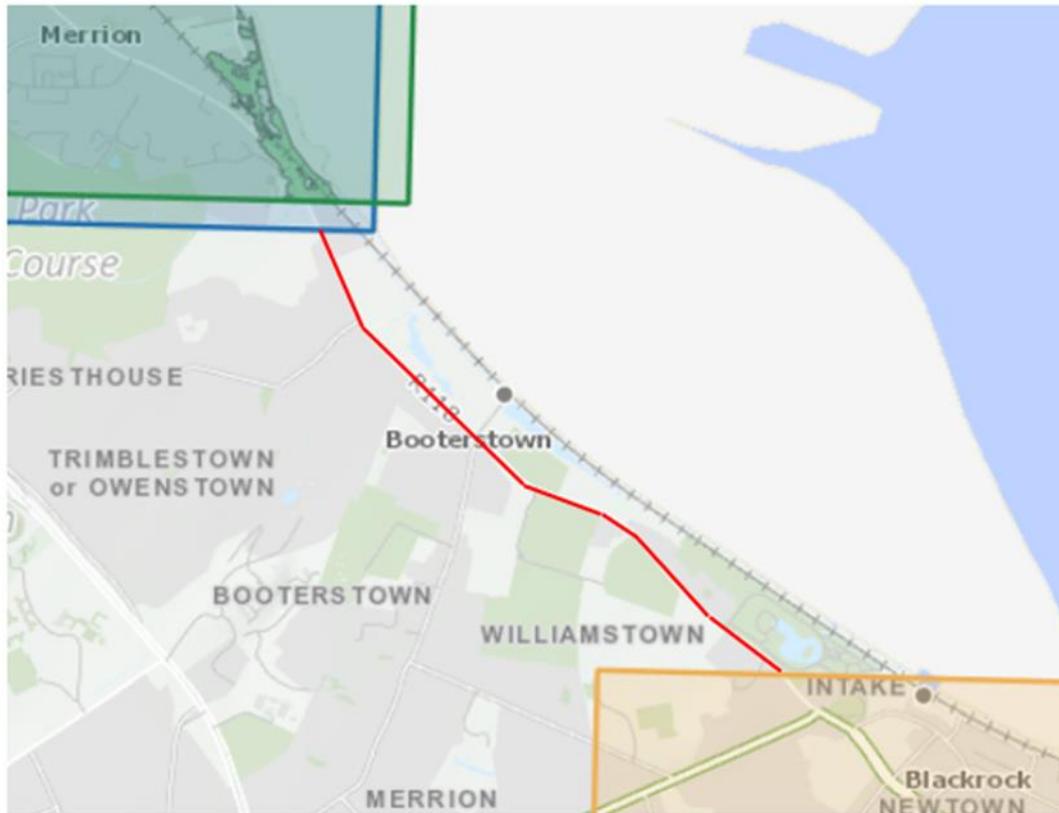


Figure 7: Blackrock to Merrion (no available CFRAM maps)

Frascati Road between Monkstown and Blackrock crosses over the Carysfort Maretimo stream. The stream flows from south to north, is heavily modified and is culverted underneath Frascati Road, before discharging to Dublin Bay. The stream has been modelled as part of the Eastern CFRAM Study.

Figure 8 includes the modelled water levels for the nodes displayed for the Carysfort Maretimo stream. The nodes closest to the site, approximately 0.25km, are 1061M00061 upstream and 1061M00014I downstream. The estimated water levels are listed below.

Table 6: Modelled flood levels along Carysfort Maretimo stream

Node	1 in 100 year event (1%AEP)	1 in 1000 year event (0.1%AEP)
1061M00061	14.49m OD	14.68m OD
1061M00014I	9.96m OD	10.52m OD

The Frascati Road levels at the stream crossing are between 12.3mOD and 12.85mOD. The modelling exercise indicates that the stream overtops the banks and causes flooding to Frascati Road during the 1 in 1000 year flood event (Flood Zone B).

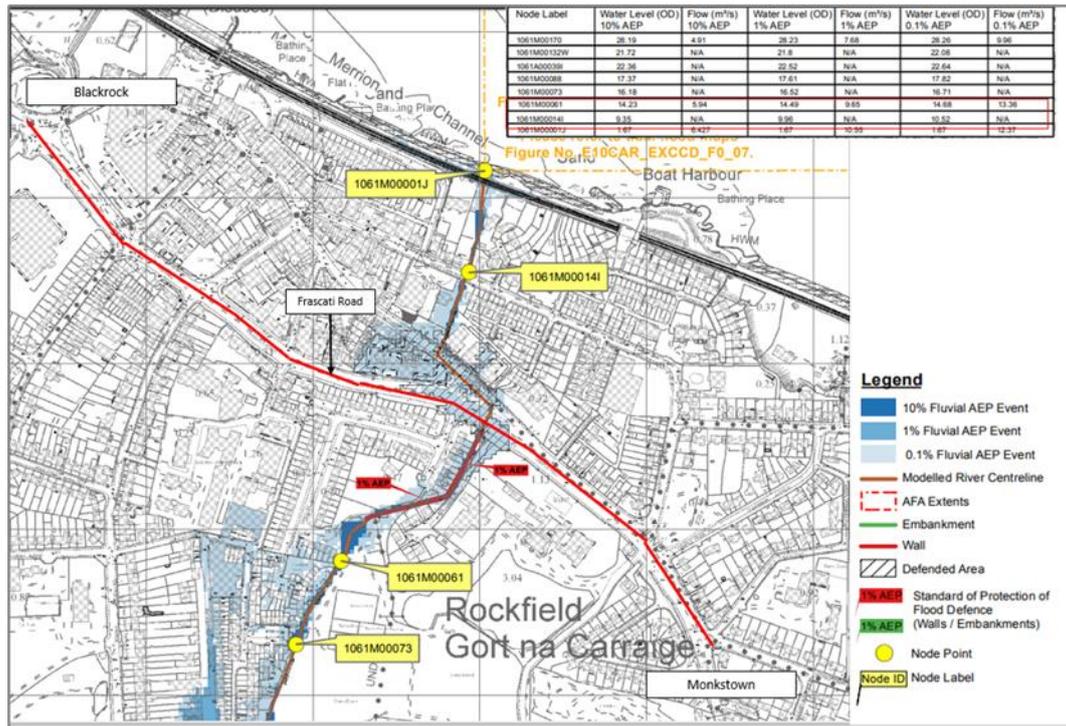


Figure 8: Monkstown to Blackrock fluvial flood risk (CFRAM studies)

4.2 Tidal Flood Risk

An extract from the Eastern CFRAM coastal flood extent map is displayed in Figure 9 and Figure 10. The predicted tidal flood extents for three separate return period events are presented on the map (1 in 10, 200 year and 1000-year tidal flood extents.)

As illustrated in Figure 9, parts of the proposed route fall within the 1 in 200 year tidal extents and is therefore located in Flood Zone A. The modelled water levels for the nodes are displayed below. The nodes closest to the site are 0937C00023 with water level 3.10mOD during the 1 in 200 year flood event and 3.34mOD during the 1 in 1000 year flood event. The road levels in the area are between 2.6mOD and 4.5mOD.

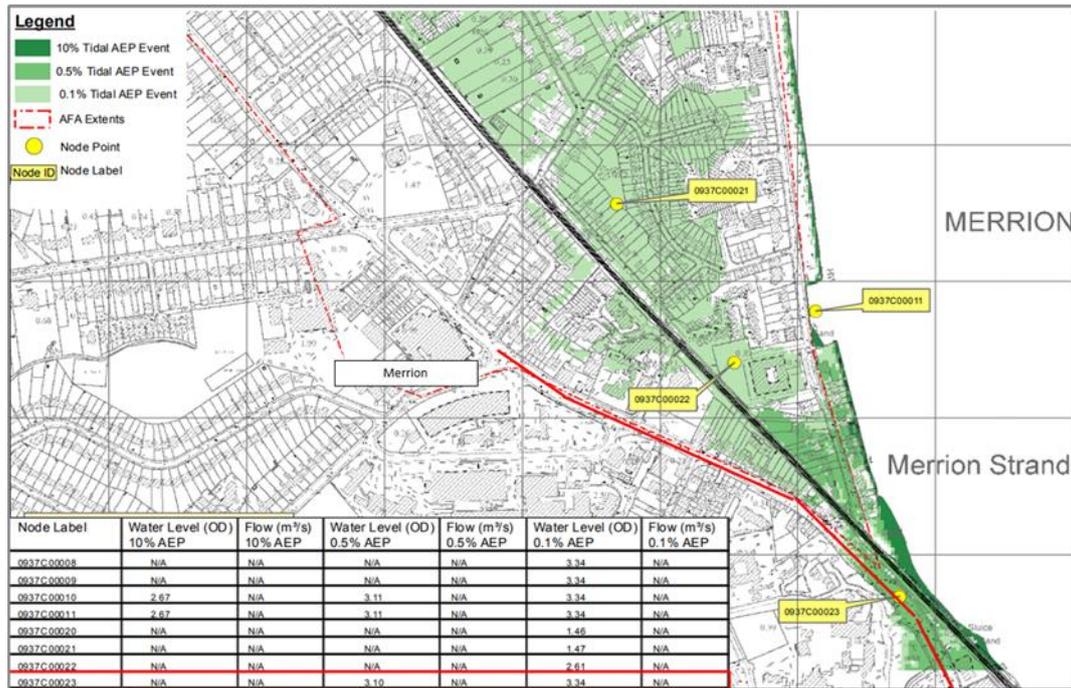


Figure 9: Merrion tidal flood risk (CFRAM studies)

Coastal modelling has also been undertaken as part of the CFRAM studies. Figure 10 indicates no coastal flood risk for the proposed section of the road from Monkstown to Blackrock.

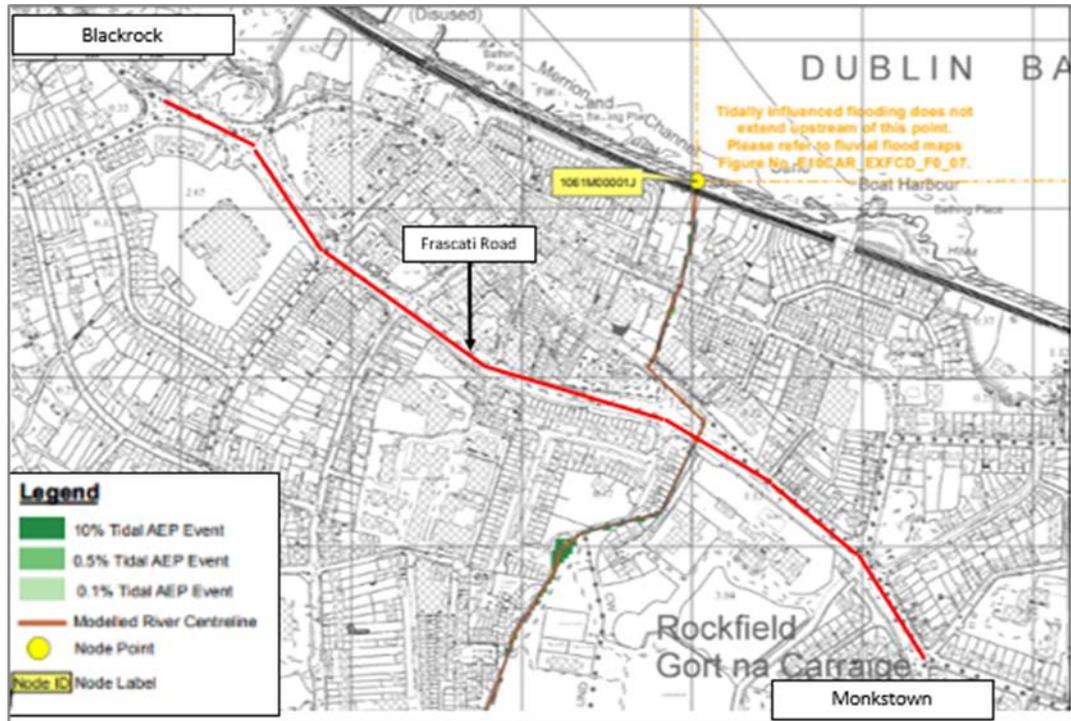


Figure 10: Monkstown to Blackrock tidal flood risk (CFRAM studies)

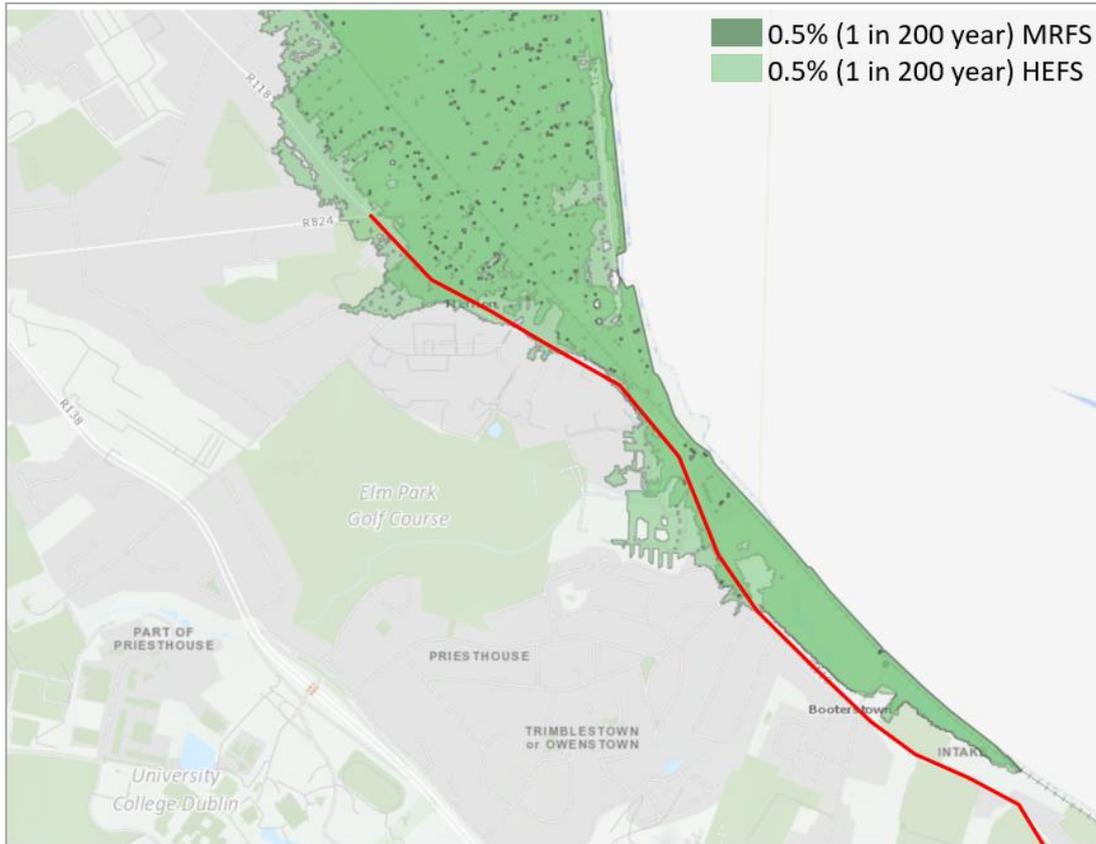


Figure 11: Booterstown to Merrion Future scenarios (CFRAM studies)

Figure 11 shows the mid-range and high-end future scenarios for the medium risk of flooding that take into account the potential effects of climate change (increase in rainfall of 20% and sea level rise of 500mm for MRFS and increase in rainfall of 30% and sea level rise of 1000mm) for the 1 in 200 return period event. As seen, the proposed section of the route from Booterstown to Merrion falls within the future scenario flood extents and will be in Flood Zone A or B in the future. While it is predicted that flood risk will increase in the future at this part of the site, it is not in the scope of the project to significantly increase road levels to mitigate the risk.

4.3 Pluvial Flooding/Urban Drainage

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low point in the topography.

The risk of pluvial flooding has been assessed by the flood maps produced as part of the Preliminary Flood Risk Assessment (PFRA) by the Office of Public Works (OPW) as shown in Figure 12. It is noted that PFRA mapping is not available for the entirety of the route and as such, the section from Monkstown to Blackrock cannot be assessed for pluvial drainage via the PFRA maps.

The PFRA map indicates that there are sporadic areas at a risk of pluvial flooding along the route which is largely within the 1% AEP with smaller sections in the 10% AEP.

In addition, a historic flood event was noted on Rock Road in October 2002 (refer to Section 3.2.2).

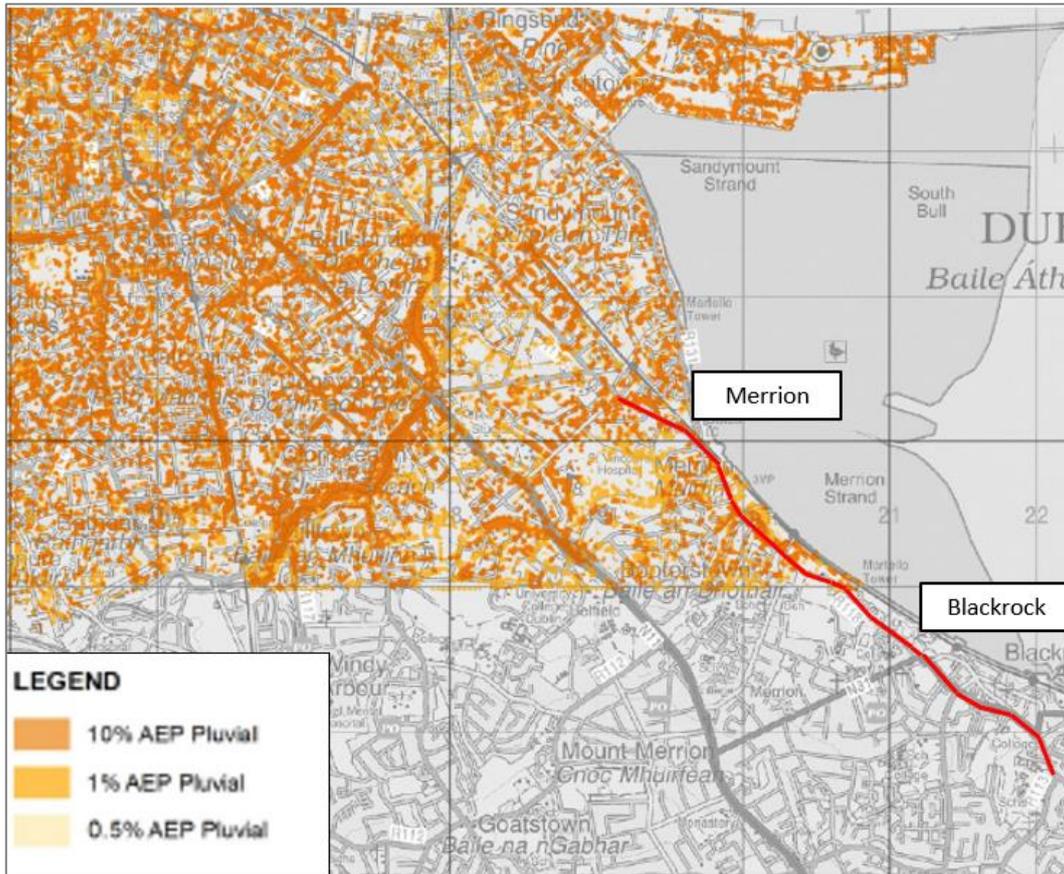


Figure 12: Extract from OPW PFRA Pluvial Flood Maps

The *Dublin City Council Flood Resilience City Project* was carried out in conjunction with Jacobs in 2012. This study was carried out to detail pluvial flood risk assessment of pilot areas in Dublin City. Dublin Central (East Wall) and Dublin South East (Georges Quay and South Inner City) areas were reviewed for the proposed development, however, the site boundary lies outside the study extent.

As the scheme does not propose significant level changes, it is beyond the scope of the project to mitigate flooding for the existing road network in its entirety. “Hotspots” of pluvial flooding, however, have been identified and will be remediated through the design of the BusConnects drainage infrastructure where feasible. These areas are:

1. areas where the PFRA mapping has highlighted pluvial flood risk for continuous lengths of road in excess of 150m
2. where historical flood mapping has highlighted a past pluvial flood events, and

3. where topographical survey has indicated a low-point in the road alignment adjacent to or alongside the BusConnects route without drainage inlets (i.e. undrained sag points).

The above pluvial flooding areas will be mitigated through provision of additional drainage inlets, upsizing of the pipe network and/or localised regrading of the existing road alignment. This will reduce the risk of ponding and surface water collecting at localised low points.

All new surface water sewers provided as part of the scheme shall be designed so that no flooding will occur for a return period up to 30 years. This is an improvement when compared to some of the existing historical drainage infrastructure to be replaced and will reduce the risk of pluvial flooding.

Also, as part of the scheme new drainage infrastructure will be provided which will include new Sustainable (Urban) Drainage Systems (SuDS) such as rain gardens, swales and tree pits. These SuDS features will provide some surface water storage and thus reduce the risk of pluvial flooding.

In summary, there is a risk of pluvial flooding along the proposed route, however, this risk will be reduced as a result of the drainage improvements of the BusConnects project.

4.4 Groundwater Flooding

Groundwater flooding can occur during lengthy periods of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

The groundwater vulnerability for the proposed route is presented in Figure 13. It indicates that the groundwater vulnerability varies across the site. Most of the site falls into the “Moderate to High” groundwater vulnerability categories with a portion of the site around Booterstown assigned “Extreme” groundwater vulnerability classification.

Site Investigations (SI) have been undertaken as part of the project. Six cable percussion boreholes were taken to a maximum depth of 7.5m bgl within the Section 1 and 2 extents, three of which were located at Booterstown Nature Reserve (R15-CP05,06,07), one on the junction of R118 with Castledawson Avenue (R15-CP02), one on R118 adjacent to Blackrock Park (R15-CP03) and one at St Vincent’s Park estate on R113 (R15-CP04).

Groundwater has been encountered at 2.5-4.1m bgl in Booterstown Nature reserve, whereas no groundwater was encountered at the other three boreholes. While the groundwater levels are considered low and not imposing flood risk to the site, they may have seasonal fluctuations.

The proposed works do not involve any excavations, significant changes in levels or basement construction. As the scheme is on existing roads with no known flooding specifically due to groundwater, it is not expected that this risk will increase to the site or surrounding areas due to the construction of the scheme.

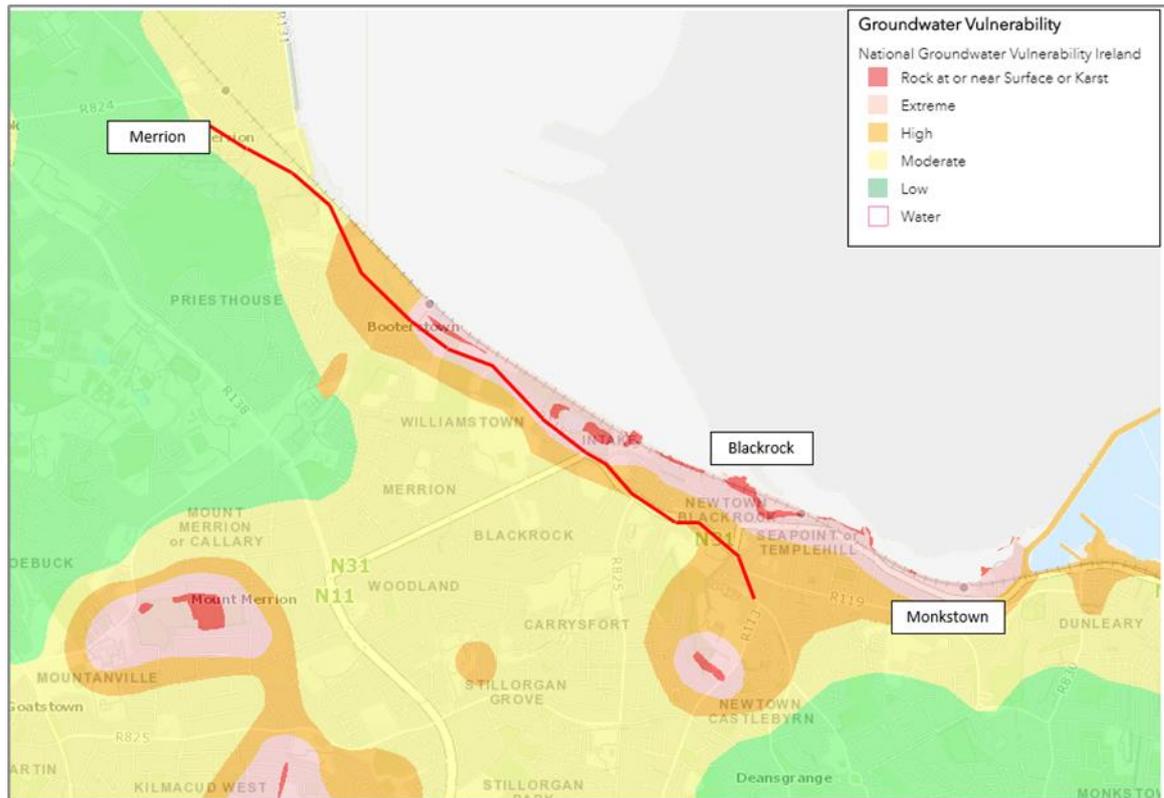


Figure 13: GSI Groundwater Vulnerability Mapping (Blackrock to Merrion)

4.5 Summary of Existing Flood Risk

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources has been assessed and is summarised as follows:

- The proposed route at Sections 1 and 2 from Blackrock to Merrion has varying levels of flood risk along the route. A section of the route at Merrion is in the 1 in 1000-year fluvial flood extent, therefore, is located within Flood Zone B – medium risk. However, this area is defended, so the flood risk is reduced to low;
- The section of the route on Frascati Road is in the 1 in 1000-year flood extent (Flood Zone B – medium risk);
- The majority of the site is deemed to be at low risk from tidal flooding, however, a section of the route at Merrion Strand falls in the 1 in 200-year flood extents (Flood Zone A – high risk);
- Parts of the road between Merrion and Booterstown are predicted to be at risk of tidal flooding in the future, under the mid-range and high-end climate change allowances (+500mm and +1000mm increase in sea level rise);
- The risk of pluvial flooding to the site is currently considered medium to high; and
- The risk of groundwater flooding to the site is considered medium.

5 Application of “The Planning System and Flood Risk Management” Guidelines for Sections 1 and 2

5.1 Flood Zones

There are a number of flood zones identified along the proposed route as the route spans from Monkstown to Merrion.

- Area 1: Merrion Road lies within Flood Zone B (1 in 1000-year fluvial flood extents), however this area has additional flood defences;
- Area 2: Frascati Road lies within Flood Zone B (1 in 1000-year fluvial flood extents);
- Area 3: Merrion Strand lies within Flood Zone A (1 in 200-year tidal flood extents);
- The rest of the route is at a low risk of flooding from rivers and the coast therefore is Flood Zone C; and
- The risk of pluvial flooding along the majority of the proposed route is medium, with areas at high risk, however, this risk will be reduced as a result of the proposed scheme.

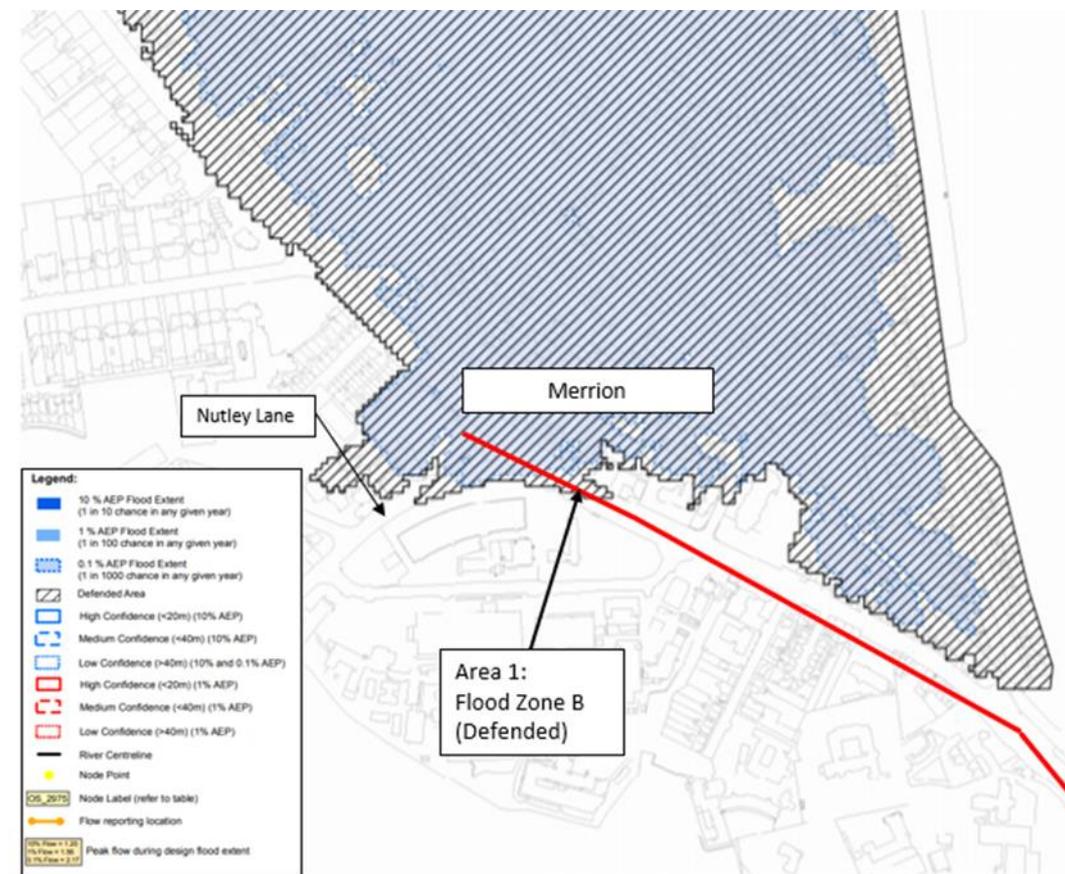


Figure 14: Area 1 Flood Zone Identification

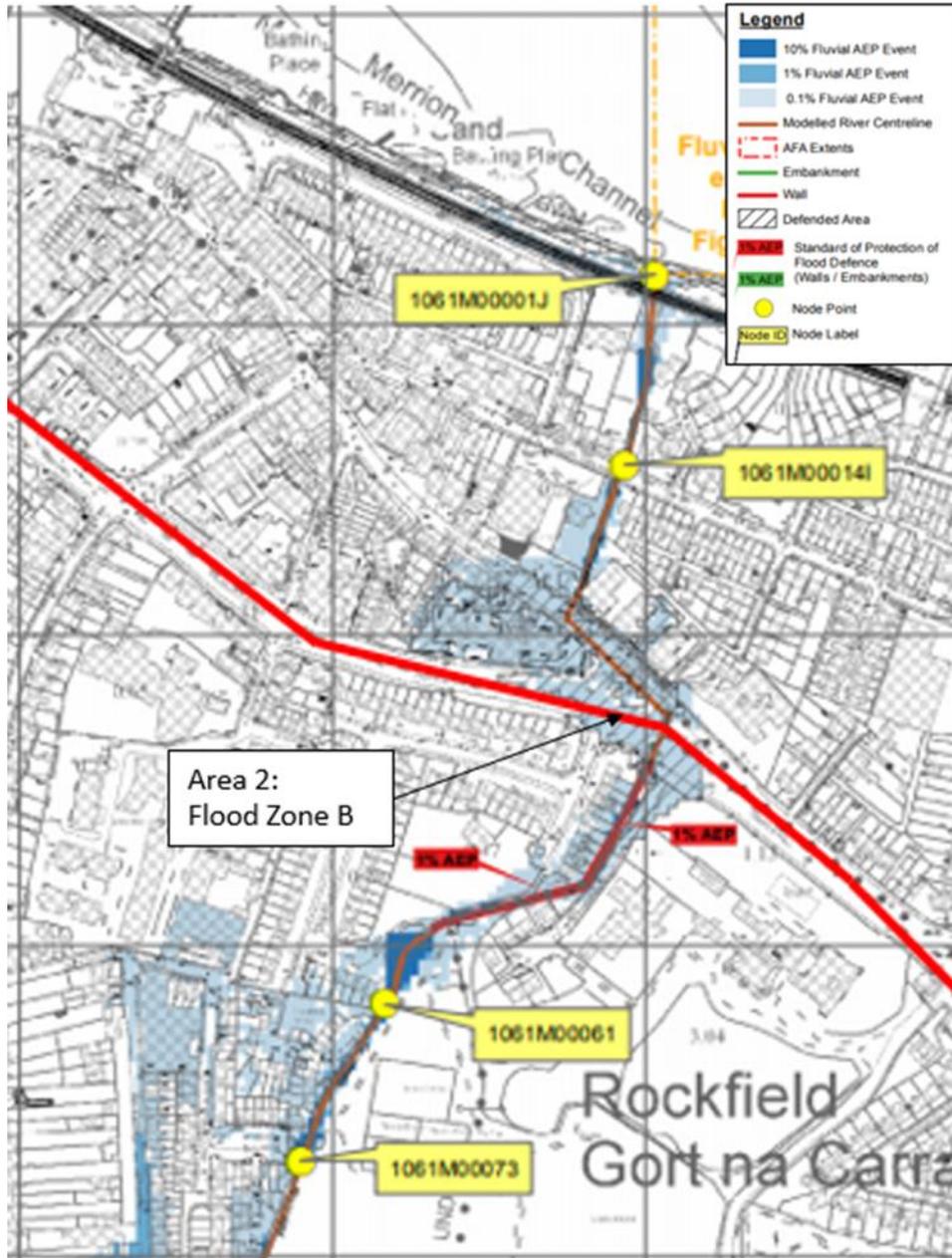


Figure 15: Area 2 Flood Zone Identification

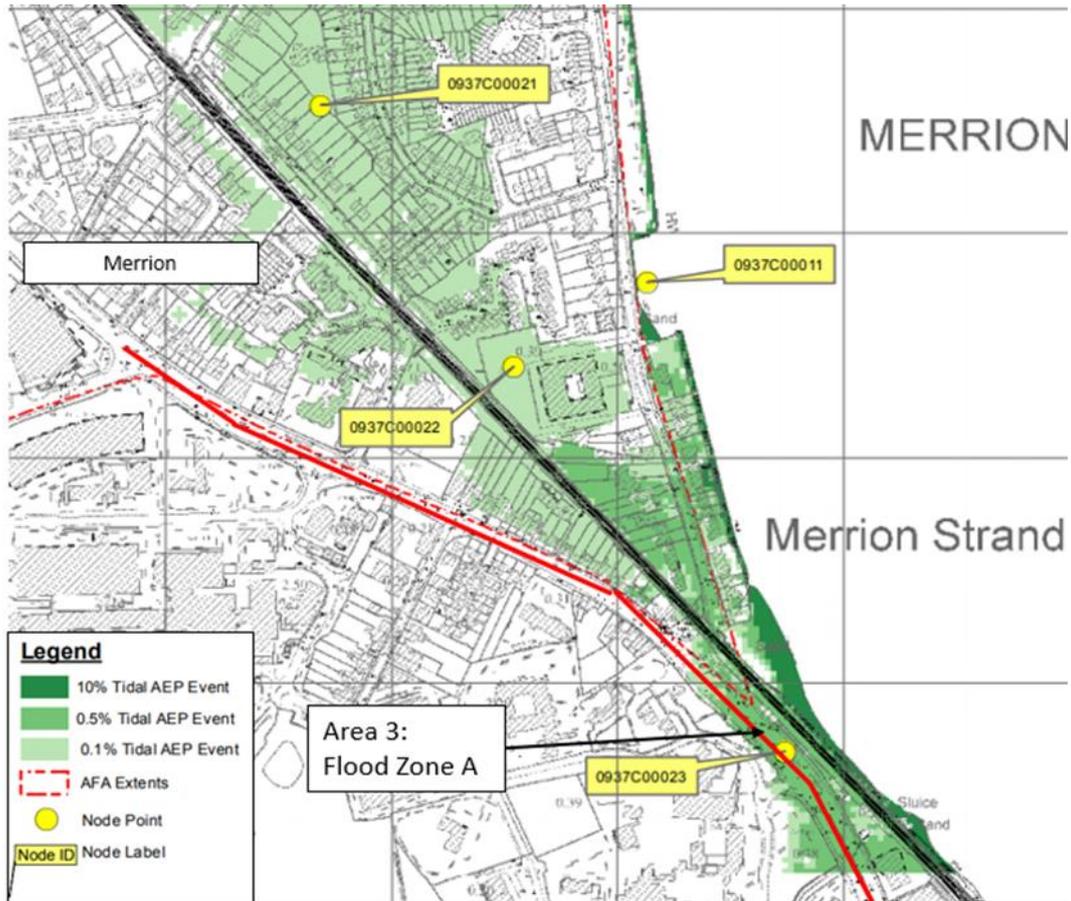


Figure 16: Area 3 Flood Zone Identification

5.2 Vulnerability Classification

As per Table 2, it is considered that the proposed development is classified as a ‘highly vulnerable development’ as per the vulnerability classification.

As the proposed development is a “highly vulnerable development,” a Justification Test is required for those sections of the route which are within Flood Zone A and Flood Zone B.

5.3 Justification Test

The Justification Test is comprised of two processes:

1. The first is the Plan-Making Justification Test (described in Chapter 4 of ‘The Planning System and Flood Risk Management’ guidelines) and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
2. The second is the Development Management Justification Test (described in Chapter 5 of ‘The Planning System and Flood Risk Management’ guidelines) and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

5.4 Plan-Making Justification Test

A Plan-Making Justification test formed part of the Strategic Flood Risk Assessment. The Strategic Development Zone (SDZ) Planning Scheme as approved notes that all proposed developments must include a site-specific flood risk assessment (SSFRA). It is further confirmed that the SSFRA is not required to carry out a Plan-Making Justification test, given that this exercise has already been carried out as part of the adopted SDZ Planning Scheme.

5.5 Development Management Justification Test

Box 5.1 of the Justification Test in the Planning Guidelines requires two criteria to be met:

- The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines;
- The proposal has been subject to an appropriate flood risk assessment that demonstrates:
 - i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
 - ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible; and
 - iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.

The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

5.5.1 Development Management Justification Test – Item 1

With regards to Item 1, we consider that this criterion has been met as follows:

- *The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines.*

As shown in Figure 17, the proposed location site lies within a number of GZT zones, predominately R2 existing residential, R3 residential, mixed residential and other uses and O1 strategic reserve, white land. Strategic Reserve, white land (O1) is to cater for those cases where land is zoned for development at some time in the future, but no objectives or specific controls are indicated. The site is currently used as a main road and, therefore, there is no change in the form of development.

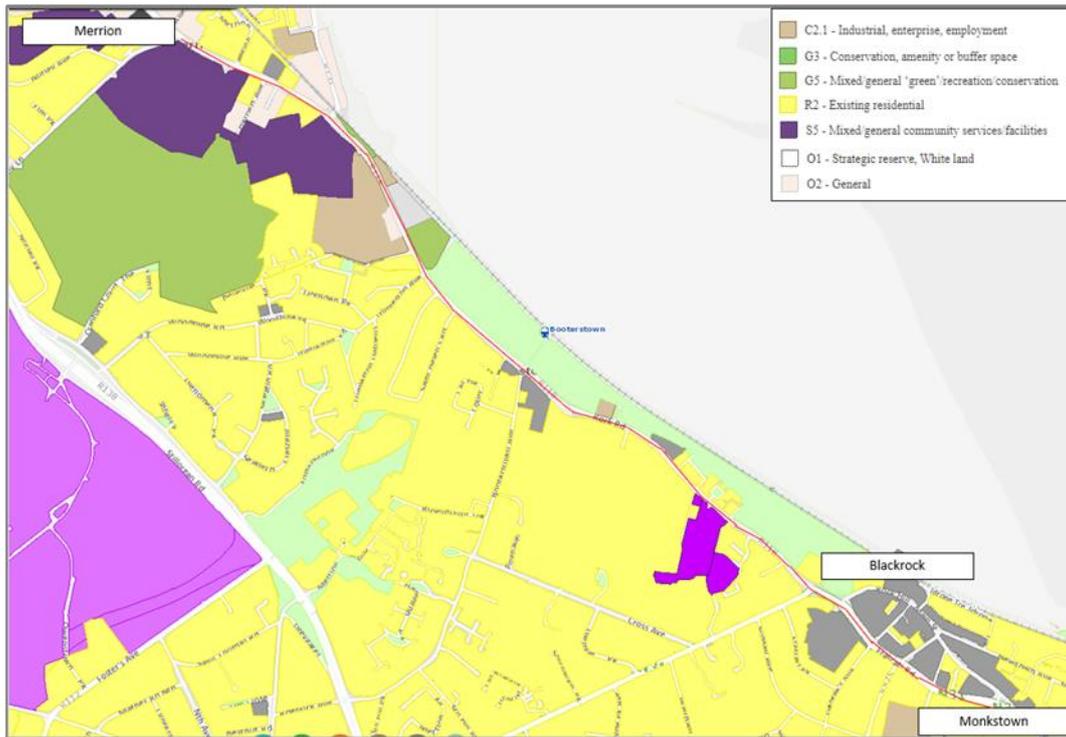


Figure 17: Dublin City Council 2016-2022: Current Development Plan

5.5.2 Development Management Justification Test – Item 2

With regards to Item 2, we consider that these criteria have been met as follows:

- *The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.*

As all three areas identified are existing roadways, it is not proposed to alter the extents of hardstanding area or raise the road level in this area. Therefore, development of the BusConnects route in this area will not increase flood risk elsewhere. This area meets the criteria for Part 2(i).

- *The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonable possible.*

The majority of areas along the route which are within a predicted flood extents zone are existing roads and will not increase flood risk compared to the existing scenario.

Any new roads, cycleways etc. constructed as part of the scheme will include appropriate mitigation measures to reduce the risk of flooding included at detailed design stage. As outlined in Section 4.3 pluvial flood risk will be mitigated by the incorporation of SuDS features into the drainage system where necessary. This will reduce the risk of ponding and surface water collecting at localised low points.

The mitigation measures proposed will minimise the flood risk to people, property, the economy and the environment.

It is therefore considered that the proposed development satisfies the criteria of Part 2(ii) of the Development Management Justification Test.

- *The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.*

The measures ensure that residual risks to the area and/or development will be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2(iii) of the development management Justification Test.

- *The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.*

The scheme has been designed to the highest standards and creates a connection of Bus services along core routes of Dublin. Measures to address the flood risk have been incorporated into the design without compromising the streetscape and functioning of the development.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2 (iv) of the development management Justification Test.

5.6 Justification Test – Conclusion

The scheme satisfies the requirements of the Plan-Making Justification Test and the requirements of Development Justification Test Part 2.

6 Existing Flood Risk at Sections 3, 4 and 5

6.1 Fluvial Flooding

6.1.1 Dodder CFRAM Study

Extracts from the Dodder CFRAMS fluvial flood extent map is displayed in Figure 18, Figure 19 and Figure 20. The predicted fluvial flood extents and levels for three return period events are presented on the map (1 in 10, 100- and 1000-year tidal flood extents).

The fluvial maps produced as part of the Dodder CFRAM study does not cover the full proposed route as indicated in Figure 18.

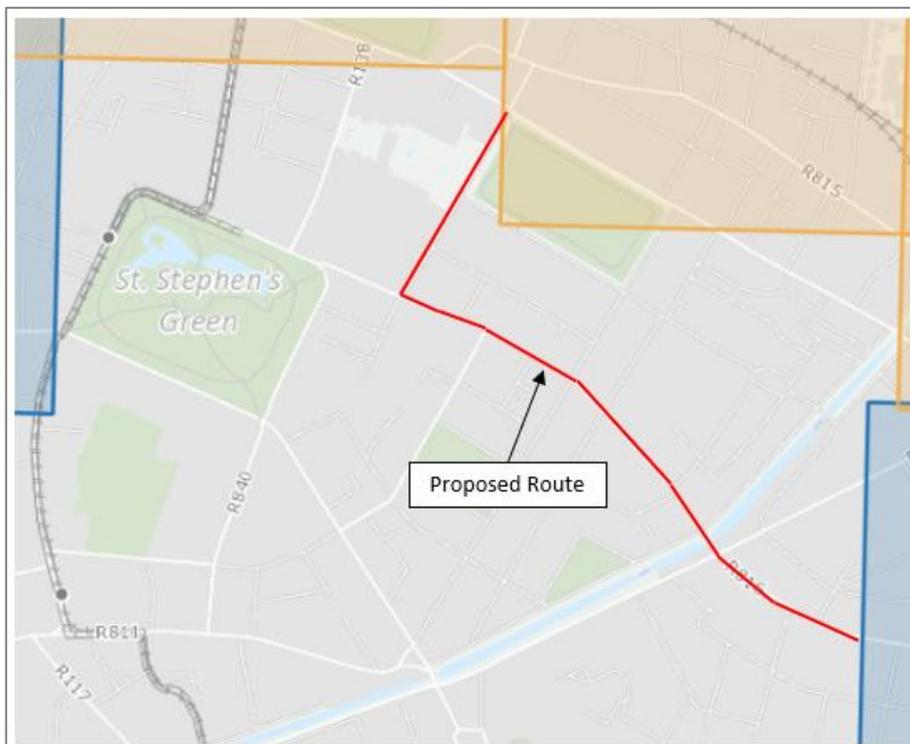


Figure 18: City Centre (no coverage by CFRAM studies)

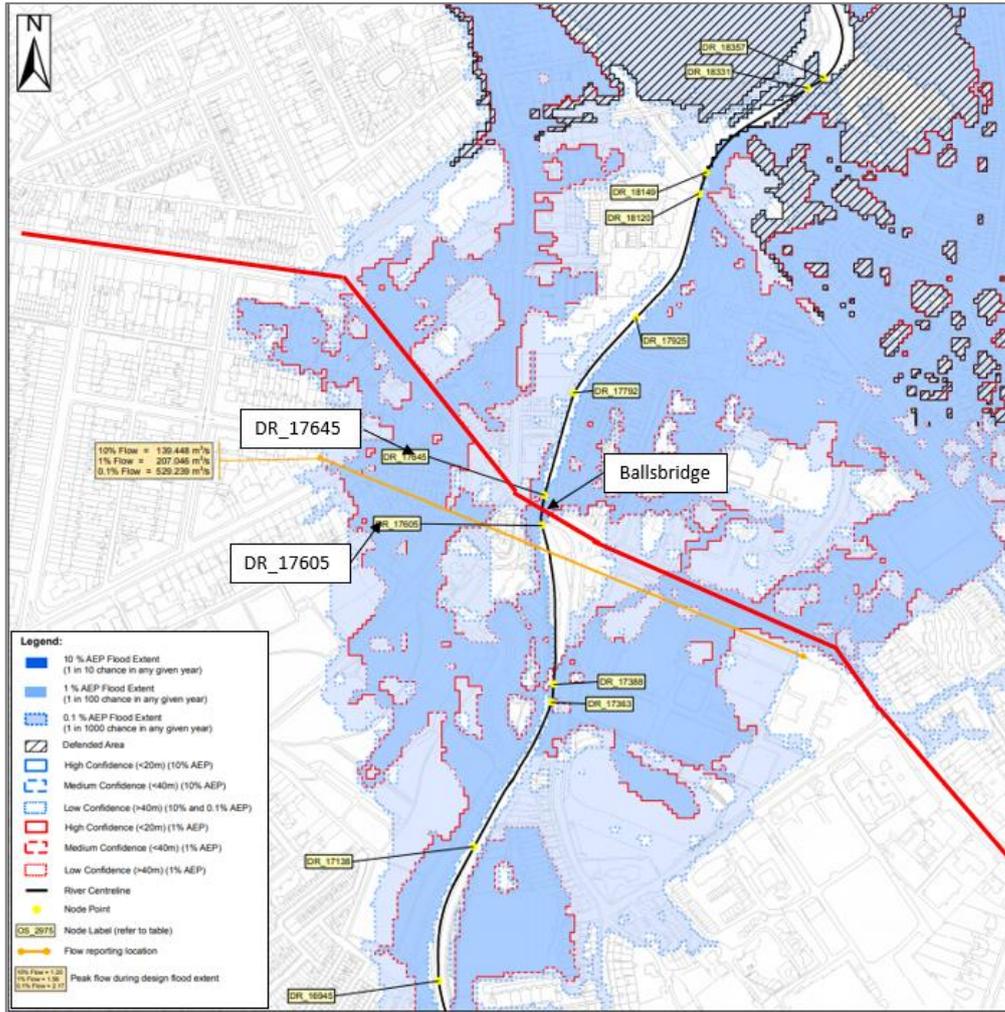


Figure 19: Ballsbridge fluvial flood risk (CFRAM studies)

Parts of the scheme are at risk of flooding from the River Dodder.

Figure 19 includes the modelled water levels for the nodes displayed. The nodes closest to the site are DR_17645 and DR_17605 with water levels for the 1 in 100-year flood event estimated to 4.92m OD and 5.23m OD respectively. Based on the topographic survey, the road levels in the area shown at risk of flooding are between 3.70m OD to 4.8m OD, suggesting that the CFRAM mapping represents accurately the risk of flooding on site.

The Lower Dodder Flood Alleviation Scheme was initiated in 2012 following the finalisation of the Dodder CFRAM study. The scheme proposes flood defences (walls and embankments) along both sides of the Dodder up to the 1 in 100 year flood defence level. Parts of that scheme have been completed, while other parts are due to be completed in the very near future. Following completion of the flood defence works, Pembroke Road, Ballsbridge and Merrion Road will be protected for up to the 1 in 100 year fluvial flood event. The proposed flood defences along the Dodder in this area are shown in Appendix A.

While the site is currently at high risk of fluvial flooding from the River Dodder, in the near future and following completion of the flood defence scheme, the site will be protected from the 1 in 100 year flood event. The road will still be at risk of flooding during the 1 in 1000 year flood event (Flood Zone B).

As shown in Figure 20, a section of the proposed route falls in an area at risk of flooding during the 1 in 1000 year flood event (Flood Zone B) from the River Dodder. This area is currently benefitting from flood defences. The risk of flooding to this area is considered low. There is an unlikely residual risk of breaching of defences that could impose risk of flooding to the site.

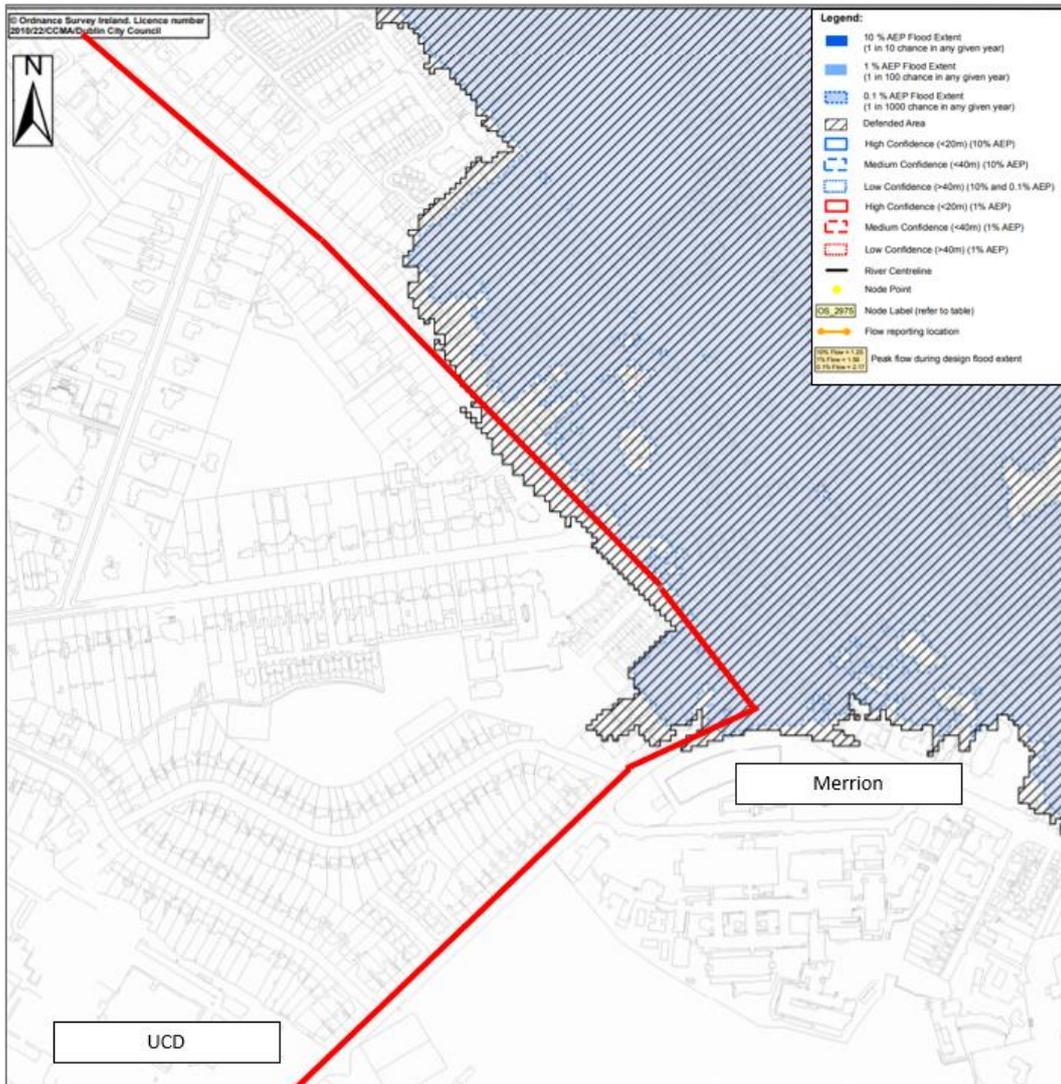


Figure 20: UCD fluvial flood risk (CFRAM studies)

6.2 Tidal Flood Risk

6.2.1 Dodder CFRAM Study

An extract from the Dodder CFRAM coastal flood extent map is displayed in Figure 21. The predicted tidal flood extents for three separate return period events are presented on the map (1 in 10, 200 year and 1000-year tidal flood extents.)

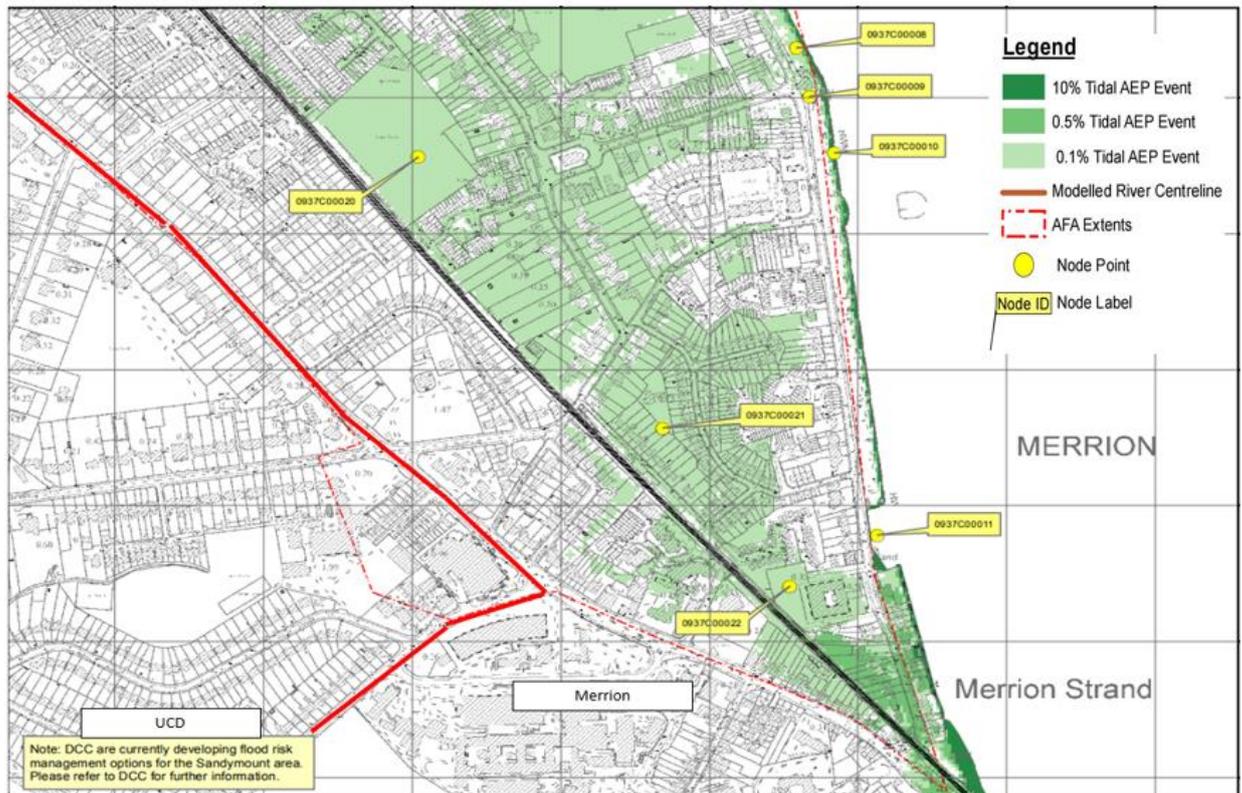


Figure 21: UCD – Merrion tidal flood risk (CFRAM studies)

As shown in Figure 21, there is no risk of coastal flooding along the proposed route in the existing scenario.

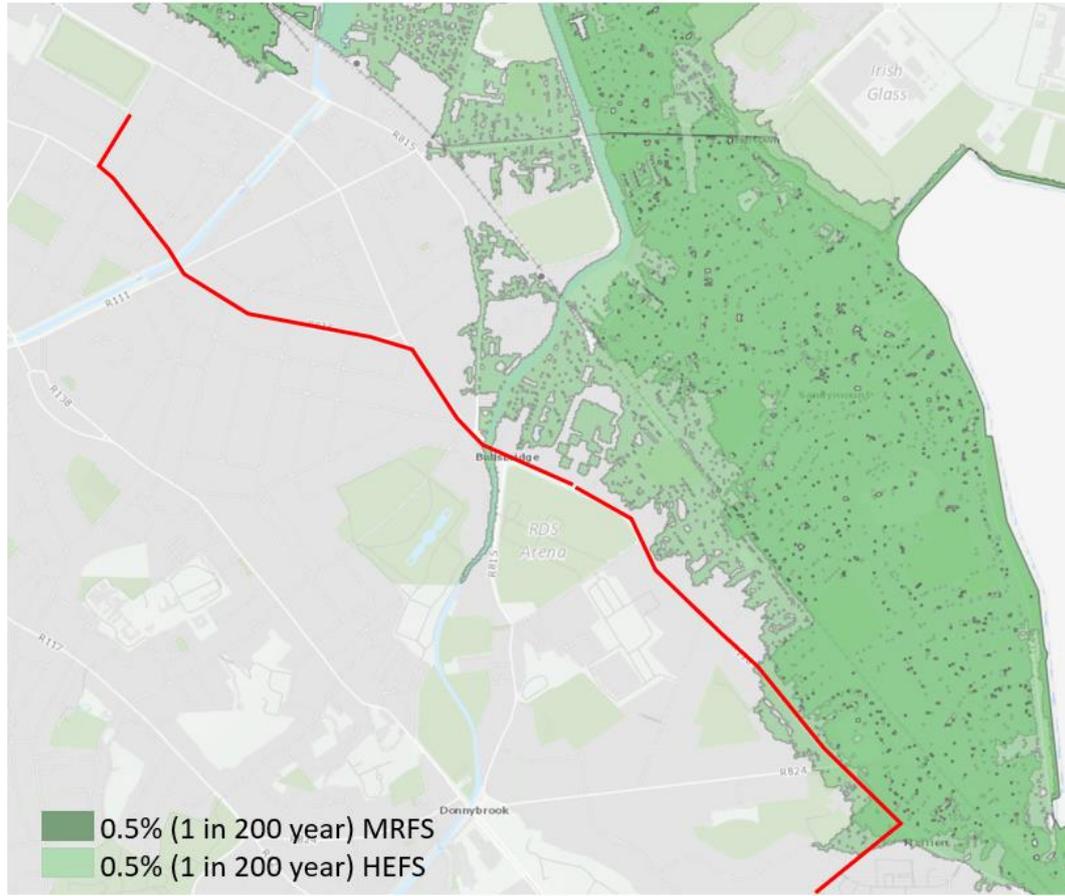


Figure 22: Merrion to Centre Future scenarios for 1 in 200 year event (CFRAM studies)

Figure 22 shows the mid-range and high-end future scenario of the 1 in 200 year event (medium risk) extents that take in the potential effects of climate change (increase in rainfall of 20% and sea level rise of 500mm for MRFS and increase of 30% in rainfall and sea level rise of 1000mm for HEFS). As seen, there are sections of the proposed route at the Merrion that fall within the future scenario flood zone and will move into Flood Zone A or B in the future. While it is predicted that flood risk will increase in the future at this part of the site, it is not in the scope of the project to significantly increase road levels to mitigate the risk.

6.3 Pluvial Flooding/Urban Drainage

Pluvial flooding occurs when extreme rainfall overwhelms drainage systems or soil infiltration capacity, causing excess rainwater to pond above ground at low points in the topography.

The risk of pluvial flooding has been assessed by the flood maps produced as part of the Preliminary Flood Risk Assessment (PFRA) by Office of Public Works (OPW). An extract from PFRA mapping along the proposed route is present in Figure 23.

The PFRA map indicates that there is risk of pluvial flooding along the route. Large sections of the route at Ballsbridge and Baggot Street Lower are within the 10% AEP. The majority of the route falls within the 1% and 10% AEP, therefore there is a risk of pluvial flooding along the route.



Figure 23: Extract from OPW PFRA Pluvial Flood Maps

The *Dublin City Council Flood Resilience City Project* was carried out in conjunction with Jacobs in 2012. This study was carried out to detail pluvial flood risk assessment of pilot areas in Dublin City. Dublin Central (East Wall) and Dublin South East (Georges Quay and South Inner City) areas were reviewed for the proposed development however the site boundary lies outside the study extent.

It is beyond the scope of the project to mitigate flooding for the existing road network in its entirety however “hotspots” of pluvial flooding have been identified and will be remediated through the design of the BusConnects drainage infrastructure where feasible. These areas are:

1. areas where the PFRA mapping has highlighted pluvial flood risk for continuous lengths of road in excess of 150m;
2. where historical flood mapping has highlighted a past pluvial flood events; and
3. where topographical survey has indicated a low-point in the road alignment adjacent to or alongside the BusConnects route without drainage inlets (i.e. undrained sag points).

The above pluvial flooding areas will be mitigated through the provision of additional drainage inlets, upsizing of the pipe network and/or localised regrading of the existing road alignment. This will reduce the risk of ponding and surface water collecting at localised low points.

All new surface water sewers provided as part of the scheme shall be designed so that no flooding will occur for a return period up to 30 years. This is an improvement when compared to some of the existing historical drainage infrastructure to be replaced and will reduce the risk of pluvial flooding.

As part of the scheme new drainage infrastructure will be provided which will include new Sustainable (Urban) Drainage Systems (SuDS) such as rain gardens, swales and tree pits. These SuDS features will provide some surface water storage and thus reduce the risk of pluvial flooding.

In summary, there is a risk of pluvial flooding along the proposed route, however, this risk exists in the present scenario and overall the flood risk profile will be reduced as a result of the BusConnects scheme.

6.4 Groundwater Flooding

Groundwater flooding can occur during lengthy period of heavy rainfall, typically during later winter/early spring when the groundwater table is already high. If the groundwater level rises above ground level, it can pond at local low points and cause periods of flooding.

The groundwater vulnerability for the proposed route is presented in Figure 24. It indicates that the groundwater vulnerability varies across the site. The proposed route falls into the “Low” and “Moderate” groundwater vulnerability.

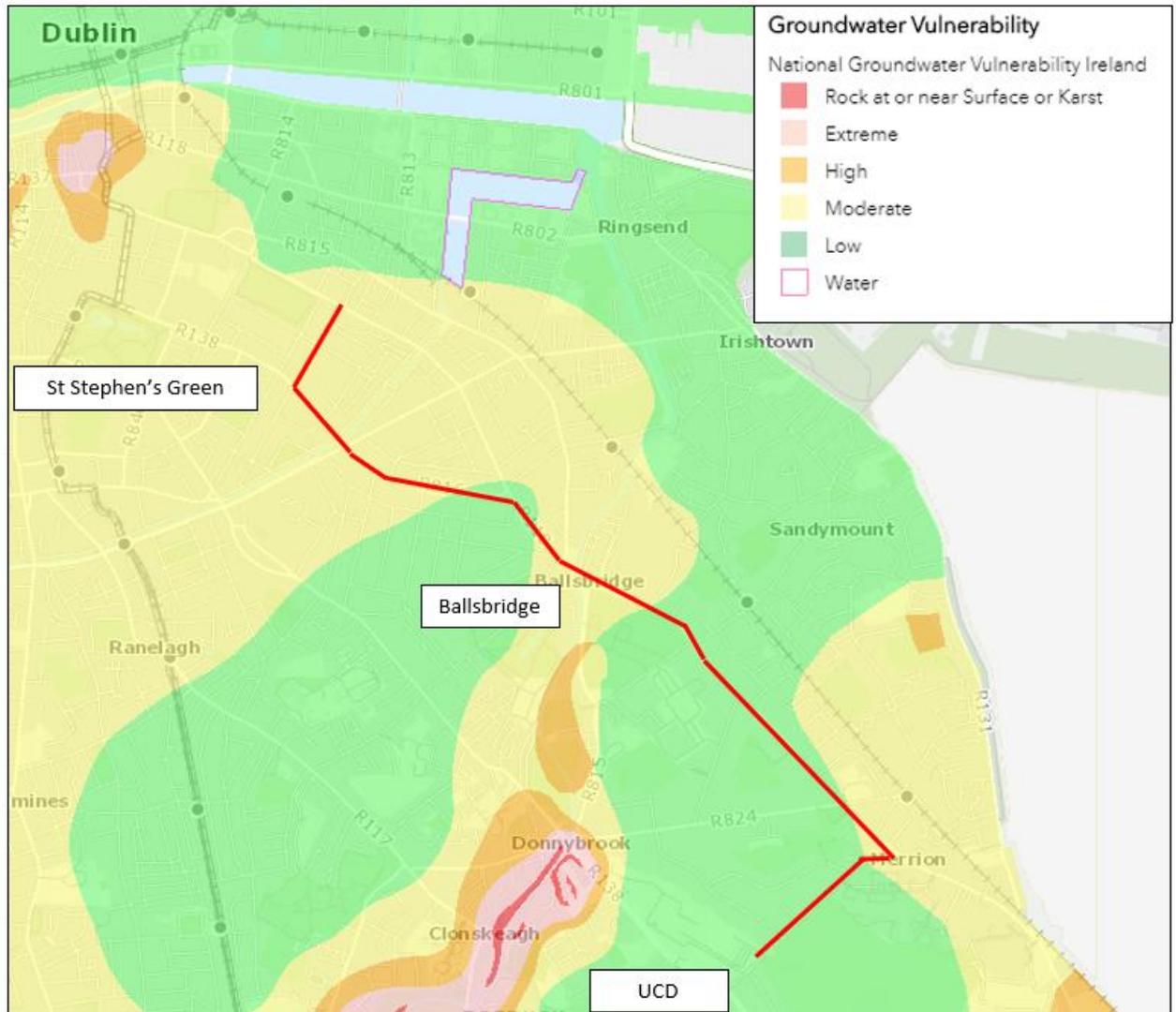


Figure 24: GSI Groundwater Vulnerability Mapping (www.gsi.ie)

The groundwater flooding risk along the route is deemed medium to low risk. As the scheme is on existing roads with no known flooding specifically due to groundwater it is not expected that this risk will increase with the construction of the scheme.

6.5 Summary of Existing Flood Risk

The risk of flooding to the existing site from fluvial, tidal, pluvial and groundwater sources has been assessed and is summarised as follows:

- The proposed route from UCD to the city centre has varying levels of flood risk along the route. The section of the route at Merrion is in the 1 in 1000-year fluvial flood extent therefore is located within Flood Zone B. However, this area is defended so the flood risk is low.
- The section of the route at Ballsbridge is in the 1 in 100-year flood extent therefore it is located in Flood Zone A. Flood defences are currently under construction to protect the area up to the 1 in 100-year flood event.

- The route is deemed to be of low risk of tidal flooding at the present scenario and medium risk of tidal flooding under the mid-range climate change allowances.
- The risk of pluvial flooding to the site is considered medium to high.
- The risk of groundwater flooding to the route is considered low to moderate.

7 Application of “The Planning System and Flood Risk Management” Guidelines for Sections 3, 4 and 5

7.1 Flood Zones

There are a number of flood zones identified along the proposed route as the route spans from UCD to City Centre:

- Area 1: Ballsbridge lies within Flood Zone A (1 in 100-year flood extents). Flood Alleviation Schemes are carried out in this area and the flood risk will be reduced from high to medium (Flood Zone B) following completion of works;
- Area 2: Merrion Road lies within Flood Zone B (1 in 1000-year flood extents), however this area benefits from existing flood defences;
- The rest of the route does not fall within any flood zone extents therefore the rest is in Flood Zone C; and
- The risk of pluvial flooding along the majority of the proposed route is medium to high, however, this risk exists in the current scenario and will be reduced as a result of the drainage strategy of the proposed scheme.

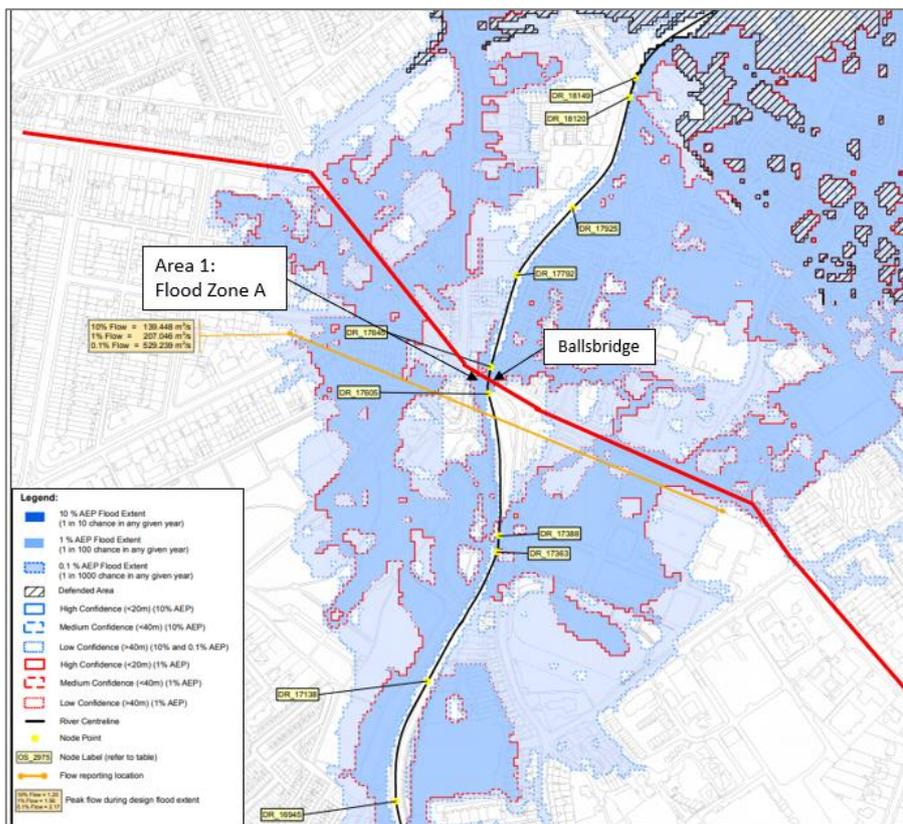


Figure 25: Area 1 Flood Zone Identification

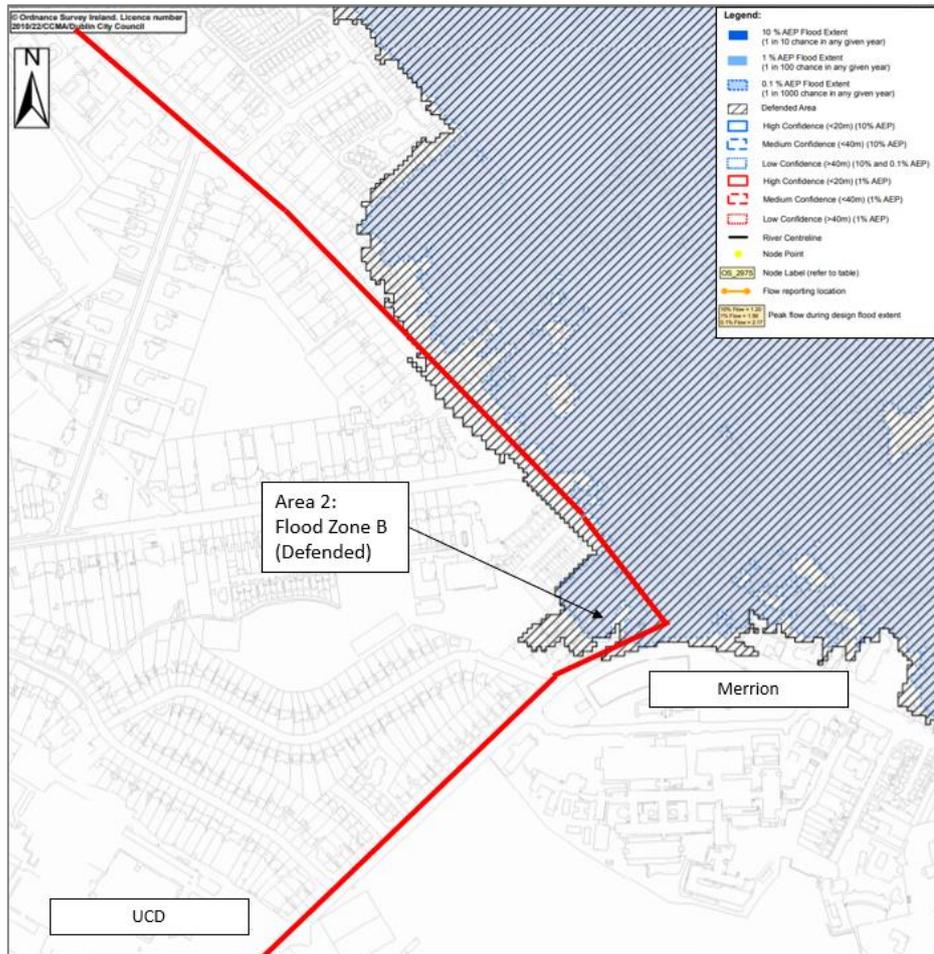


Figure 26: Area 2 Flood Zone Identification

7.2 Vulnerability Classification

As per Table 2, it is considered the proposed development is classified as a 'highly vulnerable development' as per the vulnerability classification.

As such, a Justification Test is required for those sections of the route which are within Flood Zone A and B.

7.3 Justification Test

The Justification Test is comprised of two processes:

1. The first is the Plan-Making Justification Test (described in Chapter 4 of 'The Planning System and Flood Risk Management' guidelines) and is used at the plan preparation and adoption stage where it is intended to zone or otherwise designate land which is at moderate or high risk of flooding.
2. The second is the Development Management Justification Test (described in Chapter 5 of 'The Planning System and Flood Risk Management' guidelines) and is used at the planning application stage where it is intended to develop land at moderate or high risk of flooding for uses or development vulnerable to flooding that would generally be inappropriate for that land.

7.4 Plan-Making Justification Test

A Plan-Making Justification test formed part of the Strategic Flood Risk Assessment. The Strategic Development Zone (SDZ) Planning Scheme as approved notes that all proposed developments must include a site-specific flood risk assessment (SSFRA). It is further confirmed that the SSFRA is not required to carry out a justification test, given that this exercise has already been carried out as part of the adopted SDZ Planning Scheme.

7.5 Development Management Justification Test

Box 5.1 of the Justification Test in the Planning Guidelines requires two criteria to be met:

- The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines;
- The proposal has been subject to an appropriate flood risk assessment that demonstrates:
 - i) The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk;
 - ii) The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonably possible;
 - iii) The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access; and
 - iv) The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.

7.5.1 Development Management Justification Test – Item 1

With regards to Item 1, we consider that this criterion has been met as follows:

- *The subject lands have been zoned or otherwise designated for the particular use of form of development in an operative development plan, which has been adopted or varied taking account of these guidelines.*

As shown in Figure 27, the proposed location site lies within a number of GZT zones, predominately R2 existing residential, R3 residential, mixed residential and other uses and O1 strategic reserve, white land. Strategic Reserve, white land (O1) is to cater for those cases where land is zoned for development at some time in the future, but no objectives or specific controls are indicated. The site is currently used as a main road and therefore there is no change in the form of development.

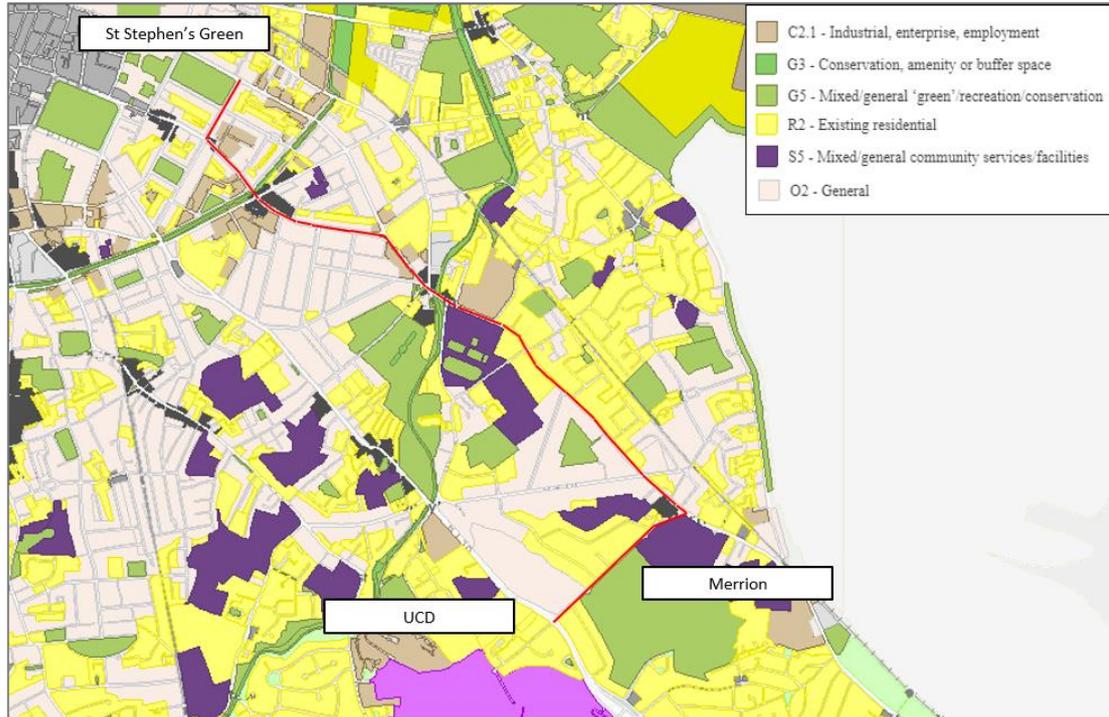


Figure 27: Dublin City Council 2016-2022: Current Development Plan

7.5.2 Development Management Justification Test – Item 2

With regards to Item 2, we consider that these criteria have been met as follows:

- i. *The development proposed will not increase flood risk elsewhere and, if practicable, will reduce overall flood risk.*

As both areas identified are existing roadways it is not proposed to alter the extents of hardstanding area or raise the road level in this area. Therefore, development of the BusConnects route in this area will not increase flood risk elsewhere. This area meets the criteria for Part 2(i).

- ii. *The development proposal includes measures to minimise flood risk to people, property, the economy and the environment as far as reasonable possible.*
 - The areas along the route which are within a predicted flood extents zone are existing roads and will not increase flood risk compared to the existing scenario.
 - As outlined in Section 4.3, pluvial flood risk will be mitigated by the incorporation of SuDS features into the drainage system where necessary. This will reduce the risk of ponding and surface water collecting at localised low points.
 - The mitigation measures proposed will minimise the flood risk to people, property, the economy and the environment.
 - It is therefore considered that the proposed development satisfies the criteria of Part 2(ii) of the development management Justification Test.

iii. *The development proposed includes measures to ensure that residual risks to the area and/or development can be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures and provisions for emergency services access.*

- Construction of the flood defences along the Dodder will finish in the next year and therefore are considered adequate for the following decades. They will provide protection for up to the 1 in 100 year flood level. The measures ensure that residual risks to the area and/or development will be managed to an acceptable level as regards the adequacy of existing flood protection measures or the design, implementation and funding of any future flood risk management measures.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2(iii) of the development management Justification Test.

iv. *The development proposed addresses the above in a manner that is also compatible with the achievement of wider planning objectives in relation to development of good urban design and vibrant and active streetscapes.*

The scheme has been designed to the highest standards and creates a connection of Bus services along core routes of Dublin. Measures to address the flood risk have been incorporated into the design without compromising the streetscape and functioning of the development.

Therefore, it is considered that the proposed development satisfies the criteria of Part 2 (iv) of the development management Justification Test.

7.6 Justification Test – Conclusion

Two areas have been identified as requiring a Justification test. These areas of the scheme satisfy the requirements of the Plan-Making Justification Test and the requirements of Development Justification Test.

8 Conclusion

This Flood Risk Assessment (FRA) has been carried out as part of the Planning Application for the proposed Belfield / Blackrock to City Centre Core Bus Corridor Scheme.

Sections 1 and 2

There are a number of historic flood events at different locations along or near to Sections 1 and 2 of the proposed scheme. The proposed scheme is largely on existing roads and will result in minimal additional paved areas and will therefore not increase the risk of these events reoccurring compared to the current scenario.

The groundwater vulnerability varies along the proposed scheme. As most of the scheme is on existing roads with no known flooding specifically due to groundwater, it is not expected that this risk will increase with the construction of the scheme.

The pluvial flood risk along the majority of the proposed route is medium, however, this risk exists in the current scenario and will be reduced as a result of the proposed scheme.

All new surface water sewers provided as part of the scheme shall be designed so that no flooding will occur for a return period up to 30 years. This is an improvement when compared to some of the existing historical drainage infrastructure to be replaced and will reduce the risk of pluvial flooding. Also, as part of the scheme, new drainage infrastructure will be provided which will include new Sustainable (Urban) Drainage Systems (SuDS) such as rain gardens, swales and tree pits. These SuDS features will provide some surface water storage and thus reduce the risk of pluvial flooding.

There are two areas along the proposed scheme where there is a risk of fluvial flooding as identified in Section 4.1. The two areas consist of Area 1 at Merrion Road and Area 2 at Frascati Road which lies within Flood Zone B.

There is one area identified along the proposed scheme where there is a risk of coastal flooding as identified in Section 4.2. Area 3 at Merrion Strand falls within Flood Zone A.

As areas of the scheme are identified as being within Flood Zone A and Flood Zone B, the Justification Test is required. The Plan-Making Justification Test and Development Management Justification have been assessed and passed, therefore, further investigation of the flood risk in the form of a Stage 2 FRA does not need to be carried out.

Sections 3, 4 and 5

There are a number of historic flood events at different locations along or near to Sections 1, 2 and 3 of the proposed scheme. Parts of the River Dodder Flood Alleviation Scheme and upgrades to the local drainage network have since been carried out, reducing the risk of flooding in this area.

The pluvial flood risk along the majority of the proposed route is medium to high, however, this risk exists in the current scenario and will be reduced as a result of the proposed scheme.

As with Sections 1 and 2, all new surface water sewers provided as part of the scheme shall be designed so that no flooding will occur for a return period up to 30 years. This is an improvement when compared to some of the existing historical drainage infrastructure to be replaced and will reduce the risk of pluvial flooding. Also, as part of the scheme, new drainage infrastructure will be provided which will include new Sustainable (Urban) Drainage Systems (SuDS) such as rain gardens, swales and tree pits. These SuDS features will provide some surface water storage and thus reduce the risk of pluvial flooding.

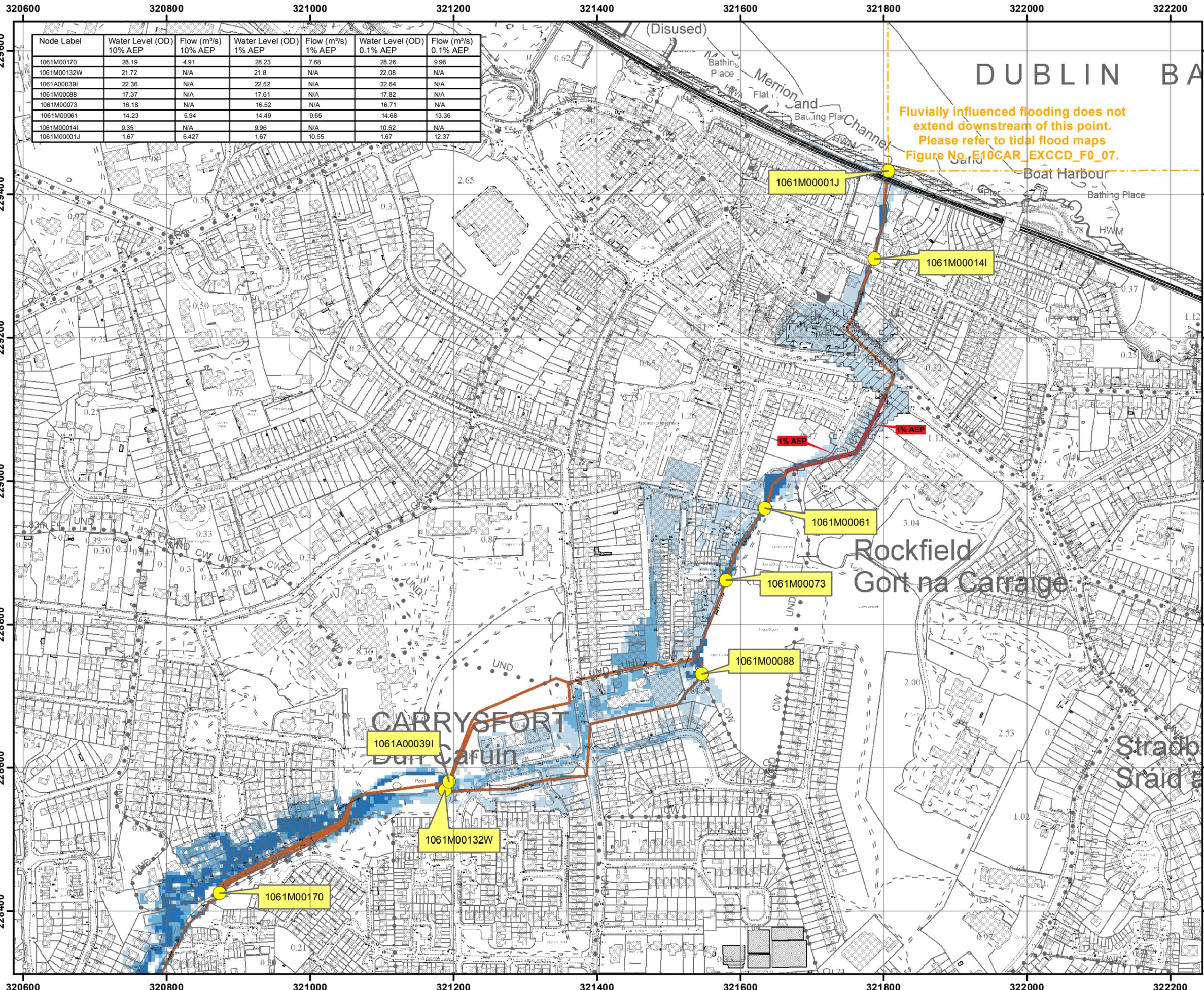
The groundwater vulnerability varies along the proposed scheme from low to moderate. As most of the scheme is on existing roads with no known flooding specifically due to groundwater, it is not expected that this risk will increase with the construction of the scheme.

There are two areas along the proposed scheme where there is a risk of fluvial flooding as identified in Section 6.1. There are two areas along the proposed route where there is a risk of fluvial flooding. The two areas consist of Area 1 at Ballsbridge which lies within Flood Zone A and Area 2 at Merrion Road which lies in Flood Zone B.

As areas of the scheme are identified as being within Flood Zone A and Flood Zone B, the Justification Test is required. The Plan-Making and Development Management Justification Tests have been assessed and passed, therefore, further investigation of the flood risk in the form of a Stage 2 FRA does not need to be carried out.

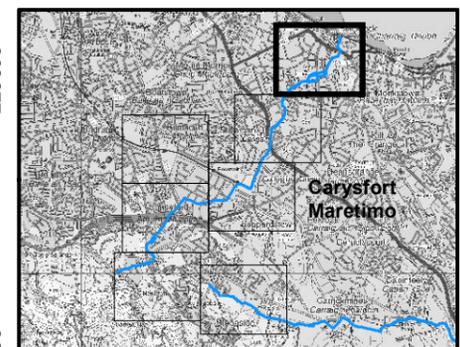
Appendix A

**CFRAM Drawings and Dodder
FRS plans**



Node Label	Water Level (OD) 10% AEP	Flow (m³/s) 10% AEP	Water Level (OD) 1% AEP	Flow (m³/s) 1% AEP	Water Level (OD) 0.1% AEP	Flow (m³/s) 0.1% AEP
1061M00170	28.19	4.91	28.23	7.68	28.26	9.96
1061M00132W	21.72	N/A	21.8	N/A	22.08	N/A
1061A00039I	22.36	N/A	22.52	N/A	22.64	N/A
1061M00088	17.37	N/A	17.61	N/A	17.82	N/A
1061M00073	16.18	N/A	16.52	N/A	16.71	N/A
1061M00061	14.23	5.94	14.49	9.65	14.68	13.36
1061M00014I	9.35	N/A	9.96	N/A	10.52	N/A
1061M00001J	1.67	6.427	1.67	10.55	1.67	12.37

Fluvially influenced flooding does not extend downstream of this point. Please refer to tidal flood maps Figure No. E10CAR_EXCCD_F0_07.



IMPORTANT USER NOTE: THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

Legend

- 10% Fluvial AEP Event
- 1% Fluvial AEP Event
- 0.1% Fluvial AEP Event
- Modelled River Centreline
- AFA Extents
- Embankment
- Wall
- Defended Area
- 1% AEP Standard of Protection of Flood Defence (Walls / Embankments)
- 1% AEP
- Node Point
- Node ID Node Label

FINAL

REV:	NOTE:	DATE:
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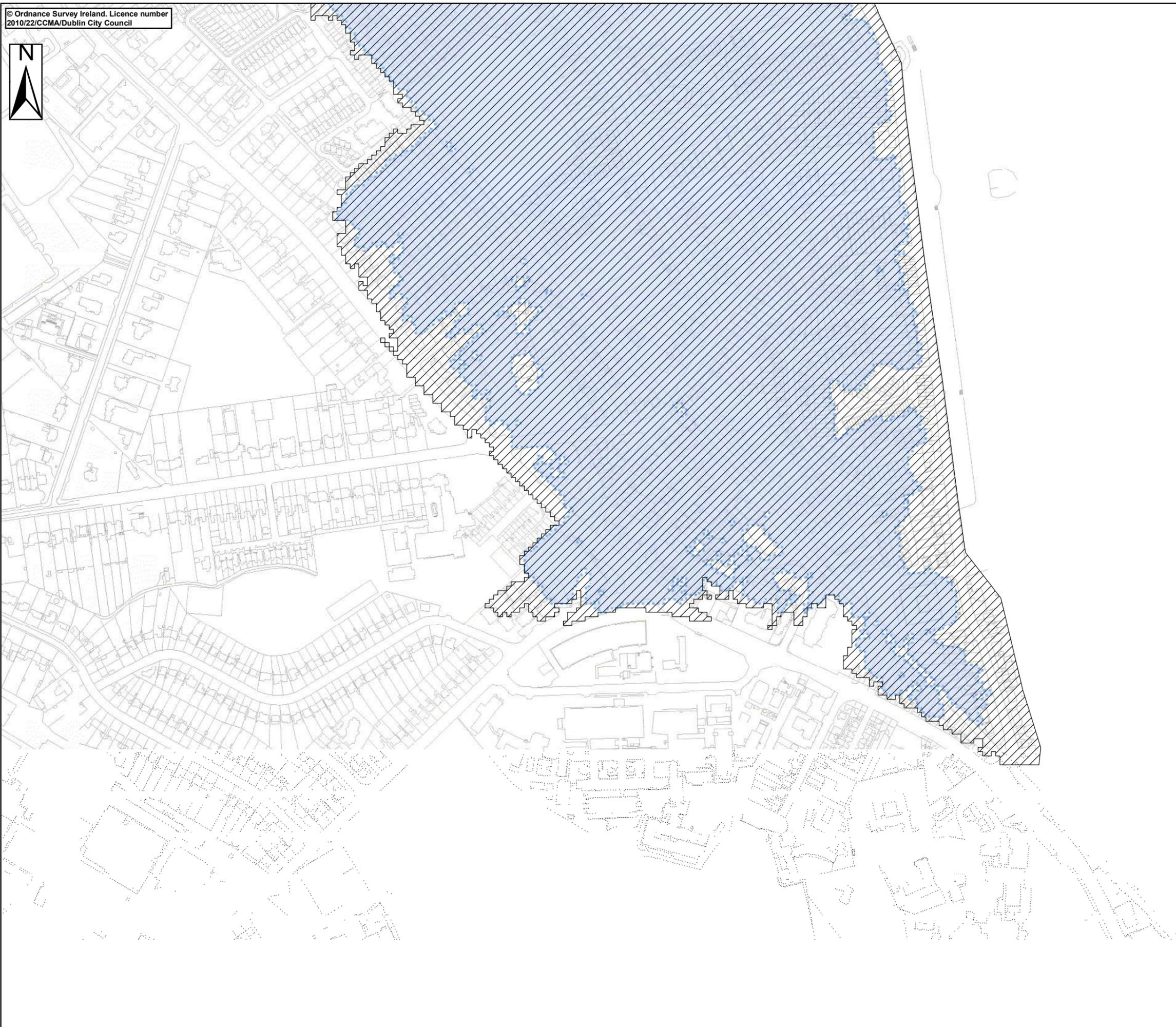
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

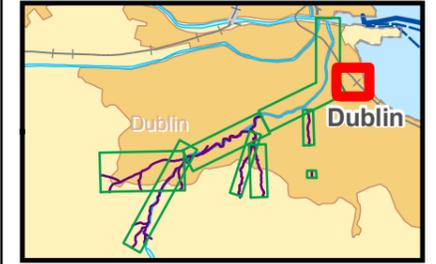
T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Map:	
Carysfort Maretimo Fluvial Flood Extents	
Map Type: EXTENT	
Source: FLUVIAL	
Map Area: HPW	
Scenario: CURRENT	
Drawn By: C.C.	Date: 27 October 2017
Checked By: A.S.	Date: 27 October 2017
Approved By: S.P.	Date: 27 October 2017
Drawing No.:	
E09CAR_EXFCD_F2_07	
Map Series: Page 7 of 7	
Drawing Scale: 1:5,000 @ A3	





Location Plan:



Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- OS_2975 Node Label (refer to table)
- Flow reporting location
- 10% Flow = 1.20
1% Flow = 1.56
0.1% Flow = 2.17 Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:



Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

PRESENT DAY DODDER

Map Type: FLOOD EXTENT

Source: FLUVIAL FLOODING

Map Area: URBAN AREA

Scenario: CURRENT

Drawn By : A.A.B Date : 26 November 2010

Checked By : A.J. Date : 26 November 2010

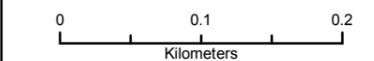
Approved By : A.G.B Date : 26 November 2010

Figure No. :

DR/EXT/UA/CURS/101

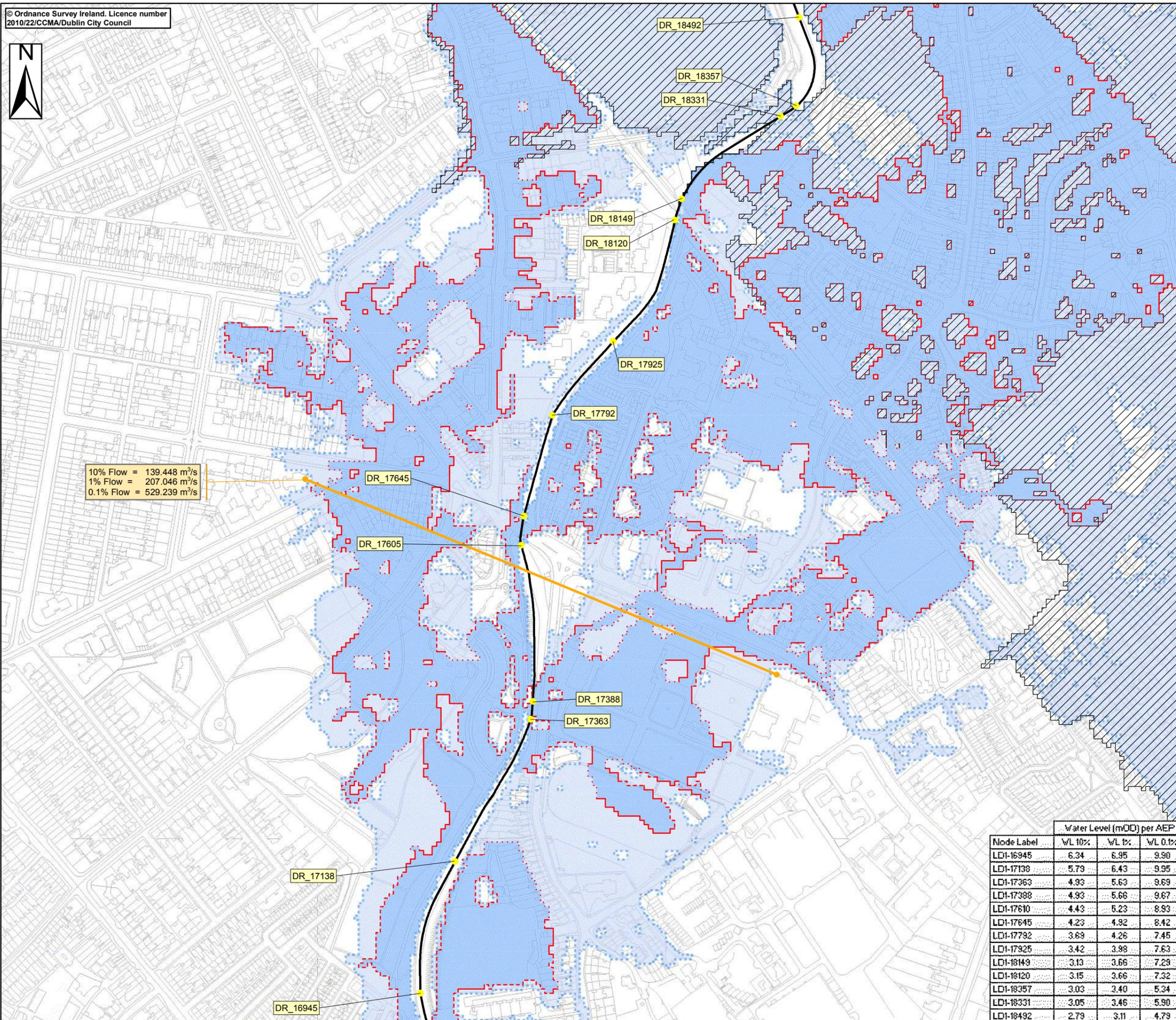
Map Series : Page 12 of 12

Drawing Scale : 1: 5,000 Plot Scale : 1:1 @ A3



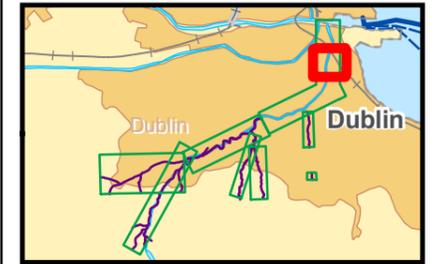
RPS Consulting Engineers

ELMWOOD HOUSE TEL : 028 9066 7914
74 BOUCHER ROAD FAX : 028 9066 8286
BELFAST BT12 6RZ www.rpsgroup.com/Ireland



10% Flow = 139.448 m³/s
 1% Flow = 207.046 m³/s
 0.1% Flow = 529.239 m³/s

Location Plan:



Legend:

- 10 % AEP Flood Extent (1 in 10 chance in any given year)
- 1 % AEP Flood Extent (1 in 100 chance in any given year)
- 0.1 % AEP Flood Extent (1 in 1000 chance in any given year)
- Defended Area
- High Confidence (<20m) (10% AEP)
- Medium Confidence (<40m) (10% AEP)
- Low Confidence (>40m) (10% and 0.1% AEP)
- High Confidence (<20m) (1% AEP)
- Medium Confidence (<40m) (1% AEP)
- Low Confidence (>40m) (1% AEP)
- River Centreline
- Node Point
- OS_2975 Node Label (refer to table)
- Flow reporting location
- Peak flow during design flood extent

USER NOTE:

USERS OF THESE MAPS SHOULD REFER TO THE DETAILED DESCRIPTION OF THEIR DERIVATION, LIMITATIONS IN ACCURACY AND GUIDANCE AND CONDITIONS OF USE PROVIDED AT THE FRONT OF THIS BOUND VOLUME. IF THIS MAP DOES NOT FORM PART OF BOUND VOLUME, IT SHOULD NOT BE USED FOR ANY PURPOSE.

Client:



Project:

DODDER CATCHMENT FLOOD RISK ASSESSMENT AND MANAGEMENT STUDY

Map:

PRESENT DAY DODDER

Map Type: FLOOD EXTENT

Source: FLUVIAL FLOODING

Map Area: URBAN AREA

Scenario: CURRENT

Drawn By : A.A.B Date : 26 November 2010

Checked By : A.J. Date : 26 November 2010

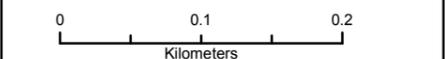
Approved By : A.G.B Date : 26 November 2010

Figure No.:

DR/EXT/UA/CURS/101

Map Series : Page 9 of 12

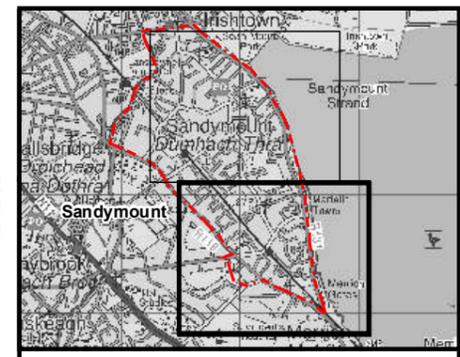
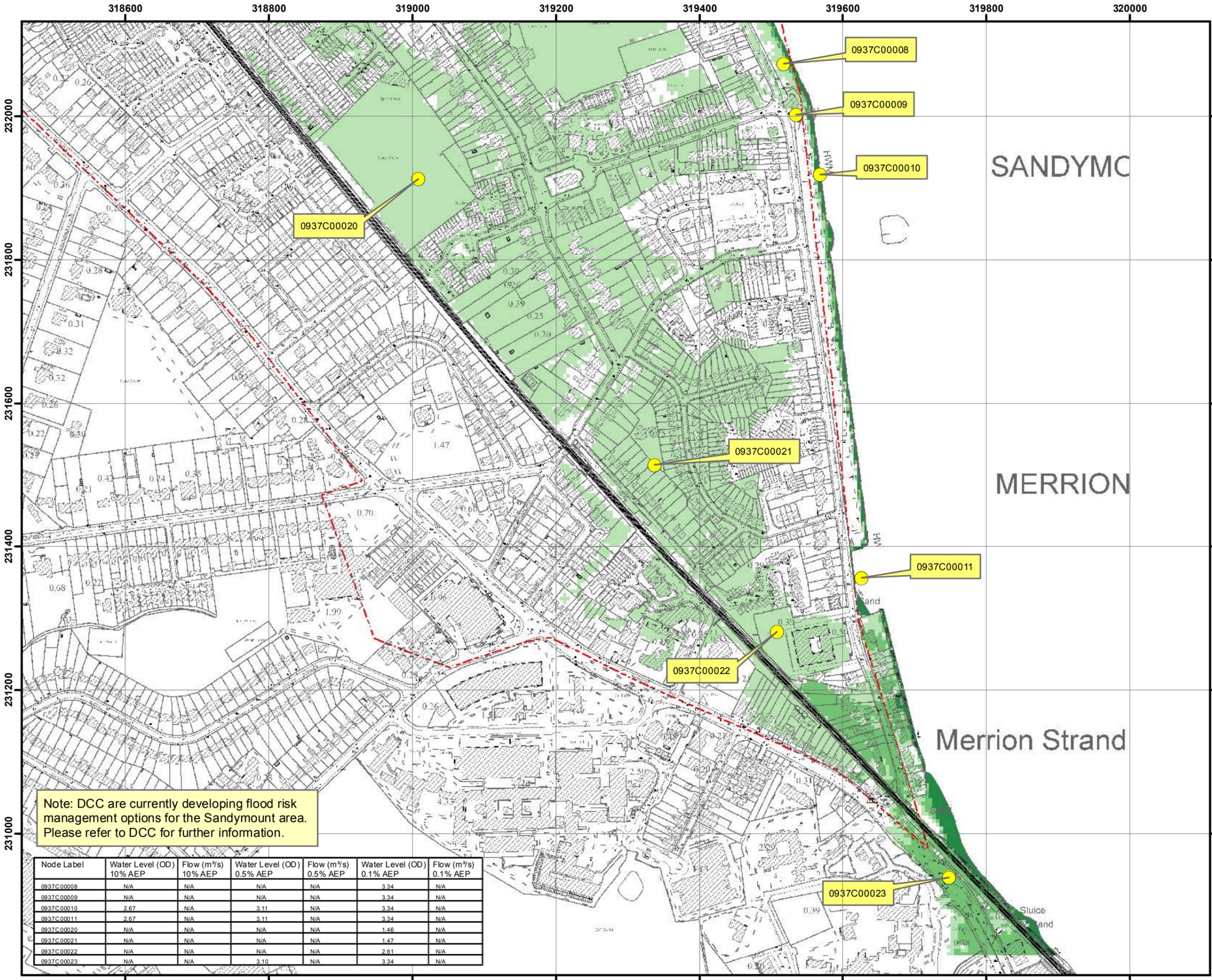
Drawing Scale : 1 : 5,000 Plot Scale : 1:1 @ A3



Node Label	Water Level (mOD) per AEP		
	W/L 10%	W/L 1%	W/L 0.1%
LD1-16945	6.34	6.95	9.90
LD1-17138	5.79	6.43	9.95
LD1-17363	4.93	5.63	9.69
LD1-17398	4.93	5.66	9.67
LD1-17610	4.43	5.23	8.93
LD1-17645	4.23	4.92	8.42
LD1-17792	3.69	4.26	7.45
LD1-17925	3.42	3.98	7.63
LD1-18149	3.13	3.66	7.29
LD1-18120	3.15	3.66	7.32
LD1-18357	3.03	3.40	5.34
LD1-18331	3.05	3.46	5.90
LD1-18492	2.79	3.11	4.79

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ELMWOOD HOUSE TEL : 028 9066 7914
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 BELFAST BT12 6RZ www.rpsgroup.com/Ireland



IMPORTANT USER NOTE:
THE VIEWER OF THIS MAP SHOULD REFER TO THE DISCLAIMER, GUIDANCE NOTES AND CONDITIONS OF USE THAT ACCOMPANY THIS MAP.

- Legend**
- 10% Tidal AEP Event
 - 0.5% Tidal AEP Event
 - 0.1% Tidal AEP Event
 - AFA Extents
 - Node Point
 - Node ID Node Label

FINAL

REV: 01	NOTE: Amendments to Flood Extents.	DATE: 06/12/16
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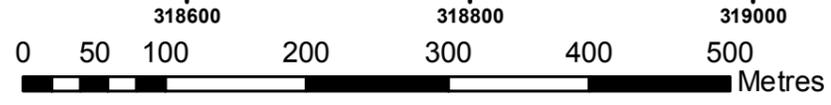
The Office of Public Works
Jonathan Swift Street
Trim
Co Meath

Elmwood House
74 Boucher Road
Belfast
BT12 6RZ

T +44(0) 28 90 667914
F +44(0) 28 90 668286
W www.rpsgroup.com
E ireland@rpsgroup.com

Note: DCC are currently developing flood risk management options for the Sandymount area. Please refer to DCC for further information.

Node Label	Water Level (OD) 10% AEP	Flow (m ³ /s) 10% AEP	Water Level (OD) 0.5% AEP	Flow (m ³ /s) 0.5% AEP	Water Level (OD) 0.1% AEP	Flow (m ³ /s) 0.1% AEP
0937C00008	N/A	N/A	N/A	N/A	3.34	N/A
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0937C00010	2.67	N/A	3.11	N/A	3.34	N/A
0937C00011	2.67	N/A	3.11	N/A	3.34	N/A
0937C00020	N/A	N/A	N/A	N/A	1.46	N/A
0937C00021	N/A	N/A	N/A	N/A	1.47	N/A
0937C00022	N/A	N/A	N/A	N/A	2.61	N/A
0937C00023	N/A	N/A	3.10	N/A	3.34	N/A



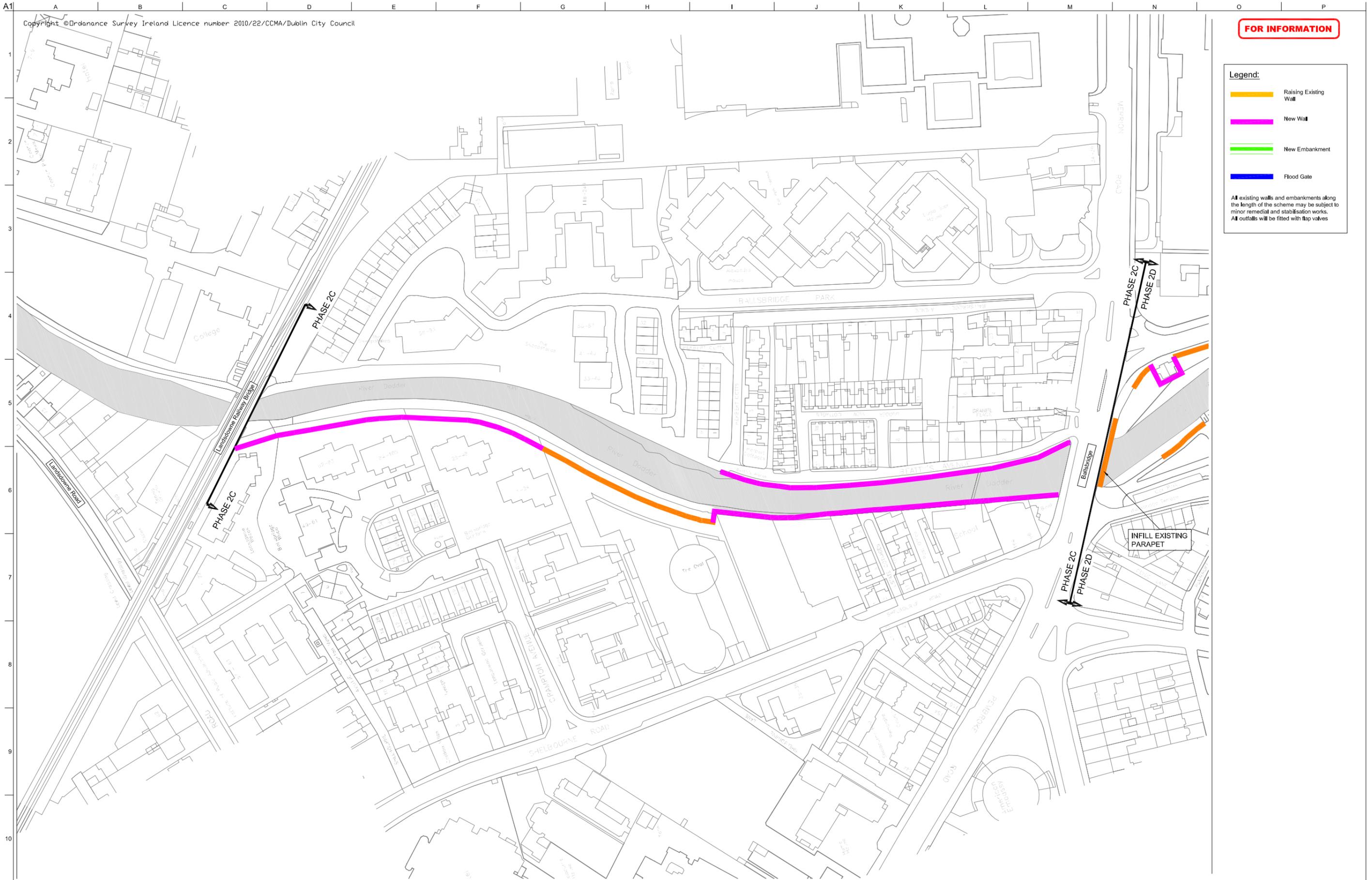
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Map Type:	EXTENT
Source:	TIDAL
Map Area:	COASTAL
Scenario:	CURRENT
Drawn By:	C.McG. Date : 14 November 2017
Checked By:	A.S. Date : 14 November 2017
Approved By:	S.P. Date : 14 November 2017
Drawing No.:	E09SAN_EXCCD_F2_02
Map Series:	Page 2 of 2
Drawing Scale:	1:5,000 @ A3

FOR INFORMATION

Legend:

-  Raising Existing Wall
-  New Wall
-  New Embankment
-  Flood Gate

All existing walls and embankments along the length of the scheme may be subject to minor remedial and stabilisation works.
All outfalls will be fitted with flap valves



Issue	Date	By	Chkd	Appd
I1	18/06/2012	BL	JMc	RB
I0	08/06/2012	SR	JMc	RB

Clients



DUBLIN CITY COUNCIL
Comhairle Cathrach Bhaile Átha Cliath
ENVIRONMENT AND ENGINEERING DEPARTMENT
An Roinn Comhshaoil agus Innealtreacht

Civic Offices,
Wood Quay,
Dublin 8.

Contractor



OPW
The Office of Public Works
An Oifis de Phobail na hÉireann

Project Title
Dodder Flood Alleviation Project

Scale at A1: 1:1000
Date: June 2012

Consultant



ARUP
Arup, 50 Ringsend Road
Dublin 4
Tel +353(0)1 233 4455 Fax +353(0)1 668 3169
www.arup.ie

Drawing Title
Part 8
Location Map
Sheet 01 of 04

For Information

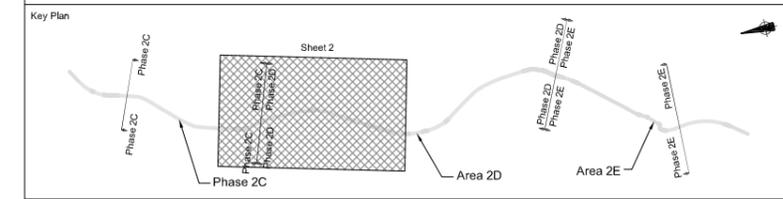
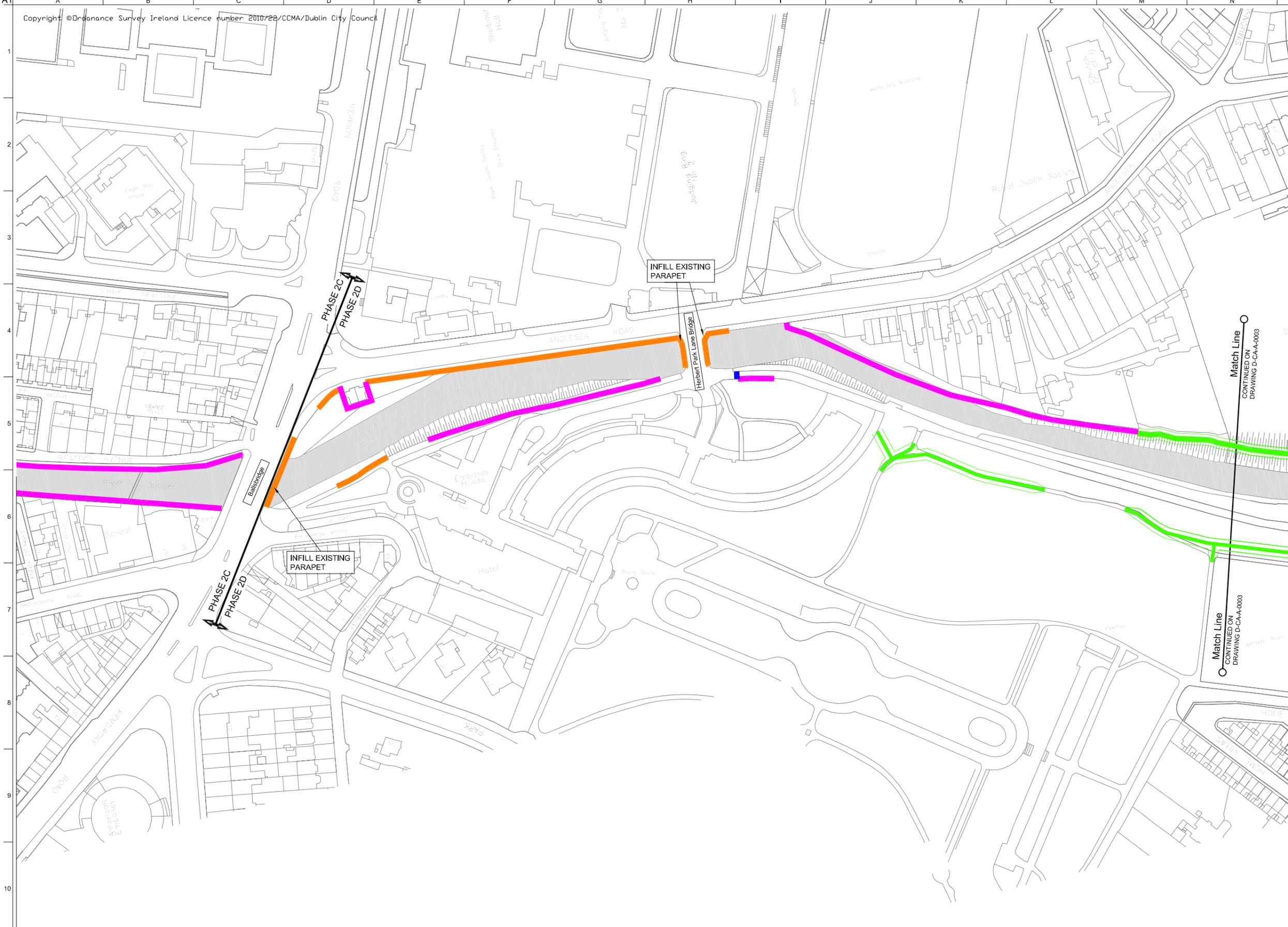
Project No 219346	Drawing No D-CA-A-0001	Issue D02
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FOR INFORMATION

Legend:

-  Raising Existing Wall
-  New Wall
-  New Embankment
-  Flood Gate

All existing walls and embankments along the length of the scheme may be subject to minor remedial and stabilisation works.
All outfalls will be fitted with flap valves



Issue	Date	By	Chkd	Appd
I1	18/06/2012	BL	JMc	RB
I0	08/06/2012	SR	JMc	RB

Clients



DUBLIN CITY COUNCIL
Comhairle Cathrach Bhaile Átha Cliath
ENVIRONMENT AND ENGINEERING DEPARTMENT
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Civic Offices,
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Dublin 8.

Contractor



OPW
The Office of Public Works
An Oifis de Rannsóidhe na Poiblí

Project Title
Dodder Flood Alleviation Project

Scale at A1
1:1000

Date: June 2012

Consultant



ARUP
Arup, 50 Ringsend Road
Dublin 4
Tel +353(0)1 233 4455 Fax +353(0)1 668 3169
www.arup.ie

Drawing Title
Part 8
Location Map
Sheet 02 of 04

For Information

Project No 219346	Drawing No D-CA-A-0002	Issue D02
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