

Royal Canal Urban Greenway

Preliminary Design Report

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Contents

1	Introduction.....	1
1.1	Scheme Objectives	1
1.2	Project Background	2
1.3	Purpose of the Preliminary Design Report	3
1.4	Stakeholder Consultation	4
1.5	Audit of the Existing Situation	6
1.6	Proposed Construction Procurement Method	6
1.7	Preliminary Design Drawings.....	7
1.8	Report Structure	8
2	Policy Context and Design Standards.....	10
2.1	Policy Context.....	10
2.2	Design Standards.....	10
3	The Proposed Development	12
3.1	Proposed Development Description.....	12
3.1.1	Section 1 – Kildare County Border to Hansfield Railway Bridge (Ch. 0000 – 3200).....	13
3.1.2	Section 2 – Hansfield Railway Bridge to Kennan Bridge (Ch. 3200 – 5300).....	14
3.1.3	Section 3 – Kennan Bridge to Talbot Bridge (Chainage 5300 – 8100).....	14
3.2	Associated Infrastructure Projects	15
4	Preliminary Design	16
4.1	Scheme Cross Sections & Typologies.....	16
4.1.1	Section 1	16
4.1.2	Section 2.....	16
4.1.3	Section 3.....	19
4.1.4	Structural Elements	22
4.2	Horizontal & Vertical Alignment	23

4.3	Junction Layouts.....	24
4.4	Public Lighting.....	25
4.5	Surface Water Drainage.....	26
4.6	DMURS Design Compliance Statement	27
4.7	Road Safety and Road User Audit	27
5	Ground Investigation and Ground Condition.....	29
5.1	Ground Investigation Overview	29
5.2	Desktop Study.....	29
5.2.1	Existing Quaternary Sediments	30
5.2.2	Existing Solid Geology	30
5.2.3	Active mines and mineral localities	32
5.2.4	Aggregate Potential	32
5.2.5	Hydrogeology	33
5.3	Scope of Ground Investigation	36
5.4	Summary of Ground Investigation and Material Properties	37
5.4.1	Topsoil & Surfacing.....	37
5.4.2	Made Ground	37
5.4.3	Cohesive Deposits	37
5.4.4	Granular Deposits.....	38
5.4.5	Bedrock	38
5.4.6	Groundwater	38
5.4.7	Laboratory Testing.....	38
5.5	Geotechnical Input to Design Development	39
5.6	Geotechnical Input to Structures.....	39
5.6.1	Foundations for Small Structures or Chambers.....	39
5.6.2	Foundations for Bridge Structures	40

5.6.3	Foundations for Cantilever Structure	40
6	Pavement, Kerbs, Footways and Paved Areas.....	42
6.1	Pavement.....	42
6.1.1	Opportunities for Innovation, Reuse, and Recycling.....	43
6.2	Kerbs, Footways and Paved Areas.....	43
6.2.1	Overview of Kerbs, Footways and Paved Areas.....	43
6.2.2	Design Considerations	44
6.2.3	Pavement Design	45
6.2.4	Opportunities for Innovation, Reuse, and Recycling.....	48
7	Structures	50
7.1	Overview	50
7.2	Summary of Structures.....	50
7.2.1	Embankments and Retaining Structures.....	50
7.2.2	Pre-Cast Concrete Cantilevered Boardwalk	51
7.2.3	Boardwalk at Dr Troy Bridge and Delwood Area	52
7.2.4	Delwood Area Works including Quarry Bridge	53
7.2.5	Landmark Bridge	55
7.2.6	Proposed Underpass.....	56
8	Drainage, Hydrology, and Flood Risk	58
8.1	Overview of Drainage Strategy	58
8.2	Existing Watercourses and Culverts.....	58
8.3	Existing Drainage Description	59
8.4	Preliminary Drainage Design	60
8.5	Flood Risk.....	66
9	Utilities	68
9.1	Overview of Utilities Strategy and Survey	68

9.1.1	Record Information	68
9.1.2	Utility Surveys	68
9.1.3	Consultation with Utility Service Providers	69
9.2	Overview of Service Interactions	69
9.2.1	euNetworks Strategic Fibre	70
9.2.2	Electricity Supply	71
9.2.3	Water Supply	72
9.2.4	Foul Water Drainage	73
9.2.5	Gas Supply	73
9.2.6	Telecommunications	74
10	Excavations and Waste Quantities	76
10.1	Overview of Waste Quantities	76
10.2	Waste Estimate Summary	77
10.2.1	Demolition	77
10.2.2	Excavation	78
10.2.3	Construction Waste	79
10.2.4	Municipal Waste	81
10.2.5	Operational Waste	81
11	Traffic Signs, Traffic Signals, and Road Markings.....	82
11.1	Overview.....	82
11.2	Traffic Signs and Road Markings.....	82
11.3	Traffic Signals.....	83
11.3.1	Above Ground Infrastructure	83
11.3.2	Underground Infrastructure	84
11.4	Maintenance	86
12	Land Use and Accommodation Works	87

12.1	Summary of Land Use	87
12.1.1	Section 1 – Kildare County Border to Hansfield Railway Bridge (Ch. 0000 – 3200) ..	87
12.1.2	Section 2 – Hansfield Railway Bridge to Kennan Bridge (Ch. 3200 – 5300)	87
12.1.3	Section 3 – Kennan Bridge to Talbot Bridge (Chainage 5300 – 8100).....	88
12.2	Demolition.....	88
12.3	Summary of Accommodation Works and Boundary Treatment	89
13	Landscape and Urban Realm	92
14	Conclusion.....	93

Figure

Figure 1-1	The Royal Canal Urban Greenway Route Overview	3
Figure 3-1	Proposed Development Route Overview	13
Figure 4-1	Indicative cross section of scheme Section 1 [Chainage +0000 to +3200].....	16
Figure 4-2	Photo showing recently constructed route through St. Joseph’s Clonsilla development	17
Figure 4-3	Indicative cross section of bituminous route alongside Hansfield Road [Chainage +3660 to +4230].....	17
Figure 4-4	Indicative cross section of precast concrete cantilevered boardwalk	18
Figure 4-5	Indicative cross section of bituminous route alongside Old Schoolhouse Lands [Chainage +4610 to +5365]	19
Figure 4-6	Indicative cross section of bituminous route on northern embankment [Chainage +5300 to +5910].....	19
Figure 4-7	Indicative cross section where the greenway follows Sheepmoor Lane	20
Figure 4-8	Indicative Photomontage Sheepmoor Lane proposal	20
Figure 4-9	Indicative cross section of route along northern embankment [Generally Chainage +6285 to +7040].....	21

Figure 4-10 Indicative cross section of route through the Brompton Green area [Generally Chainage +6640 to +7080]	21
Figure 4-11 Indicative cross section of bituminous route along existing southern towpath [Chainage +7300 to +8100]	22
Figure 4-12 Table 4 extracted from DN-GEO-03040	24
Figure 5-1 Quaternary Sediments (GSI data, 2026 GSI Geology Mapping).....	30
Figure 5-2 Bedrock Geology 100k Map (GSI data, 2026 GSI Geology Mapping)	31
Figure 5-3 Active mines and mineral localities (GSI data, 2026 GSI Public Data Mapping)	32
Figure 5-4 Crushed Rock Aggregate Potential (GSI data, 2026 GSI Aggregate Potential Mapping) 33	
Figure 5-5 Aquifer setting (GSI data, 2026 GSI Groundwater Mapping)	34
Figure 5-6 Groundwater Vulnerability (GSI data, 2026 GSI Groundwater Mapping).....	35
Figure 5-7 Subsoil Permeability (GSI data, 2026 GSI Groundwater Mapping)	36
Figure 6-1 Example of Unbound Surface Greenway (Royal Canal Greenway between Maynooth and Leixlip).....	46
Figure 6-2 Typical Detail of Bituminous Pavement Construction Form.....	47
Figure 6-3 Examples of Bituminous Greenways (Netherlands and Ireland)	47
Figure 7-1 Example Earth Reinforcement Product: TensarTech™	51
Figure 7-2 Section of the proposed 4m wide cantilevered boardwalk east of Callaghan Bridge...	52
Figure 7-3 Typical Sketch Detail of Steel Deck Boardwalk	53
Figure 7-4 Quarry Bridge elevation	54
Figure 7-5 Layout of the proposed Quarry Bridge and associated screening	54
Figure 7-6 Layout of Landmark Bridge Main Span	56
Figure 7-7 Indicative section of underpass construction in relation to Granard Bridge	57
Figure 8-1: Existing Watercourses and Catchments (Source: https://gis.epa.ie/EPAMaps/default)	59
Figure 8-2 Drainage Type Effectiveness (Sources: Guidelines for Road Drainage)	62
Figure 11-1 Extract from Chapter 7 of the TSM (Figure 7.53 therein)	83

Figure 11-2 Extract from TSM Chapter 9 showing typical layout of Toucan Crossing Signals	84
Figure 12-1 Extract from FCC Development Plan Land Zoning map, Blanchardstown South	88
Figure 12-2 Cross section of Greenway behind Delwood Park (Source: Architectural Drawings – Appendix B, Public Consultation Document)	90
Figure 12-3 Image illustrating the greenway adjacent to the Brompton green area with fencing/planting provided	91

Table

Table 1-1 Preliminary Design Drawings	7
Table 8-1 Existing Storm Water Drainage Network	60
Table 8-2 Summary of Proposed Surface Water Infrastructure	63
Table 9-1 Potential Strategic Fibre Network Interactions	70
Table 9-2 Potential Electrical Network Interactions	71
Table 9-3 Potential Water Supply Network Interactions	72
Table 9-4 Potential Foul Water Drainage Network Interactions	73
Table 9-5 Potential Gas Supply Network Interactions	73
Table 9-6 Potential Telecommunications Network Interactions	74
Table 10-1 Expected Waste Materials to be Generated from Demolition	78
Table 10-2 Summary of Expected Excavation Material Quantities	78
Table 10-3 Estimated Quantities of Major Construction Materials Required	80

1 Introduction

The Royal Canal Urban Greenway (hereafter referred to as the 'Proposed Development') is a pedestrian and cycle route which is to be constructed along or adjacent to the Royal Canal as it heads eastwards from the Kildare County Boundary to the Old Navan Road (near 12th Lock) to connect with a previously constructed section of the Greenway. The proposed development is a joint scheme. Fingal County Council (the Client) is the scheme promoter in conjunction with the National Transport Authority (NTA) as the funding body and Waterways Ireland (WI), who are the principal property owner.

1.1 Scheme Objectives

The following objectives have been established for the Proposed Development:

- To deliver a premium quality combined pedestrian and cycle route which will serve projected recreational and commuter demand;
- To improve the canal corridor as a recreational pedestrian and cycle route;
- To improve connectivity between the canal and adjacent residential neighbourhoods;
- To deliver enhanced permeability via sustainable modes of walking and cycling in a manner that balances the security of the greenway user and respects potentially affected landowners & residents in accordance with best practice urban design;
- To encourage use of sustainable modes of transport, and interlink with existing public transport (with links to Train Stations) and proposed public transport schemes such as DART + West;
- To deliver a greenway which respects the environmental, conservation and heritage sensitivities within the Study Area;
- To create a first-class cycling facility and tourist attraction which can contribute to the economic development of County Fingal;
- Connect to the completed phase of the Greenway at Ashtown and tie in with the section to be completed by Kildare County Council;
- Raise the profile of cycling and inspire people to cycle;
- Increased cyclist and pedestrian safety;
- Tackle obesity and promote activity and create a better quality of life;

- Reduce congestion and the number of motorised vehicle trips;
- To deliver the scheme in compliance with DMURS, NCM and the latest design standards;
- To meet the requirements of Fingal County Council Departments, the NTA, Iarnród Éireann, National Parks and Wildlife Service and other key stakeholders;
- To consult with the statutory and non-statutory stakeholders at all stages during the project;
- To meet planning and statutory requirements;
- To meet the environmental requirements including mitigation measures outlined;
- To protect the current uses of the canal / scheme and to respect the access requirements of Waterways Ireland, as primary landowner within the Study Area, and other users such as anglers, walkers and barges;
- To protect the Royal Canal or ensure that its historical context is protected in the delivery of this greenway;
- To deliver a safe combined pedestrian and cycle route, which meets the standards set out for a Greenway in the NTA's "Cycle Design Manual" (published in 2023) and TII Publication "Rural Cycleway Design, DN-GEO-03047, Feb 2025", subject to detailed engineering design and the mitigation measures presented in the SEA and Natura Impact Statement accompanying the Greater Dublin Area Cycle Network Plan.

1.2 Project Background

The Royal Canal links the River Shannon in County Longford to the River Liffey in Dublin City's Docklands. On its way, it passes close to several towns, including Mullingar, Kilcock, Maynooth and Leixlip before entering Fingal where it passes through the built-up areas of Clonsilla, Coolmine, Castleknock and Blanchardstown on its way towards the north city.

Fingal County Council (FCC), as the Contracting Authority, is responsible for the delivery of a pedestrian and cycle route which is to be constructed along or adjacent to the Royal Canal as it heads eastwards from the Kildare County Boundary to the Old Navan Road (near 12th Lock) to connect with a previously constructed section of the Greenway.

Along with the scheme objectives set out in Section 1.1, FCC's overall objective is to deliver a safe combined pedestrian and cycle route, which meets the standards set out for a Greenway in the NTA's "Cycle Design Manual" (published in 2023) and TII Publication "Rural Cycleway Design, DN-

GEO-03047, Feb 2025", subject to detailed engineering design and the mitigation measures presented in the SEA and Natura Impact Statement accompanying the Greater Dublin Area Cycle Network Plan.

The scheme will provide a shared pedestrian / cycle route on / adjacent to the Royal Canal towpath over an approximate length of 8.1km which will tie in with the completed section of the Ashtown Greenway at Talbot Bridge (Old Navan Road) in the east and the Kildare County Council greenway section at the county boundary in the west. The extent of the scheme is illustrated in Figure 1-1.

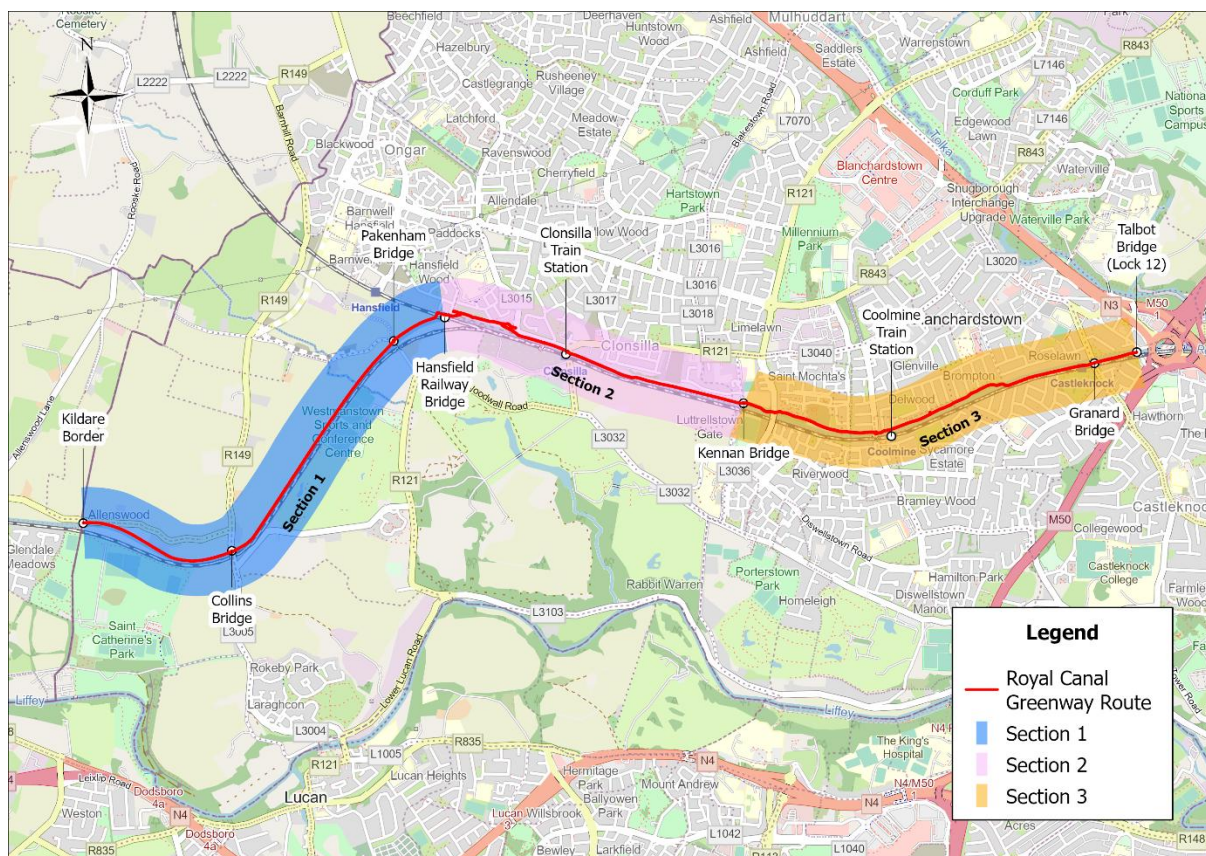


Figure 1-1 The Royal Canal Urban Greenway Route Overview

For further information on the strategic context and need for the Proposed Development, refer to Route Options Assessment Main Report.

1.3 Purpose of the Preliminary Design Report

This Preliminary Design Report (PDR) sets out the preliminary design of the Proposed Development, and supports the Compulsory Purchase Order (CPO) documentation and Environmental Impact Assessment Report (EIAR) which form part of the Planning Application to An Coimisiún Pleanála.

1.4 Stakeholder Consultation

Extensive engagement has taken place since the project inception in 2018 and has continued to the current date. Consultation has been undertaken by the Project Team with the various departments in Fingal County Council (FCC), with the National Transport Authority (NTA) and Waterways Ireland (WI), in order to discuss the feasibility of particular route options.

Consultation with the general public, residential groups, elected representatives, other state bodies, such as An Garda Síochána, National Parks and Wildlife Service (NPWS), Inland Fisheries and Iarnród Éireann, as well as other interested parties has also been undertaken. There was a Non-Statutory Public Consultation on the emerging preferred route held in February 2019. As part of this consultation, there were meetings with elected members and residential groups which also followed the public consultation. A second Non-Statutory Public Consultation was subsequently held in 2021 on the Preferred Route Option.

1.4.1.1 First Non-Statutory Public Consultation (2019)

The Emerging Preferred Route for the proposed development was presented during a Non-Statutory Public Consultation held from 25th February to 27th March 2019.

A total of 602 submissions were received. The majority of the submissions received (from the general public) as part of the public consultation process related to a 1km section of route between Kirkpatrick Bridge (Coolmine Road) and 400m west of Castleknock Train Station. The most common concerns mentioned were increased traffic, anti-social behaviour and crime and biodiversity impacts.

Many submissions were in favour of the Emerging Preferred Route, however, a greater number were in favour of the greenway to be specifically on the southern side of the Canal between Kirkpatrick Bridge and Granard Bridge at Castleknock Station.

The concerns raised have been thoroughly reviewed with reference to their alignment with local and national policy and the scheme project objectives and this has formed a core consideration in the progression of the Option Development and Assessment process leading to the identification of the Preferred Route. Preliminary designs were prepared for both options on the north and south of the canal between Kirkpatrick and Granard Bridges as a result of the concerns raised in the 2019 consultation process. This included consideration of the anticipated constructability of the designs which was then incorporated into a refined options assessment process which is presented in the Route Options Assessment Main Report.

For further information on the submissions received and responses to the most common and other specific issues, please refer to the Non-Statutory Public Consultation Report submitted as part of the application.

1.4.1.2 Second Non-Statutory Public Consultation (2021)

The second round of Non-Statutory public consultation ran over a period of 6 weeks from 25th March 2021 to 7th July 2021. Observations were submitted online via the FCC Consultation Portal website or by post.

This second Non-Statutory Public Consultation was delivered during the COVID-19 pandemic and due to public health restrictions on gatherings, FCC were not in a position to hold a traditional, in-person public consultation event during this round of public consultation. Letters were delivered to each individual potentially impacted property affected by the Proposed Development that, in addition to providing information about the Proposed Development, offered a one-to-one meeting to discuss the likely impact, issues and concerns.

A total of 506 submissions highlighted issues surrounding traffic management, parking and access routes. 284 submissions contained commentary on elements on the scheme design including suggested changes and general queries relating to scheme features.

A number of changes to the design were made based on feedback received during the second round of public consultation and dialogue with stakeholders. However, the changes made to the Draft Preferred Route Option have been relatively small scale.

For further information on the submissions received and responses to the most common and other specific issues, please refer to the Non-Statutory Public Consultation Report submitted as part of the application.

1.4.1.3 Key Stakeholder Consultation

Ongoing consultation has been undertaken with a number of stakeholder groups in order to discuss strategic and specific elements of the scheme. This consultation has assisted in guiding technical and strategic elements of the scheme. Ongoing consultation and engagement has been undertaken with the National Transport Authority, the various departments of Fingal County Council, Waterways Ireland, An Garda Síochána, Iarnród Éireann and DART+ West, Dublin Cycling Campaign, Royal Canal Amenity Group (RCAG) and Elected Representatives and Local Residential Groups throughout the route options assessment process. A summary of some of the feedback

from the key stakeholders to date is outlined in the Route Options Assessment Main Report and the Non-Statutory Public Consultation Report submitted as part of the application.

1.5 Audit of the Existing Situation

The following surveys and desktop studies have been conducted to inform the preliminary design of the Proposed Development.

- Problem identification, including route walk / cycle;
- Existing Structures Study;
- Existing Route Collision Analysis;
- Baseline Tree Survey;
- Phase 1 Utility Survey;
- Ground Investigations;
- Various ecological surveys (including bat, otter, birds and other habitat surveys);
- Archaeological and cultural heritage surveys; and
- Traffic Surveys (JTC, ATC, pedestrian and cyclist counts).

These surveys have been supplemented with secondary record data including utility record information, Office of Public Works (OPW) Catchment Flood Risk Assessment and Management (CFRAM) Flood Models, Uisce Éireann (UÉ) drainage models and existing traffic signal data.

1.6 Proposed Construction Procurement Method

It is anticipated that following the successful attainment of planning permission the scheme would progress to detailed design. On completion of detailed design, it is envisaged that the construction of the scheme will be tendered under a “Public Works Contract for Civil Engineering Works Designed by the Employer” contract.

Consequently, the design information presented in this report ensures that the objectives of the Proposed Development are met, in accordance with current design standards and guidance documents. It further ensures that sufficient land will be acquired during the Compulsory Purchase Order (CPO) process to construct the Proposed Development and fulfil the design requirements.

Future design stages will be constrained by the requirement to adhere to the design requirements, to incorporate the mitigation specified in the Environmental Impact Assessment Report (EIAR) and

to utilise the available land for its construction and any proposed design modifications will require FCC review and acceptance prior to implementation into the Proposed Development design.

1.7 Preliminary Design Drawings

A set of preliminary design drawings have been prepared to convey the scheme design principles for each discipline and should be read in conjunction with this Preliminary Design Report. Table 1-1 provides a description of the drawings and relevant design content displayed in each of the series as applicable for the Proposed Development.

Table 1-1 Preliminary Design Drawings

Drawing Series Description	Design Content
Site Location Map & Red Line Boundary Drawings	Defines the full extent of the works & planning red line boundary. Outlines the scheme chainage structure and provides context for other notable locations along the route.
Route Alignment Drawings	Displays information for conveying the overarching scheme design intent, providing information on the proposed greenway route, in addition to identification of specific items of note to the scheme (structures or significant features which may be further described on other drawing series).
Drainage Drawings	Displays information for conveying the design intent for the drainage portion of the works including identification of SuDS measures, and outline design for the proposed drainage discharge strategy along the route.
Lighting Design Drawing	Provides an indication of the proposed modification works to the existing lighting infrastructure along the route in addition to identification of any proposed lighting infrastructure locations.
Bridge Design Drawings	Provides details relating to proposed structures / bridges along the route.

Drawing Series Description	Design Content
Architectural Drawings	Provides conceptual drawings relating to proposed architectural elements along the route such as the proposed bridge structures.
Land Requirement Drawings (CPO)	To be read in conjunction with the Route Alignment Drawings. Provides an indication of the locations for the proposed boundary modification and land take works along the route.
Tree Survey drawings	Provides information relating to existing trees along the route and identification of trees to be removed resulting from the arborist assessments
Compound Drawings	Presents the locations and extents of proposed compound locations that have been considered as part of the planning documentation.
Landscaping Drawings	Provides information relating to urban realm and landscaping proposals including proposed tree/planting regime, proposed surface finishes, and proposed boundary treatment and key street furniture notes.

1.8 Report Structure

The structure for the remainder of this report is set out as follows:

- Chapter 2: Policy Context and Design Standards – This chapter briefly identifies the policies and overview of the approach taken for application of design standards which have been applied to the preliminary design.
- Chapter 3: The Proposed Development – This chapter provides an overview of the design intent at various locations along the Proposed Development, providing a description of the route in more detailed subsections. An outline of the key interactions with other infrastructure projects is also provided.
- Chapter 4: Preliminary Design – This chapter provides an overview of the key design parameters used for the geometric designs and descriptions of the design elements such

as proposed cross-sections, junctions, public lighting and drainage, with more detailed descriptions of relevant elements provided in subsequent chapters.

- Chapter 5: Ground Investigation and Ground Condition – This chapter provides an overview of the ground investigation process and existing ground conditions
- Chapter 6: Pavement, Kerbs, Footways and Paved Areas – This chapter gives an overview of the existing pavement situation and proposed pavement design for the scheme
- Chapter 7: Structures – In this chapter an overview of the structures strategy is provided, along with a summary of principal and minor structures, retaining walls and embankments, where applicable.
- Chapter 8: Drainage, Hydrology and Flood Risk – This chapter provides an overview of the drainage strategy, including descriptions of existing watercourses and culverts, alongside a summary of the drainage design for each section along the scheme, including the consideration of drainage at structures and the maximisation of SuDS features.
- Chapter 9: Utilities – This chapter shows the utilities design strategy, documents surveys undertaken to date and identifies potential conflicts.
- Chapter 10: Excavations and Waste Quantities – This chapter provides an overview of the excavations associated with the works and waste quantities for the Proposed Development.
- Chapter 12: Traffic Signs, Traffic Signals and Communications – In this chapter the design strategy for traffic signs, road markings, traffic signals and communications equipment is outlined, alongside descriptions of how these elements can be maintained and monitored safely and securely.
- Chapter 12: Land use and Accommodation Works – This chapter outlines land use and acquisition requirements, affected land and property owners, and proposed accommodation works and boundary treatments
- Chapter 13: Landscape and Urban Realm – This chapter is an overview of the landscape and urban realm design strategy focussing on the existing trees and proposed mitigation

2 Policy Context and Design Standards

2.1 Policy Context

The following national, regional and local policies have been reviewed and considered in the development of the Proposed Development:

- National Planning Framework (2040)
- National Development Plan (2026-2035)
- Strategy For The Future Development of National and Regional Greenways (2018)
- Smarter Travel: A Sustainable Transport Future (2009-2020)
- Climate Action Plan (2025)
- Heritage & Biodiversity Plan 2030
- National Physical Activity Framework (2024 - 2040)
- Regional Spatial and Economic Strategy (RSES) 2020-2032 & Metropolitan Area Strategic Plan (MASP) (2019)
- Transport Strategy for The Greater Dublin Area (2022-2042)
- Greater Dublin Area Cycle Network Plan (2023)
- Fingal County Development Plan (2023 – 2029)
- Fingal Tourism Strategy
- Fingal Local Economic and Community Plan
- Hansfield SDZ Planning Scheme April 2006

For further information on these documents and how they relate to the Proposed Development, refer to Route Options Assessment Main Report.

2.2 Design Standards

Design standards applied on the Proposed Development are stated within the applicable chapters of this report. A non-exhaustive list of such design standards and guidelines applied on the Proposed Development is as follows:

- The Design Manual for Urban Roads and Streets (DMURS);
- Permeability Best Practice Guide (2015)

- Cycle Design Manual (CDM - 2023);
- TII Publications – including (non-exhaustive):
 - Rural Cycleway Design (Offline & Greenway), TII Publications DN-GEO-03047 (2025)
 - Geometric Design of Junctions (priority junctions, direct accesses, roundabouts, grade separated, and compact grade separated junctions) DN-GEO-03060 (2017)
 - Subways for Pedestrians and Pedal Cyclists Layout and Dimensions DN-GEO-03040 (2000)
- The Traffic Signs Manual (TSM);
- Guidance on the use of Tactile Paving (2005);
- Building for Everyone: A Universal Design Approach
- Irish Wheelchair Association's (IWA) Best Practice Access Guidelines; and
- Greater Dublin Strategic Drainage Study (GDSDS).

3 The Proposed Development

3.1 Proposed Development Description

The Proposed Development will provide a shared pedestrian and cycle route adjacent to the Royal Canal over an approximate length of 8.1km. This will tie in with the completed Ashtown to Castleknock section of the Royal Canal Greenway to the east and the Kildare County Council greenway section at the County boundary to the west.

It will provide a high quality, safe, attractive and environmentally sympathetic walking and cycling corridor serving Castleknock, Blanchardstown, Clonsilla, Coolmine and the wider Dublin 15 area. The greenway will encourage recreation while offering an attractive sustainable transport choice for school children and commuters, bringing significant environmental, economic and health benefits to the wider community.

The Proposed Development is divided into three sections as follows – and as generally indicated in Figure 3-1:

- Section 1 – Kildare County Border to Hansfield Railway Bridge (Ch. 0000 – 3200)
- Section 2 – Hansfield Railway Bridge to Kennan Bridge (Ch. 3200 – 5300)
- Section 3 – Kennan Bridge to Talbot Bridge (Chainage 5300 – 8100)

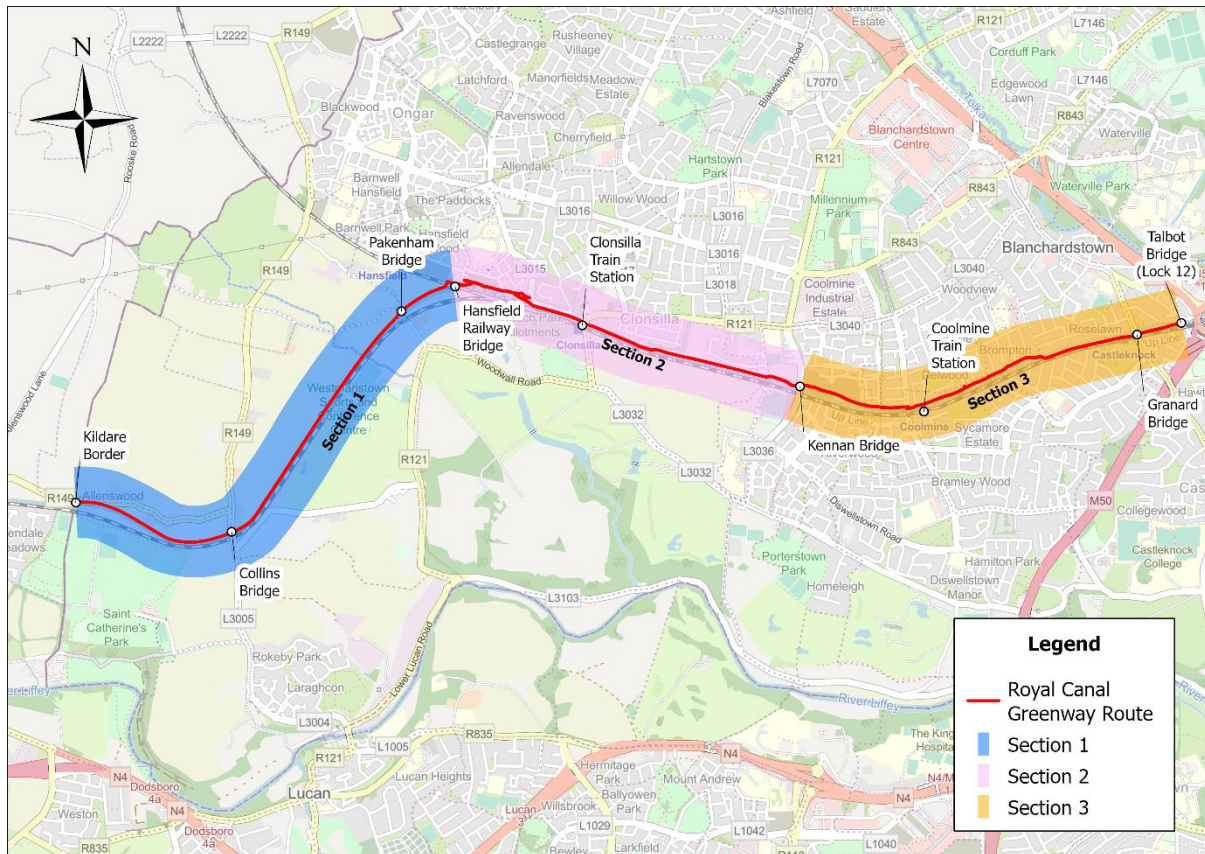


Figure 3-1 Proposed Development Route Overview

3.1.1 Section 1 – Kildare County Border to Hansfield Railway Bridge (Ch. 0000 – 3200)

The Proposed Development will follow the existing towpath along the northern side of the Royal Canal from the Kildare County Council boundary line to Hansfield Railway Bridge. The Greenway will be constructed as a 2m – 3m wide (within existing embankment widths) granular unbound surface from the Kildare/Fingal County Council boundary line to Hansfield Bridge (Railway Bridge). Short sections of bound pavement will be constructed on approach to junctions with Clonee Road (R149) and Milestown road (R121). The greenway will continue through the existing pedestrian underpass by Hansfield Railway Bridge.

The total construction thickness will range from 0.2m on stiff ground and up to 0.5m on soft ground. Construction of the greenway will involve removal of the topsoil layer to a depth of typically 0.15m and build-up of the gravel thickness to a level of up to 0.35m above surrounding ground level. Refer to the Construction Methodology Report (170239-DBFL-XX-XX-RP-C-0003) for further details on the proposed build-up.

3.1.2 Section 2 – Hansfield Railway Bridge to Kennan Bridge (Ch. 3200 – 5300)

The greenway will be constructed on the northern side of the Royal Canal from Hansfield to Kennan Bridge via Porterstown School House lands between Callaghan and Kennan bridges.

Following the Hansfield Railway Bridge, the greenway route will enter the St. Joseph's Clonsilla Residential Development and follow a recently constructed pedestrian and cycle facility through these lands. The route will then connect through to the adjacent existing woodlands. This involves the construction of a new 4m wide route, clearance of existing trees, the demolition of two existing properties (and a number of ancillary structures), followed by the widening of the existing pedestrian route to 4m along the northern side of Royal Canal from Hansfield Road access to the proposed sloped section into the Porterstown Old School House lands.

This 70m sloped section of the greenway is to be constructed to access the Old School House lands. A 3m wide paved cycle route along the majority of the route within the Old School House lands is the primary design proposal, along with upgrading the existing towpath to bound surface (2m width).

Refer to the Construction Methodology Report (170239-DBFL-XX-XX-RP-C-0003) for further details on the proposed works and build-ups.

3.1.3 Section 3 – Kennan Bridge to Talbot Bridge (Chainage 5300 – 8100)

The Greenway will be provided on the northern side of the Royal Canal from Kennan Bridge to Kirkpatrick Bridge via Sheepmoor Lane. The proposed route is located north of the wooded area along the northern embankment from Kennan Bridge to Sheepmoor Lane which has the benefit of minimising the impact on trees.

The scheme will follow the pedestrian/cycle facilities proposed as part of the Windmill Court Residential Development followed by the existing roadway along Sheepmoor Lane.

The Greenway will be situated on the upper level of the northern embankment, from Coolmine Road (Kirkpatrick Bridge) to the Brompton green area (Ch. 6250-6850), which has the benefit of minimising tree removal and the potential visual impact of the scheme on the Canal.

The Proposed Development is routed near the top of the northern embankment (adjacent to Delwood Park residential back gardens) and into the open space at Brompton which has the benefit of minimising the potential impact on highly sensitive trees (Oak-Ash-Hazel Woodland WN2) and habitats. To prevent the greenway overlooking the back gardens of the residents of Delwood Park and for security reasons, the ground level of the greenway will be lowered from

existing levels and security fencing, and defensive planting will be provided between the greenway and the back gardens to increase security and any visual intrusion.

A bridge structure will be required to enable the proposed greenway to cross an historic quarry area on the northern embankment (Ch. +6500m) – referred to as the ‘Quarry Bridge’.

A 4m paved greenway will be provided on the southern side of the Brompton green area (Ch. 6850-7090). Planting and railings will be provided along this section of the greenway. The scheme will provide opportunities for users to access Brompton & Roselawn estates.

The route crosses from the northern side to the southern side of the Royal Canal at chainage 7090-7350 (before Roselawn Road). The Greenway will cross the Canal over an architecturally designed pedestrian and cycle bridge – referred to as the ‘Landmark Bridge’. The bridge will respect existing uses along the Canal and existing and future operations on the Dublin to Maynooth rail line.

The greenway will continue on the southern side of the Royal Canal, past Castleknock Station and under Castleknock Road through a proposed greenway underpass.

A paved 4m wide greenway will be provided on the southern towpath from Granard Bridge to the 12th Lock Hotel. Due a pinch point between the hotel and the canal a 3m wide greenway is only feasible from the 12th Lock Hotel to Talbot Bridge/Old Navan Road (150m). The greenway will tie into the current Ashtown section of the Royal Canal Greenway at Talbot Bridge providing continued linkage onwards to Dublin City.

Refer to the Construction Methodology Report (170239-DBFL-XX-XX-RP-C-0003) for further details on the proposed works and build-ups.

3.2 Associated Infrastructure Projects

The designs have been developed in an integrated manner with several other adjacent infrastructure projects, such as:

- St. Joseph’s Clonsilla Residential Development
- DART+ West Proposals
- Windmill Court Residential Development
- Kellystown Bridge Proposal

4 Preliminary Design

4.1 Scheme Cross Sections & Typologies

The Proposed Development is to be made up of a number of fundamental construction forms and cross sections depending on location. Each of the below cross-section typologies forms is outlined further detail provided as part of the Construction Methodology Report which also forms part of the submission. Further information on the design principles associated with the proposed build-ups is included in Section 6.

4.1.1 Section 1

4.1.1.1 Ch. +000 – Ch. +3200 – Bituminous Unbound Pavement

With reference to the scheme sections as set out in Section 3.1 of this report, Section 1 of the Proposed Development (within the rural setting) will largely follow the existing canal tow path and will be constructed reflect the existing unbound gravel surfacing. The cross-section width of the greenway will be between 2m and 3m from the commencement of the scheme to Collins Bridge (refer to Figure 4-1), then to Pakenham Bridge, and finally from Pakenham Bridge to Hansfield Railway Bridge.

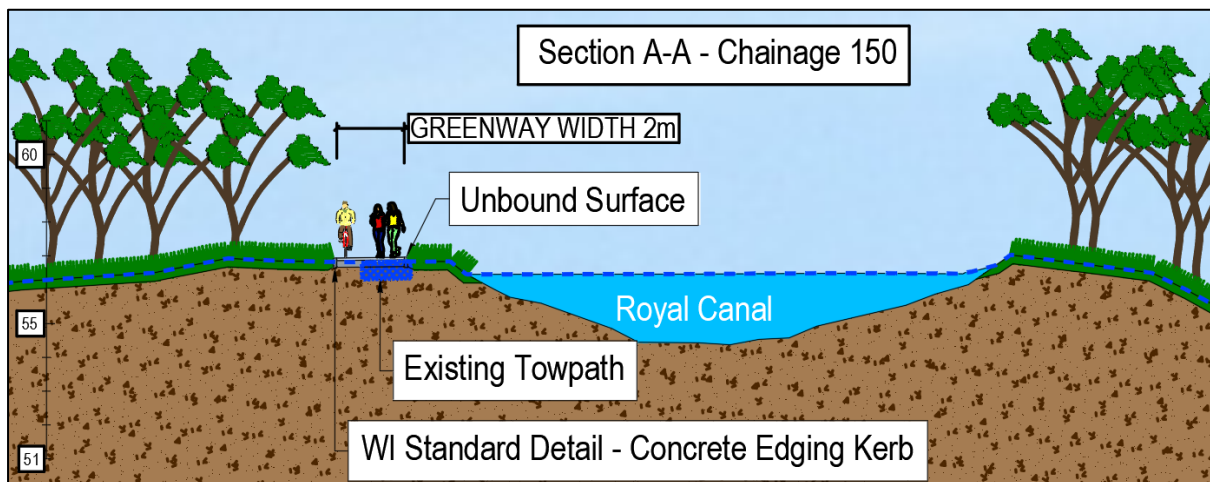


Figure 4-1 Indicative cross section of scheme Section 1 [Chainage +0000 to +3200]

4.1.2 Section 2

4.1.2.1 Ch. +3200 – Ch. +3660 – Existing Pathway

With reference to the scheme sections as set out in Section 3.1, Section 2 of the Proposed Development will make use of a recently constructed pedestrian and cycle route through the St. Joseph's Clonsilla development (refer to Figure 4-2), approximately 4m – 4.5m wide, entering to

the north of the Hansfield Railway Bridge, and returning to the canal banks at Hansfield Road [from approximately Chainage +3200 to +3660].



Figure 4-2 Photo showing recently constructed route through St. Joseph's Clonsilla development

4.1.2.2 Ch. +3660 – Ch. +4230 – Bituminous Flexible Pavement

Section 2 will in part follow the existing canal towpath route and will be constructed as a bituminous pavement build-up, with widening of the towpath where necessary to between 3m and 4m, as indicatively shown in Figure 5-3.

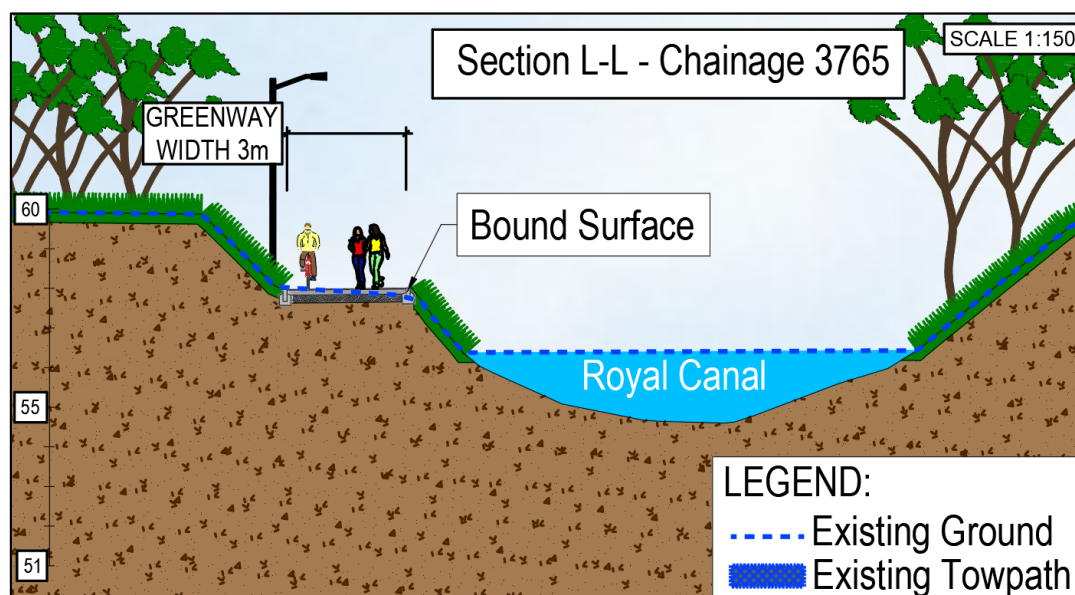


Figure 4-3 Indicative cross section of bituminous route alongside Hansfield Road [Chainage +3660 to +4230]

4.1.2.2.1.1.1.1 5.1.2.3 Ch. +4230 – Ch. +4610 – Precast Concrete Cantilevered Boardwalk

In addition to the bituminous pavement, Section 2 also includes a portion of 4m wide cantilevered boardwalk with precast concrete surfacing on a piled steel structure raised above the existing surface from approximately Chainage +4230 to +4610, as demonstrated in Figure 5-4.

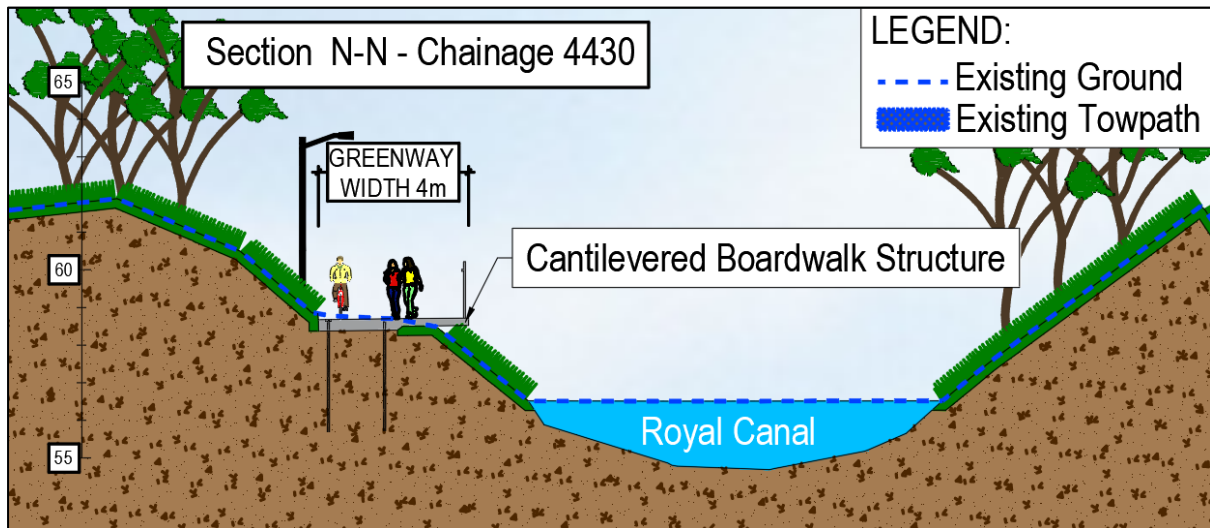


Figure 4-4 Indicative cross section of precast concrete cantilevered boardwalk

4.1.2.3 Ch. +4610 – Ch. +5365 – Segregated Cycleway & Pedestrian Footpath (Bitumen Bound)

The route will also deviate from the existing tow path in parts to construct a new 3m wide bituminous greenway further north away from the canal, particularly alongside the Old Schoolhouse Lands, as indicated in Figure 4-5.

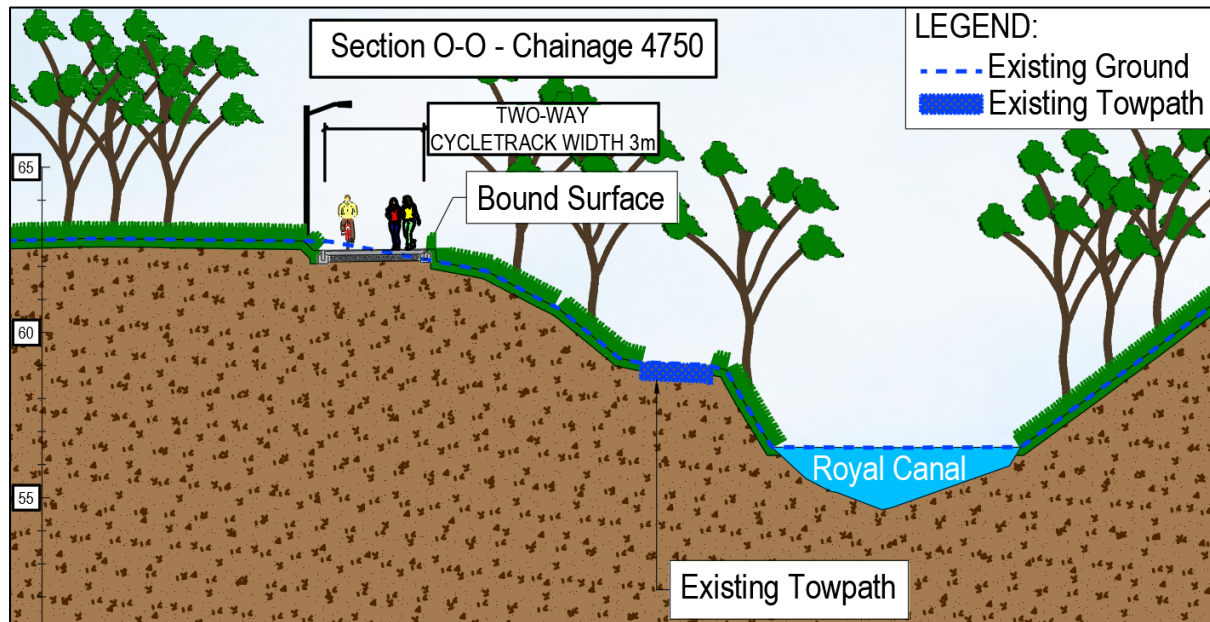


Figure 4-5 Indicative cross section of bituminous route alongside Old Schoolhouse Lands [Chainage +4610 to +5365]

4.1.3 Section 3

4.1.3.1 Ch. +5370 – Ch. +5980 – Bituminous Flexible Pavement & Elevated Boardwalk

Section 3 (continuing through the urban setting) will also largely comprise a newly constructed route to the north of the canal constructed as a bituminous pavement build-up, 4m in width, ranging from approximately 5m to 10m above the existing canal banks (Figure 4-6).

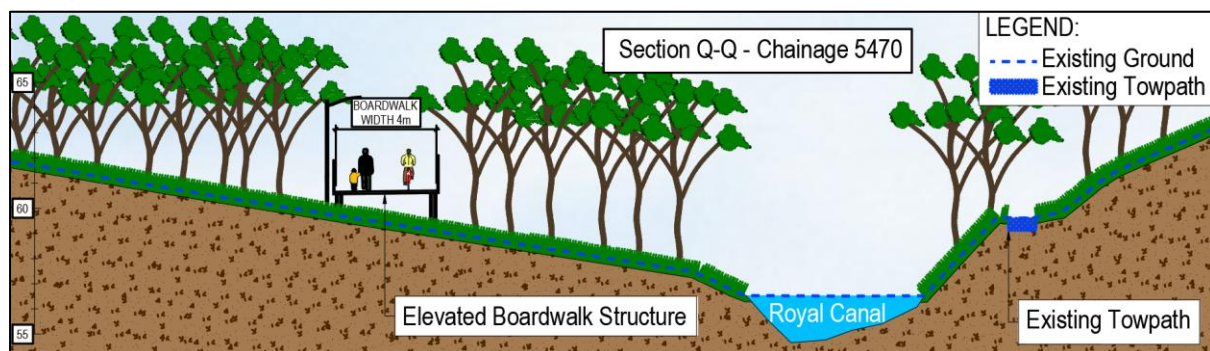


Figure 4-6 Indicative cross section of bituminous route on northern embankment [Chainage +5300 to +5910]

4.1.3.2 Ch. +5620 – Ch. +6275 – Existing Roadway

Section 3 also includes a portion of existing roadway as the scheme ties into the existing Windmill Court Development [from approximately Chainage +5620 to +5980] and Sheepmoor Lane [from approximately Chainage +5980 to +6275]. The latter will involve localised improvements to the

road pavement and widening into an adjacent verge to achieve an optimum width of 4m along Sheepmoor Lane where practicable. An indicative cross section of this is shown in Figure 5-7. It is also proposed to provide traffic calming by optically narrowing the carriageway, through the use of alternative block paving either side of the carriageway, as indicated in the photomontage of Sheepmoor Lane within Figure 5-8.

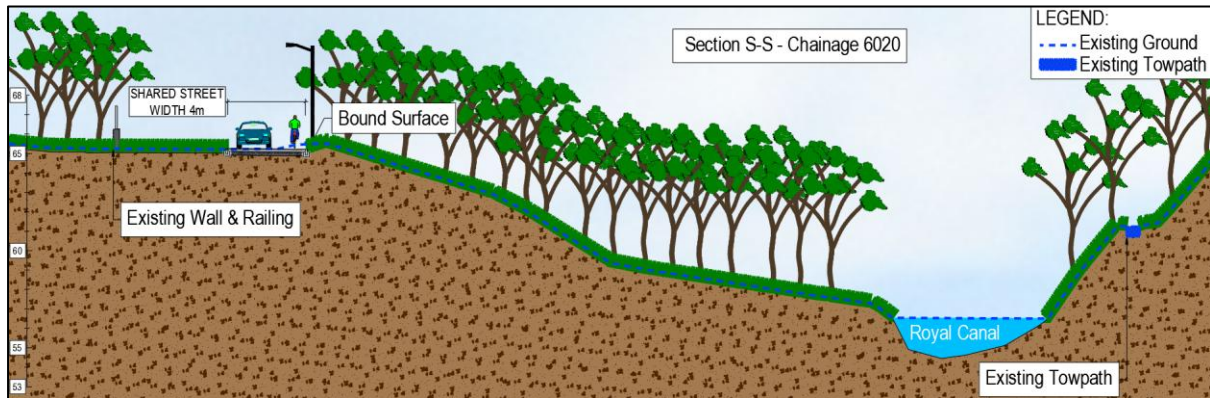


Figure 4-7 Indicative cross section where the greenway follows Sheepmoor Lane



Figure 4-8 Indicative Photomontage Sheepmoor Lane proposal

4.1.3.3 Ch. +6285 – Ch. 7080 - Bituminous Flexible Pavement & Elevated Boardwalk

In Section 3, on either approach to the Quarry Bridge [Chainage +6285 to +6495 and +6560 to +6640], the proposed construction consists of a 4m wide new bituminous pavement constructed through existing landscaped areas. A section of this will require excavation down to the required finish level below the adjacent properties to avoid overlooking issues, refer to Figure 4-9, while other portions will be raised along a boardwalk, see Figure 4-10, via a piled steel structure due to the undulating local topography. The section leading up to the Proposed Landmark Bridge in the Brompton Green area, continues as flexible bituminous pavement.

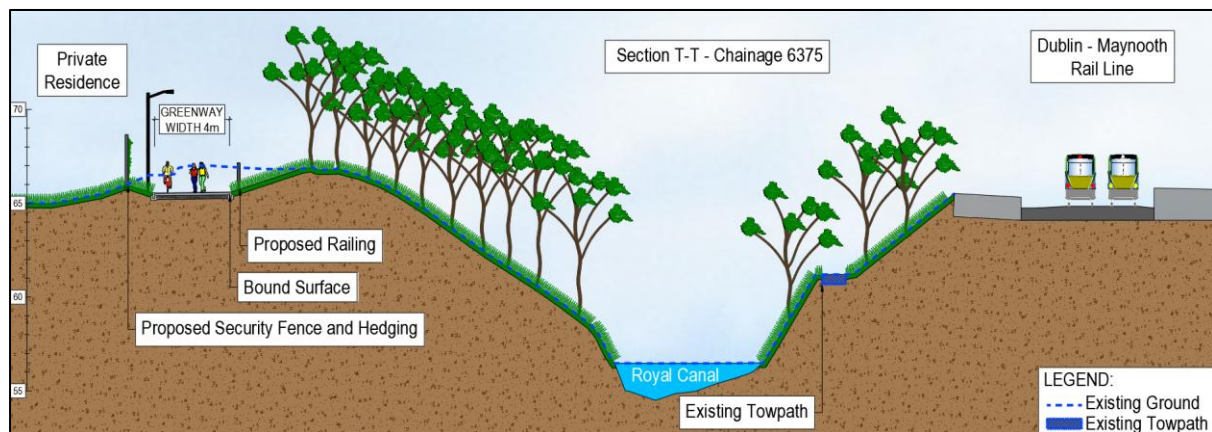


Figure 4-9 Indicative cross section of route along northern embankment [Generally Chainage +6285 to +7040]

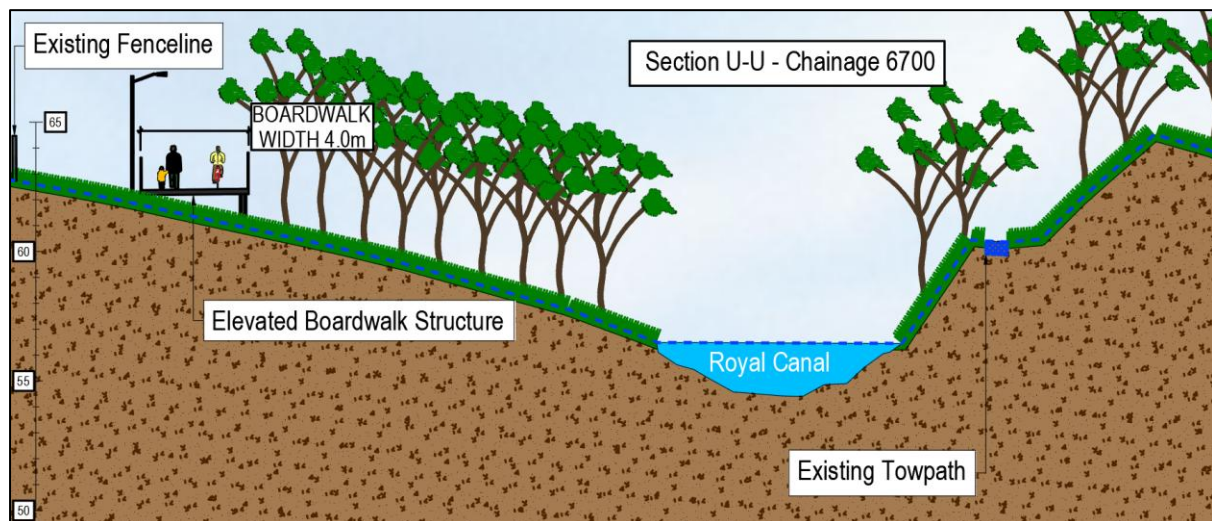


Figure 4-10 Indicative cross section of route through the Brompton Green area [Generally Chainage +6640 to +7080]

4.1.3.4 Ch. +7300 – Ch. 8100 – Bituminous Flexible Pavement

Still within Section 3, following the transition across the Landmark Bridge where the greenway will go from the northern canal embankment to the southern embankment, there will be a widening

of the existing towpath south of the canal reconstructed as a 4m wide bituminous pavement build-up (Figure 4-11).

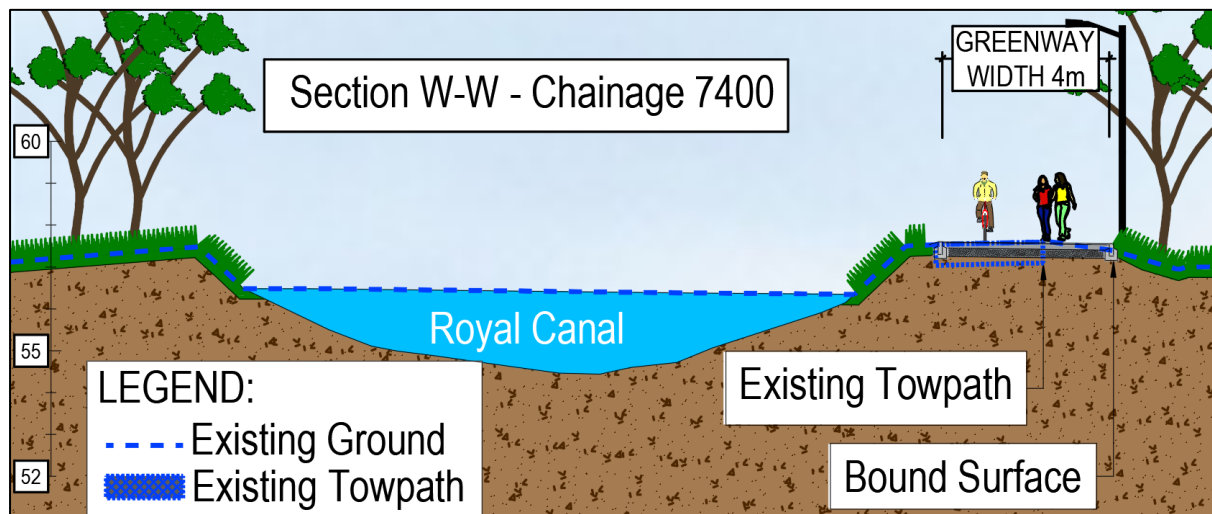


Figure 4-11 Indicative cross section of bituminous route along existing southern towpath [Chainage +7300 to +8100]

4.1.4 Structural Elements

Due to the topography, minor retaining structures into the embankment will be required along some portions, particularly in the Hansfield area (Ch. +3760 to +4100 approximately). Loading conditions such as trees or buildings above the retaining walls will factor into the detailed design of said structures, informing their final dimensions.

A cantilevered boardwalk is proposed in the section leading up to the Old Schoolhouse grounds. The structure has been proposed given the proximity of the greenway to the canal and to minimise the impact on habitat in this area. The boardwalk will be constructed from Chainage +4235 to +4600.

A sloped section (approx. 70m in length) [from approximately Chainage +4540 to +4610], and associated retaining works is proposed to raise from the towpath to the upper level of the Old Schoolhouse lands. This sloping largely follows the existing contours as the route deviates to the upper level of the embankment, with a c. 4 metre longitudinal level difference.

A portion of the route passes beneath the Dr Troy bridge. The elevation difference west of the bridge and the existing path, constructed as part of the windmill court development, requires the greenway be elevated. This will maintain a comfortable longitudinal grade of 1:21 while allowing ample headroom between Dr Troy Bridge Soffit and the boardwalk surface. It is proposed to construct the greenway as an elevated boardwalk from Chainage +5550 to +5610.

In addition to the general greenway route in Section 3, the works include the construction of two bridge structures: the 'Quarry Bridge' crossing an existing quarry along the northern banks; and the 'Landmark Bridge' traversing the canal itself. Sections east of the Quarry Bridge will need to span hollows to maintain an appropriate vertical alignment and to link the greenway to the adjacent Landmark Bridge approach. As such, these shall be raised along a boardwalk via a piled steel structure. This will comprise a steel deck structure on appropriately spaced UCs piled and grouted. Each of these will provide a 4m wide greenway route tying in with adjacent cross-sections.

Section 3 also comprises a new underpass to be constructed beneath Castleknock Road on the southern side of the Granard Bridge. This will provide a clear 5.2m wide bituminous pavement route with minimum 2.5m clear height through the underpass.

Refer to Chapter 7 herein and the Construction Methodology Report (170239-DBFL-XX-XX-RP-C-0003) for further details on the proposed structural works.

For ease of reference a preliminary list of Structural elements is included as follows:

- Retaining wall [Ch. +3760 to +4100]
- Cantilevered Boardwalk [Ch. +4230 to +4600]
- Retaining wall [Ch. +4540 to +4610]
- Elevated Boardwalk [Ch. +5460 to +5610]
- Quarry Bridge [Ch. +6490 to +6560]
- Elevated Boardwalk [Ch. +6640 to +6800]
- Landmark Bridge [Ch. +7080 to +7350]
- Castleknock underpass [Ch. +7810 to +7830]

4.2 Horizontal & Vertical Alignment

By its nature a greenway is a low-key and low impact feature. As set out above, it will generally consist of a 3m to 4m wide pathway and will largely follow the natural topography as much as possible with some areas of earthworks for cuttings and embankments and raised bridge/boardwalk sections.

The proposed greenway complies with the TII Publication "Rural Cycleway Design (Offline & Greenway)", which outlines the suitable curvature for cyclists is 25m radius for a maximum speed of 30km/h or lower where appropriate, with a minimum radius of 4m at 10km/h. The desirable maximum gradient applied therefore was 3%, but the guidance allows for this to be relaxed to 5%,

or an absolute maximum of 10% over sections less than 100 metres in length. Generally, however, the greenway has been designed so that gradients will not be steeper than 1 in 21 so as to provide a gently sloped route (in accordance with Building for Everyone: A Universal Design Approach and IWA Best Practice Access Guidelines).

The greenway vertical alignment will generally match the existing ground level of the existing tow path or existing greenfield sections, except for the boardwalk, bridge, and underpass sections.

The proposed underpass has been designed with a minimum clear height of 2.5m, taking account of the existing geometry and ensuring the bridge and roadway (and services therein) oversailing is not undermined. The total length of the proposed underpass is approximately 16m, and as such is in accordance with DN-GEO-03040 Subways for Pedestrians and Pedal Cyclists Layout and Dimensions, refer to Figure 4-12.

SUBWAY LENGTH (m)	HEIGHT (m)	WIDTH (m)
< 23	2.4	4.0
≥ 23	2.7	

Figure 4-12 Table 4 extracted from DN-GEO-03040

4.3 Junction Layouts

While the greenway is largely segregated from road traffic, there are a number of interfaces where road crossings are required. As such, junction layouts have been designed in accordance with the design standards set out in Section 3.2, as well as with cognisance of existing topographical and road constraints. The Proposed Development includes three signalised junctions with the existing road network, each designed as a 4m wide toucan crossing, and one unsignalised zebra crossing at Talbot Bridge. The crossings will incorporate appropriate tactile paving and transitions between the pedestrian footpath and the shared pedestrian and cycle greenway.

The three signalised toucan crossings and one zebra crossing are as follows:

- Collins Bridge (Ch. 1090) – signalised toucan crossing;

- Pakenham Bridge (Ch. 2880) – signalised toucan crossing;
- Kirkpatrick Bridge (Ch. 6250) – signalised toucan crossing; and
- Talbot Bridge (Ch. 8095) – zebra crossing.

Refer to Chapter 12 for further details on the design of the signalised toucan crossings.

In addition to these signalised junctions, there are also a number of interfaces with surrounding pedestrian and cycle links. These will incorporate appropriate signage and tactile paving indicating the transition to/from shared the pedestrian and cyclist greenway space and pedestrian only space. The locations of these are as follows:

- Connections from Hansfield Road (Ch. 3770 & 4040);
- Connection from Weaver's Wood (Ch. 4400);
- Connections from Windmill Court Residential Development (Ch. 5550 to 5930);
- Connections along Sheepmoor Lane (Ch. 5930 to 6240)
- Connection from Delwood Close (Ch. 6650);
- Connection from Brompton Grove, & Brompton Green (Ch. 6890, 6940, & 7100);
- Connections at Granard Bridge (Ch. 7720 to 7810); and
- Connections at 12th Lock (Ch. 8000 to 8090).

4.4 Public Lighting

There is generally no existing public lighting along this section of the Royal Canal Greenway forming the Proposed Development. New public lighting will be provided along the greenway from Hansfield to the Old Navan Road (Talbot Bridge) (largely comprising Section 2 and 3).

New public lighting is not proposed to be provided initially on the western section of the greenway from the Kildare/Fingal County Boundary to the Hansfield Railway Bridge due to its rural nature (largely comprising Section 1).

New public lighting is however proposed along the remaining sections of the Proposed Development, as set out in the Public Lighting Layout Drawings (ref. SES 08322). This will largely comprise 6m high lighting columns, with illuminated handrails along the Landmark Bridge.

Existing lighting associated with the road corridor at interfaces and existing amenity lands, such as at Brompton, will be maintained.

Along the sections where new operational lighting is proposed for security and safety, any external lighting for the proposed development shall strictly follow the guidelines set out in the Royal Canal Bat Assessment Report (prepared by Bat Eco Services for the Proposed Development) and these shall be strictly implemented during construction and operation phase of the proposed development.

All new public lighting will be designed and installed in accordance with the specific lighting and electrical items set out the following National Standards and guides, including but not limited to:

- EN 13201: 2014 Road Lighting (all sections);
- ET211:2003 'Code of Practice for Public Lighting Installations in Residential Areas';
- BS 5489-1 'Code of practice for the design of road lighting';
- TII Publication CC-SPW-01300 - Specification for Road Lighting Columns and CCTV Masts;
- TII Publication CC-SPW-01400 - Specification for Electrical Work for Road Lighting and Traffic Signs;
- TII Standard Construction Details, Series 1300 & 1400;
- IS EN 40 – Lighting Columns; and
- Institution of Lighting Professionals "GN01 Guidance Notes for Reduction of Obtrusive Light".

All new lighting will aim to minimise the effects of obtrusive light at night and reduce visual impact during daylight. Lighting schemes will comply with the 'Guidance Notes for the Reduction of Light Pollution' issued by the Institution of Lighting Professionals (ILP).

4.5 Surface Water Drainage

Surface water runoff from the proposed unbound and bituminous flexible pavement and concrete surfaced sections of the greenway (including boardwalks) will generally run over the edge and soak naturally to the underlying soil or to a filter drain for treatment and storage if practicable. Even where an unbound surface is proposed, the cycle track will be constructed so that surface water is shed to the sides, notwithstanding the fact that the surface is permeable. This is to prevent the sub-surface from becoming saturated. While the raised section of bridges will drain off to the underlying soil or canal.

Further information on the surface water drainage for the scheme can be found in Chapter 8 and in the Flood Risk Assessment Report (170239-X-X-XXX-RP-DBFL-CE-0002).

4.6 DMURS Design Compliance Statement

The Proposed Development has been designed in line with the principles and guidance outlined within the DMURS 2019. The scheme proposals have been developed in direct response to the aims and objectives of the as set out in Section 1.1 which have common synergies with the Core Design Principles of DMURS.

The adopted design approach successfully achieves the appropriate balance between the functional requirements of different network users whilst enhancing the sense of place. The implementation of enhanced pedestrian and cycling infrastructure actively manages movement by offering real modal and route choices along this amenity route.

Specific attributes of the Proposed Development design which contribute to achieving this DMURS objective include:

- The inclusion of multiple connections to the surrounding residential areas supports the creation of integrated street networks which promote higher levels of permeability and legibility for all users, and in particular more sustainable forms of transport;
- The upgrading of the existing tow path and provision of new sections of high-quality greenway ensures the creation of a safe, comfortable and attractive pedestrian and cyclist environment; and
- The inclusion of new and enhanced pedestrian and cyclist crossing facilities will promote increased activity along the Proposed Development, providing safe desire lines for pedestrians and cyclist to/from at all road crossings. The Proposed Development also removes the existing uncontrolled crossings and the associated safety risks that they present to greenway users at the vehicle dominated locations.

The scheme proposals are the outcome of an integrated urban design and landscaping strategy to enhance the function and place for the surrounding area with access to the greenway and thereby facilitating a safer environment for pedestrians and cyclists.

4.7 Road Safety and Road User Audit

The TII Publication 'GE-STY-01024 Road Safety Audit' document provides an outline of the typical stages for road safety audits and are noted below as follows:

- Stage F: Route selection, prior to route choice;
- Stage 1: Completion of preliminary design prior to land acquisition procedures;

- Stage 2: Completion of detailed design, prior to tender of construction contract. In the case of Design and Build contracts, a Stage 2 audit shall be completed prior to construction taking place;
- Stage 1 & 2: Completion of detailed design, prior to tender of construction contract, for small schemes where only one design stage audit is appropriate;
- Stage 3: Completion of construction (prior to opening of the scheme, or part of the scheme to traffic wherever possible); and
- Stage 4: Early operation at 2 to 4 months' post road opening with live traffic.

A Stage 1 Road Safety Audit has been undertaken on the preliminary design, with recommendations provided on amendments to the Proposed Development. Refer to the RSA report in as submitted for this application [P22126-PMCE-XX-XX-RP-SA-3_0001-5.0-Stage 1 RSA].

5 Ground Investigation and Ground Condition

5.1 Ground Investigation Overview

As part of the options assessment and design development, a desk study was undertaken along the route of the Proposed Development. A Ground Investigation (GI) was scoped and designed based on the findings of the desk study review. The following sections outline the desk study sources, the anticipated ground conditions, the scoped GI, the GI results and their interpretation. A separate section presents hydrogeological information. The last section presents the geotechnical considerations relevant to the proposed structures along the Proposed Development.

Refer also to Ground Investigation Report submitted with this application.

5.2 Desktop Study

The site setting and geotechnical information for the site were obtained from publicly available information. The publicly available sources of information reviewed are as follows:

- 1836 – 1842 Historic map 6 inch (Geohive)
- 1888 – 1913 Historic map 25 inch (Geohive)
- 1830 – 1930 Historic map 6 inch – Cassini (Geohive)
- Contour map (EPA)
- Geological Survey of Ireland (GSI)
- Quaternary Sediments and Geomorphology map (GSI)
- Teagasc Soils map (GSI)
- Unconsolidated Sediments map (GSI)
- Bedrock, Geology100k map (GSI)
- Karst Features map (GSI)
- Depth to Bedrock map (GSI)
- Groundwater Aquifer map (GSI)
- Groundwater Vulnerability map (GSI)
- Groundwater Wells and Springs map (GSI)
- Groundwater Recharge map (GSI)

- Subsoil Permeability map (GSI)
- Active and Historic Pits and Quarries map (GSI)
- Mineral localities map (GSI)
- Historic Ground Investigations map (GSI)
- In-house Ground Investigations database

5.2.1 Existing Quaternary Sediments

The subsoils underlying the majority of the route are comprised of Quaternary aged Glacial Till (boulder clay). GSI Quaternary sediment mapping indicates the route to be underlain by tills of limestone of along with an isolated areas of Alluvium and sections of subcropping/outcropping rock primarily along the route of the Royal Canal. An extract from GSI mapping is presented in Figure 5-1.

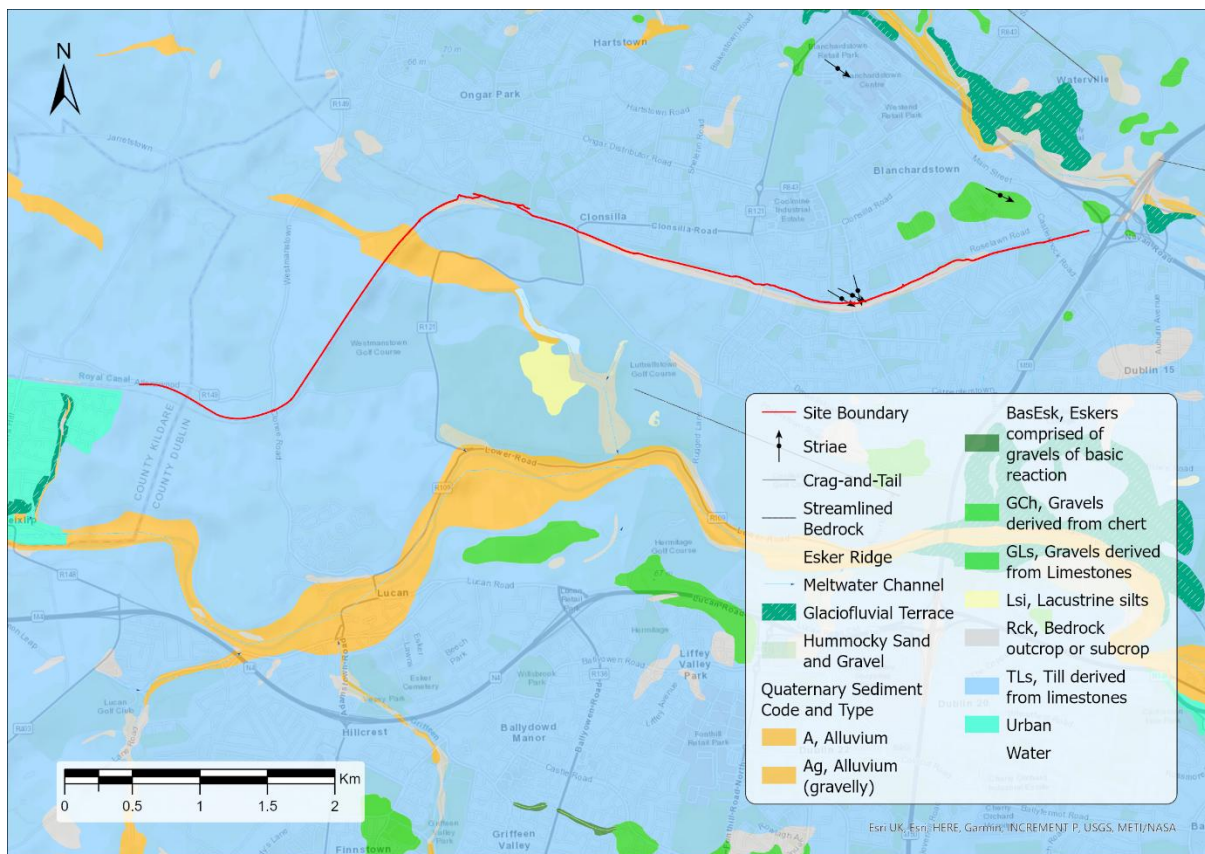


Figure 5-1 Quaternary Sediments (GSI data, 2026 [GSI Geology Mapping](#))

5.2.2 Existing Solid Geology

The 1:100,000 GSI bedrock Geology Map (Sheet 16) indicates that the Proposed Development is underlain in the most part by Dark Limestone and Shale ('calp) (Lucan Formation), with the

eastern most approximately 650m being underlain by Calcareous shale, limestone conglomerate (Tober Colleen Formation). An extract from GSI mapping is presented in Figure 5-2.

The bedrock within the Lucan Formation is described in geological mapping as a Carboniferous Limestone of Late Chadian to Asbian Stage. This formation underlies much of central and north Dublin. The bedrock within the Tober Colleen Formation is described in geological mapping as a Carboniferous Calcareous shale, limestone conglomerate of Chadian Stage. The map also indicates bedrock outcrops alongside the canal over a number of sections.

A fault is also identified on the 1:100,000 GSI bedrock Geology Map (Sheet 16), traversing the Proposed Development approximately 165m west of Porterstown Road. Within the ground investigation this was not viewed as a significant geotechnical risk item as the sands and gravels overlying the variable bedrock are considered to be sufficiently dense to facilitate a piled foundation. This will be confirmed through further site investigation at Detailed Design stage.

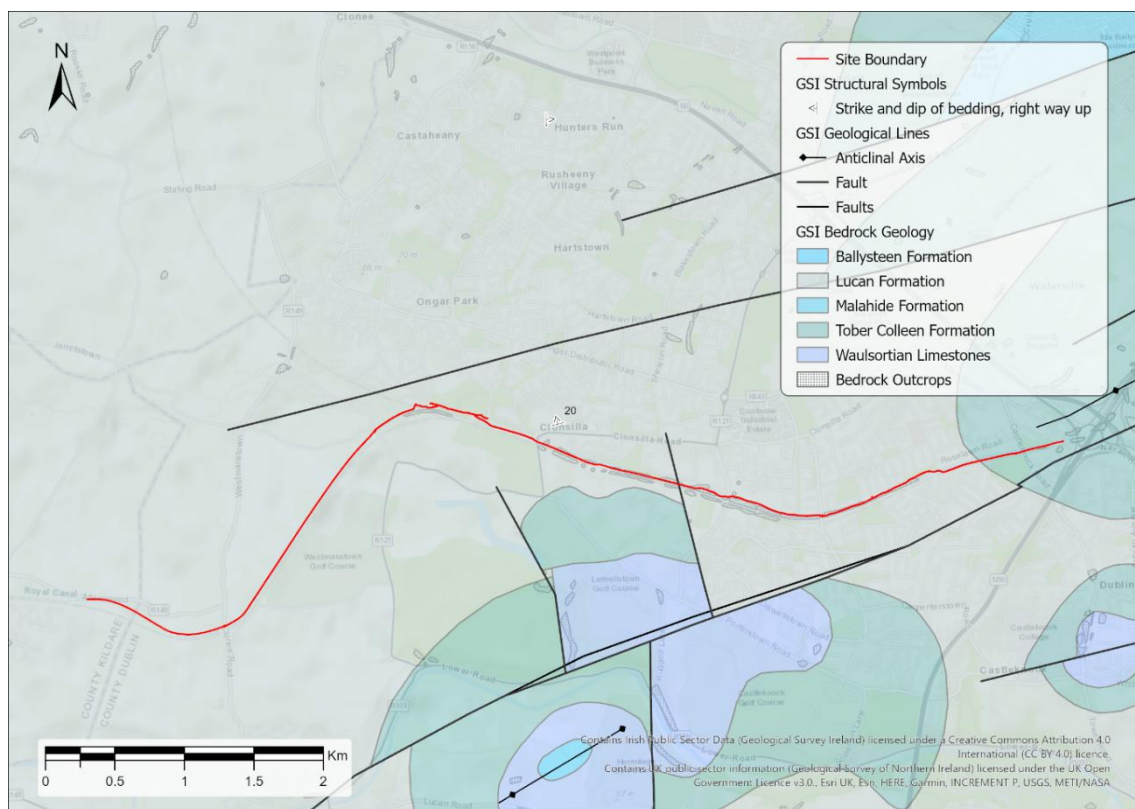


Figure 5-2 Bedrock Geology 100k Map (GSI data, 2026 [GSI Geology Mapping](#))

The underlying bedrock is primarily dark limestone and, as demonstrated in Figure 5-2, the GSI karst landforms database shows there are no Karst features recorded within the extents of the Proposed Development, with the nearest being a spring c. 700m west of the scheme in Newtown.

5.2.3 Active mines and mineral localities

There are no Quarries or mines affected by the proposed roads scheme. An instance of a clay deposit being found is shown on historical mapping on the southern banks of the Royal Canal, outside the scheme extents, to the southeast of Clonsilla Station. Similarly traces of galena, lead, and copper in quartz veins were noted to have been found in the Calp on the southern banks of the Royal Canal, outside the scheme extents, to the southeast of Porterstown Road bridge. These are outside the scheme extents and are unaffected by proposed works.

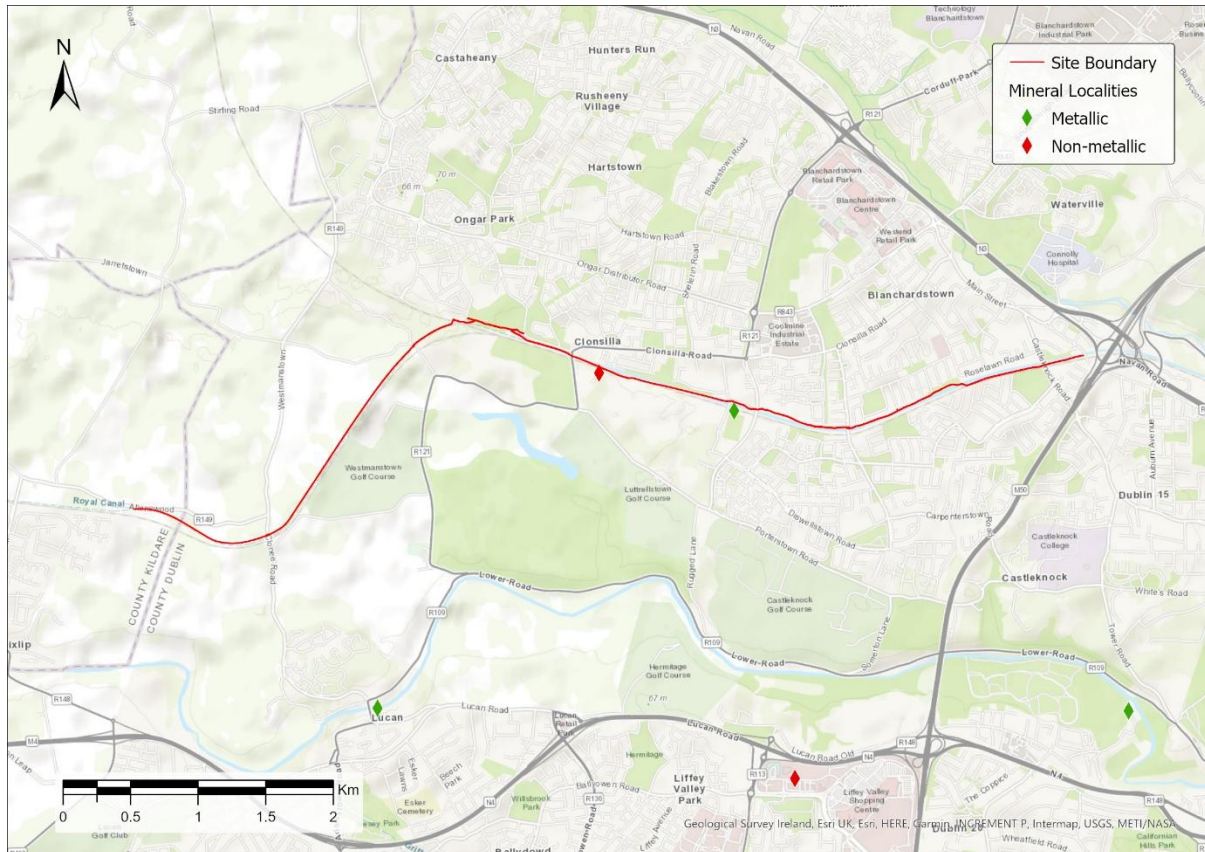


Figure 5-3 Active mines and mineral localities (GSI data, 2026 [GSI Public Data Mapping](#))

5.2.4 Aggregate Potential

The GSI aggregate potential mapping shows the crushed rock aggregate potential along the western section of the study area as generally low with areas of moderate to high around Collins Bridge and towards Hansfield, with a localised area of very high potential at Hansfield railway crossing. Along the remainder of the route, the crushed rock aggregate potential is generally high, with exception of one section of moderate potential and with areas of shallower rock showing very high potential. This is demonstrated in Figure 5-4.

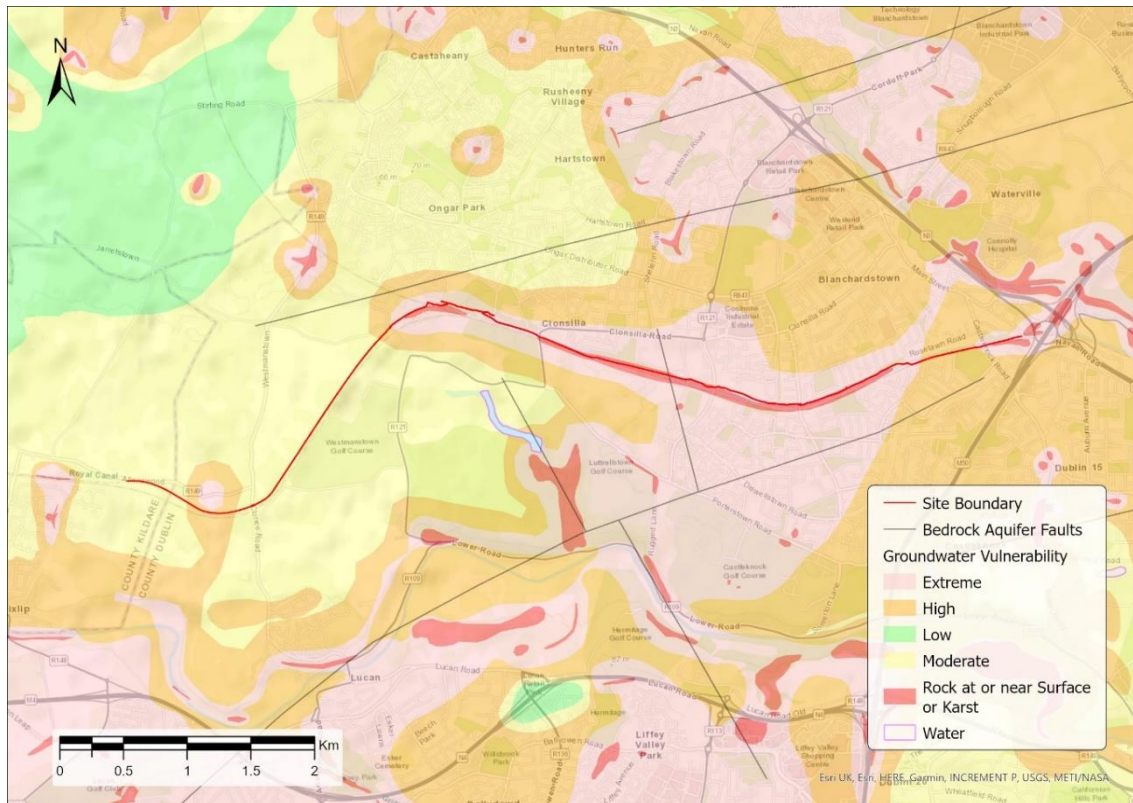


Figure 5-4 Crushed Rock Aggregate Potential (GSI data, 2026 [GSI Aggregate Potential Mapping](#))

The granular aggregate potential along the route is very low in the vicinity of the Rusk River crossing south of the Pakenham Bridge.

5.2.5 Hydrogeology

5.2.5.1 Aquifers

The GSI groundwater aquifer map indicates that the bedrock aquifer underlying the majority of the Proposed Development is classified as a “*Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones*”, with the exception of the easternmost 700m which are underlain by a “*Poor Aquifer - Bedrock which is Generally Unproductive except for Local Zones*”. This is shown in Figure 5-5.

The GSI gravel aquifer map shows there are no gravel aquifers within the study area.

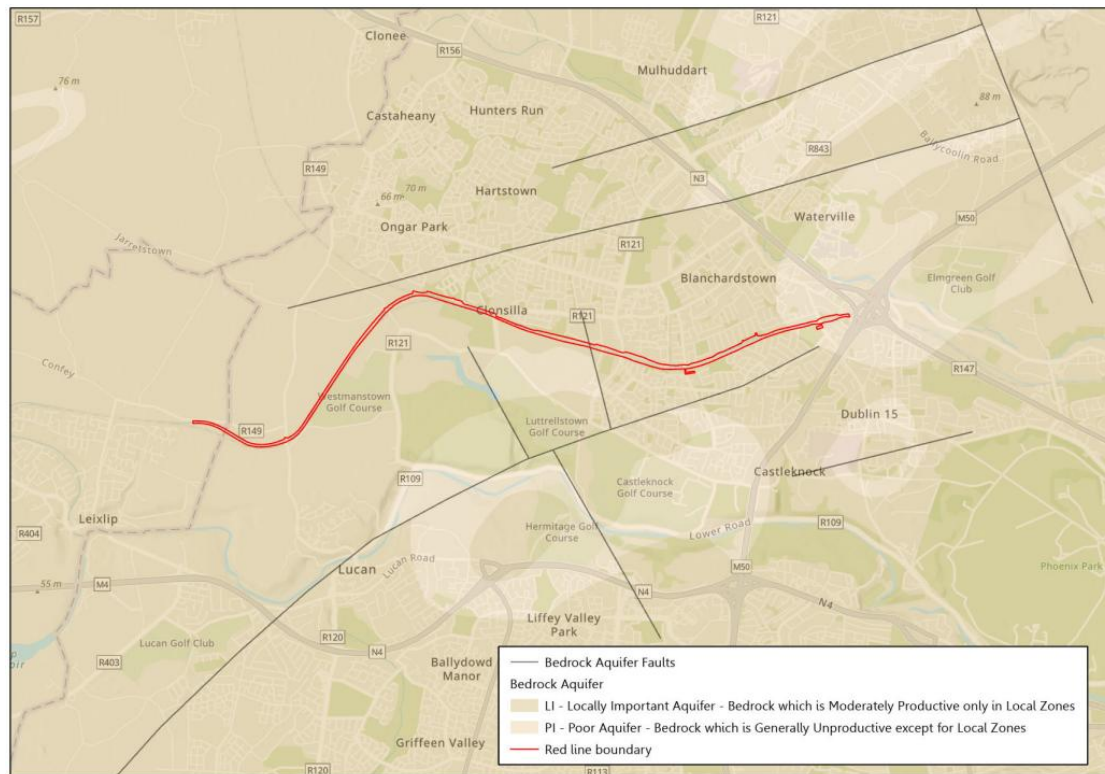


Figure 5-5 Aquifer setting (GSI data, 2026 [GSI Groundwater Mapping](#))

5.2.5.2 Groundwater Vulnerability

Groundwater Vulnerability is a term used to represent the intrinsic geological and hydrogeological characteristics that determine the ease with which groundwater may be contaminated by human activities. Groundwater vulnerability is varied across the entire Proposed Development extents and in the vicinity – as shown in Figure 13.4 – ranging from Moderate to Extreme. In addition, there are areas of Rock at or near the surface. Areas of highest vulnerability correspond to these areas of near surface bedrock and thin soil depths. It is noted that the aquifer vulnerability classification does not consider the nature of the underlying ‘receiving’ aquifer with respect to resource value or significance of pollution occurring and is only a reflection on the protection afforded to the aquifer by overlying deposits.



Figure 5-6 Groundwater Vulnerability (GSI data, 2026 [GSI Groundwater Mapping](#))

5.2.5.3 Subsoil Permeability

Based on the relevant GSI map the subsoil permeability is assessed as low for the majority of the western section of the route, and for the portion in the eastern extents to the west of Castleknock train station. It is noted that the permeability has not been mapped/assessed for the central section of route and for the easternmost extents. This is demonstrated in Figure 5-7.

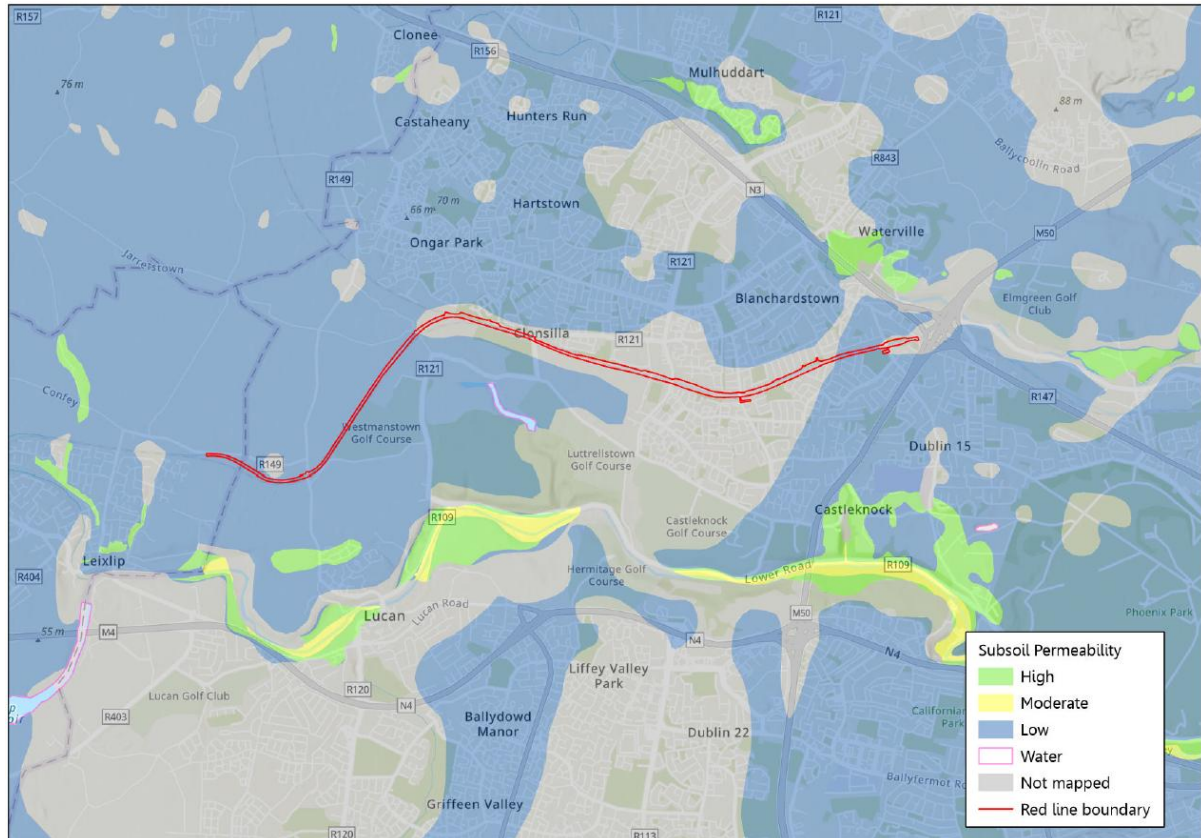


Figure 5-7 Subsoil Permeability (GSI data, 2026 [GSI Groundwater Mapping](#))

5.2.5.4 Other

The GSI map (Wells and Springs) does not record any well/spring within the Proposed Development extents.

The route does not lie within a Group Scheme or Public Supply Source Protection Area.

5.3 Scope of Ground Investigation

Following a review of the Proposed Development and the findings of the desk study, a ground investigation (GI) was specified. The GI scope for Proposed Development is presented herein.

The purpose of the site investigation was to investigate subsurface conditions utilising a variety of investigative methods in accordance with the project specification. The scope of the work undertaken for this project included the following:

- 47 No. Slit trenches to a maximum depth of 1.5m BGL;
- 3 No. Rotary Core Boreholes to a maximum depth of 23.20m BGL;
- 11 No. Hand diamond drilled Cores to a maximum depth of 0.5m BGL;

- 18 No. Angled Rotary Core Boreholes from a barge on the Canal to a maximum depth of 5.5m;
- Plate load and TRL probe testing at slit trench locations to determine CBR value; and
- Geotechnical, Chemical, and Rock Laboratory testing.

The results of the Ground investigation were generally in accordance with geological mapping – as described in Section 5.4 and within the Ground Investigation Report as submitted with this application.

5.4 Summary of Ground Investigation and Material Properties

5.4.1 Topsoil & Surfacing

Topsoil was encountered in all of exploratory holes along the western end of the Proposed Development and was present to a maximum depth of 0.20m BGL.

Moving east Slit trenches encountered either Topsoil, Tarmacadam or Gravel Surfacing. A number of slit trenches encountered surfacing consisting of sandy angular to sub angular fine to coarse Gravel to depths of between 0.1m and 0.19m BGL placed on top of Geotextile.

The slit trenches carried out in existing paved sections of the towpath encountered Tarmacadam to a depth of 0.06 and 0.12mBGL. Those undertaken along Sheepmoor Lane, also encountered Tarmacadam to depths of 0.05 and 0.08m BGL.

Topsoil and other surfacing will be excavated and removed as required as part of the site preparation.

5.4.2 Made Ground

Made Ground deposits were encountered beneath the Topsoil/Surfacing in the majority of the slit trenches and were present to a depth of between 0.2m and 1.5m BGL. These deposits were described generally as brown sandy slightly gravelly CLAY. Cobbles and boulders were encountered where noted on the exploratory hole logs (refer to Ground Investigation Report) In some slit trenches the made ground contained occasional fragments of concrete, red brick, glass, ceramic, wood and plastic as noted on the exploratory hole logs.

5.4.3 Cohesive Deposits

Cohesive deposits were generally encountered beneath the Made Ground and were described typically describes as brown sandy gravelly CLAY. The secondary sand and gravel constituents varied across the site and with depth, with granular lenses occasionally present in the glacial till matrix. These deposits had some, occasional or frequent cobble and boulder content where noted

on the exploratory hole logs. The strength of the cohesive deposits was typically firm in the majority of the exploratory holes and in some locations increased to firm to stiff or stiff with depth.

5.4.4 Granular Deposits

Granular deposits were generally not encountered within the exploratory holes but were encountered within one rotary borehole and was typically described as either Grey brown clayey gravelly fine to coarse SAND or sandy fine to coarse GRAVEL, however there was limited recovery in these materials. These deposits were categorised as typically dense.

5.4.5 Bedrock

In general, the rock encountered during the ground investigation is consistent with the published geology for the area, with the rotary core boreholes carried out between Coolmine and generally recovering Medium strong to very strong grey/dark grey fine to medium grained LIMESTONE with calcite veins. The geophysical survey undertaken suggested the bedrock is generally between 0.5 and 3.5m deep in the Coolmine area, and then deepens towards Castleknock Station towards the eastern end of the section within the range 2.5m to 25mBGL.

5.4.6 Groundwater

Groundwater strikes were noted on the exploratory hole logs where they occurred. Slit trenches were typically terminated on encountering groundwater. It is noted that the exploratory holes did not remain open for sufficiently long periods of time to establish the hydrogeological regime and groundwater levels would be expected to vary with the tide, time of year, rainfall, nearby construction and other factors. Further investigation shall be carried out as part of the Detailed Design stage.

5.4.7 Laboratory Testing

5.4.7.1 Geotechnical Laboratory Testing

The geotechnical testing carried out on soil samples recovered generally confirm the descriptions on the logs with the primary constituent of the cohesive deposits found to be a CLAY of low to intermediate plasticity. The Particle Size Distribution tests confirm that generally the cohesive deposits are well-graded with percentages of sands and gravels ranging between 6% and 60% generally with fines contents of 17% to 72%.

5.4.7.2 Chemical Laboratory Testing

The pH and sulphate testing carried out indicate that pH results are near neutral and that the water-soluble sulphate results is low when compared to the guideline values from BRE Special Digest 1:2005. The samples tested classify the soil as a Design Sulphate Level DS-1.

5.4.7.3 Rock Laboratory Testing

The rock testing carried out on samples recovered from the boreholes reported Unconfined Compressive Strength (UCS) values ranging between 13.6 and 63.7 MPa while the point load testing gave Is_{50} values ranging between 2.87 to 8.93 MPa. The Is_{50} results correlate to the UCS values using a factor of approximately 20, giving values of 57.4 MPa and 178.6 MPa. These results correlate to the strength descriptions ranging between of Weak to Very Strong and confirming the variability of this stratum and the descriptions on the logs. The average of the UCS testing and associated correlated values from the point loading suggest the limestone rock is typically medium strong to strong.

5.5 Geotechnical Input to Design Development

The preliminary design was informed by site investigations undertaken by Ground Investigations Ireland 'Ground Investigation Report (Rev B)' and potential alternative design options considered for the southern embankment were also subjected to independent expert peer review by Gavin & Doherty Geosolutions Ltd (GDG). For further information on these investigations and assessments and how they informed the Proposed Development, refer to Route Options Assessment Main Report.

The proposed pavements shall be designed in accordance with the CBR test results included in the Ground Investigation Report. The low CBR test results indicated that a capping layer or a sufficient depth of crushed stone fill shall be required.

5.6 Geotechnical Input to Structures

5.6.1 Foundations for Small Structures or Chambers

Given that small structures or chambers will be required along the route of the Proposed Development, the GI carried out provided input regarding the basis of design for same. An allowable bearing capacity of 50 kN/m² shall be applied for conventional strip or pad foundations on the firm cohesive deposits that are encountered in the majority of the slit trenches along the route between a depths of 0.3m and 1.5m BGL.

The possibility for variation in the depth of the made ground along the route will be considered and foundation inspections shall be carried out. Any soft spots encountered at the proposed foundation depths shall be excavated and backfilled in accordance with TII Specification for Road Works Series 600.

In any part of the site, should part of a foundation be proposed to be sitting on rock, the proposed foundation in question shall be lowered to the competent rock stratum to avoid differential settlement.

It is noted that the pH and sulphate testing completed on samples recovered from the exploratory holes indicates the pH results are near neutral and the sulphate results are low, when compared to the guideline values from BRE Special Digest 1:2005. No special precautions are therefore proposed for concrete foundations to prevent sulphate attack. The samples tested were below the limits of DS1 in the BRE Special Digest 1:2005.

5.6.2 Foundations for Bridge Structures

As noted herein, the Proposed Development includes two bridge structures, the 'Quarry Bridge' and the 'Landmark Bridge', both of which are located between the Coolmine and Castleknock train stations.

Due to the high loading anticipated, the presence of softer cohesive / made ground deposits and the practicality of excavating traditional foundations next to the canal, piled foundations are proposed and are considered to be more economically advantageous for the proposed structure. The type, size and depth of the pile foundations shall be confirmed by a specialist piling contractor based on the loading from the proposed structure developed in detailed design.

Conventional foundations may be considered, if deemed to be appropriate through design development and further investigation at specific locations.

5.6.3 Foundations for Cantilever Structure

As described herein, the Proposed Development along the northern side of the canal includes a cantilevered platform where the existing towpath is narrow from approximately Chainage +4120 to +4540.

Along this section of the canal, the depth to rock is generally shallow but does vary at depths of between 1.3m and 1.5m BGL. This is based on slit trenches no. 23 to 25 carried out.

Due to the presence of variable made ground / Cohesive deposits it was determined that the structure be founded on rock through micro-piling. A bearing capacity in the of 1000kN/m2 is

achievable for conventional foundations on the limestone rock however it was deemed more economically advantageous and practical to utilise micro-piles. The final type, size and depth of the micro-piles shall be confirmed by a specialist piling contractor based on the loading from the proposed structure at Detailed Design Stage.

6 Pavement, Kerbs, Footways and Paved Areas

6.1 Pavement

This section sets out the preliminary design strategy for the pavement associated with the general traffic lanes and other specific trafficked areas (e.g., access roads) impacted by the Proposed Development – largely associated with the road crossings proposed, as well as where existing roadways form part of the route such as along Sheepmoor Lane.

The detailed design of pavement assets shall be based on the following standards:

- DN-PAV-03021 (Dec. 2010) – Pavement and Foundation Design;
- DN-PAV-03023 (Jun. 2020) – Surfacing Materials for New and Maintenance Construction for use in Ireland;
- AM-PAV-06050 (Mar. 2020) – Pavement Assessment, Repair and Renewal Principles;
- PE-SMG-02002 (Dec. 2010) – Traffic Assessment;
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks;
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General;
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures; and
- CC-SPW-00900 (Sep. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials.

The different pavement assets shall be designed taking consideration of:

- Changes in road geometry;
- Existing pavement construction build-up; and
- Existing pavement condition.

Given that Sheepmoor Lane ranges in width from approximately 2.5m to 4m, it is proposed that any widening at Sheepmoor Lane shall generally be the full width of the roadway. The widened lane shall be tied to the existing pavement as per transverse and longitudinal joint (if not being carried out across the full width) details CC-SCD-00703 (Sep. 2010) and CC-SCD-00704 (Dec. 2010), respectively.

In order to estimate inform design proposals, as well as to estimate the construction and waste quantities for the Proposed Development pavement works, the following assumptions were taken:

- where full depth reconstruction is anticipated (e.g., across toucan crossings and along Sheepmoor Lane if necessary), a conservative fully flexible pavement design is assumed as 350mm of bituminous mixtures on top of 150mm of subbase material, with capping material requirements to be determined through local site investigations.
- where there are existing deteriorated pavement surfaces and where it is confirmed throughout site investigation that full depth new flexible pavement is not required, surface dressing is proposed in accordance with CC-SPW-00900.

6.1.1 Opportunities for Innovation, Reuse, and Recycling

Innovative materials and processes delivering enhanced environmental, social and financial benefits are being promoted in the ongoing pavement design process.

Current opportunities include but are not limited to:

- Incorporation of minimum 20% of Reclaimed Asphalt into new asphalt concrete base and binder layers of the pavement;
- Excavated capping layer material to be reused as new capping material if compliant with current standards; and
- Excavated subbase layer material to be reused as new subbase material if compliant with current standards.

6.2 Kerbs, Footways and Paved Areas

6.2.1 Overview of Kerbs, Footways and Paved Areas

This section sets out the preliminary design strategy for the kerbs, footways and paved areas (KFPA) assets:

- Kerbs; and
- Greenway surfaces, footways and cycleways (concrete, bituminous and unbound).

The detailed design of KFPA assets shall be based on the following standards:

- DN-GEO-03047 (Feb 2025) – Rural Cycleway Design (Offline & Greenway)
- DN-PAV-03021 (Dec. 2010) – Pavement and Foundation Design;
- DN-PAV-03026 (Jan. 2005) – Footway Design;

- PE-SMG-02002 (Dec. 2010) – Traffic Assessment;
- CC-SPW-00600 (Mar. 2013) – Specification for Road Works Series 600 – Earthworks;
- CC-SPW-00700 (Jan. 2016) – Specification for Road Works Series 700 – Road Pavements – General;
- CC-SPW-00800 (Mar. 2013) – Specification for Road Works Series 800 – Road Pavements – Unbound and Cement Bound Mixtures;
- CC-SPW-00900 (Sep. 2017) – Specification for Road Works Series 900 – Road Pavements – Bituminous Materials;
- CC-SPW-01000 (Mar. 2013) – Specification for Road Works Series 1000 – Road Pavements – Concrete Materials; and
- CC-SPW-01100 (Feb. 2012) – Specification for Road Works Series 1100 – Kerbs, Footways and Paved Areas.

This section identifies the proposed KFPA strategy, setting out the design development considerations for the pavement works in current and future design stages. It also outlines the key elements for consideration for future testing requirements, and consideration of opportunities in reusable and recyclable materials in new pavement materials in the detailed design stage.

The different KFPA assets are designed taking consideration of:

- Geometric Design;
- Existing surface construction build-up and setting; and
- Existing surface condition.

6.2.2 Design Considerations

The design elements expected to have an impact on the preliminary pavement design are:

Geometry

Given that the paved greenway sections are proposed to be construction along the existing towpath (generally gravel or unpaved) or through greenfield areas, the design assumption is that the Proposed Development will involve full depth construction. This is considered to be necessary even in section where the proposed surface may reflect the existing surface given the proposed widening of the towpath to a 3m to 4m greenway surface, with the full depth construction proposed to ensure a consistent construction.

Existing Setting

The existing towpath and canal bank routes consist of a number of different surfaces and geometries, and the Proposed Development seeks to bring consistency in the provision of a 3m to 4m wide greenway. As set out in the DN-GEO-03047 Rural Cycleway Design, asphalt surfacing is the most popular among cyclists because of its evenness and high skid resistance and as such shall be the primary surface type for the main greenway section – making a more comfortable, convenient, and accessible walking surface for those with mobility impairments, and for users with buggies and prams.

However, in rural cycleway and greenway situations, where the cycleways attractiveness is just as important as comfort, dust path construction or other loose material construction can be the preferred option in order to blend with the environment and to avoid unnecessary impacts in forests, along protected heritage trails, tow paths and along river banks. The application of loose surfaces can enhance the cycleways' appeal to its users due to its more natural aesthetics.

As such, in the areas of particular ecological sensitivity along the Proposed Development (specifically in Section 1) an unbound surface is considered to be appropriate, in keeping with the existing rural setting.

In addition, the existing setting may limit the size and nature of construction plant which can be utilised, and as such pavement types for which hand laying is permitted within CC-SPW-00900 are preferred.

Existing Surface Conditions

For the greenway sections that will be fully reconstructed and new full depth construction in greenfield section, the design of the foundation will be based on an assumed Design CBR of 2.5%, the minimum permitted value as per Clause 3.23 of DN-PAV-03021 (Dec. 2010).

In such scenarios, where there are existing deteriorated bound surfaces and where it is confirmed throughout site investigation that full depth new flexible pavement is not required, surface dressing is proposed in accordance with CC-SPW-00900.

6.2.3 Pavement Design

As outlined in the works above, the Proposed Development is to be made up of a number of fundamental pavement construction forms and surface materials depending on location.

- Unbound
- Bituminous Flexible Pavement

- Existing Pavement

The ambition in terms of pavement materials is to reuse or recycle all of the excavated materials. The specification of materials and processes with a reduced environmental impact will be prioritised.

The proposed design for each is as follows:

Unbound Pavement

In the more rural settings, this unbound pavement construction is considered the most appropriate, as per DN-GEO-03047, and shall be constructed in line with DN-GEO-03047 and the recommendations of the TII Design Manual for Roads and Bridges (TII DMRB).

The pavement will be formed by placing approximately 200mm of imported granular subbase material (UGM A to CC-SPW-00800) on a geotextile separator and finished with approximately 75mm of gravel surface course (well graded with maximum aggregate size of 6mm). The width of the greenway will range from 3m to 4m and restrained on each side with a timber edging.

A typical example is provided in Figure 6-1 for illustration.

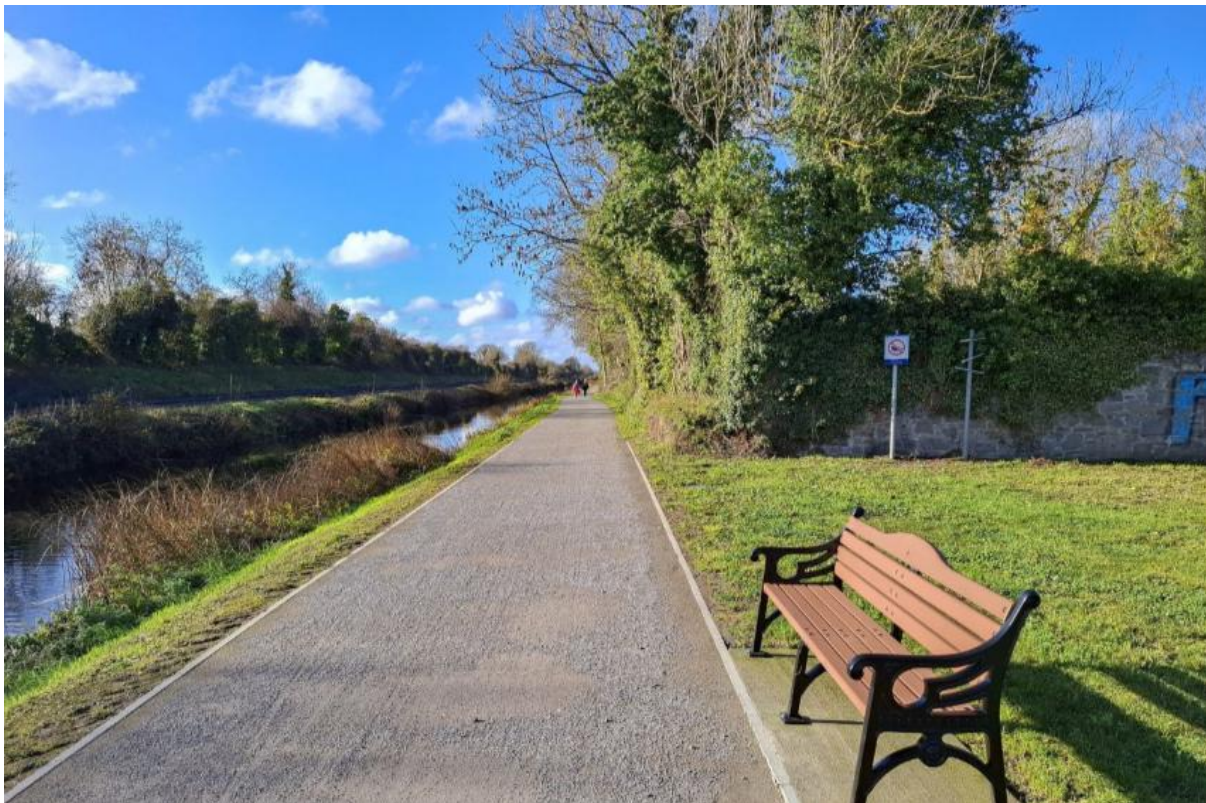


Figure 6-1 Example of Unbound Surface Greenway (Royal Canal Greenway between Maynooth and Leixlip).

Bituminous Flexible Pavement

Bituminous construction is considered the most appropriate for the majority of the scheme and shall be constructed in accordance with DN-GEO-03047, CC-SPW-00900 and the recommendations of the TII DMRB.

A 150mm layer of imported granular subbase material (UGM A to CC-SPW-00800) will be placed and compacted on a geotextile separator. This shall be increased to 200mm layer of UGM A in sections of greenway which are expected to be lightly trafficked. The upper pavement surface will be made up of a 50mm base layer of dense asphalt concrete (AC20) overlain by a 25mm surface layer of stone mastic asphalt (SMA 10), both meeting the requirements of the TII Specification for Road Works, and to EN 13108-1 and EN 13108-6 respectively. Concrete kerb restraints will be provided on either side of the pavement construction to provide a neat maintainable solution.

A typical detail of this proposed arrangement is shown in Figure 6-2.

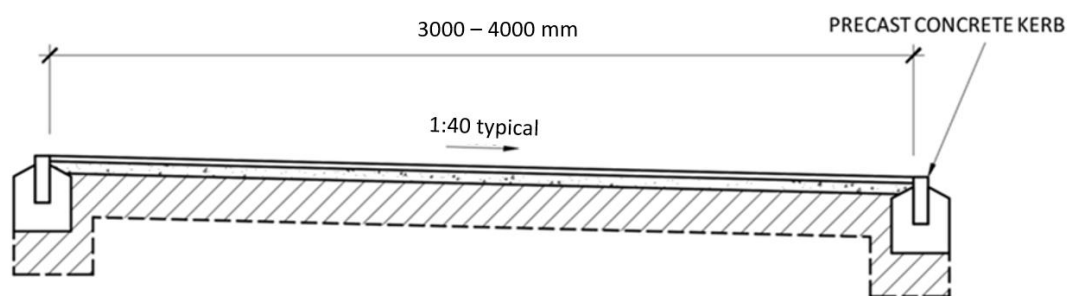


Figure 6-2 Typical Detail of Bituminous Pavement Construction Form

Typical greenway examples are provided in Figure 6-3 for illustration.



Figure 6-3 Examples of Bituminous Greenways (Netherlands and Ireland)

For bituminous section, the bituminous layer(s) will make use of as much recycled material as practicable. While Stone Mastic Asphalt (SMA) is proposed for the surface course, Low Energy

Bound Mixtures (LEBM) could be considered as an alternative to the conventional mixtures and assessed at detailed design stage.

On either approach to the Quarry Bridge, the proposed construction consists of 4m wide new bituminous pavement surfacing constructed through existing landscaped areas. The construction detail shall be in keeping with TII Standard Construction Detail CC-SCD-01104 in relation to materials and depths.

Existing Pavement

Where existing areas are proposed to be maintained – for example the eastern portions of Section 3 follow the existing paved surfaces in the vicinity of Castleknock Train Station and approach the 12th Lock – their condition will be assessed visually before proposing any potential rehabilitation works. Where there are existing deteriorated bound surfaces and where it is confirmed throughout site investigation that full depth new flexible pavement is not required, surface dressing is proposed in accordance with CC-SPW-00900.

6.2.4 Opportunities for Innovation, Reuse, and Recycling

Innovative materials and processes delivering enhanced environmental, social and financial benefits are being promoted in the ongoing pavement design process.

Current opportunities include but are not limited to:

- Incorporation of minimum 20% of Reclaimed Asphalt into new asphalt concrete base and binder layers of the pavement;
- Excavated capping layer material to be reused as new capping material if compliant with current standards;
- Excavated subbase layer material to be reused as new subbase material if compliant with current standards;
- Up to 50% of capping and subbase materials could be substituted with Reclaimed Asphalt;
- Concrete elements could also make use of more sustainable hydraulic binders. A replacement rate of up to 70% of ground granulated blastfurnace slag (ggbfs) is permitted by I.S EN 206-2013+A2:2021, provided that strength performance of the combination is demonstrated to be at least a class 42.5 N cement in accordance with Annex NE of that standard; and

- Aggregate for base/binder layer for the bituminous sections could be 100% Reclaimed Asphalt (Low Energy Bound Material – LEBM).

7 Structures

7.1 Overview

Aside from the main sections of greenway, the Proposed Development requires new structures at various locations along the route. The sections below summarise where new structures are required. A separate Bridge Structures Options Assessment Report has been prepared covering each of the principal bridge structures. This report [170239-DBFL-XX-XX-RP-C-0010] is submitted with this application.

Refer to the Construction Methodology Report (170239-DBFL-XX-XX-RP-C-0003) for further details on the proposed construction considerations.

7.2 Summary of Structures

7.2.1 Embankments and Retaining Structures

Due to the topography, minor retaining structures into the embankment will be required along some portions, particularly in the Hansfield area (Ch. +3760 to +4100 approximately). Loading conditions such as trees or buildings above the retaining walls will factor into the detailed design of said structures, informing their final design – and preliminary consideration of same has been given in determining approximate dimensions.

A sloped section (approx. 70m in length) and associated retaining works will also be constructed to raise from the towpath to the upper level of the Old Schoolhouse lands. This sloping largely follows the existing contours as the route deviates to the upper level of the embankment, with a c. 4 metre longitudinal level difference.

Various sections of the greenway, particular approaches to existing road crossings, will require embankments to be graded at slopes steeper than 1:3. The approaches to Clonee Road, (Ch. +1065) and Milestown Road (Ch. +2840) within Section 1 and the approach to the proposed underpass at Castleknock will require embankment slopes up to 1:0.75 to maintain adequate longitudinal gradients. Intermittent sections along the greenway route will also require slopes of up to 1:1 to fit within spatial constraints. It is proposed that these slopes be retained by specialist designed reinforced earth systems that allow for planting on these slopes to retain the rural look and feel of the greenway. Figure 7-1 below extracted from a brochure by TensarTech™, is an example system that could be specified.

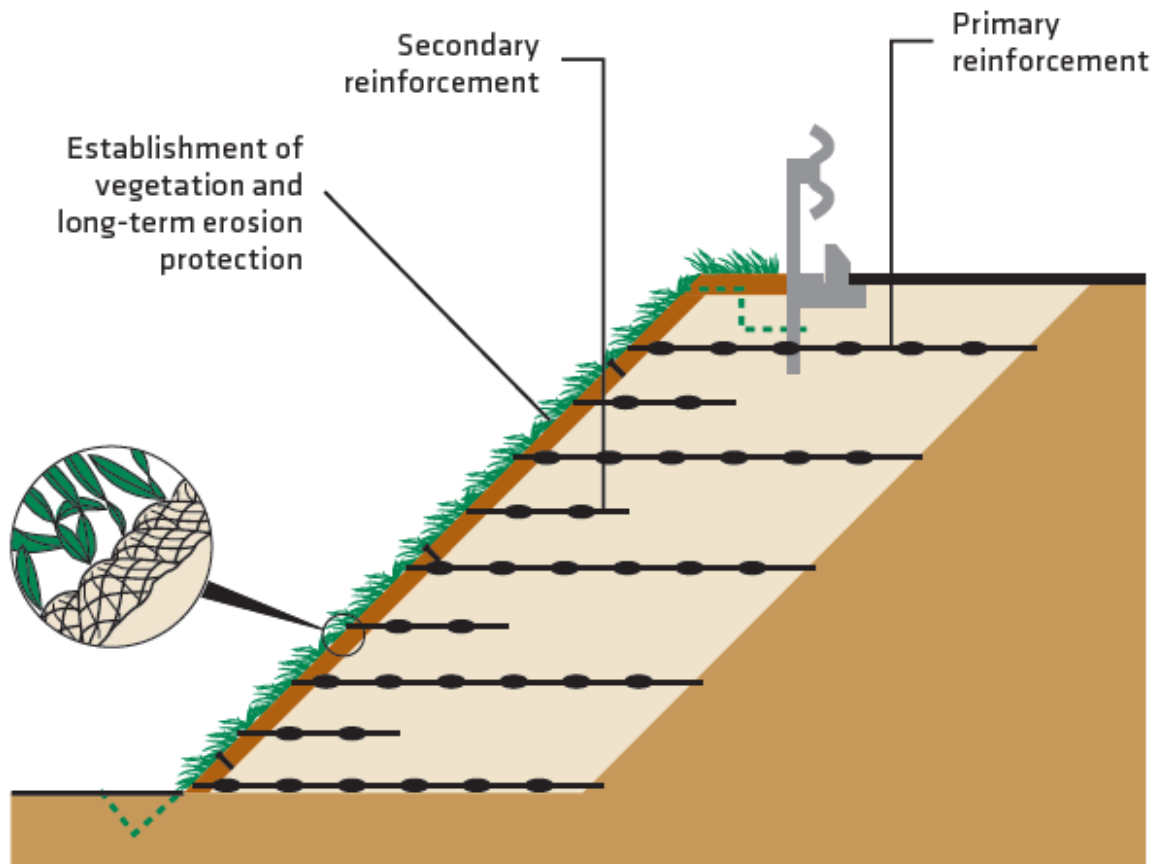


Figure 7-1 Example Earth Reinforcement Product: TensarTech™

7.2.2 Pre-Cast Concrete Cantilevered Boardwalk

In addition to the bituminous pavement, Section 2 also includes a portion of 4m wide cantilevered boardwalk with pre-cast concrete surfacing on a piled steel structure raised above the existing surface – refer to Figure 7-2 – from approximately Chainage +4140 to +4540. This was considered the most appropriate design solution to protect underlying ecological habitats along the canal.

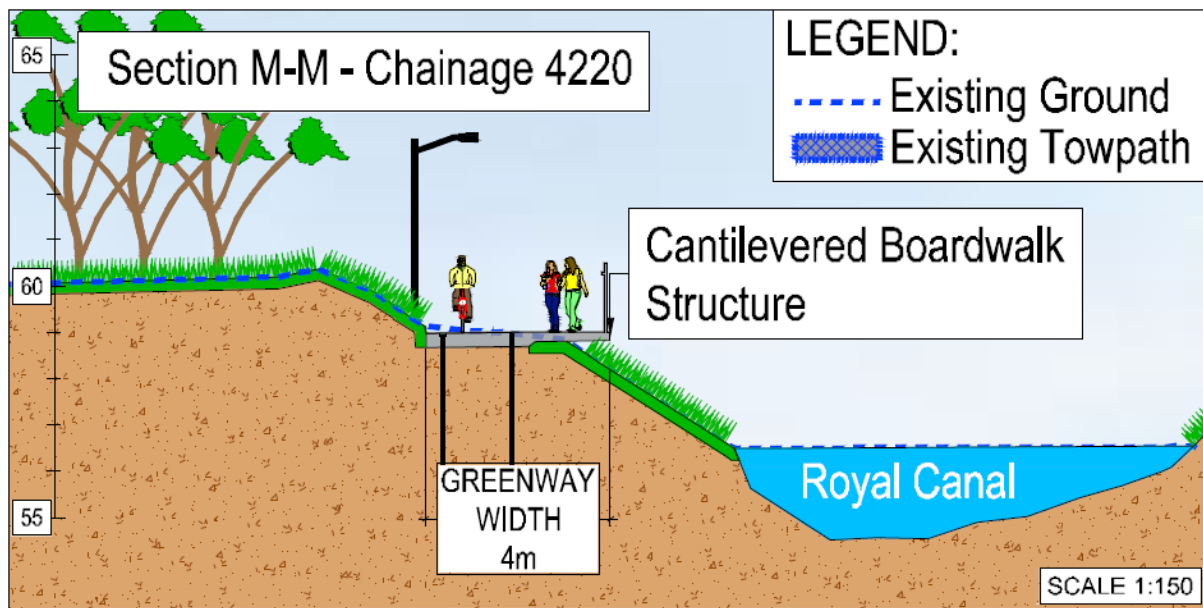


Figure 7-2 Section of the proposed 4m wide cantilevered boardwalk east of Callaghan Bridge

The reinforced pre-cast concrete deck is proposed to be constructed in 1m long sections, each 4m wide with a depth of 0.3m on the inside edge, stepping to 0.2m depth as it extends outwards. The reinforcement quantity is anticipated to be approximately 200kg/m³ of concrete. Fixing is proposed to be via 32mm diameter micro-piles, with appropriate grouting, anchored to the deck reinforcement.

The modular design of this boardwalk has been considered in terms of constructability. Construction of the boardwalk will take place between the Clonsilla Road Bridge to the West and Porterstown Road Bridge to the East of the site – will full details provided in the Construction Methodology Report.

7.2.3 Boardwalk at Dr Troy Bridge and Delwood Area

The greenway route is proposed to cross below the Dr Troy bridge. It was found that an existing 900mm gas main runs somewhat parallel with the Dr Troy bridge. From discussions held with GNI it was determined that a retained earth fill solution would not be appropriate near the gas main and that an elevated steel deck boardwalk would be preferable for maintenance and protection of the gas main during construction.

This will comprise a steel deck structure on appropriately spaced UCs piled and grouted. Spans will be chosen such that piles can be installed on either end of the Dr Troy bridge. A temporary and removable piling mat will be constructed within the works area to provide a level running surface for the piling rig. The surface will be formed by a metal deck with bituminous screed to

provide consistency of finish with the adjacent flexible pavement sections. Where the boardwalk ties into the greenway on either end of this section, retaining structures would be constructed to accommodate bridge abutments.

A typical construction section in the context of the greenway is provided as part of the drawing package, and a typical sketch detail of potential structural elements is shown in Figure 1-1 for illustration.

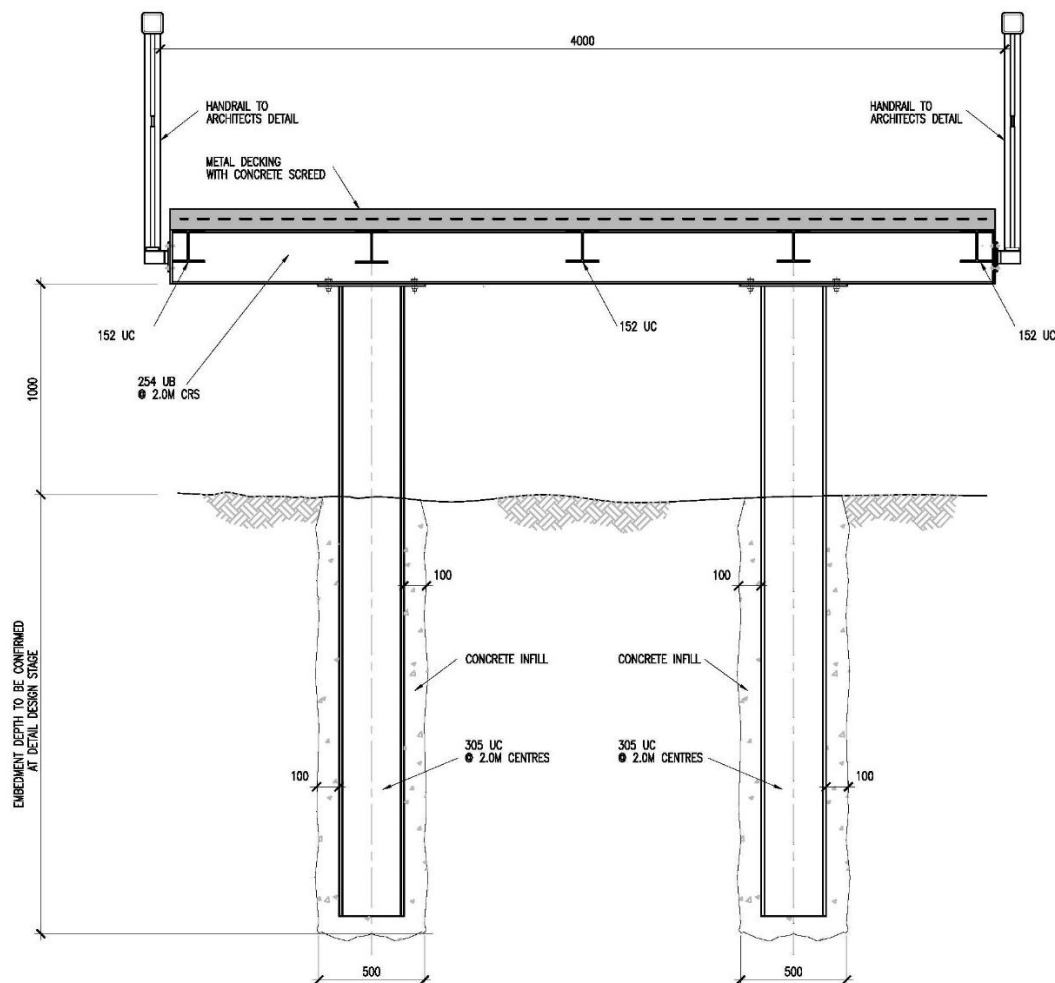


Figure 7-3 Typical Sketch Detail of Steel Deck Boardwalk

7.2.4 Delwood Area Works including Quarry Bridge

In addition to the general greenway route in Section 3, the works include the construction of a bridge structure crossing an existing quarry along the northern banks (referred to as the 'Quarry Bridge'). At a rock inlet which is a historic quarry section (Ch. +6500m) this 30m single span composite steel beam and concrete deck bridge is proposed, incorporating some earth retaining elements. See Figure 7-4 below and for further details, refer to the submitted with this application.

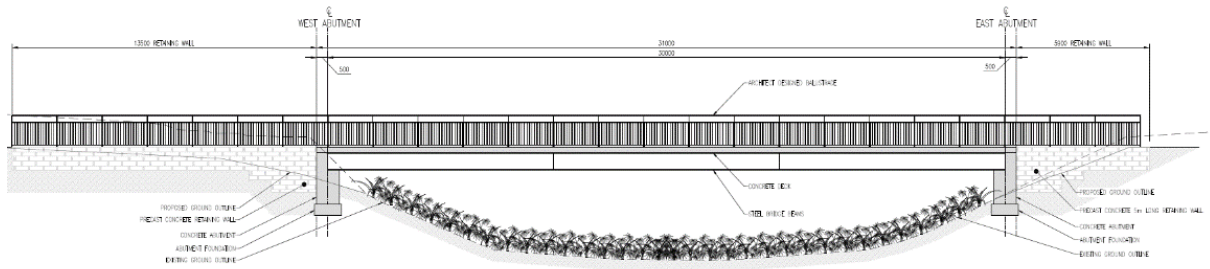


Figure 7-4 Quarry Bridge elevation

To minimise the impact on highly sensitive trees (Oak-Ash-Hazel Woodland WN2) and habitats, the route is to be constructed near the top of the northern embankment (adjacent to Delwood Park residential back gardens) and into the open space at Brompton. To prevent the greenway overlooking the back gardens of the residents of Delwood Park and for security reasons, the ground level of the greenway will be lowered. Also, security fencing and defensive planting will be installed between the greenway and the back gardens to increase security and any visual intrusion, as demonstrated in Figure 7-5.

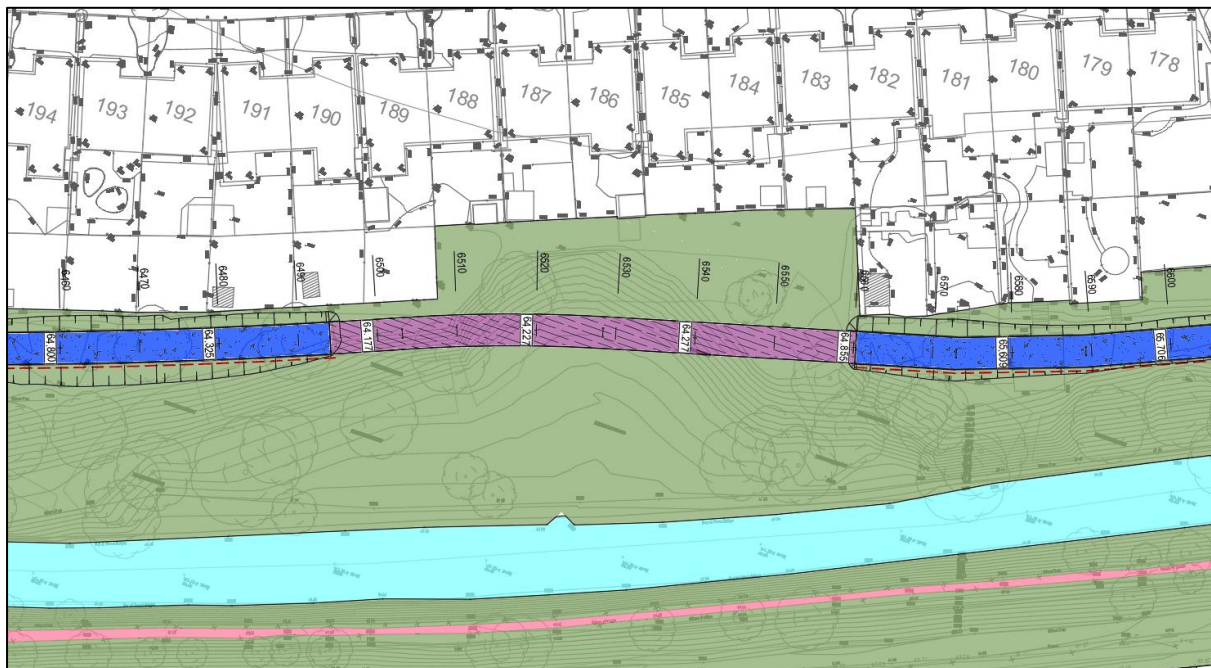


Figure 7-5 Layout of the proposed Quarry Bridge and associated screening

To construct the Quarry Bridge, the greenway will be constructed to base course from either side of the bridge via Coolmine Road (west) and Brompton. The constructed route will act as a haul road for the construction of the bridge. Mini-diggers will track to the bridge location, spoil will be removed by dumpers, and the steel beams will be craned into position from both sides and bolted in-situ.

In order to prevent the greenway overlooking the back gardens of the residents of Delwood Park and for security reasons, the ground level of the greenway is proposed to be lowered to match, or be lower than, the existing ground level. In addition, due to the topography, sections east of the Quarry Bridge, will need to span hollows to maintain an appropriate vertical alignment and to link the greenway to the adjacent Landmark Bridge approach. As such these shall be raised along a boardwalk via a piled steel structure. This will comprise a steel deck structure on appropriately spaced UCs piled and grouted. The surface will be formed by a metal deck with bituminous screed to provide consistency of finish with the adjacent flexible pavement sections.

Further narrative on the bridge design is set out in the Bridge Structures Option Assessment (170239-DBFL-XX-XX-RP-C-0010).

7.2.5 Landmark Bridge

The other bridge on the Proposed Development will be traversing the canal itself (referred to as the 'Landmark Bridge'). The steel bridge will be approximately 200m in length and will have a max single span of 30m across the Royal Canal itself. The proposed bridge will be architecturally designed to be aesthetically pleasing and fit into surrounding environment – refer to Figure 7-6. The foundation arrangement shall comprise appropriately sized piled foundations to the dense sands and gravels or bedrock where available.

A geological fault is noted in a direction skew to the canal in this area, however, it is not viewed as a significant geotechnical risk item as the sands and gravels overlying the variable bedrock are considered to be sufficiently dense to facilitate a piled foundation. This will be confirmed through further site investigation at Detailed Design stage.

Similar to the bridge at the quarry, the approaching greenway will be initially constructed either side of the canal, therefore, providing an access route to then construct the abutments and to crane the steel beams into position.

Alternatively, the steel beams could be transported and craned into position from a barge.

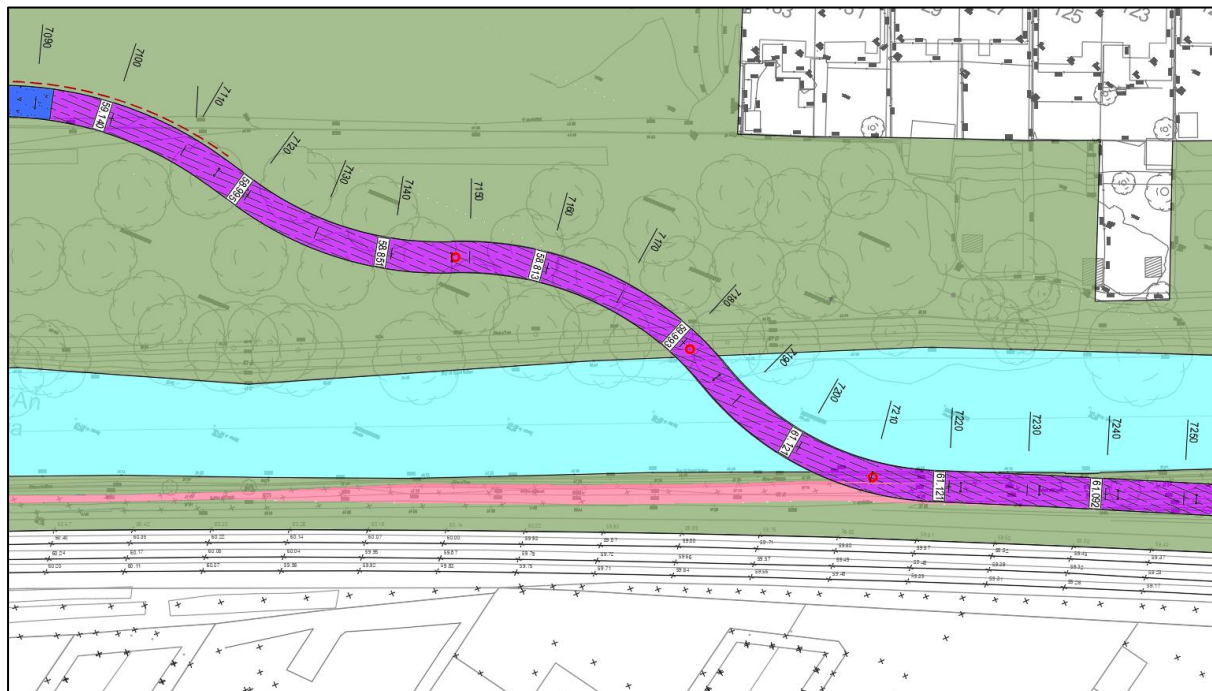


Figure 7-6 Layout of Landmark Bridge Main Span

The proposed bridge shall tie-in on the southern towpath east of an existing pinch point at Ch. 7000-7160 (created by the railway masonry retaining wall and the towpath). As the towpath begins to widen from Ch.7220 eastwards towards Granard Bridge, there is sufficient available width for construction of the bridge abutment and greenway at this location, while maintaining at least 4.5m (minimum) separation from Iarnród Éireann assets. The piles shall also be positioned so as to maintain the operation of the existing towpath on the southern side to enable the towing of barges and for maintenance purposes. A 3m height clearance will also be maintained along this existing towpath under the bridge sections for maintenance machinery.

Further narrative on the bridge design is set out in the Bridge Structures Option Assessment (170239-DBFL-XX-XX-RP-C-0010).

7.2.6 Proposed Underpass

Section 3 also includes a new underpass to be constructed beneath Castleknock Road on the southern side of the Granard Bridge (which is a protected structure with Reg. No. 11354002). This will provide a clear 4m wide bituminous pavement route with minimum 2.5m clear height through the underpass.

The proposed underpass has been designed with a minimum clear height of 2.5m, taking account of the existing geometry and ensuring the bridge and roadway (and services therein) oversailing is not undermined. The total covered length of the proposed underpass is approximately 16m,

with approaches of approximately 40m in length to the west and east to tie-in with the greenway either side.

The anticipated construction method for same will be a cut-and-cover technique, representative of the TII Standard Construction Details CC-SCD-02501, CC-SCD-02502, and CC-SCD-02503, with an extract from same shown in Figure 7-7. The excavation shall be carried out with cognisance of the railway line to the south and the bridge structures both to the north (particularly Granard Bridge) and south, with appropriate retention of material if a 1:1 sloped excavation is not achievable.

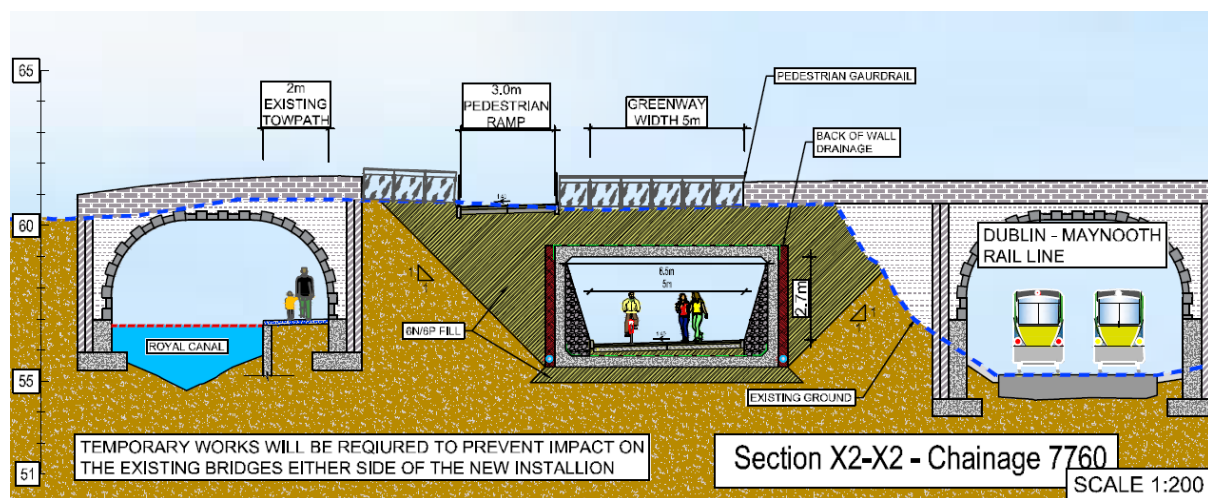


Figure 7-7 Indicative section of underpass construction in relation to Granard Bridge

While the minimum clearance to the road surface is set as 600mm, it is considered that a clearance of 1.5m is more prudent in this scenario to account for potential underground services within the roadway above.

The utilities identified within the roadway / footpath crossing the Granard Bridge at this location are as follows (according to available utility survey and record drawings):

- MV/LV (10KV/20KV/400V/230V) Underground Cable Routes (at a depth of approx. 0.4m BGL according to utility survey);
- 1 no. 9" dia. watermain (depth not determined in utility survey);
- 1 no. 525mm dia. foul drain (depth not determined in utility survey);
- 180 PE-80 25 mbar gas mains (depth not determined in utility survey); and
- Multiple telecommunications ducts (at depths up to approx. 1m BGL according to utility survey).

8 Drainage, Hydrology, and Flood Risk

8.1 Overview of Drainage Strategy

The design strategy was developed taking into account the following documents:

- Greater Dublin Regional Code of Practice (GDRCoP);
- Greater Dublin Strategic Drainage Study (GDSDS);
- Department of Transport Guidelines for Road Drainage (GRD);
- Department of Housing Planning and Local Government Nature-based Solutions to the Management of Rainwater and Surface Water Runoff in Urban Areas - Water Sensitive Urban Design Best Practice Interim Guidance Document;
- Planning requirements of Fingal County Council;
- TII requirements; and
- international best practices such as CIRIA The SuDS Manual (C753).

The principal objectives of drainage design are as follows:

- To drain surface water from existing and proposed pavement areas and maintain the existing standard of service.
- To maintain existing runoff rates from existing and newly paved surfaces using SuDS.
- To minimise the impact of the runoff from new paved areas on the surrounding environment using SuDS. The drainage system should ensure that surface water drains from existing and new pavement areas be limited by the capacity of the receiving environment.

Drainage of newly paved areas will include SuDS measures to treat and attenuate any additional runoff so that there is appropriate treatment to ensure runoff quality.

8.2 Existing Watercourses and Culverts

The location of existing watercourses and culverts has been identified using EPA Mapping (<https://gis.epa.ie/EPAMaps/default>) – and are presented in Figure 8-1. A Flood Risk Assessment has been completed on the preliminary design and are summarised in Section 8.5.

The Royal Canal is the closest surface waterbody to the Proposed Development, running alongside the scheme, and it discharges into the River Liffey downstream of the Proposed Development. In

addition there is one other watercourse in the direct vicinity of the scheme, as noted above, being the Rusk River/Watercourse which is a tributary of the River Liffey. The Rusk River traverses the Royal Canal via a culvert. The Rusk River, which runs through Luttrellstown Golf Course downstream of crossing the Proposed Development. An artificial lake within the Luttrellstown Golf Course, into which the Rusk River flows, located c. 535m from the Proposed Development at its closest point. An outlet from this lake discharges back into the Rusk River.

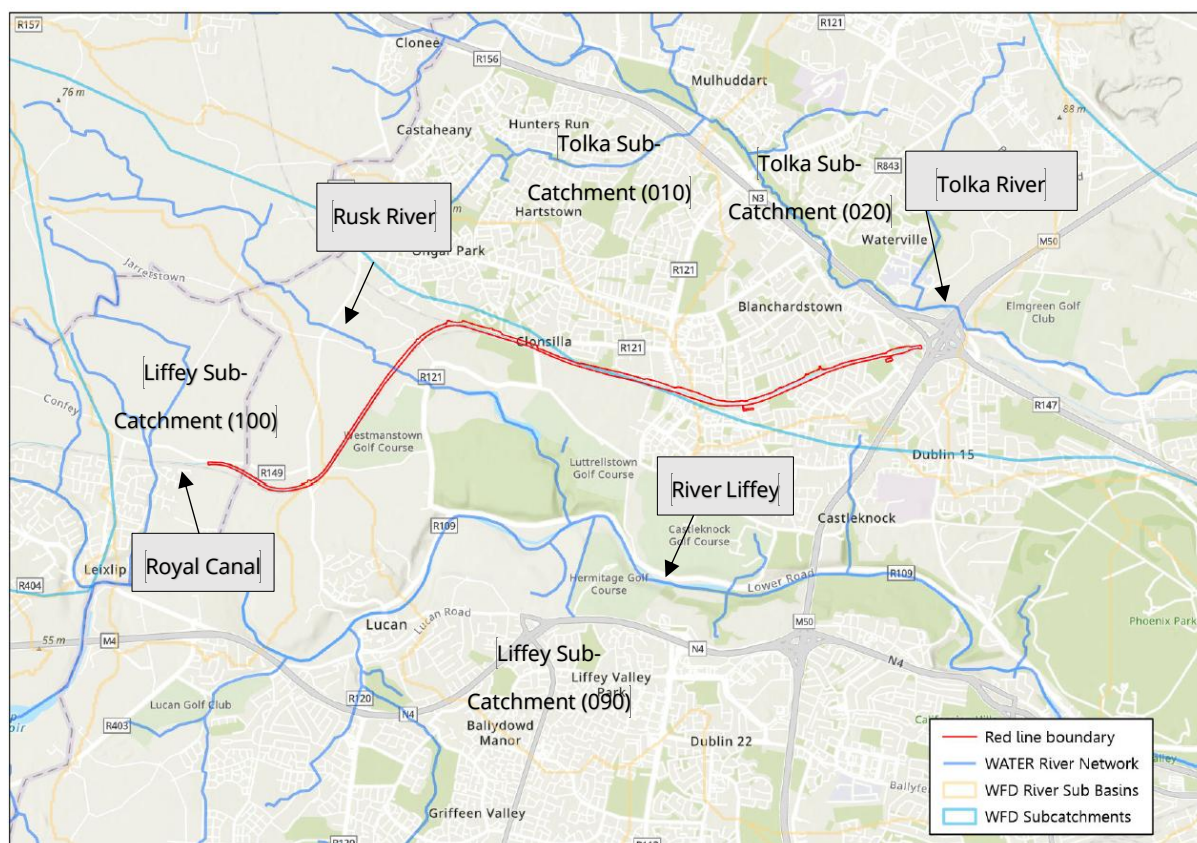


Figure 8-1: Existing Watercourses and Catchments (Source: <https://gis.epa.ie/EPAMaps/default>)

8.3 Existing Drainage Description

There are a number of surface water drainage networks in the vicinity of the Proposed Development as identified on the extracted record maps, received from Uisce Éireann (formerly Uisce Éireann) in the design development. In general, the infrastructure follows existing roads and therefore primarily traverses the Proposed Development at the bridge crossings and junctions, with the exception of a number of standalone crossings and outfalls directly into the canal. The existing networks in the vicinity are listed in Table 8-1.

Location	Chainage	Description
South of Pakenham Bridge	+2510	1000mm dia. storm drain (culverted beneath canal)
West of Callaghan Bridge	+3580	300mm dia. outfall to canal
West of Callaghan Bridge	+3640 to 3750	1500mm dia. storm drain (assumed to be culverted beneath canal)
Kennan Bridge	+5340	1 no. 225mm dia. storm drain
Kirkpatrick Bridge	+6250	Multiple 150mm to 225mm dia. storm drains
Talbot Bridge	+8100	1 no. 1200mm dia. storm drain

Table 8-1 Existing Storm Water Drainage Network

8.4 Preliminary Drainage Design

The purpose of the design will be to replicate, and improve upon where practicable, the existing situation. Surface water runoff from the proposed unbound and bituminous flexible pavement and concrete surfaced sections of the greenway (including boardwalks) will generally run over the edge and soak naturally to the underlying soil or to a filter drain for treatment and storage. While the raised section of bridges will drain off to the underlying soil or canal. Drainage types such as Filter Drainage and Over the Edge Drainage have taken precedence over piped systems given the lack of opportunities to connect to existing piped drainage networks – although piped drainage was required in certain scenarios, such as linear drainage channels and piped outfalls.

The following drainage systems were considered for the Proposed Development where new paved areas are proposed – as defined in the GRD:

- **Over the Edge Drainage** – This method of drainage is applicable to embankment conditions where the embankment is constructed of free draining material. It is not appropriate on embankments constructed of silty or clayey, moisture susceptible soils.

Over the edge drainage occurs on several roads on the network where the road elevation when constructed was higher than the area on one or both sides of the carriageway. This drainage can be very effective once the maintenance of the carriageway edge is undertaken to ensure surface water can flow over the edge.

- **Filter Drains** – Filter drains are particularly useful in draining the paved road, cycle way, and footpath networks and used throughout the country. They are frequently employed

in Ireland because groundwater levels tend to be high and sub-surface drainage systems such as filter drains are needed to control water levels under the subbase of the pavement which would compromise the pavement structure. These systems are used independently or in combination with kerb systems or concrete channels and piped systems.

A filter drain is a gravel filled trench, topped with crushed rock as a surface layer to minimise the likelihood of stones being scattered on the adjacent paved greenway. Generally, filter drains have a perforated pipe at the base. Runoff flows slowly through the granular material, trapping sediments and providing attenuation. Flow is then directed to the perforated pipe, which conveys run-off into a waterbody. A geotextile material should be used to control the flow of sediments. Drainage networks which incorporate filter drains can provide a degree of control over pollution. Monitoring results suggest that filter drains have a finite lifespan. A maintenance cycle for filter drains needs to incorporate replacement of the top section of filter material.

- **Linear Drainage Channel** (referred to in the GRD as Aco Drains) – Aco drains are particularly used in the urban areas. They are designed for removal and conveyance of surface water. They are a modular trench drain manufactured from either stainless steel, corrosion resistant polymer concrete, or fiberglass, together with grates from a variety of materials for all loading applications. The correct loading class must be chosen for the gratings to ensure suitability for the installation location, whether it be pedestrian loading or vehicular loadings.

Aco drains collect rainwater through the grating, the collected water then flows along the length of the channel. The channel is then connected into the storm water network. When choosing the location of Aco drains care should be taken to provide safe and suitable access to maintenance.

- **Concrete Channels** – Concrete channels are normally rounded or triangular concrete sections, either slip-formed, cast-in-situ or precast and set at the edge of the road pavement, flush with the road surface. Benefits of the channel would include ease of maintenance and the fact that long lengths can be constructed quickly and relatively inexpensively. Channel outlets can be located at significant spacings and possibly coincident with existing watercourses. However, roads with flat longitudinal gradients may necessitate discharge of channels fairly frequently into outfalls or parallel longitudinal carrier pipes in order to minimise the size of the channels.

The GRD outlines the effectiveness of the drainage types using different sub-headings. The classification used for each sub-heading is

- **Green:** Rated high under the sub-heading
- **Amber:** Rated medium under the sub-heading
- **Red:** Rated poor under the sub-heading.

Shows an extract from the GRD demonstrating the effectiveness of each drainage type based on the relevant sub-headings.

Drainage Type	Drainage Type Effectiveness								
	Ease of Construction	Cost of Construction	Rural Location Suitability	Urban Location Suitability	Maintenance Requirements	Life Span	Road User Safety	Traffic Loading	Sediment Capture
Kerb & Gullies	Amber	Red	Amber	Green	Amber	Green	Amber	Amber	Green
Drainage Kerbs	Amber	Red	Red	Green	Red	Red	Amber	Red	Amber
Kerb Inlet Gullies	Amber	Red	Red	Green	Amber	Green	Amber	Amber	Green
Aco Drains	Amber	Red	Red	Green	Red	Red	Green	Red	Amber
Slot Drains	Amber	Red	Red	Green	Red	Red	Green	Red	Amber
Filter Drains	Green	Amber	Green	Red	Amber	Red	Green	Amber	Green
Open Drains	Green	Amber	Green	Red	Amber	Green	Red	Green	Amber
Verge Removal	Green	Amber	Green	Red	Amber	Amber	Green	Amber	Amber
Concrete Channels	Amber	Amber	Green	Amber	Green	Green	Amber	Amber	Red
Over the Edge Drainage	Green	Green	Green	Red	Green	Green	Red	Amber	Green
Soakaway and Infiltration Trench	Amber	Red	Green	Amber	Amber	Amber	Green	Amber	Green
Bio-retention	Red	Red	Green	Amber	Amber	Green	Amber	NA	Amber
Attenuation Basins	Red	Red	Green	Amber	Amber	Green	Amber	NA	Amber
Attenuation Tanks	Red	Red	Green	Amber	Amber	Amber	Amber	Amber	Amber
Swales	Amber	Amber	Green	Green	Amber	Green	Amber	NA	Green
Wetlands	Red	Red	Green	Red	Amber	Green	Amber	NA	Green

Figure 8-2 Drainage Type Effectiveness (Sources: Guidelines for Road Drainage)

The selected drainage types (primarily over the edge, supplemented by filter drains where practicable) were deemed the most effective based on relevant sub-headings and have therefore been employed within the design at various locations based on the characteristics of each portion. It is anticipated that this will need to be supplemented by linear drains and concrete channels at localised low points where necessary to avoid excessive ponding, and the locations of same shall be determined through detailed design development. The proposed drainage regimes for the Proposed Development are listed in Table 8-2 and shown on drawings 170239-1301 to 1305.

Where filter drains and linear drainage channels are necessary, they will be sized accordingly for the area being drained, in accordance with the regulations e.g. Greater Dublin Strategic Drainage Strategy (GSDSDS), taking account of flood exceedance e.g. for storms return periods over 1% AEP and incorporating 20% climate change.

Table 8-2 Summary of Proposed Surface Water Infrastructure

Location	Chainage	Description
Section 1		
West of Collins Bridge	+0000 to +0200	No existing piped drainage. Over-the-edge from unbound surface to northern edge.
West of Collins Bridge	+0200 to +1045	No existing piped drainage. Over the edge from unbound surface to existing ditch to northern edge.
Collins Bridge	+1045 to +1060	Roadway run off to existing gullies on roadway. Footpaths graded away from roadway to greenway drainage due to geometry.
Collins Bridge to Pakenham Bridge	+1060 to +2870	No existing piped drainage. Over the edge from unbound surface to existing ditch to northern edge.
Pakenham Bridge	+2823 to +2860	Roadway run off to existing roadside verge. Footpaths graded away from roadway to greenway drainage due to geometry.
Pakenham Bridge to railway underpass	+2860 to +3180	No existing piped drainage nor drainage ditch. Over the edge from unbound surface to southern edge to Royal Canal . Cross section and contour constraints precludes filter drain as treatment.
Railway Underpass	+3180 to +3220	Existing underpass drainage in the form of linear drainage channel at low point.

Location	Chainage	Description
Section 2		
Railway Underpass to Hansfield Area	+3220 to +3660	As per existing drainage along St. Joseph's route.
Hansfield Area	+3660 to +3760	No existing piped drainage nor drainage ditch. Filter drain on southern edge of bituminous pavement and concrete surfaces.
Hansfield Area to Callaghan Bridge	+3760 to +4160	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to Royal Canal . Cross section and contour constraints precludes filter drain as treatment.
Callaghan Bridge Underpass	+4100 to +4140	Existing regime of over the edge to Royal Canal .
Callaghan Bridge to sloped section of greenway	+4140 to +4610	No existing piped drainage nor drainage ditch. Filter drain on northern edge of precast concrete boardwalk.
Sloped section of greenway	+4560 to +4610	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to surrounding vegetation.
Old Schoolhouse Lands	+4610 to +5360	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to surrounding vegetation.

Location	Chainage	Description
Section 3		
Kennan Bridge	+5360 to +5370	Roadway run off to existing gullies on roadway. Footpaths graded towards roadway draining to existing gullies.
Kennan Bridge to Windmill Court	+5370 to +5460	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to surrounding vegetation.
Windmill Court & Sheepmoor Lane	+5460 to +6270	Existing road drainage regime to be replicated.
Kirkpatrick Bridge	+6270 to +6285	Roadway run off to existing gullies on roadway. Footpaths graded towards roadway draining to existing gullies.
Kirkpatrick Bridge to 'Quarry Bridge'	+6285 to +6470	No existing piped drainage nor drainage ditch. Levels/contours preclude over the edge flow. Filter drain on southern edge of bituminous pavement.
'Quarry Bridge'	+6490 to +6560	Run off falling from bridge to existing soils and vegetation below.
'Quarry Bridge' to Raised Boardwalk	+6560 to +6640	No existing piped drainage nor drainage ditch. Levels/contours preclude over the edge flow. Filter drain on southern edge of concrete surface.
Raised Boardwalk	+6640 to +6810	Run off falling from boardwalk to existing soils and vegetation below
Raised Boardwalk to 'Landmark Bridge'	+67810 to +7090	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to northern edge to surrounding grassed area.
'Landmark Bridge'	+7090 to +7350	Run off falling from bridge to existing soils, vegetation, and canal below.

Location	Chainage	Description
'Landmark Bridge' to Castleknock Station	+7350 to +7810	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to surrounding vegetation.
Castleknock Station to Granard Bridge	+7810 to +7830	Existing drainage regime to be utilised including linear drainage channels.
Granard Bridge underpass	+7810 to +7830	Filter drain on southern edge of bituminous pavement surface from east end of underpass. Concrete channel on of bituminous pavement through underpass falling west to east, draining to filter drain. Aco drains provided at low point connecting to filter drain.
Granard Bridge underpass to 12 th Lock	+7830 to +7960	No existing piped drainage nor drainage ditch. Over the edge from bituminous pavement surface to southern edge to surrounding vegetation.
12 th Lock area	+7960 to +8090	Existing drainage regime to be utilised
Talbot Bridge	+8090 to +8100	Roadway run off to existing gullies on roadway. Footpaths graded towards roadway draining to existing gullies.

8.5 Flood Risk

A Site Specific Flood Risk Assessment (SSFRA) has been prepared for the Proposed Development, as submitted for this application. The SSFRA is a high-level study of the Proposed Development to identify flood risks to the project and any potential flooding issues arising due to the project. The report informs the planning process and identifies whether a further assessment is required.

Based on a thorough review and assessment of the flood risks associated with the Proposed Development the following conclusions were drawn:

- The proposed greenway can be classified both as less vulnerable when considered as a local transport link and water compatible when considered as a leisure-based amenity. It is considered that a Justification Test is not required, and the development associated with the Proposed Development is appropriate due to being within Flood Zone C and not being considered a highly vulnerable development.

- It is clear from the flooding analysis that the proposed site is not at significant risk from fluvial, tidal, pluvial or groundwater flooding due to its geographic location and topography. There is particularly negligible or no predicted coastal flooding risk
- The most prominent flood risk associated with the greenway route is the section of the Proposed Development apparently across the 0.1% AEP flood zone at Barnhill within Flood zone B, in the vicinity of the Rusk River Crossing. A level analysis revealed that existing towpath levels (+57.25m OD) and constructed greenway levels (+57.65m OD) were above the modelled flood levels (+56.981m OD), putting the proposed development in Flood Zone C.
- Pluvial flooding associated with proposed piped drainage networks will be managed to reduce the potential impact on the greenway. Design measures will be put in place based on recommendations made in the GDSDS and taking direction from CIRIA 753 'The SuDs Manual'.
- The construction forms, irrespective of location, will be robust and resilient requiring limited maintenance following a flood event. This ensures that the 'Mitigation principle' has been applied in accordance with The Planning System and Flood Risk Management Guidelines Sequential Approach. Further detail on the construction forms is provided in the Construction Methodology Report submitted as part of this application.
- The Planning System and Flood Risk Management Guideline's Sequential Approach has been followed through this assessment in the preparation of the Proposed Development design. No further detailed assessment is required.

In summary, the Proposed Development is considered to be in compliance with The Planning System and Flood Risk Management Guidelines for Planning Authorities, and a further detailed Site-Specific Flood Risk Assessment is not required.

9 Utilities

9.1 Overview of Utilities Strategy and Survey

Utility records from all providers were sought at an early stage of the scheme design and a utility survey was commissioned. These records and utility mapping, combined with topographic survey records, walk over inspections and desktop analysis of the Proposed Development identified areas of risk to existing assets. Where risk was initially identified to high value assets, such as strategic fibre networks, high voltage ESB cables, high pressure gas mains and trunk water mains, a review was undertaken to ascertain if the risk could be mitigated by amending the highways design whilst still meeting the objectives of the scheme. Some areas of conflict were designed out at this stage; however, some remain and will be accommodated within the overall scheme design.

9.1.1 Record Information

Available utility records were obtained from service providers and reviewed along the Routes. These records have assisted with informing the scheme design. Utility records were received from the following service providers:

- euNetworks Strategic Fibre (formerly owned by Inland Fibre Telecom Ltd.)
- Uisce Éireann (including surface and foul drainage and watermains);
- Gas Networks Ireland (GNI);
- Electrical Supply Board (ESB);
- Eir;
- Virgin Media;
- BT; and
- eNet.

9.1.2 Utility Surveys

A targeted utility survey, including GPR (Ground Penetrating Radar), was commissioned to investigate accessible areas along the route (generally in the vicinity of the bridge crossings) – particularly where high value assets were identified on the record drawings.

In addition, 47 no. slit trenches were carried out along the route as part of a site investigation exercise. The locations were checked using a CAT scan to minimise the potential for encountering services during the excavation, and the utilities were physically identified and surveyed where encountered.

The results of the utility survey have been reviewed to confirm the adequacy of design provisions made with respect to potential diversions.

9.1.3 Consultation with Utility Service Providers

Where deemed necessary, consultation with all relevant utility service providers was undertaken. Specific liaison took place with euNetworks Strategic Fibre. The fibre had been indicated on record drawings, and while not encountered in the utility surveys carried out, it was subsequently located through the slit trenches forming part of the Ground Investigation. It was noted to be at a relatively shallow depth. The Proposed Development proposals were outlined to them and scenarios where utility infrastructure might be impacted by the Proposed Development were discussed.

The asset owner was able to provide as-built drawings and information on appropriate construction practices to be employed which were used in the design development to ensure that the risk of impact to the asset is minimised. It was agreed that in the event of any works being carried out on the tow path along the route of the fibre the duct network should be located by careful hand excavation in the presence of representative from the utility owner.

9.2 Overview of Service Interactions

The construction of the Proposed Development may result in interactions with existing utility assets. These potential interactions have been identified relating to the following services:

- euNetworks Strategic Fibre (formerly owned by Inland Fibre Telecom Ltd.)
- Electricity (ESB);
- Water (Uisce Éireann);
- Storm Water Drainage (Uisce Éireann) [refer to Section 8 herein];
- Foul Water Drainage (Uisce Éireann);
- Gas (GNI); and
- General Telecommunications (including Virgin Media, eNet, Eir, BT, and others).

In addition to the above, it may be necessary to relocate and upgrade some of the existing public lighting and traffic signalling network and equipment where they are present along the extents of the scheme – such as at road crossings and along routes with existing public lighting.

The services interactions and any potential diversions will need to be considered in the design and construction of the scheme. The design considerations have been taken into account as much as

possible at this stage, but it is likely that design modifications will be required at detailed design stage when further site investigations have taken place.

Where diversions are required, during construction it may be necessary to maintain supply to certain services. This will require the retention and protection of existing utility supplies until such time as permanent diversions can be commissioned, or alternatively the construction of temporary diversions to facilitate completion of the works including the permanent diversion of services. The sequence of works must also take into account the need to liaise with service providers and, subject to their availability to carry out diversions, staging of the works may be necessary.

The potential interactions with existing services as part of this development are discussed in the following paragraphs and are summarised in Table 9-1 through Table 9-6.

9.2.1 euNetworks Strategic Fibre

There is a strategic fibre optic services operated by euNetworks (formerly owned by Inland Fibre Telecom Ltd.) – which connects to various facilities and data centres throughout Ireland and Europe – running along the existing towpath from the western extent of the Proposed Development, past Collins Bridge, to Pakenham Bridge.

The depth of cover to the duct has been indicated by the operator as approximately 400mm and this was verified through the site investigation carried out, with the ducting being encountered and surveyed within a number of slit trenches. While layout drawings have been received by the operator, it is noted that this route is also identified as part of the Virgin Media network on the record drawings obtained and survey drawings.

The potential interactions identified are listed in Table 9-1.

Table 9-1 Potential Strategic Fibre Network Interactions

Location	Chainage	Description
Tow path from start of scheme to Pakenham Bridge	+0000 to +2895	3 no. euNetworks Strategic Fibre ducts along one route
Pakenham Bridge	+2895	1 no. euNetworks Strategic Fibre ducts route

There are no amendments to the Strategic Fibre Network proposed as part of the Proposed Development.

9.2.2 Electricity Supply

Despite extensive high voltage transmission lines and local distribution infrastructure in the surrounding areas with a mix of overhead and underground cables, there is minimal existing infrastructure within the extents of the Proposed Development – with the exception of a number of localised crossings of the scheme. The following networks are located throughout the overall area as shown on the record maps obtained:

- ESB Green-MV (10KV/20KV) Overhead Lines;
- ESB Blue-LV (400V/230V) Overhead Lines;
- ESB Cyan-38KV and Higher Voltage Underground Cable Routes;
- ESB Red-MV/LV (10KV/20KV/400V/230V) Underground Cable Routes; and
- Other electrical supply ducts and overhead lines (identified on underground utility survey).

In general, the infrastructure follows existing roads and will therefore primarily traverse the Proposed Development at the bridge crossings and junctions, with the exception of a number of underground and overhead crossings. The potential interactions identified are listed in Table 9-2.

Table 9-2 Potential Electrical Network Interactions

Location	Chainage	Description
East of Collins Bridge	+1250	• 2 no. Green-MV (10KV/20KV) Overhead Lines
Pakenham Bridge	+2850 to +2900	• Multiple Blue-LV (400V/230V) Overhead Lines • Multiple other electrical supply ducts
West of Callaghan Bridge	+3740	• 1 no. Blue-LV (400V/230V) Overhead Lines
Callaghan Bridge	+4100 to +4130	• Multiple Blue-LV (400V/230V) Overhead Lines • Multiple other electrical supply ducts
Kennan Bridge	+5340	• 1 no. other overhead line
Dr Troy Bridge	+5550	• Multiple Cyan-38KV and Higher Voltage Underground Cable Routes* *[not identified on GPR survey – assumed to be within bridge structure oversailing the scheme]
Along Sheepmore Lane	+5940 to +6250	• 1 no. other overhead line
Kirkpatrick Bridge	+6250	• 1 no. Blue-LV (400V/230V) Overhead Lines • Multiple other electrical supply ducts
Granard Bridge	+7790	• Multiple Red-MV/LV (10KV/20KV/400V/230V) Underground Cable Routes • 1 no. other overhead line

Location	Chainage	Description
Talbot Bridge	+8100	1 no. Blue-LV (400V/230V) Overhead Lines - Multiple Red-MV/LV (10KV/20KV/400V/230V) Underground Cable Routes

The proposed electrical network required for the Proposed Development shall comprise the supply to the new public lighting and new traffic signal infrastructure, as well as potential local diversions and for potential temporary connections associated with construction compound facilities.

9.2.3 Water Supply

There are a number of Uisce Éireann watermains in the vicinity of the Proposed Development as shown on the record maps obtained. In general, the infrastructure follows existing roads and therefore primarily traverses the Proposed Development at the bridge crossings and junctions, with the exception of a number of standalone crossings. The potential interactions identified are listed in Table 9-3.

Table 9-3 Potential Water Supply Network Interactions

Location	Chainage	Description
West of Collins Bridge	+0820	2 no. 1000mm dia. watermain (assumed to be crossing beneath canal – not oversailing)
Collins Bridge	+1090	- Multiple 100mm - 200mm dia. watermains - Multiple undefined watermain
Pakenham Bridge	+2875	1 no. 100mm dia. watermain
West of Callaghan Bridge	+3570	2 no. 1000mm dia. watermain (assumed to be oversailing canal)
Callaghan Bridge	+4115	1 no. 5" dia. watermain
Kennan Bridge	+5340	1 no. 4" dia. watermain
Dr Troy Bridge	+5550	Multiple 150mm to 200mm dia. watermain* *[not identified on GPR survey – assumed to be within bridge structure oversailing the scheme]
Along Sheepmore Lane	+6000 to +6250	1 no. 3" dia. watermain
Kirkpatrick Bridge	+6250	1 no. 4" dia. watermain
Granard Bridge	+7790	1 no. 9" dia. watermain
Talbot Bridge	+8100	1 no. 12" dia. watermain

There is no proposed water supply network required for the Proposed Development, with the exception of potential local diversions and for potential temporary connections associated with construction compound facilities.

9.2.4 Foul Water Drainage

There are a number of foul water drainage networks in the vicinity of the Proposed Development as shown on the extracted record maps obtained, received from Uisce Éireann (formerly Uisce Éireann) in the design development. In general, the infrastructure follows existing roads either side of the Royal Canal (and generally outside the Proposed Development extents) with minimal crossings over the canal. The potential interactions identified are listed in Table 9-4.

Table 9-4 Potential Foul Water Drainage Network Interactions

Location	Chainage	Description
West of Callaghan Bridge	+3930 to +4115	1 no. 450mm dia. foul drain
Callaghan Bridge	+4115	1 no. 300mm dia. foul drain 1 no. 375mm dia. foul drain
West of Granard Bridge	+7770	1 no. 525mm dia. foul drain

There is no proposed foul drainage network required for the Proposed Development, with the exception of potential local diversions and for potential temporary connections associated with construction compound welfare facilities.

9.2.5 Gas Supply

There are a number of gas supply networks in the vicinity of the Proposed Development as shown on the record maps. In general, the infrastructure follows existing roads either side of the Royal Canal (and generally outside the Proposed Development extents) with minimal crossings over the canal. The potential interactions identified are listed in Table 9-5.

Table 9-5 Potential Gas Supply Network Interactions

Location	Chainage	Description
South of Pakenham Bridge	+2530	1 no. 200mm ST 40 bar crossing (crossing beneath canal) [High Pressure]
North of Callaghan Bridge	+4115	1 no. 180 PE 4 bar gas main
Dr Troy Bridge	+5550	1 no. 900mm ST 70 bar crossing* *[not identified on GPR survey – assumed to be within bridge structure oversailing the scheme]
Kirkpatrick Bridge	+6250	1 no. Medium Pressure Strategic Pipe
North of Granard Bridge	+7790	Multiple 180 PE-80 25 mbar gas mains
Talbot Bridge	+8100	1 no. 90 PE-80 [12 In] 25 mbar gas main

Location	Chainage	Description
South of Pakenham Bridge	+2530	1 no. 200mm ST 40 bar crossing (crossing beneath canal) [High Pressure]
North of Callaghan Bridge	+4115	1 no. 180 PE 4 bar gas main

There is no proposed gas supply network required for the Proposed Development, with the exception of potential local diversions and for potential temporary connections associated with construction compound facilities.

9.2.6 Telecommunications

There are a number of telecommunications networks in the vicinity of the Proposed Development. The following service provider networks are located throughout the overall area as shown on the record maps obtained:

- eNet Open Access Networks;
- Virgin Media;
- OpenEir; and
- Traffic communications ducting.

In general, the infrastructure follows existing roads either side of the Royal Canal (and generally outside the Proposed Development extents) with minimal crossings over the canal. The potential interactions identified are listed in Table 9-6.

Table 9-6 Potential Telecommunications Network Interactions

Location	Chainage	Description
Collins Bridge	+1090	1 no. Eir duct route
Pakenham Bridge	+2895	1 no. eNet duct route 1 no. Eir duct route - Multiple Traffic duct routes
Callaghan Bridge	+4115	- Multiple Eir duct routes - Multiple Traffic duct routes
Kennan Bridge	+5340	1 no. Eir duct route - Multiple Traffic duct routes
Dr Troy Bridge	+5550	1 no. Eir duct route* 1 no. Virgin Media duct route* *[not identified on GPR survey – assumed to be within bridge structure oversailing the scheme]
Along Sheepmore Lane	+5930 to +6250	1 no. Eir overhead line

Location	Chainage	Description
Kirkpatrick Bridge	+6250	• Multiple Eir duct routes • Multiple Traffic duct routes
Granard Bridge	+7790	• Multiple Eir duct routes • Multiple Virgin Media duct routes • Multiple Traffic duct routes
Talbot Bridge	+8100	• Multiple Eir duct routes

There is no proposed telecommunications network required for the Proposed Development, with the exception of potential local diversions and for potential temporary connections associated with construction compound facilities.

10 Excavations and Waste Quantities

10.1 Overview of Waste Quantities

The majority of the waste arisings from the works are likely to accumulate from excavation related activities resulting from greenway construction and drainage/utility works in addition to proposed bridge and underpass structures. A waste calculation was carried out for the Proposed Development to quantify and classify the likely material types in accordance with TII GE-ENV-01101 and the European Waste Catalogue waste codes. The waste quantities associated with soil and stones (waste code 17 06 02) were further broken down into the likely TII material specification to establish an understanding of the volume of materials that could potentially be reused/recycled. In developing the waste estimate quantities, a number of assumptions were required to undertake the assessment which have been outlined where relevant.

Due to the nature of the works in a largely constrained environment, with the Proposed Development primarily following existing contours, there are limited opportunities to provide a cut/fill balance of materials that could be more readily accommodated on a greenfield project where earthworks embankments / bunds are more common. Material from the existing unbound and bituminous pavement layers could be sent to a suitable recovery facility for recycling and reuse as recycled aggregate material in the industry. Any existing made ground material will need to be tested for quality and contamination and could potentially be sent to a suitable soil recovery facility also for reuse as general fill or general landscape fill material in the industry, following appropriate procedures.

Future design stages will undertake additional site investigations to inform the detailed pavement design and associated excavation quantity assessment. Various mitigations could be considered during the design and construction works to offset the net volume of material that will be sent off site to a soil recovery facility including stockpiling of existing subbase, capping layer and top soil material on site for direct reuse in the proposed works (subject to quality testing, construction sequencing and material availability versus demand given the intermittent nature of the works). Similarly, there are potentially other opportunities within the proposed pavement design/construction to further offset the net volume of natural aggregate material requirements through consideration for the use of recycled aggregates and reclaimed asphalt material. Suitable recycled aggregates and appropriate site won material could be implemented in the proposed road base/binder layers, subbase layers under footpath/cycle tracks, and capping layer material within the road pavement. Adopting these mitigations in the proposed designs may have

significant benefits in offsetting the overall quantity of natural aggregate materials requirements and could potentially realise up to a significant volume of recycled/reused aggregates to improve the overall sustainability of the Proposed Development.

Waste arisings from street furniture, trees and materials from within the public domain (17 01 02 Bricks, 17 04 07 Mixed metals, 17 02 03 Plastic, 17 02 01 wood, 17 02 02 Glass) are also likely to result from the nature of the demolition works at Hansfield and the general clearance of street furniture where required. These materials will need to be segregated by waste classification on site and sent to a suitable recovery facility for recycling. The principles of prevention and minimisation will be further considered in detailed design/construction stages through value engineering, substitution or reuse of materials, and effective methods or control systems (e.g., just in time deliveries/ effective spoil management) so that waste production is minimised.

10.2 Waste Estimate Summary

The majority of the waste arisings from the construction of the Proposed Development accumulates from excavation related activities and demolition works. The waste produced as a result of the Proposed Development has been summarised below along with an outline of how this waste will be managed.

10.2.1 Demolition

While some demolition works are associated with the construction of this Greenway, they are considered to be small scale in nature. For example, works at Granard Bridge will involve the construction of an underpass which may also involve minor demolition works – although these works have been assessed under Excavation herein. Specifically, there are two houses with total estimated floor area of 670 sqm near Hansfield Road which require demolition in the Proposed Development works.

A project specific Resource and Waste Management Plan (RWMP) (doc. ref. 257501.270WMR01) was developed for the scheme and estimates that approximately 402.0 tonnes of demolition waste will be generated.

The estimated demolition waste comprises glass, concrete, bricks, tiles and ceramics, plasterboard, asphalt, metals, slate and timber. These materials will be segregated on site where practicable and directed towards reuse, recycling or recovery, with disposal used only where no higher-order waste management option is reasonably available. Table 10-1 presents the estimated demolition waste quantities based on the RWMP.

Table 10-1 Expected Waste Materials to be Generated from Demolition

Waste Type	Quantity (tonnes)	Primary Management Route
Glass	36.2	Recycle / disposal
Concrete, bricks, tiles and ceramics	205.0	Reuse / recovery / recycling
Plasterboard	16.1	Reuse / recycling / disposal
Asphalt	4.0	Reuse / recycling
Metals	60.3	Recycling
Slate	32.2	Recycling / disposal
Timber	48.2	Reuse / recycling / disposal
Total	402.0	Reuse / recycling / recovery prioritised

The estimated 402.0 tonnes of demolition waste expected to be generated as a result of this element of the Proposed Development is equivalent to less than 0.01% of the national C&D waste baseline.

10.2.2 Excavation

Based on the preliminary cut and fill assessment carried out by DBFL Consulting Engineers Ltd. and reported in the RWMP, the total volume of material to be excavated is estimated to be approximately 14,776m³. It is currently envisaged that approximately 11,899m³ of suitable excavated material will be reused on site for fill and engineering purposes, including stabilised material. The remaining volume of approximately 2,880m³ will be removed off site, subject to material classification and suitability for reuse, recovery or disposal. A summary of excavated material is included in Table 10-2 below.

Table 10-2 Summary of Expected Excavation Material Quantities

Material Category	Source Activity	Volume (m³)	Anticipated Reuse / Recovery (%)
Soil and Stones	Ground/Soil Excavation	2,454.5	80
Soil and Stones	Bulk Excavation	7,151.3	80
Topsoil	Topsoil Excavation	3,537.8	80

Crushed Rock / Gravel	Gravel/Stone Excavation	781.5	90
Bituminous Mixtures	Asphalt Excavation	197.8	80
Concrete	Concrete Excavation	148.9	80
Soil and Stones	Structural Excavation	504.0	80
Total		14,776	11,899

Due to the nature of the works in constrained environment there are limited opportunities to achieve a cut/fill balance of materials that could be more readily accommodated on a greenfield project where earthworks embankments/ bunds are more common. Where material is excavated, it is envisaged that the contractor will however seek to reuse or recycle it, where practicable, within the Proposed Development.

Future design stages will undertake additional site investigations to inform the detailed pavement design and associated excavation quantity assessment.

10.2.3 Construction Waste

Construction works, site offices and temporary works facilities are also likely to generate waste. Construction waste can vary significantly from site to site but typically would include the following non-hazardous fractions:

- Soil and stone;
- Concrete, brick, tiles and ceramics;
- Bituminous mixtures;
- Metals;
- Wood;
- Municipal type wastes generated by construction employees; and
- Other.

The hazardous waste streams which could arise from construction activities may include the following;

- Waste electrical and electronic equipment (WEEE) components;
- Batteries;

- Asbestos;
- Wood preservatives;
- Liquid fuels; and
- Contaminated soil.

Also included within this definition are surplus and damaged products and materials arising in the course of construction work or used temporarily during the course of on-site activities.

The construction of the Proposed Development will require the importation of a number of key construction materials for the Proposed Development works. This material will include items such as concrete, granular fill / aggregate, bituminous mixtures and structural steel. Table 10-3 provides an estimate of the quantities of the major materials required to complete the Construction Phase of the Proposed Development.

Table 10-3 Estimated Quantities of Major Construction Materials Required

Description	Quantity (tonnes)
Bituminous Mixtures	4,830
Concrete	1,872
Precast Concrete	1,416
Aggregates	15,470
Structural Steel	2,407
Fill Material / Capping	To be confirmed at detailed design stage
Total	25,995

Note: The requirement for imported fill material will be confirmed during detailed design and construction-stage preparation of the updated RWMP. Imported fill has therefore not been included in the total presented in Table 10-3. Where imported fill is required, the material will be tested and certified, where required, to confirm its engineering and environmental suitability for the proposed end use. Suitable recycled, secondary or site-won materials will be used where practicable, subject to specification, testing and regulatory requirements.

In the case of the Proposed Development the most likely type of construction waste will be surplus concrete and unusable or damaged construction materials such as utility ducts and pipes. Quantities of these materials are estimated to be small; assumed to be approximately between 5% to 15% of construction material delivered to site.

10.2.4 Municipal Waste

It is anticipated that there will be approximately 15 to 25, possibly up to 30 at peak, construction staff employed over the Construction Phase of the Proposed Development. Small volumes of general municipal wastes will be generated by construction staff during the Construction Phase (e.g. from offices and welfare facilities). Segregation facilities will be provided on the construction site to ensure that recovery and recycling of such wastes is maximised.

10.2.5 Operational Waste

C&D waste may arise in the Operation Phase as a result of carriageway and/or greenway maintenance which will be undertaken at regular intervals, or as necessary. This will primarily consist of bituminous mixtures and gravel surfacing due to maintenance of carriageway and/or greenway pavement. 7

11 Traffic Signs, Traffic Signals, and Road Markings

11.1 Overview

The existing signage and road markings along the extents of the Proposed Development will be modified to clearly communicate information, regulatory and safety messages to the greenway and road users. Traffic signs and road markings will be reviewed and confirmed as part of the detailed design, and they will be designed in compliance with the Traffic Signs Manual (2019). At interfaces with the public roads, the proposed signage and junction layouts (generally comprising toucan crossings) have been outlined in the design drawings.

As recommended in DN-GEO-03047 Rural Cycleway Design, the design intent is that road markings shall be kept to a minimum as part of the Proposed Development.

11.2 Traffic Signs and Road Markings

The detailed design shall be undertaken to assess any amendments to the existing road traffic signage and road markings, with reference to information signs (TSM Chapter 2), regulatory signs (TSM Chapter 5), warning signs (TSM Chapter 6), and road markings (TSM Chapter 7).

As stated in TSM Chapter 1, in urban areas the obstruction caused by posts located in narrow pedestrian footways should be minimised ensuring that pedestrian and cycle access is unimpeded by any such signage infrastructure – which is particularly necessary at the road crossings alongside existing bridges. Therefore, where practicable, signs are to be placed on single poles, or larger signs will be cantilevered from a post at the back of the footway using H-frames where necessary. Passively safe posts will be introduced where practicable to eliminate the need for vehicle restraint systems.

At the start and end of each greenway section where it connects with a public road, Sign RUS 058 shall be erected to signify that the facilities are shared between pedestrians and cyclists. Where footways join the shared greenway, in order to warn visually impaired people that they are stepping into a shared space, the signage will be supplemented by a corduroy tactile surface installed across the footway/footpath to a depth of 800mm where it joins the shared route.



RUS 058:
SHARED TRACK FOR PEDAL
CYCLES AND PEDESTRIANS

Road markings at signalised road crossings shall be in accordance with Chapter 7.16 of the TSM, with reference to Figure 11-1, with the M131 Pedestrian Lines spaced 4m apart to form the crossing.

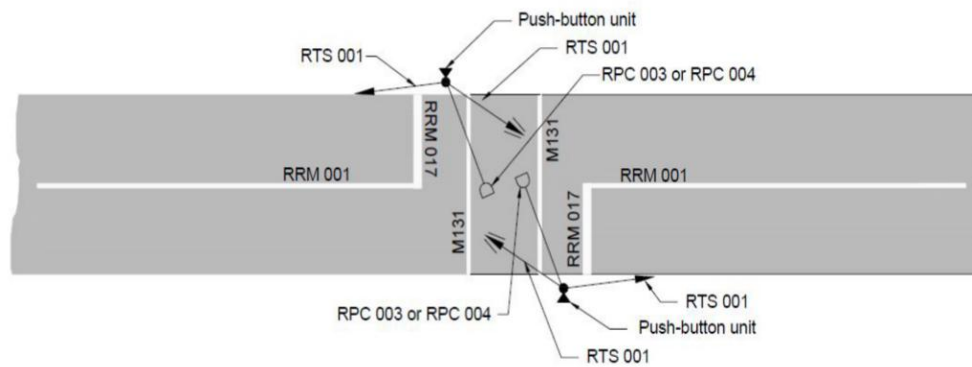


Figure 11-1 Extract from Chapter 7 of the TSM (Figure 7.53 therein)

11.3 Traffic Signals

The traffic signal requirements in the Proposed Development relate to the provision of new toucan crossings and conversion of existing uncontrolled crossings to toucan crossings where the greenway traverses the public road. As such there is no existing traffic signal infrastructure at these locations to be utilised, and new infrastructure is required.

11.3.1 Above Ground Infrastructure

All traffic signal equipment has been designed in accordance with Chapter 9 of the TSM, which clearly defines the requirements and positioning of traffic signal heads, detection equipment, and associated traffic signal poles, with particular reference to Chapter 9.4 therein regarding positioning.

Single height Traffic Signal poles typically 3m (as measured from the ground) shall generally be provided on the Proposed Development to mount traffic signal heads, push button units, and other equipment. Where additional visibility of the signals is required by the motorist – e.g. where vertical alignment of approaching bridges affects forward visibility – double height poles, (typically 6m) shall be provided. Chapter 9 of the TSM provides a typical layout of required signal heads for Toucan Crossings within Figure 9E14, an extract of which is shown in Figure 11-2, with the symbols as per Appendices 9A and 9B therein. This layout shall be adhered to in the traffic signal design for the Proposed Development.

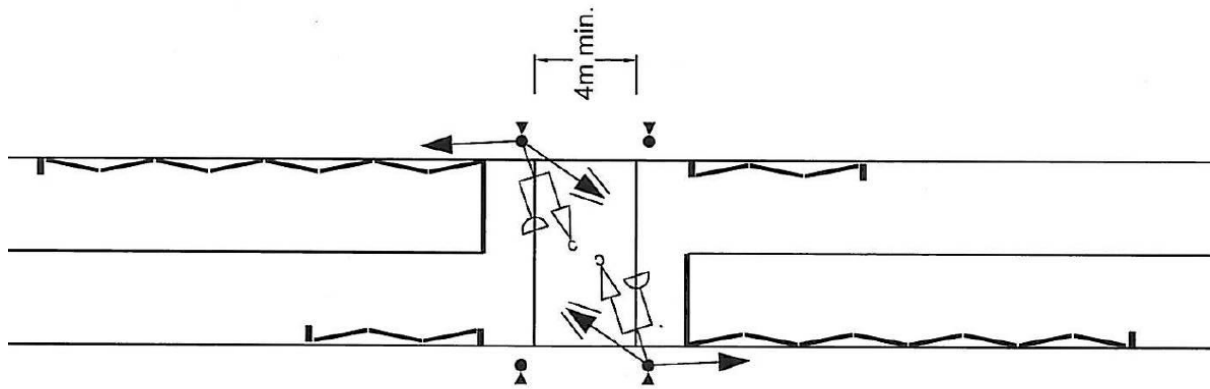


Figure 11-2 Extract from TSM Chapter 9 showing typical layout of Toucan Crossing Signals

As per TII Standard Construction Detail CC-SCD-05135, signalised crossing locations will require a roadside cabinet to house and protect electronic, electrical and communications equipment. Due to health and safety, design, space, operational and maintenance constraints, it is often necessary to separate these cabinets in accordance with their function. Typically, a junction will have cabinets for:

- Traffic Signal Control Cabinets;
- Fibre Breakout Cabinets; and
- Electricity supply Metering, Mini and Micro pillars.

Cabinets will be positioned to allow for ease of access by maintenance personnel and to minimise their impact on the receiving environment. When accessing cabinets, maintenance personnel will require a clear view of the associated equipment and of approaching vehicles, pedestrians, and cyclists. Cabinets are often positioned at the back of footpaths, to minimise the impact on the effective width of the footpath. In all cases the consideration of the siting of such roadside equipment shall prioritize the access for pedestrians and cyclists in the area and balance the aesthetics of the urban realm with maintenance requirements.

11.3.2 Underground Infrastructure

It is anticipated that the toucan crossings shall operate as standalone signals and not be connected to the surrounding traffic ducting network, due to their nature and function. As such the required underground infrastructure relates only to that which is required to form the required network for the elements at each location. Each location will however require a connection to the existing power supply network in the vicinity.

Each device, mounting structure, and cabinet will have associated underground infrastructure including ducts for:

- Power Cables – installed equipment will require a power supply to function, this is facilitated by a ducting connection between the electricity supply point and equipment location. This connection is normally a single power supply duct.
- Device Cables – devices will require cabling between field equipment and control equipment. For example, two to four ducts traversing the roadway (in accordance with TII Standard Construction Detail CC-SCD-00561) will be provided at each junction to allow for cabling between the traffic signal controller and the traffic signal poles. It is necessary when designing the ducting provision that sufficient spare capacity is provided to allow for changes to the field equipment, deployment of additional equipment, or damage to the ducting provision.

Chambers will be required at the termination points of ducts, at regular intervals along ducts, at changes in direction, and at breakout points for devices. The position of chambers will be designed to be away from carriageways, pedestrian and cycle desire lines, and tactile paving. It is important when positioning chambers that they can be accessed in a safe manner, without the need for extensive traffic and pedestrian management.

Individual chambers will be designed and sized with consideration given to the number of ducts and cables that will be routed through the chamber, and the need to provide maintenance loops of cables within the chambers. Unless prior agreement is in place, chambers will not be shared between users.

All cabinets, poles and mounting structures will require a foundation or mounting frame to be constructed to allow for their installation. It is envisaged that for traffic signal poles and other lightweight mounting structures retention sockets will be installed to allow for the easy installation, maintenance and replacement of structures.

Cabinet mountings will be designed and constructed in accordance with the manufacturer and FCC's standard details, including the incorporation of required vaults, chambers, earthing rods and mats.

11.4 Maintenance

All traffic signal equipment will be designed and located to be accessed and maintained frequently. Where practicable, all equipment will be accessible without disrupting pedestrian, bicycle, or vehicle traffic and without the use of special equipment.

Apparatus will be designed and located to allow for easy access and the safe maintenance of the Proposed Development into the future. This will include:

- Use of retention sockets, where applicable, for the erection of Traffic Signals and other equipment mounting poles to allow for the ease of installation, maintenance and replacement;
- The use of lightweight equipment poles, where appropriate.
- Placement of poles and retention sockets within 7m of chambers to provide ease of installation and replacement of cables;
- Locating chambers away from pedestrian desire lines, and areas of tactile paving. This is to provide for a reduced impact of Traffic Management;
- Where practicable, safe areas to be identified for the access and parking of maintenance vehicles; and
- Locating controller, and other, cabinets in positions that allow for safe access and clear visibility of the operation of the junction.

12 Land Use and Accommodation Works

12.1 Summary of Land Use

The land use along the Proposed Development comprises areas of a rural/peri-urban nature, predominately farmlands in the western extents, moving from rural to predominantly suburban in nature in the central and eastern extents. The various land uses are described in the sections below. The extent of the impact due to the Proposed Development on a landowner's holding is shown on the Compulsory Purchase Order maps and covered under Planning reporting.

The following is a description of the land use along the Proposed Development within the three scheme sections.

12.1.1 Section 1 – Kildare County Border to Hansfield Railway Bridge (Ch. 0000 – 3200)

This section is rural/peri-urban in nature, predominately farmlands, however, it also adjoins local amenities such Westmanstown Golf Club and Westmanstown Sports Centre. There are a number of Protected Structures in Section 1 of the Study Area. The Record of Protected Structures is compiled and maintained by Fingal County Council. The Royal Canal itself is the main protected structure in Section 1 along with Collins Bridge and Pakenham Bridge.

12.1.2 Section 2 – Hansfield Railway Bridge to Kennan Bridge (Ch. 3200 – 5300)

The character of the Study Area changes from rural to predominantly suburban in nature. This section is predominately residential on the northern side of the canal with farmlands on the southern side. There is significant development ongoing within Hansfield Strategic Development Zone (SDZ) with further plans for development on the southern side of the canal, east of Clonsilla Train Station, see extract from the land zoning map for the FCC Development Plan (brown hatching) in Figure 12-1. There are a number of Protected Structures in Section 2 of the Study Area. The Record of Protected Structures is compiled and maintained by Fingal County Council. The Royal Canal itself is the main protected structure in Section 2 along with Callaghan Bridge, Kennan Bridge, Porterstown School House, Clonsilla Signal Box, and Porterstown Crossing Keeper's House (former).

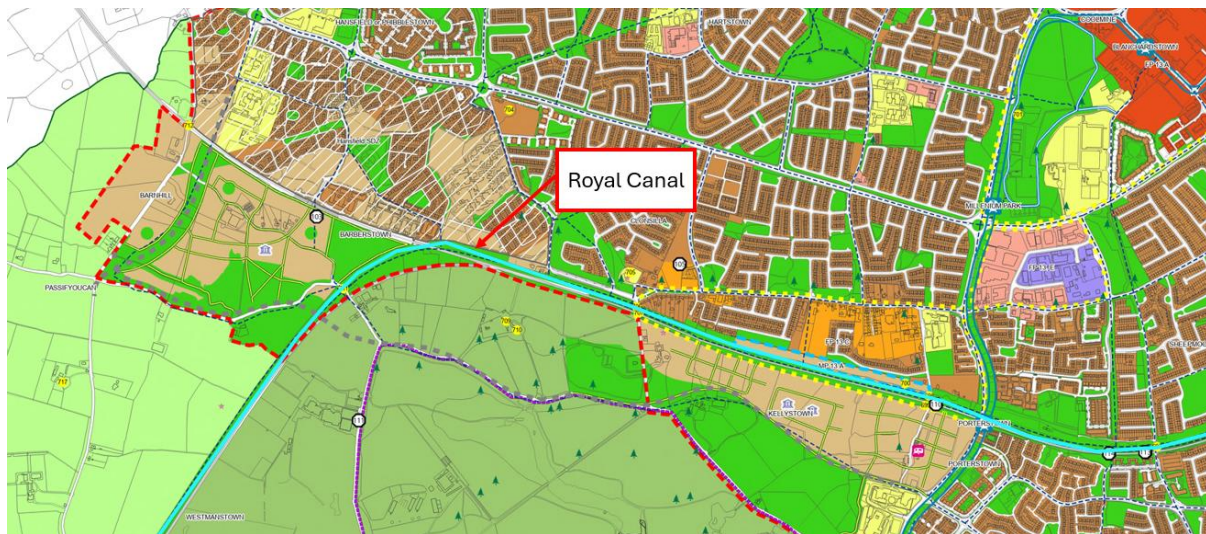


Figure 12-1 Extract from FCC Development Plan Land Zoning map, Blanchardstown South

Permanent land take is required through this section to facilitate the scheme, including the residential site at Hansfield Road (including the demolition of existing properties), as well as the route through the Old School House Lands.

12.1.3 Section 3 – Kennan Bridge to Talbot Bridge (Chainage 5300 – 8100)

This section is predominately urban with extensive residential catchments on both sides of the Canal. There are employment and retail establishments at Coolmine Industrial Estate such as Power City, Ford Motors etc and many educational sites such as Luttrellstown Community School, St. Mochta's National School and St Brigid's Girl School in Section 3. The 'Deep Sinking' section is between Clonsilla Road and Castleknock Road. The 'Deep Sinking' section therefore continues through Section 3 from Porterstown Road to Castleknock Road.

There are a number of Protected Structures in Section 3. The Royal Canal itself is the main protected structure in Section 3. Within this section the Royal Canal is a manmade channel cut into the landscape in the 18th century as a navigation route and has earthen banks and a towpath running alongside. There are also three protected bridges in Section 3 – Kirkpatrick Bridge, Granard Bridge and Talbot Bridge.

12.2 Demolition

The demolition works will comprise the demolition of two houses and ancillary structures on approach to Hansfield Road to facilitate the routing of the Proposed Development. In addition, there will be general demolition of low boundary walls and street furniture along the route.

The demolition works shall be in accordance with the specific demolition items set out the following National Standards and guides:

- I.S EN 1991-1-6:2005 – Actions on Structures: General Actions – Actions During Execution (Including National Annex)
- BS 6187:2011 – Code of practice for full and partial demolition
- HSE Publication HSG264: Asbestos, The survey guide
- BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 1: Noise
- BS 5228 – Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration

All reasonable precautions to prevent pollution of the site, works and the general environment including streams and waterways to be taken.

All demolition waste shall be segregated and, where practicable, sent for recycling. All in accordance with guidelines as set out by the National Construction and Demolition Waste Council (NCDWC).

A waste management plan following guidelines as set out by the NCDWC shall be produced outlining the proposals with respect to waste recycling, segregation and details of landfill proposals with target percentage of each element. The following legislation should be noted:

- Protection of the Environment Act 2003.
- Waste Management (Amendment) Act 2001.
- Council Directive 1999/31/EC of 26 April 1999 on the landfill of waste.
- EU Council Decision on Waste Acceptance (2003/33/EC).
- WMA Amendment Act (#2) 2001.
- Protection of the Environment Act No. 27 2003.
- Best practice Guidelines on the preparation of Waste Management Plans for Construction and Demolition Waste

12.3 Summary of Accommodation Works and Boundary Treatment

To maintain the character and setting of the Proposed Development, the approach to undertaking the new boundary treatment works along the corridor is largely replacement on a 'like for like'

basis in terms of material selection and general aesthetics, unless otherwise noted on the drawings. Final details of boundaries where affected, will be agreed between the directly impacted landowners and FCC.

While there is no encroachment proposed into residential properties as part of the works in the Delwood area, specific boundary treatment works are proposed. In order to prevent the greenway overlooking the back gardens of the residents of Delwood Park and for security reasons, the ground level of the greenway is proposed to be lowered to match, or be lower than, the existing ground level of the adjacent back gardens and a 2m high timber palisade fence provided, with an anti-climb wire mesh fence. Defensive planting will also be provided here to increase security and any visual intrusion. Refer to Figure 12-2 for indicative cross-section of such treatment.

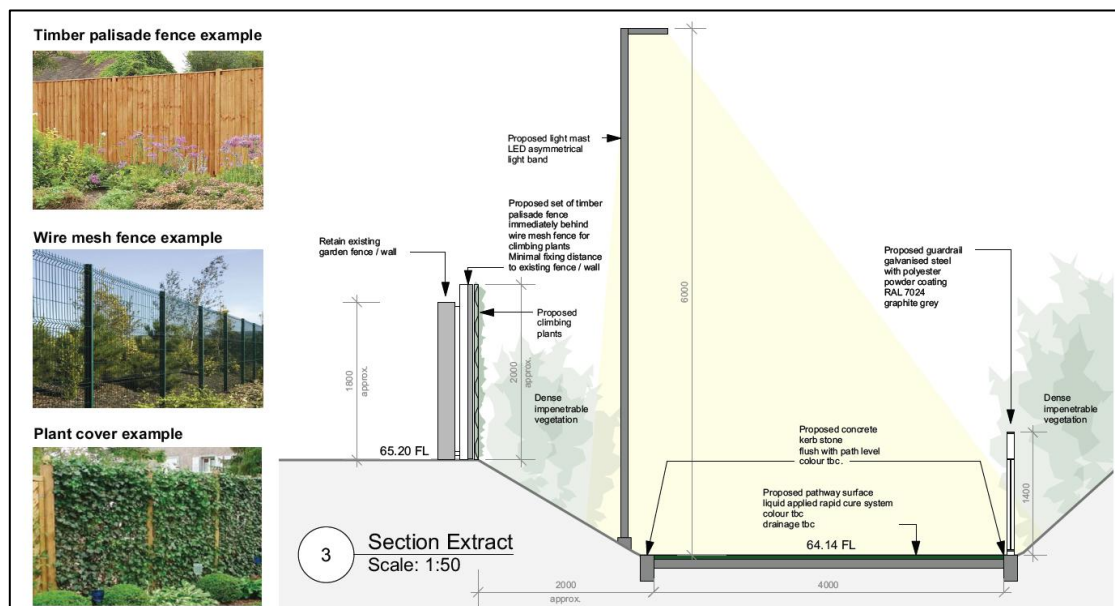


Figure 12-2 Cross section of Greenway behind Delwood Park (Source: Architectural Drawings – Appendix B, Public Consultation Document)

The design includes a 2m high fence line to be maintained along the southern side of the greenway along the section of the greenway route through the Brompton green area. To provide further privacy to the Brompton residents, planting and railings will be provided on the Brompton side of the greenway through the Brompton green area, see image below from the Public Consultation Report and 3D Animation video (Figure 12-3).



Figure 12-3 Image illustrating the greenway adjacent to the Brompton green area with fencing/planting provided

13 Landscape and Urban Realm

The Landscape and Urban Realm design for the Proposed Development has been undertaken by Áit Urbanism + Landscape. Generally, this comprises an integration of landscape design with the engineering design of the scheme, particularly in relation to surfaces, aesthetics of structural elements, SUDS integration, and lighting.

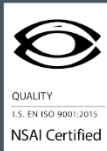
14 Conclusion

This Preliminary Design Report has presented the engineering design development undertaken for the Proposed Development to support the planning application to An Coimisiún Pleanála. The report has outlined the relevant policy context and design standards, described the Proposed Development and design objectives, and documented the preliminary engineering design across all key disciplines including highways, pavement design, structures, drainage, utilities, earthworks, land use and accommodation works, traffic signs and signals, and landscape and urban realm elements.

The report demonstrates that the Proposed Development has been developed in accordance with applicable national standards, guidance documents and best practice, taking account of the existing physical, environmental and operational constraints along the route. Appropriate consideration has been given to interactions with existing and proposed infrastructure, land requirements, drainage and flood risk management, utility diversions, structural requirements, pavement design and landscape integration.

The preliminary design has been developed to a level sufficient to establish the feasibility and constructability of the Proposed Development, identify land and environmental requirements, inform the Environmental Impact Assessment Report and Appropriate Assessment processes, and support the preparation of the associated planning application documentation.

The assessments and design information presented within this report demonstrate that the Proposed Development can be delivered in a safe, practical and efficient manner while meeting the project objectives and relevant statutory requirements. It is therefore considered that the preliminary design information accompanying the planning application provides an appropriate and robust basis for An Coimisiún Pleanála to assess the Proposed Development and determine the application. Subsequent detailed design development will be undertaken, where required, following receipt of the necessary statutory approvals and will be carried out in accordance with the commitments, mitigation measures, standards and requirements established through the planning process.



**Engineering
Sustainable
Futures**

Dublin Office

Ormond House
Upper Ormond Quay
Dublin 7, Ireland
D07 W704

+ 353 1 400 4000
info@dbfl.ie
www.dbfl.ie

Cork Office

14 South Mall
Cork, Ireland
T12 CT91

+ 353 21 202 4538
info@dbfl.ie
www.dbfl.ie

Galway Office

Odeon House
7 Eyre Square
Galway, Ireland
H91 YNC8

+ 353 91 33 55 99
info@dbfl.ie
www.dbfl.ie

Waterford Office

Suite 8b The Atrium
Maritana Gate, Canada St
Waterford, Ireland
X91 W028

+ 353 51 309 500
info@dbfl.ie
www.dbfl.ie