

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 semi-circle in the bottom-right corner, and a teal semi-circle in the bottom-left corner. There are also several white circles of varying sizes, some with blue or dark blue outlines, scattered throughout the design.

Appendix N

Flood Risk Assessment

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

Issue | 10 February 2022

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

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Appendix A

Tolka Flood Study Maps / CFRAM Maps

Executive Summary

Arup has been appointed by the National Transport Authority to prepare a Flood Risk Assessment as part of the planning application process for the Blanchardstown to City Centre Core Bus Corridor Scheme.

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 and the then Department of Environment, Heritage and Local Government.

There are a number of historic flood events at different locations along or near to 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 re-occurring compared to the current scenario.

The route lies in an area at low risk of flooding from surrounding rivers, such as the River Tolka and River Liffey. The BR_01 Tolka River bridge is proposed to be widened to the south by approximately 2m; the proposed soffit level is above the 1 in 100-year flood levels with 1.83m freeboard and the new abutments are not encroaching within the floodplain. The extension of the bridge is therefore not anticipated to have impact on the flood regime.

The proposed route from Blanchardstown to City Centre lies within Flood Zone C, area at low risk of flooding. As such, a 'Justification Test' is not required, and the development is considered appropriate.

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 Blanchardstown to City Centre Core Bus Corridor (CBC) Scheme (hereinafter called the ‘Proposed Scheme’). This FRA assesses the flood risk for the Proposed Scheme.

The Stage 1 FRA is a high-level study of the scheme to identify flood risks to the proposed scheme and any potential flooding issues arising due to the proposed scheme. 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 230 km of dedicated bus lanes and 200 km 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 1.55 million.

The Proposed Scheme is identified as forming part of the radial Core Bus Network. The BusConnects radial CBC scheme network is shown in Figure 1.

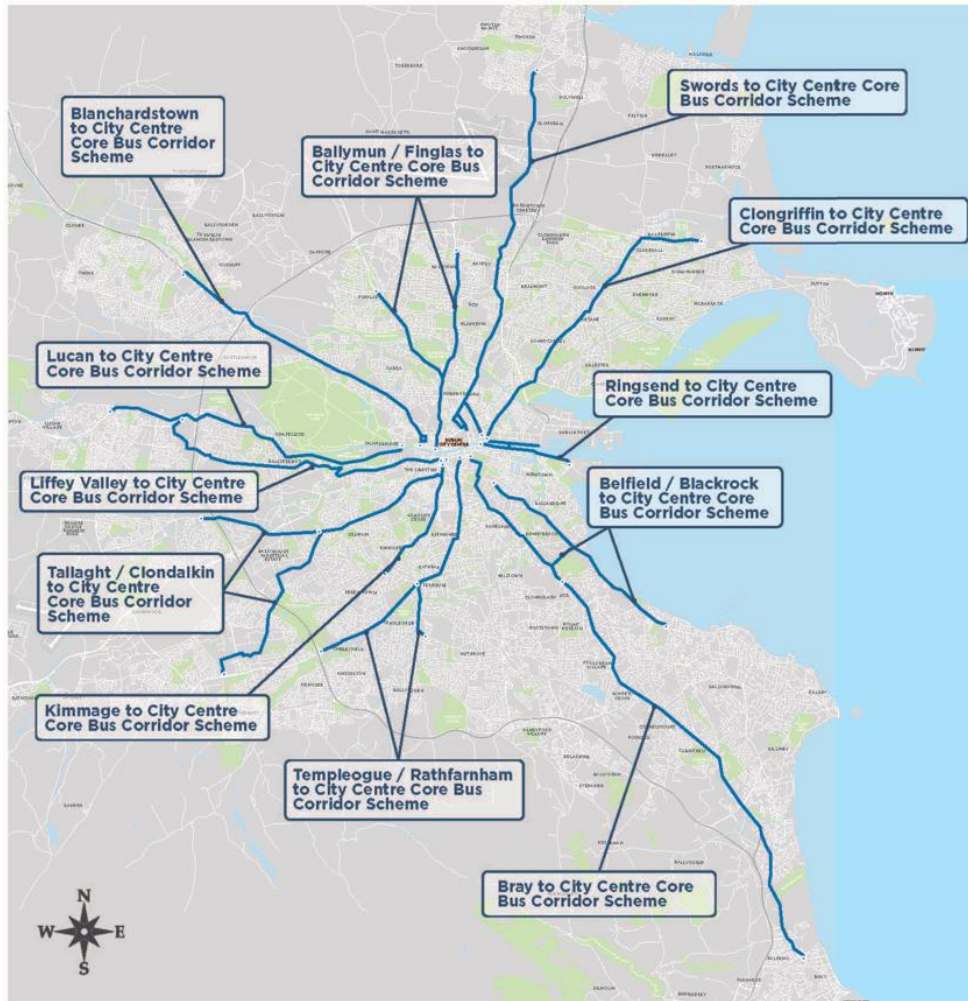


Figure 1: BusConnects CBC Scheme Network

The FRA has been undertaken in accordance with ‘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 includes 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 Dublin City Development Plan (<http://www.dublincity.ie/main-menu-services-planning-city-development-plan/dublin-city-development-plan-2016-2022>)
- Review of Fingal Development Plan 2017-2023
- Tolka River Flood Relief Scheme (DCC)
- Preliminary Flood Risk Assessment (PFRA) Mapping produced by the OPW
- Flood history of the site from the OPW National Flood Hazard Mapping website (www.floodmaps.ie);
- Guidelines for Planning Authorities on ‘The Planning System and Flood Risk Management’ published in November 2009, jointly by the OPW and the then DoEHLG;
- Topographical information received from 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/Blanchardstown to City Centre Core Bus Corridor Scheme

The Proposed Scheme commences at Junction 3 (Blanchardstown / Mulhuddart) southbound off-slip from the N3, and terminates at Ellis Quay / Arran Quay.

Refer to Figure 2 below.

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

- **Section 1:** N3 Blanchardstown Junction to N3/M50 Junction;
- **Section 2:** N3/M50 Junction to Navan Road/Old Cabra Road Junction;
- **Section 3:** Navan Road/Old Cabra Road Junction to Ellis Quay.

The extents of each of these Scheme sections are indicated in Figure 2 below.

It is noted that in the Preliminary Design Report (PDR), Sections 1 and 2 are further subdivided into two smaller sections, namely:

Section 1:

- N3 Blanchardstown Junction to Snugborough Road; and
- Snugborough Road to N3/M50 junction.

Section 2:

- N3/M50 junction to Navan Road / Ashtown Road junction; and

- Navan Road / Ashtown Road junction to Navan Road / Old Cabra Road junction.

For the purposes of this assessment however, these scheme sections have been combined.

Section 1 is bounded to the north-west by Blanchardstown Road North and to the southeast by the M50. Section 1 consists of roads through Blanchardstown Shopping Centre, the Snugborough Road Junction and the N3 dual carriageway north-west of the M50.

Section 2 is bounded to the north-west by the M50, to the east and to the south by the Navan Road / Old Cabra Road junction. Section 2 consists of two separate lengths of Navan Road; a dual carriageway west of Ashtown Road junction, and a three/four-lane urban road from Ashtown Road junction to Old Cabra Road junction.

Section 3 is bounded to the north by the Navan Road / Old Cabra Road junction and to the south by Ellis/Arran Quay. This section of the route includes Old Cabra Road, Prussia Street, Manor Street, Stoneybatter, Blackhall Place and Queen Street.

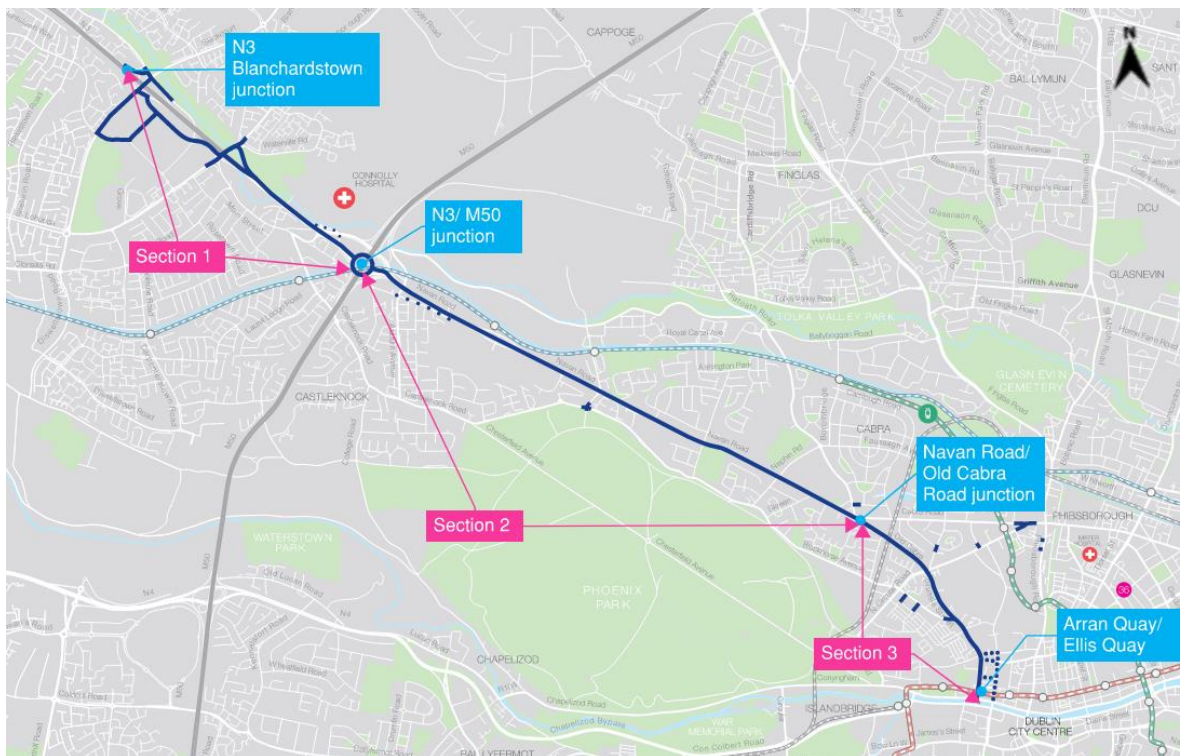


Figure 2: Proposed Route; Blanchardstown to City Centre CBC

The Proposed Scheme includes the widening of two existing bridges, the construction of a series of retaining walls and the widening and upgrading of the existing road infrastructure.

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.
- Fingal Development Plan 2017-2023.

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

In November 2009, the DoEHLG and the OPW 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 master planning 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 proposed scheme 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.

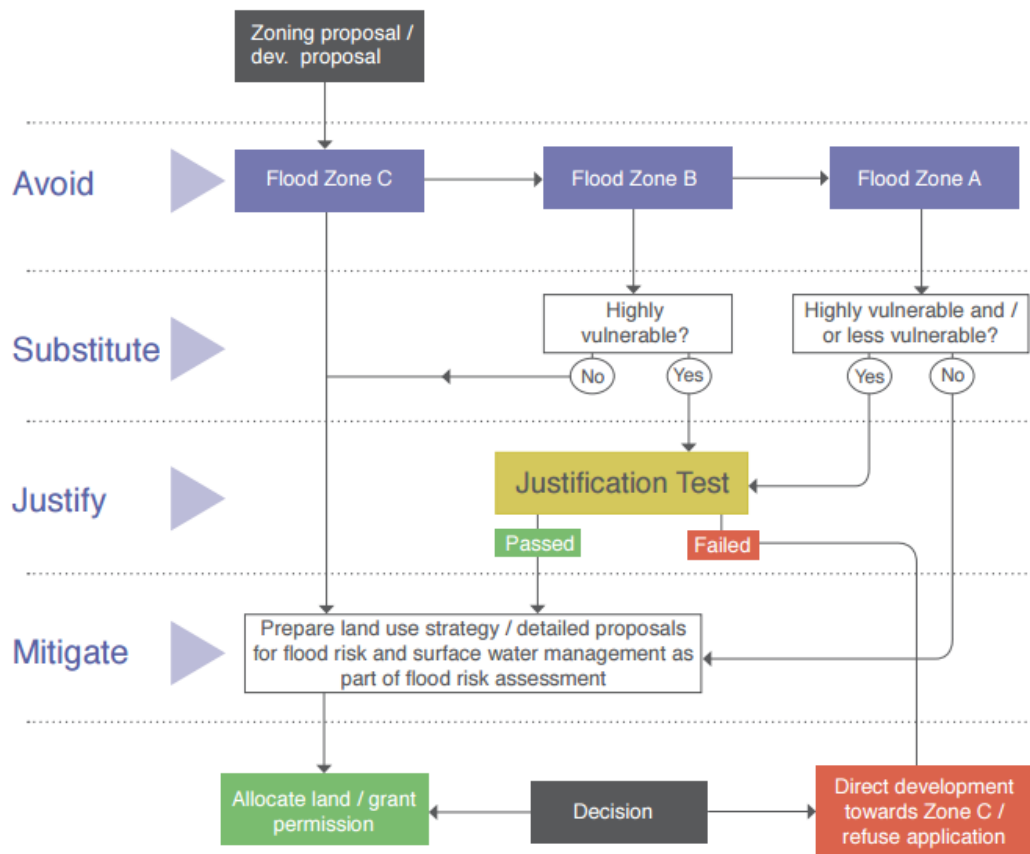


Figure 3: Sequential approach (reproduced from the Guidelines)

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

	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 (hereinafter called the ‘Plan’) was adopted by Dublin City Council on 23 September 2016 and came into effect on 21 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 6 years period.

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:

- **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 DoEHLG 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 Plan presents a number of Dublin City Council ‘Strategic Infrastructure Objectives’ (SIO) in relation to Flood Risk management that state that it is their objectives for:

- **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 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 SSFRA 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 SFRA. 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, 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 SFRA 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 Fingal Development Plan 2017-2023

As part of Section 11 of the Planning and Development Act 2000 (as amended) Fingal County Council (FCC) completed a review of the existing County Development Plan (2011 -2017) and prepared a new County Development Plan (CDP) for the period 2017–2023.

In compliance with the Directive and the Planning and Development (Strategic Environmental Assessment) Regulations 2004-2011, the Planning Authority has carried out a Strategic Environmental Assessment (SEA) of the new CDP and prepared an Environmental Report of the likely significant effects on the environment of its implementation.

Section 7 of the Strategic Flood Risk Assessment outlines surface water and flooding flood risk management policies which have been strengthened and improved upon since the previous Development Plan. The flood risk management policies are as follows:

- **SW01:** Protect and enhance the County's floodplains, wetlands and coastal areas subject to flooding as vital green infrastructure which provides space for storage and conveyance of floodwater, enabling flood risk to be more effectively managed and reducing the need to provide flood defences in the future
- **SW02:** Allow no new development within floodplains other than development which satisfies the justification test, as outlined in the Planning System and Flood Risk Management Guidelines 2009 for Planning Authorities (or any updated guidelines).
- **SW03:** Identify existing surface water drainage systems vulnerable to flooding and develop proposals to alleviate flooding in the areas served by these systems.
- **SW04:** Require the use of sustainable drainage systems (SuDS) to minimise and limit the extent of hard surfacing and paving and require the use of sustainable drainage techniques for new development or for extensions to existing developments.
- **SW05:** Discourage the use of hard nonporous surfacing and pavements within the boundaries of rural housing sites.
- **SW06:** Encourage the use of Green Roofs on apartment, commercial, leisure and educational buildings
- **SW07:** Implement the Planning System and Flood Risk Management-Guidelines for Planning Authorities (DoEHLG/OPW 2009) or any updated version of these guidelines. For lands identified in the SFRA, located in the following areas: Courtlough; Ballymadun; Rolestown; Ballyboughal; Coolatrath; Milverton, Skerries; Channell Road, Rush; Blakescross; Lanestown/Turvey; Lissenhall, Swords; Balheary, Swords; Village/Marina Area, Malahide; Streamstown, Malahide; Balgriffin; Damastown, Macetown and Clonee, Blanchardstown; Mulhuddart, Blanchardstown; Portrane; Sutton and Howth; a site-specific Flood Risk Assessment to an appropriate level of detail, addressing all potential sources of flood risk, is required, demonstrating compliance with the afore mentioned Guidelines or any updated version of these guidelines, paying particular attention to residual flood risks and any proposed site specific flood management measures.
- **SW08:** Implement the recommendations of the Fingal East Meath Flood Risk Assessment and Management Study (FEM FRAMS) when completed.

- **SW09:** Assess and implement the recommendations of the Eastern CFRAMS when complete.
- **SW10:** Require the provision of regional stormwater control facilities for all Local Area Plan lands and Strategic Development Zones with a view to also incorporating these control facilities in currently developed catchments prone to flooding.
- **SW11:** Ensure that where flood protection or alleviation works takes place that the natural and cultural heritage and rivers, streams and watercourses are protected and enhanced to the greatest extent possible.
- **SW12:** Require an environmental assessment of all proposed flood protection or alleviation works.

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 watercourses 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 tide 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 low points in the topography and cause flooding.
- 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.floodinfo.ie) have been examined as part of this flood risk assessment. Figure 4 presents the flood record for the site and its immediate vicinity, with the details shown in Table 4.

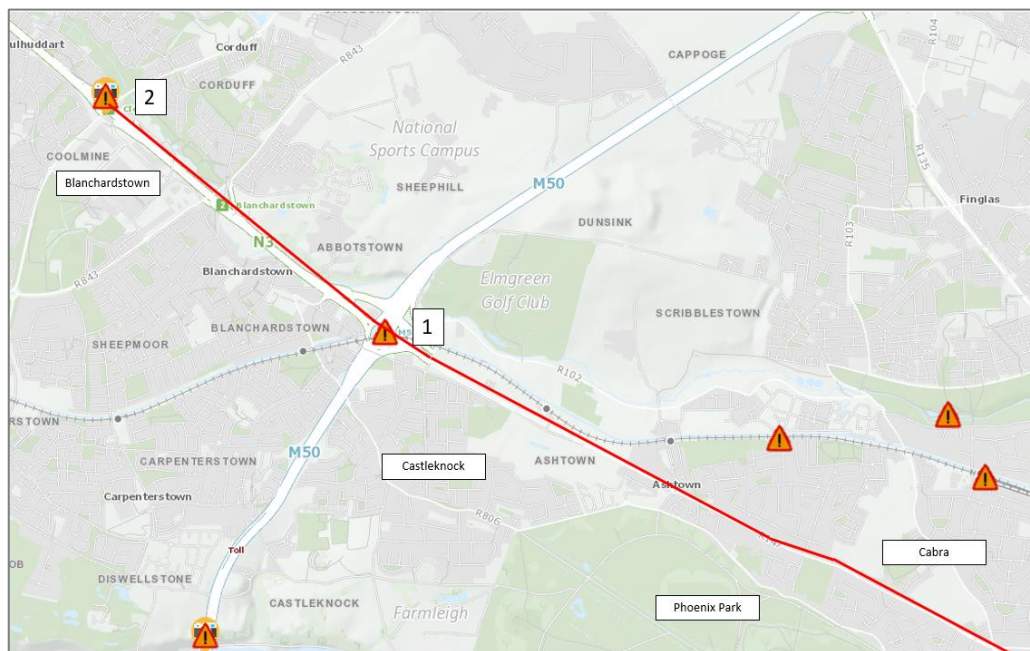


Figure 4: Historic Flood Events

Table 4: Historic Flood Events; Blanchardstown to City Centre

Flood Point No.	Date	Catchment	Flood Source	Details
1	November 2002	Tolka	Runoff	M50 at the N3 Interchange
2	November 2002	Tolka	River	Tolka Navan Road Adjacent to Tolka Valley Park

4 Existing Flood Risk

4.1 Fluvial Flooding

4.1.1 River Tolka

The River Tolka Flood Study was commissioned by Dublin City Council, in association with Fingal County Council, Meath County Council and the OPW in 2002. The 2004 and 2010 flood zone mapping for the River Tolka pre-date major infrastructural changes in the M3 area carried out over the last 15 years. However, a revision of these maps is not yet complete, as such the best available information is the 2004 Flood Zone A and 2010 Flood Zone B mapping. This mapping is being used for the Fingal County Development Plan until the completion of the OPW Tolka Review and as such forms the basis of this FRA. Please note that the road configuration has changed since the maps were produced.

An extract from Tolka Flood study (2004) is displayed in Figure 5 and in Appendix A. The predicted flood extents for three separate return period events are presented on the map for the 1 in 10, 1 in 25, 1 in 50, 1 in 100 and 1 in 200 year fluvial flood extents.

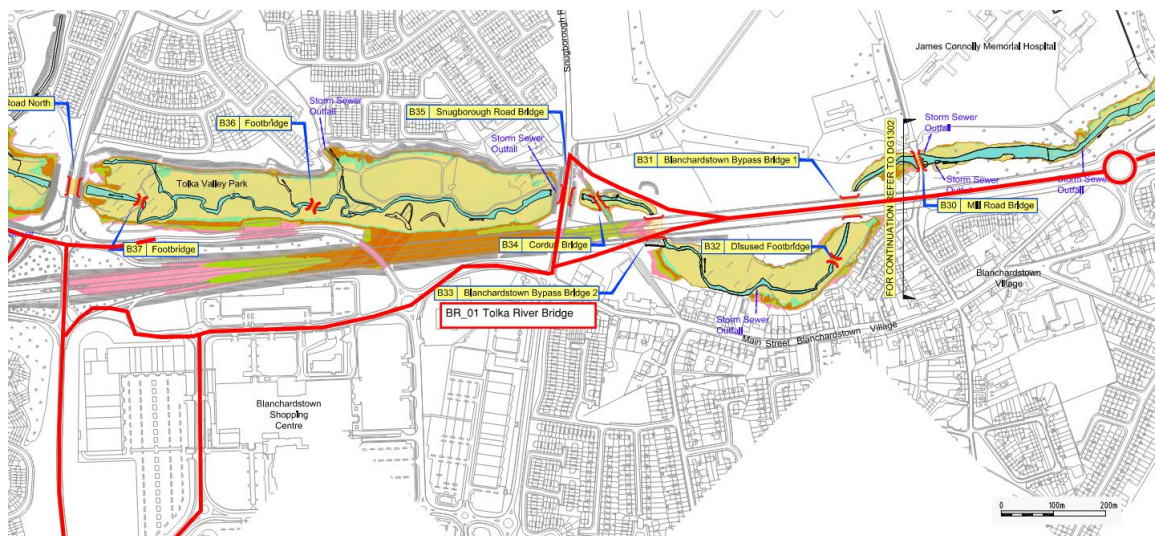


Figure 5: Extract from River Tolka Existing Condition Flood Risk Map (2004, Dublin City Council)

It can be seen from this figure that the proposed route crosses the River Tolka in three locations: at B35 Snugborough Road Bridge and at two locations on the N3 (B33 Blanchardstown Bypass Bridge 2, also referred to as BR_01 Tolka River Bridge for this planning application, and BR31 Blanchardstown Bypass Bridge 1). This is shown in greater detail on Figure 6.

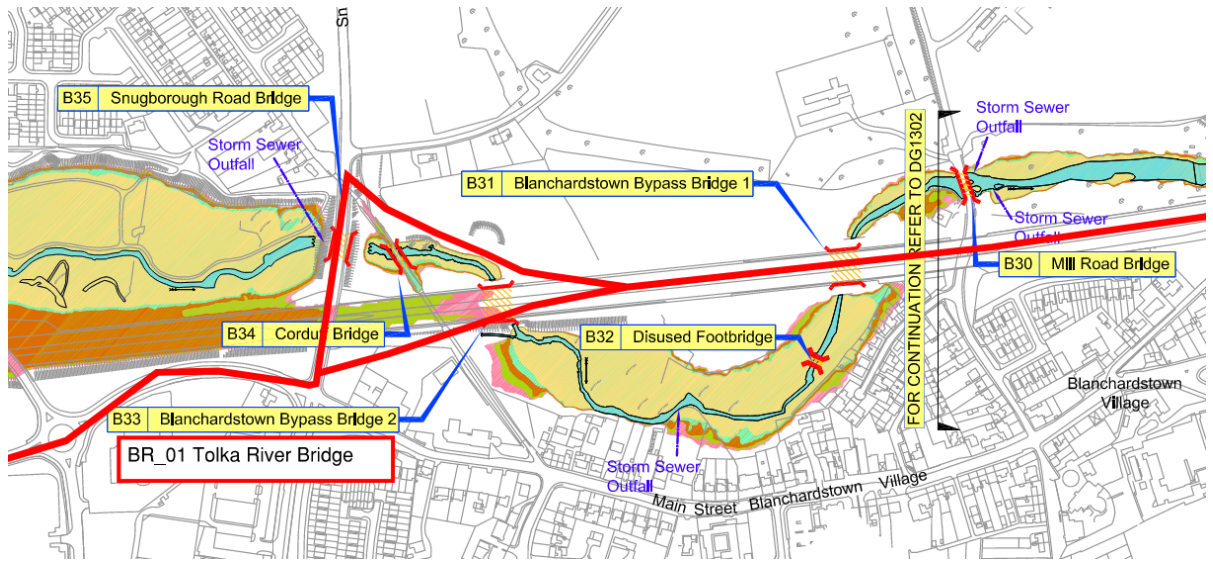


Figure 6: River Tolka Crossings

As can be seen from Figure 6, no parts of the route are currently at risk of flooding for up to the 1 in 200 year flood event. The route and project site does not extend over the parts of the N3 that is shown at risk of flooding.

For clarity, the flood zone legend is provided in Figure 7.

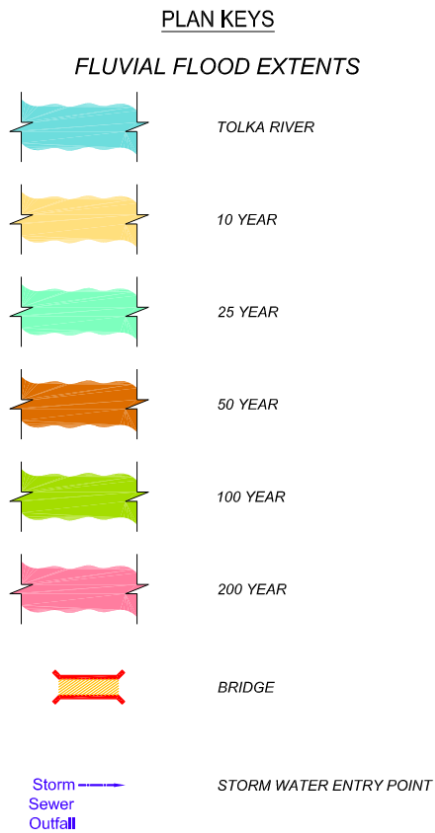


Figure 7: River Tolka Flood Extents Legend

The proposed works as part of the Tolka Flood Alleviation Scheme and resulting flood extents are shown in Figure 8. The descriptors 28 to 32 refer to the works proposed under the River Tolka Flood Alleviation Scheme as outlined in the River Tolka Flooding Study Final Report. Figure 9 is an extract from this report which describes the proposed works in this area –note Item 32 in relation to descriptors B35, B33 and B31.

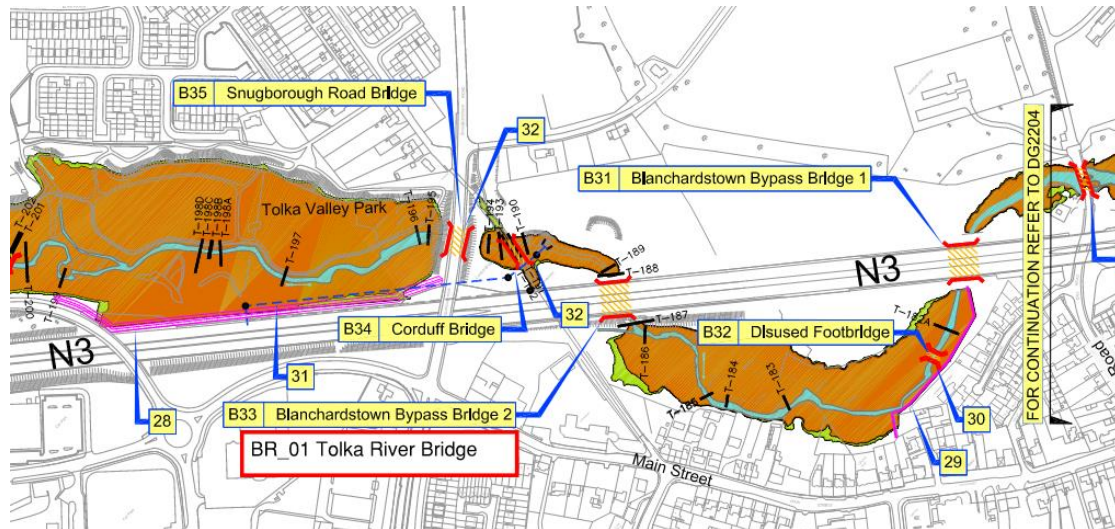


Figure 8: River Tolka Flood Alleviation Scheme and post-scheme flood extents

At Blanchardstown, the works required to reduce the flood risk to the N3 and local properties at risk include:	
Item 28	Provide a continuous earthen embankment of approximately 390m in length parallel to the N3 (cross section Ref. T-195 to T-199). This embankment will extend upstream from Snugborough Road adjacent to the northern dual carriageway.
Item 29	Provide 2m high flood wall on property boundaries at Herbert Road, Blanchardstown, over length of approximately 210m (cross section reference T- 182a to T-183).
Item 30	Remove or renew the disused walk bridges in the Tolka Valley Park which are in poor condition.
Item 31	Provide new drainage outlets from the N3 dual carriageway to discharge downstream of the Snugborough Road Bridge, including non-return flap valve arrangements or alternative drainage arrangements to protect the dual carriageway from ponding.
Item 32	Carry out detailed structural assessment of existing Corduff, Snugborough and Blanchardstown Bridges having regard to significant water pressures and scour forces associated with repeat flooding similar to that which occurred in November 2002 to ensure that the bridges and embankments will satisfactorily cope with similar conditions in the future.

Figure 9: River Tolka Flood Alleviation Scheme - proposed measures in project area

The Tolka Flood Alleviation Scheme was initiated in 2002 following a major tidal flooding event in February of that year and a major fluvial flooding event in November 2002, these had estimated return periods of 68 and 100 years respectively. Construction began in 2003 with works completed in 2009. It is not known at the time of writing whether the full extent of works in the Fingal area, as outlined in Figure 9, have been carried out. Each of the three crossings is discussed in further detail in the following subsections.

B35 Snugborough Road Bridge

The Snugborough Road Bridge crosses the River Tolka via three existing parallel culverts. The works in this area are outside of the scope of the Proposed Scheme and are being undertaken by Fingal County Council. For clarity, the flood risk is described in the following paragraphs.

It can be seen from Figure 6 that the valley immediately upstream of these culverts floods in a 1 in 10-year event however flooding downstream is kept in-bank. This suggests that the Snugborough Road culverts provide a throttle effect on the river in this area.

The River Tolka Flood Alleviation Works proposed that this bridge (i.e. three culverts) is maintained and that a detailed structural assessment is undertaken to ensure the culvert continues to function under water pressure and scour forces. The post-scheme hydraulic profile of the Tolka in this section is presented in Figure 10; this is an extract from the River Tolka Flooding Study Final Report. It can be seen from this graphic that it is anticipated that the Snugborough Road bridge will continue to act as a throttle in the future.

The blue-dashed line represents the 1 in-100 year water level; the magenta line represents a proposed flood defence embankment between the N3 and the river. The 100 year flood level at the upstream face of the culvert is 52.1m OD. The road level is 56.78m OD. Thus, a freeboard of 4.68m is provided.

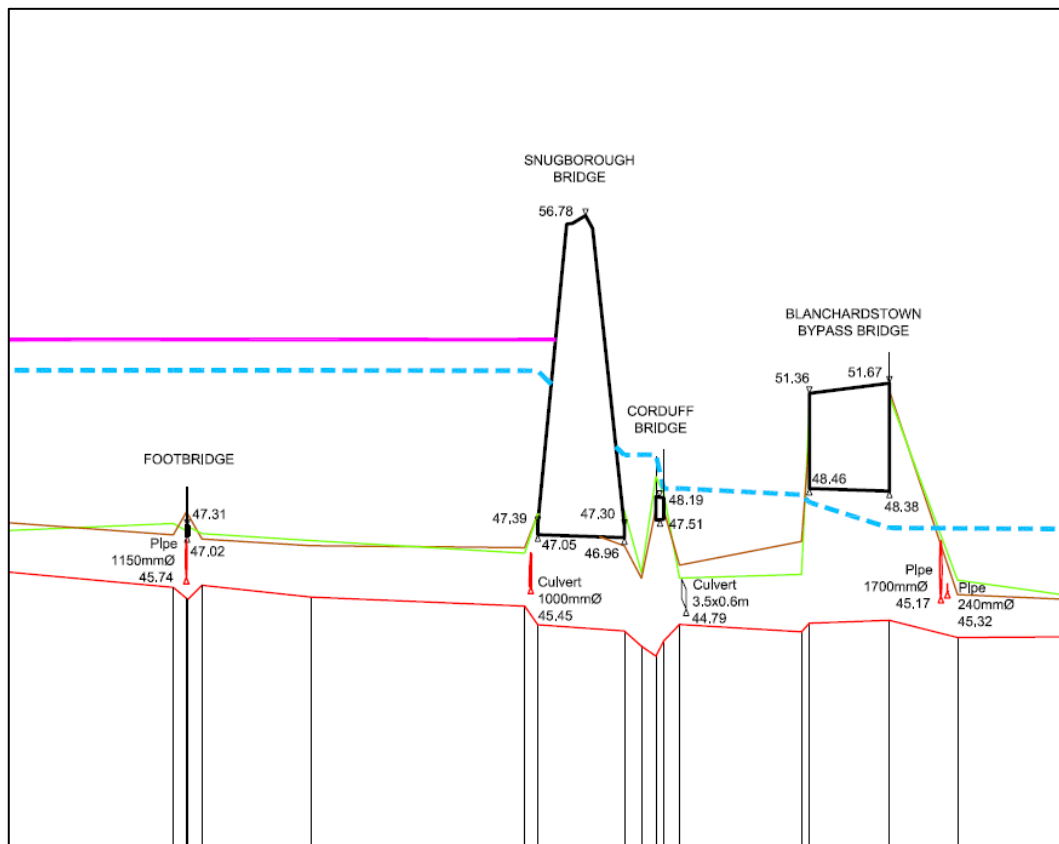


Figure 10: B35 Snugborough Road to BR_01 Tolka River Bridge, 1 in-100-year hydraulic grade line (extract from the River Tolka Flooding Study Final Report, proposed scenario)

The proposed works in this area will be undertaken by Fingal County Council. There are no alterations proposed to the culvert and as such, there is no impact or change on the fluvial flood risk profile in this area as a result of the scheme.

BR_01 Tolka River Bridge (B33 Blanchardstown Bypass Bridge 2)

The second crossing of the Tolka River is the BR_01 Tolka River Bridge. This is a corrugated steel arch which has subsequently been widened using precast concrete girders.

From Figure 10 it can be seen that this bridge flows freely in a 1 in 100 year event; i.e. no surcharging of the culvert. The 1 in 100 year flood levels at the upstream and downstream face of this bridge along with soffit levels and road levels is presented in Table 5. While the 1 in 100 year flood levels are taken from the River Tolka Flooding Study, the road and soffit levels of the bridge have been taken from a recent topographic survey undertaken for the purposes of the Bus Connects project and are shown in Table 5 below.

Table 5: BR_01 Tolka River Bridge (Blanchardstown Bypass Bridge 2)

Description	Upstream culvert	Downstream culvert
Road level (m OD)*	51.40	51.37
Soffit level (m OD)*	48.37	48.60
100-Year flood level (m OD)	48.07	47.27
Freeboard from road (m)	3.33	4.10
Freeboard from soffit (m)	0.30	1.33

*Values taken from recent topographic survey

The proposed widening of the N3 to accommodate the CBC requires this bridge to be widened further at its southern end (downstream). The bridge will be widened by approximately 2.3m using TYE beams and a cast in-situ deck slab. The abutments will be extended outwards by 4.5 m and will not encroach in the floodplain.

A section through the proposed extension is shown in Figure 11. The soffit extension will be in line with the existing beam soffit level at 48.60m OD, therefore providing a freeboard at the extension of 1330mm between the 1 in 100 year flood level and soffit.

As such, the proposed bridge extension will have no impact on the Tolka flood flows and will not cause changes to flood risk.

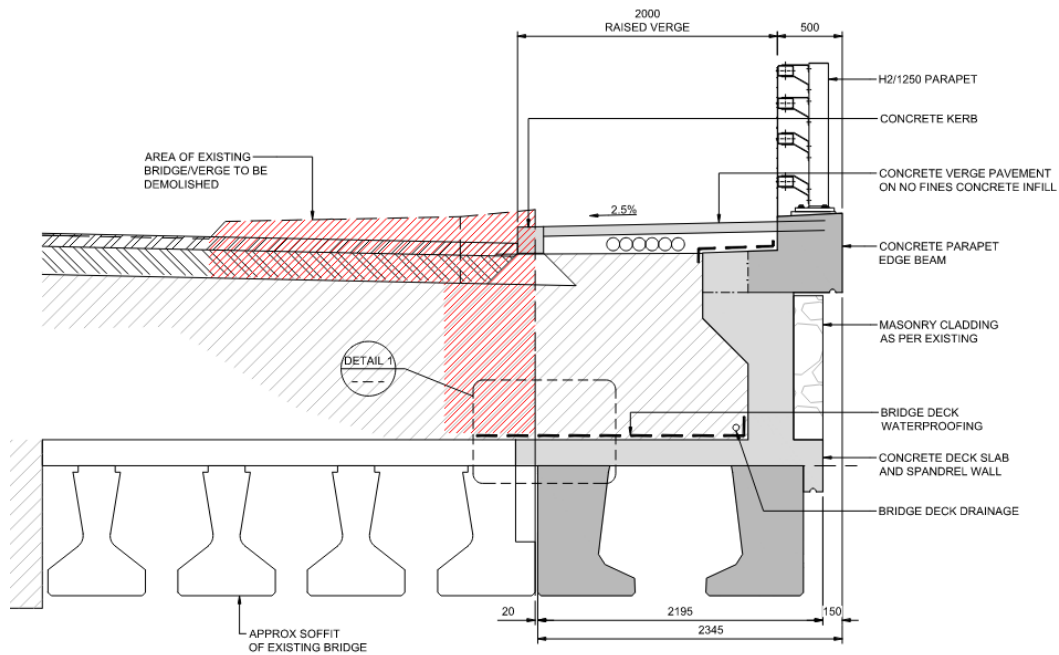


Figure 11: BR_01 Tolka River bridge extension

B31 Blanchardstown Bypass Bridge 1

The third crossing of the Tolka River is the Blanchardstown Bypass Bridge 1, i.e. the James Connolly Bridge. This is a corrugated steel arch and is shown in Figure 12.



Figure 12: B31 Blanchardstown Bypass Bridge 1

As seen in Figure 6, the N3 is outside of the floodplain in this area. From Figure 13 it can be seen that this bridge flows freely in a 1 in-100-year event; i.e. no surcharging of the culvert.

The 1 in 100-year flood levels at the upstream and downstream face of this bridge along with soffit levels and road levels is presented in Table 6.

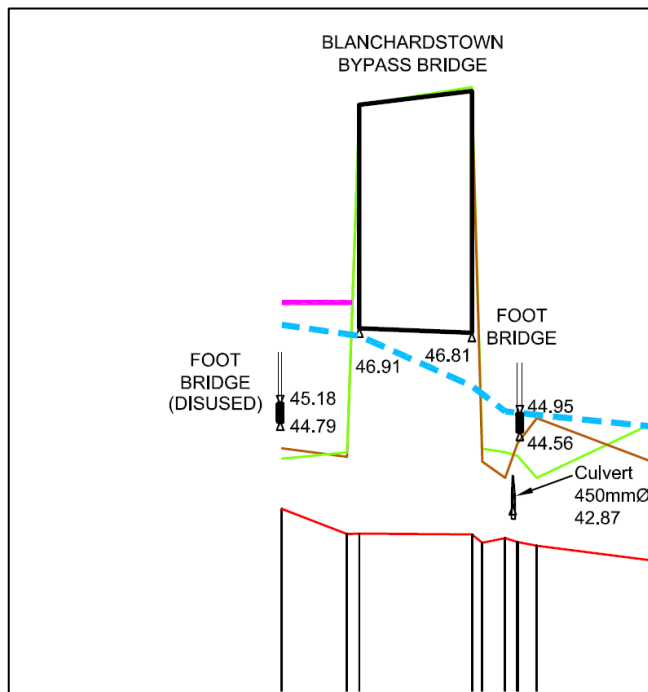


Figure 13: Blanchardstown Bypass Bridge No. 1 1 in-100-year hydraulic grade line (extract from the River Tolka Flooding Study Final Report)

Table 6: Blanchardstown Bypass Bridge 1 - levels

Description	Upstream culvert	Downstream culvert
Road level (m OD)	52.3m OD approx.	52.2m OD approx.
Soffit level (m OD)	46.910	46.810
100-Year flood level (m OD)	46.740	45.020
Freeboard from road (m)	5.56	7.18
Freeboard from soffit (m)	0.170	1.790

There are no works proposed to this bridge.

4.1.2 River Liffey

As seen in Figure 14, the proposed route at Liffey Quay does not fall within flood extents and therefore there is no flood risk.

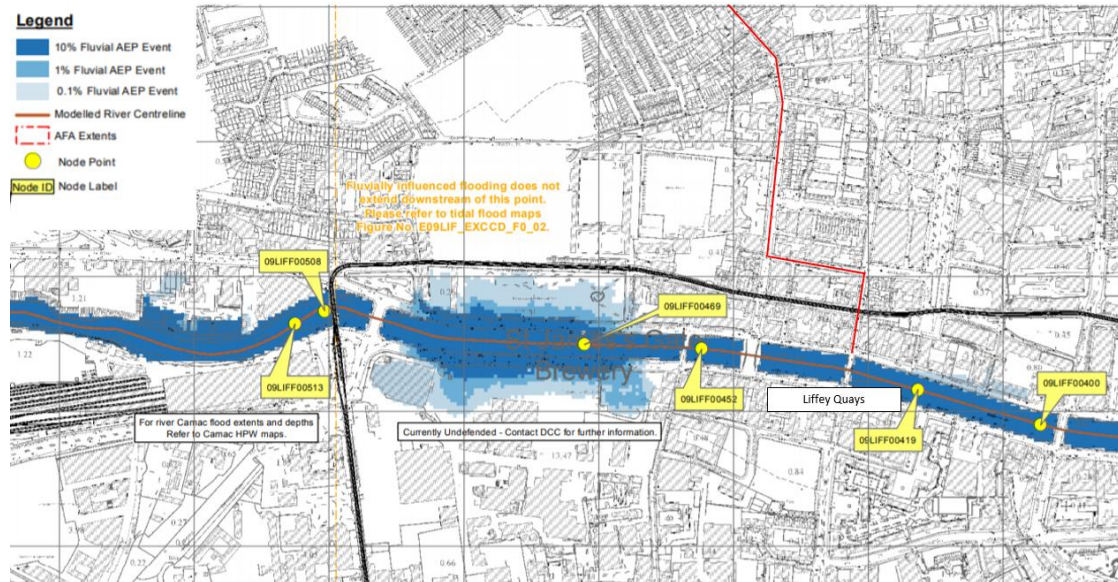


Figure 14: CFRAM Map at Liffey Quay (red line indicates proposed BusConnects Route 5)

4.2 Tidal Flood Risk

An extract from the River Liffey CFRAM coastal flood extent map is displayed in Figure 15. The predicted tidal flood extents for three separate return period events are presented on the map (1 in 10, 1 in 200 year and 1 in 1000-year tidal flood extents).

As shown in Figure 15, the proposed route does not fall within the tidal flood extent and therefore there is no tidal flood risk.

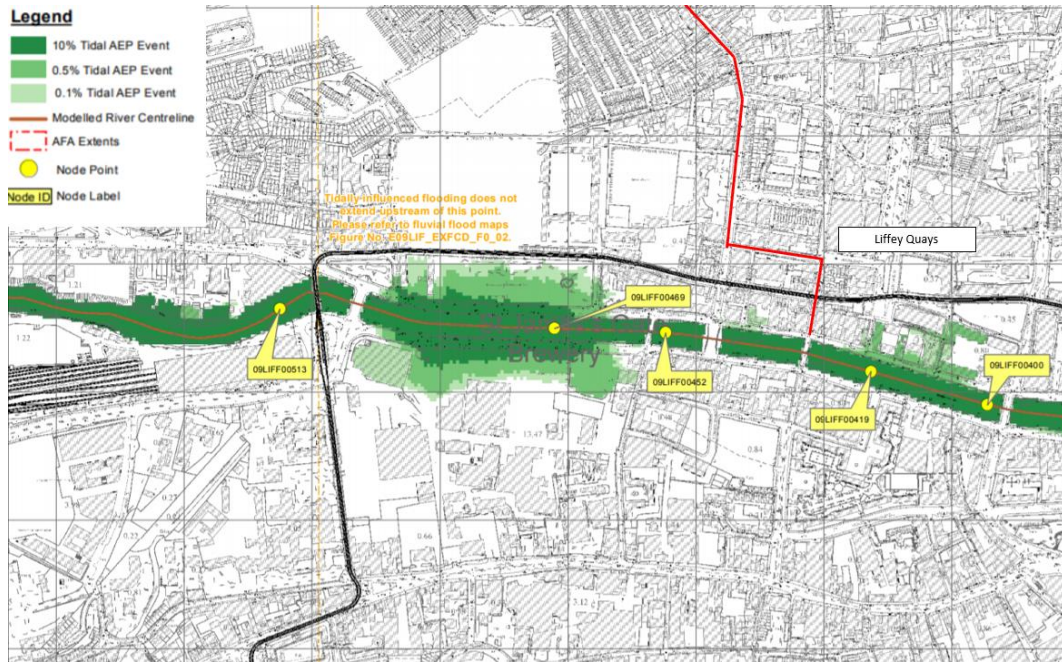


Figure 15: Coastal Flood Risk at Liffey Quay (red line indicates proposed BusConnects Route 5)

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 OPW. An extract from PFRA mapping along the proposed route is present in Figure 16 and Figure 17. The PFRA was not a detailed assessment and only a rapid assessment based on readily available information such as historic records to highlight areas that may require further assessment.

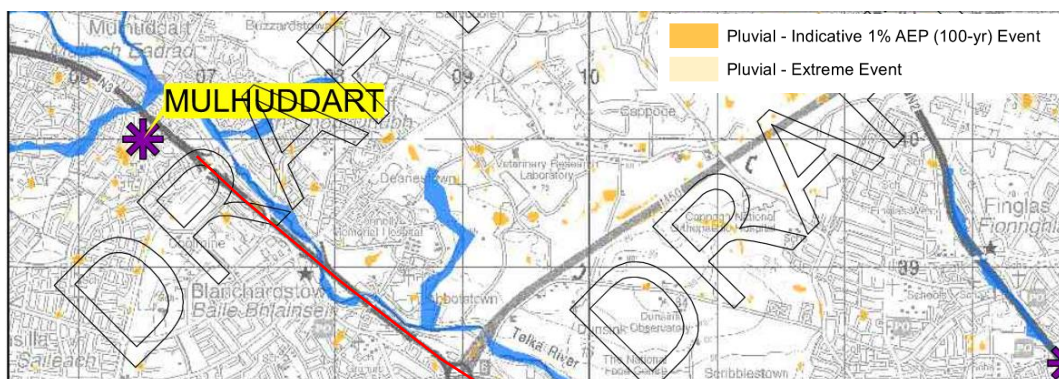


Figure 16: Extracts from PFRA – Section 1 (orange show indicative pluvial flooding)

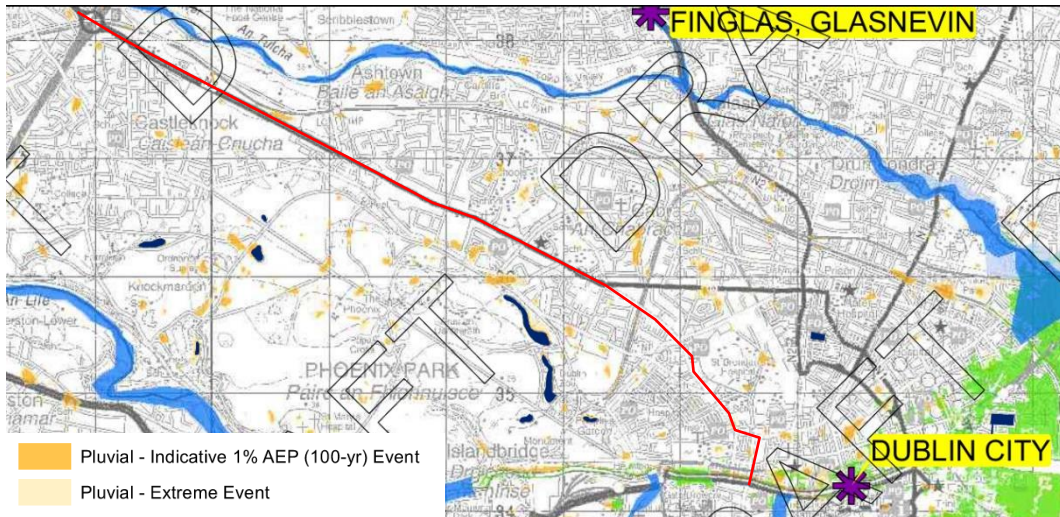


Figure 17: Extracts from PFRA – Sections 2 and 3 (orange show indicative pluvial flooding)

A more detailed assessment of pluvial flooding was done for Dublin City (areas within the M25) by OPW and Dublin City Council producing the Predictive Pluvial Flood maps. The maps at the site extents is shown in Figure 18.

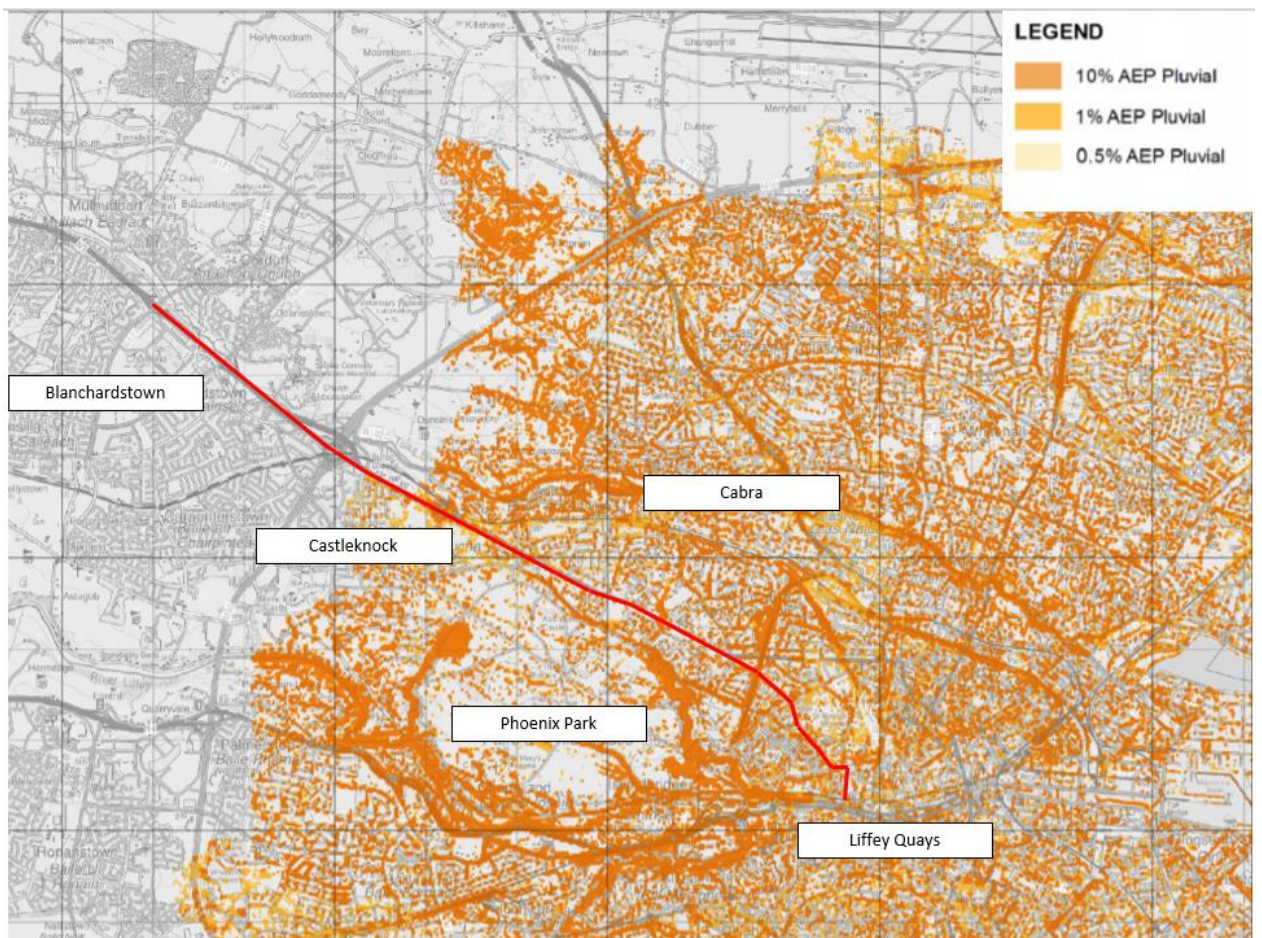


Figure 18: Extract from OPW Predictive Pluvial Flood Maps

The PFRA and Predictive Pluvial maps indicate that there are areas at risk of pluvial flooding along the route especially within the urban centre, largely within the 10% AEP; therefore, there is a high risk of pluvial flooding along the route.

The *Dublin City Council Flood Resilient 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 (George's Quay and South Inner City) areas were reviewed for the Proposed Scheme, however the site boundary lies outside the study extent.

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

1. 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 Proposed Scheme 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 Proposed 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 Proposed 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.

4.4 Groundwater Flooding

Groundwater flooding can occur during a 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 OPW Preliminary Flood Risk Assessments Groundwater Flooding Report concludes that groundwater flooding is largely confined to the West Coast of Ireland due to the hydrogeology of the area. The proposed works do not involve significant changes in levels or basement construction.

As the Proposed Scheme is on existing carriageways 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 Proposed Scheme. The risk of groundwater flooding to the site is therefore considered low.

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 entirety of the route is at low risk of fluvial flooding and therefore in Flood Zone C.
- The route is deemed to be at low risk of tidal flooding from the River Liffey.
- The risk of pluvial flooding to the route is considered high.
- The risk of groundwater flooding to the route is considered low.

5 Application of “The Planning System and Flood Risk Management” Guidelines

5.1 Flood Zones

The proposed route lies in Flood Zone C.

The risk of pluvial flooding along the majority of the Proposed Scheme is high, however the risk exists in the current scenario and will be reduced as a result of the Proposed Scheme.

5.2 Sequential Approach

Figure 3 in Section 2.1.3 illustrates the sequential approach to be adopted under the ‘Planning System and Flood Risk Management’ guidelines.

As the Proposed Scheme from Blanchardstown to City Centre lies within Flood Zone C, a Justification Test is not required.

6 Conclusion

This Flood Risk Assessment (FRA) has been carried out as part of the Planning Application for the Proposed Scheme from Blanchardstown to City Centre.

There are a number of historic flood events at different locations along or near to 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 re-occurring compared to the current scenario.

The route lies in an area at low risk of flooding from surrounding rivers, such as the River Tolka and River Liffey. The BR_01 Tolka River bridge is proposed to be widened to the south by approximately 2.3m; the proposed soffit level is above the 1 in 100-year flood levels with 1330mm freeboard and the new abutments are not encroaching within the floodplain. The extension of the bridge is therefore not anticipated to have impact on the flood regime.

The closest point of the route at Liffey quay is located approximately 1km from the nearest coastal boundary and elevated above sea level. There is therefore no risk of coastal flooding to the site in the present, or future climate change scenarios.

The OPW Preliminary Flood Risk Assessments Groundwater Flooding Report concludes that groundwater flooding is largely confined to the West Coast of Ireland due to the hydrogeology of the area. The proposed works do not involve significant changes in levels or basement construction. As the Proposed Scheme is on existing carriageways 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 Proposed Scheme. The risk of groundwater flooding to the site is therefore considered low.

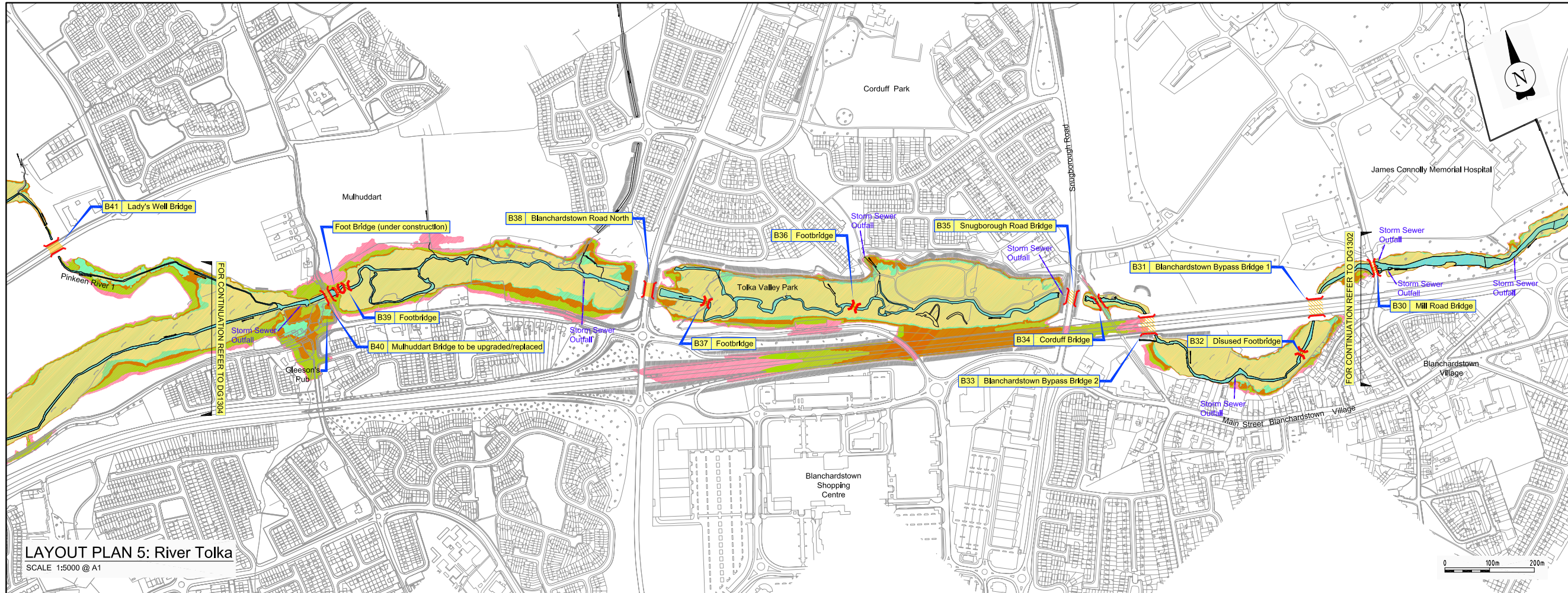
The risk of pluvial flooding along the majority of the proposed route is high, however this risk exists in the current scenario and will be reduced as a result of the Proposed Scheme. All new surface water sewers provided as part of the Proposed Scheme shall be designed so that no flooding will occur for a return period of 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 Proposed 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 proposed route from Blanchardstown to City Centre lies within Flood Zone C, area at low risk of flooding. As such, a 'Justification Test' is not required, and the development is considered appropriate.

Appendix A

**Tolka Flood Study Maps /
CFRAM Maps**

BR_01 Tolka River Bridge



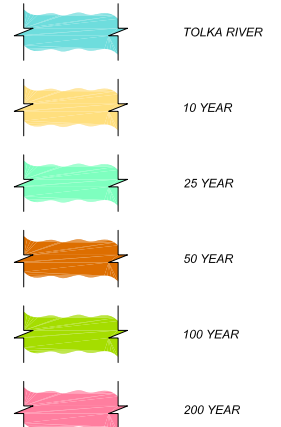
Notes/Legend

GENERAL NOTES

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- All levels are referred to Ordnance Survey Datum, Malin Head.
- DO NOT SCALE, use figured dimensions only, if in doubt ask.

PLAN KEYS

FLUVIAL FLOOD EXTENTS



BRIDGE



STORM WATER ENTRY POINT

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No.	Date	By	Amendments
F01	23/12/03	SR/SP	FINAL ISSUE
D01	30/07/03	SR/SP	Issue for Draft

Client

Dublin City Council,
Design Division (Water),
68-70 Marrowbone Lane,
Dublin 8.
Michael Phillips,
City Engineer

RPS mcOS

Block 2,
West Pier Business Campus,
Old Dun Laoghaire Road,
Dun Laoghaire,
Co. Dublin

Dublin Drainage

A Strategic Study for Greater Dublin

Issued from: DUBLIN

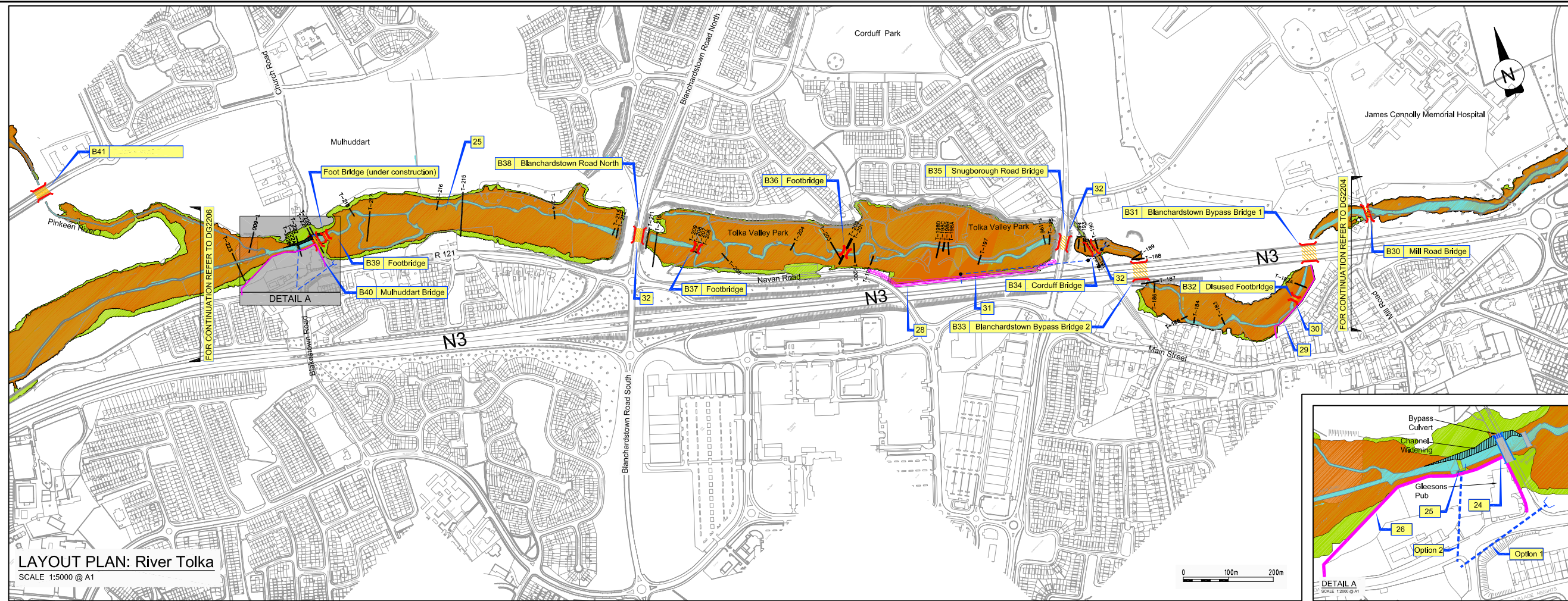
Project

RIVER TOLKA FLOODING STUDY

Title

**Existing Conditions
Flood Risk Maps**
(Plan 5 of 10)

Drawn: J.Colvin	File No: 074515001DG1303F01
Chkd: S.Baigent	Job No: 074515001
Appr: G.Gillespie	Dr. No: DG1303
Scale: 1:5000	Rev: F01
Date: July 2003	



LAYOUT PLAN: River Tolka
SCALE 1:5000 @ A1

Notes/Legend

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- All levels are referred to Ordnance Survey Datum, Malin Head.
- DO NOT SCALE, use figured dimensions only, if in doubt ask.

PROFILE

- LEFT BANK
- EXISTING LEFT RETAINING WALL
- RIGHT BANK
- EXISTING RIGHT RETAINING WALL
- BED LEVEL
- PROPOSED BED LEVEL
- PROPOSED WALL/EMBANKMENT
- 100 YEAR WATER LEVEL
- + PIPES REQUIRING FLAPPED OULETS

PLAN

- T-247 SECTION LOCATION
- PROPOSED EMBANKMENT
- PROPOSED PIPEWORK
- EXISTING WALL
- EXISTING WALL
- PROPOSED WALL
- BRIDGE
- TOLKA RIVER CHANNEL
- 50YEAR FLOOD EXTENT
- 100 YEAR FLOOD EXTENT
- X POSSIBLE DRAINAGE AND PUMPING REQUIREMENTS

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F01	23/12/03	5/5	5/5	5/5	FINAL ISSUE
D01	30/07/03	5/5	5/5	5/5	ISSUE FOR DRAFT
No.	Date	By	Amendments		

Client

Dublin City Council, Design Division (Water), 68-70 Marrowbone Lane, Dublin 8.
Michael Phillips, City Engineer

RPS mcOS

Block 2, West Pier Business Campus, Old Dun Laoghaire Road, Dun Laoghaire, Co. Dublin

Project

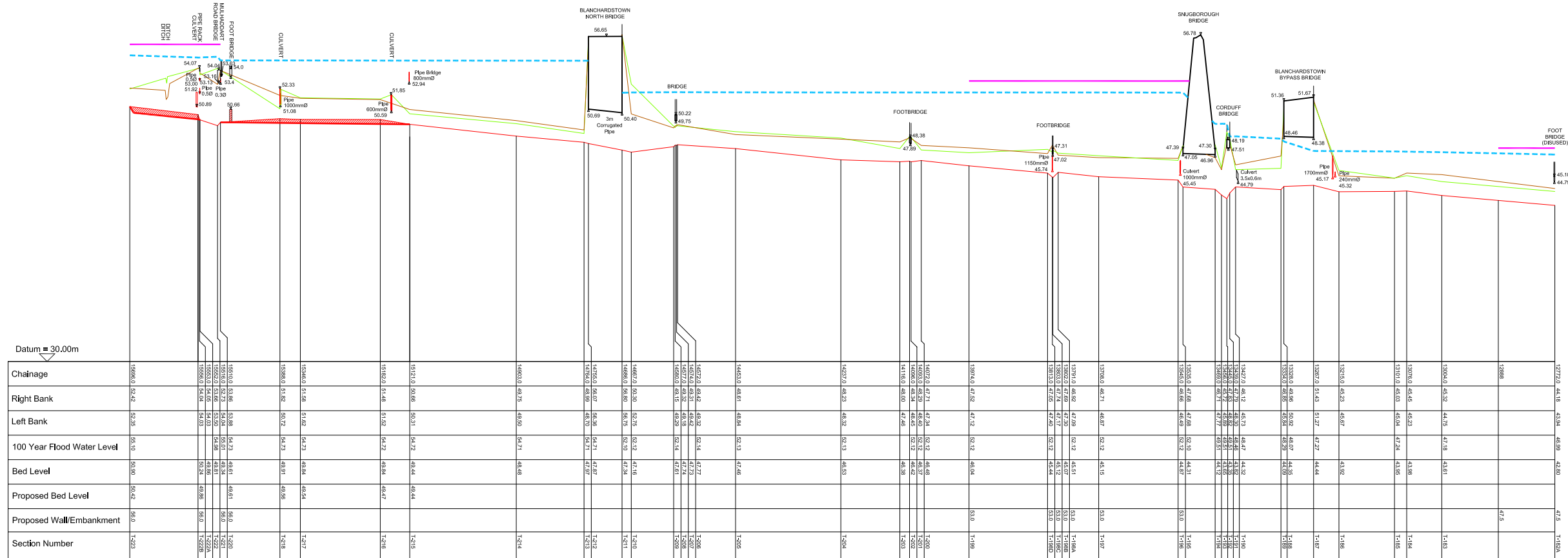
RIVER TOLKA FLOODING STUDY

Title

Future Scheme Flood Maps (Including Development To 2031)

Sheet 5 of 11

Drawn: D. Aherne	File No: 074515001DG2205F01
Chkd: S. Baigent	Job No: 074515001
Appr: G. Gillespie	Dr. No: Rev:
Scale: as shown	DG2205 F01
Date: July 2003	



Datum = 30.00m

Chainage	Right Bank	Left Bank	100 Year Flood Water Level	Bed Level	Proposed Bed Level	Proposed Wall/Embankment	Section Number
14986.0	52.42	52.36	55.16	50.99	50.42	56.0	T-223
15010.0	52.98	52.92	55.72	51.55	50.98	56.0	T-224
15034.0	53.54	53.48	56.28	52.11	51.54	56.0	T-225
15058.0	54.10	54.04	56.84	52.67	52.10	56.0	T-226
15082.0	54.66	54.60	57.40	53.23	52.66	56.0	T-227
15106.0	55.22	55.16	57.96	53.79	53.22	56.0	T-228
15130.0	55.78	55.72	58.52	54.35	53.78	56.0	T-229
15154.0	56.34	56.28	59.08	54.91	54.34	56.0	T-230
15178.0	56.90	56.84	59.64	55.47	54.90	56.0	T-231
15202.0	57.46	57.40	60.20	56.03	55.46	56.0	T-232
15226.0	58.02	57.96	60.76	56.59	56.02	56.0	T-233
15250.0	58.58	58.52	61.32	57.15	56.58	56.0	T-234
15274.0	59.14	59.08	61.88	57.71	57.14	56.0	T-235
15298.0	59.70	59.64	62.44	58.27	57.70	56.0	T-236
15322.0	60.26	60.20	63.00	58.83	58.26	56.0	T-237
15346.0	60.82	60.76	63.56	59.39	58.82	56.0	T-238
15370.0	61.38	61.32	64.12	59.95	59.38	56.0	T-239
15394.0	61.94	61.88	64.68	60.51	59.94	56.0	T-240
15418.0	62.50	62.44	65.24	61.07	60.50	56.0	T-241
15442.0	63.06	63.00	65.80	61.63	61.06	56.0	T-242
15466.0	63.62	63.56	66.36	62.19	61.62	56.0	T-243
15490.0	64.18	64.12	66.92	62.75	62.18	56.0	T-244
15514.0	64.74	64.68	67.48	63.31	62.74	56.0	T-245
15538.0	65.30	65.24	68.04	63.87	63.30	56.0	T-246
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15586.0	66.42	66.36	69.16	64.99	64.42	56.0	T-248
15610.0	66.98	66.92	69.72	65.55	64.98	56.0	T-249
15634.0	67.54	67.48	70.28	66.11	65.54	56.0	T-250
15658.0	68.10	68.04	70.84	66.67	66.10	56.0	T-251
15682.0	68.66	68.60	71.40	67.23	66.66	56.0	T-252
15706.0	69.22	69.16	71.96	67.79	67.22	56.0	T-253
15730.0	69.78	69.72	72.52	68.35	67.78	56.0	T-254
15754.0	70.34	70.28	73.08	68.91	68.34	56.0	T-255
15778.0	70.90	70.84	73.64	69.47	68.90	56.0	T-256
15802.0	71.46	71.40	74.20	70.03	69.46	56.0	T-257
15826.0	72.02	71.96	74.76	70.59	70.02	56.0	T-258
15850.0	72.58	72.52	75.32	71.15	70.58	56.0	T-259
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15898.0	73.70	73.64	76.44	72.27	71.70	56.0	T-261
15922.0	74.26	74.20	77.00	72.83	72.26	56.0	T-262
15946.0	74.82	74.76	77.56	73.39	72.82	56.0	T-263
15970.0	75.38	75.32	78.12	73.95	73.38	56.0	T-264
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16018.0	76.50	76.44	79.24	75.07	74.50	56.0	T-266
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16090.0	78.18	78.12	80.92	76.75	76.18	56.0	T-269
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16138.0	79.30	79.24	82.04	77.87	77.30	56.0	T-271
16162.0	79.86	79.80	82.60	78.43	77.86	56.0	T-272
16186.0	80.42	80.36	83.16	78.99	78.42	56.0	T-273
16210.0	80.98	80.92	83.72	79.55	78.98	56.0	T-274
16234.0	81.54	81.48	84.28	80.11	79.54	56.0	T-275
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16282.0	82.66	82.60	85.40	81.23	80.66	56.0	T-277
16306.0	83.22	83.16	85.96	81.79	81.22	56.0	T-278
16330.0	83.78	83.72	86.52	82.35	81.78	56.0	T-279
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16378.0	84.90	84.84	87.64	83.47	82.90	56.0	T-281
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16426.0	86.02	85.96	88.76	84.59	84.02	56.0	T-283
16450.0	86.58	86.52	89.32	85.15	84.58	56.0	T-284
16474.0	87.14	87.08	89.88	85.71	85.14	56.0	T-285
16498.0	87.70	87.64	90.44	86.27	85.70	56.0	T-286
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16546.0	88.82	88.76	91.56	87.39	86.82	56.0	T-288
16570.0	89.38	89.32	92.12	87.95	87.38	56.0	T-289
16594.0	89.94	89.88	92.68	88.51	87.94	56.0	T-290
16618.0	90.50	90.44	93.24	89.07	88.50	56.0	T-291
16642.0	91.06	91.00	93.80	89.63	89.06	56.0	T-292
16666.0	91.62	91.56	94.36	90.19	89.62	56.0	T-293
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16858.0	96.10	96.04	98.84	94.67	94.10	56.0	T-301
16882.0	96.66	96.60	99.40	95.23	94.66	56.0	T-302
16906.0	97.22	97.16	99.96	95.79	95.22	56.0	T-303
16930.0	97.78	97.72	100.52	96.35	95.78	56.0	T-304
16954.0	98.34	98.28	101.08	96.91	96.34	56.0	T-305
16978.0	98.90	98.84	101.64	97.47	96.90	56.0	T-306
17002.0	99.46	99.40	102.20	98.03	97.46	56.0	T-307
17026.0	100.02	99.96	102.76	98.59	98.02	56.0	T-308
17050.0	100.58	100.52	103.32	99.15	98.58	56.0	T-309
17074.0	101.14	101.08	103.88	99.71	99.14	56.0	T-310
17098.0	101.70	101.64	104.44	100.27	99.70	56.0	T-311
17122.0	102.26	102.20	105.00	100.83	100.26	56.0	T-312
17146.0	102.82	102.76	105.56	101.39	100.82	56.0	T-313
17170.0	103.38	103.32	106.12	101.95	101.38	56.0	T-314
17194.0	103.94	103.88	106.68	102.51	101.94	56.0	T-315
17218.0	104.50	104.44	107.24	103.07	102.50	56.0	T-316
17242.0	105.06	105.00	107.80	103.63	103.06	56.0	T-317
17266.0	105.62	105.56	108.36	104.19	103.62	56.0	T-318
17290.0	106.18	106.12	108.92	104.75	104.18	56.0	T-319
17314.0	106.74	106.68	109.48	105.31	104.74	56.0	T-320
17338.0	107.30	107.24	110.04	105.87	105.30	56.0	T-321
17362.0	107.86	107.80	110.60	106.43	105.86	56.0	T-322
17386.0	108.42	108.36	111.16	106.99	106.42	56.0	T-323
17410.0	108.98	108.92	111.72	107.55	106.98	56.0	T-324
17434.0	109.54	109.48	112.28	108.11	107.54	56.0	T-325
17458.0	110.10	110.04	112.84	108.67	108.10	56.0	T-326
17482.0	110.66	110.60	113.40	109.23	108.66	56.0	T-327
17506.0	111.22	111.16	113.96	109.79	109.22	56.0	T-328
17530.0	111.78	111.72	114.52</				