Comhairle Contae Fhine Gall
Fingal County Council

Broadmeadow Way Proposed Greenway
Between Malahide Demesne and
Newbridge Demesne

Volume 2
EIAR - Main Text

May 2019

fingal.ie

Broadmeadow Way
Proposed Greenway Between Malahide Demesne and Newbridge Demesne

Environmental Impact Assessment Report Documents

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Volume 2: EIAR Main Text
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on behalf of
Fingal County Council

May 2019

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Donabate Local Area Plan 2016. Fingal County Council, March 2016.

Donabate Urban Centre Strategy. Fingal County Council, June 2010.

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Permanent and Temporary Preservation Orders (PO, TPO) maintained by the Department of Culture, Heritage and the Gaeltacht .

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Record of Protected Structures contained in appendices of Fingal Development Plan 2017-2023.

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Up-to-date oblique aerial photographs.

Glossary

AADT:	Annual Average Daily Traffic (expressed in vehicles per day).
ABP:	An Bord Pleanála.
CEMP:	Construction Environmental Management Plan.
CO:	Carbon Monoxide.
CO_2	Carbon Dioxide.
CPO:	Compulsory Purchase Order.
cSAC:	Candidate Special Area of Conservation.
CSO:	Central Statistics Office.
DART:	Dublin Area Rapid Transit.
dB(A):	Unit used to measure the intensity of sound. The "A" denotes that levels were "A" weighted".
DCCAE:	Department of Communications, Climate Action and Environment.
DCHG:	Department of Culture, Heritage and the Gaeltacht .
DECLG:	Department of Environment, Community and Local Government.
DEFRA:	Department for Environment Food & Rural Affairs (UK).
DETR:	Department of the Environment, Transport and the Regions (UK).
DMRB:	Design Manual for Roads and Bridges.
DTTAS:	Department of Transport, Tourism and Sport.
EIAR:	Environmental Impact Assessment Report.
EPA:	Environmental Protection Agency.
GHG:	Greenhouse Gases.
GSI:	Geological Survey of Ireland.
ha:	One hectare is equal to 10,000 square metres.
HGV:	Heavy goods vehicle.
Hz:	Hertz.
ICOMOS:	International Council on Monuments and Sites.
IEMA:	Institute of Environmental Management and Assessment.
IFI:	Inland Fisheries Ireland.
I-WeBS:	Irish Wetland Bird Survey.
km:	Kilometres.
kph:	Kilometres per hour.
$L_{A:}$	Denotes, measurements were made using the A- weighting network. The A-weighting represents the response of the human ear to sound.
$L_{A10,T}$	The noise level exceeded for 10% of the measurement over a period of time (T). This is normally used as a measure of road traffic noise.
$L_{A90,T}$	The A-weighted noise level exceeded for 90% of the measurement over a period of time (T). This is normally used to indicate background noise.
$L_{Aeq,T}$	The continuous equivalent A-weighted sound pressure level. This is an “average” of the sound pressure level over a period of time (T).
$L_{Amax,T}$	Is the maximum A-weighted sound level measured during a period of time (T).
$L_{Amin,T}$	Is the minimum A-weighted sound level measured during a period of time (T).
LAP:	Local Area Plan.
Luas:	Tram/light rail system in Dublin,
Luft:	TA Luft Guidance Technical Instructions on Air Quality Control.
LVIA:	Landscape and Visual Impact Assessment.
m bgl:	Metres below ground level.
NHA:	Natural Heritage Areas.
NIAH:	National Inventory of Architectural Heritage.

NIS: Natura Impact Statement.
NMI: National Museum of Ireland.
NMS: National Monuments Service.
NO_2: Nitrogen Dioxide.
NO_X: Nitrogen Oxides.
NPWS: National Parks and Wildlife Service.
NRA: National Roads Authority.
NSL: Noise Sensitive Location.
NTO: National Trails Office.
NTS: Non-Technical Summary.
OD: Ordnance Datum.
OPW: The Office of Public Works.
OSI: Ordnance Survey Ireland.
PM_{10}: Particulate matter measuring 10 micrometres or less in diameter.
$PM_{2.5}$: Particulate matter measuring 2.5 micrometres or less in diameter.
Pb: Lead.
PMGs: Project Management Guidelines.
pNHA: Proposed Natural Heritage Areas.
POWSCAR: Place of Work, School or College - Census of Anonymised Records.
RMP: Record of Monuments and Places.
RPS: Record of Protected Structures.
RSA: Road Safety Authority.
SAC: Special Area of Conservation.
SCI: Special Conservation Interests.
SI: Statutory Instrument.
SMR: Sites and Monuments Record.
SO_2: Sulphur Dioxide.
SPA: Special Protection Area.
SuDS: Sustainable Drainage System.
TII: Transport Infrastructure Ireland.
VDI: Verein Deutscher Ingenieure (Association of German Engineers).
VOC: Volatile Organic Compound.
WFD: Water Framework Directive.
WHO: World Health Organisation.
WWTP: Waste Water Treatment Plan.
ZVI: Zone of Visual Influence.

Environmental Impact Assessment Report
Main Text

1.0 Introduction

1.0.1 Fingal County Council proposes to develop the Broadmeadow Way, a new greenway (shared footpath and cycleway) between Malahide Demesne and Newbridge Demesne via the railway causeway across the Malahide Estuary (see Volume 3-Figure 1). The proposed greenway would be c. 6km in length. Much of the proposed greenway follows existing pathways and roads.

1.0.2 The application for consent from An Bord Pleanála is being made pursuant to the Planning and Development Acts 2000, as amended (PDA 2000), specifically:

- Development by a Local Authority requiring: Environmental Impact Assessment (Part X of PDA 2000); Appropriate Assessment (Part XAB of PDA 2000); Local Authority own development (Part XI of PDA 2000)
  - Environmental Impact Assessment: Section 172(1) of the PDA 2000 read with section 172(1A)(a) of the PDA 2000 and section 175(2) of the PDA 2000
  - Appropriate Assessment: Section 177S(2)(h) of the PDA 2000 and section 177AE(2) of the PDA 2000.

1.0.3 The project also proposes developments on the foreshore and as such the following is also applicable:

- Local Authority foreshore development (section 226 of Part XV of PDA 2000)
  - Environmental Impact Assessment: Section 172(1) of the PDA 2000 read with section 172(1A)(a) of the PDA 2000 and section 226(1) of the PDA 2000
  - Appropriate Assessment: Section 177S(2)(h) of the PDA 2000.

1.0.4 As a Local Authority own development, the project was Screened for the Requirement for EIA in accordance with Article 120 of the Planning and Development Regulations 2001, as amended (PDR 2001) for Sub-threshold Environmental Impact Assessment Report (EIAR), and with regard to the criteria set out in Schedule 7 and the information required as set out in Schedule 7A of the PDR 2001.

1.0.5 In accordance with Article 120(1) of the PDR 2001, the Screening for the requirement for EIA concluded that there is significant and realistic doubt in regard to the likelihood of significant effects on the environment arising from the proposed development, and having reviewed the criteria set out in Schedule 7 and the information specified in Schedule 7A of the PDR 2001, determined that the development would be likely to have such effects and required the preparation of an EIAR in respect of the development.

1.0.6 This document is an Environmental Impact Assessment Report (EIAR) prepared on behalf of Fingal County Council to support a planning application to An Bord Pleanála. The EIAR was prepared having regard to the *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)* (EPA, 2017), and *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015).

1.0.7 The EIAR is presented in four volumes as below:

- Volume 1 – Non-Technical Summary.
- Volume 2 – EIAR Main Text.
- Volume 3 – EIAR Drawings and Figures.
- Volume 4A – EIAR Appendix 1.
- Volume 4B – EIAR Appendix 2.
- Volume 4C – EIAR Appendices 3-18.

1.0.8 General guidance and legislation applicable to the preparation of this EIAR is set out in the preamble pages vi to viii. A glossary of terms is provided on pages ix to x.

1.0.9 Baseline environmental information and key constraints for the study area are identified in an Environmental Constraints Report (see Volume 4A). An Environmental Route Options Report was also prepared (Volume 4B).

1.0.10 This document is laid out in sections which consider the subject areas of environmental impact assessment, such as:

(a) Policy Background and Alternatives.
(b) Project Description.
(c) Traffic and Transportation.
(d) Population and Human Health.
(e) Biodiversity.
(f) Land and Soil.
(g) Water.
(h) Air and Climate.
(i) Noise and Vibration.
(j) Material Assets.
(k) Archaeology and Cultural Heritage.
(l) Architectural Heritage.
(m) Landscape.
(n) Interaction between the factors referred to in points (c) to (m).

1.0.11 The relationship between prescribed environmental factors and chapter headings of the EIAR is shown in Table 1.1 below:

Table 1.1 Relationship Between Prescribed Environmental Factors and Chapter Headings of EIAR.

Environmental Factor	Heading	Chapter
Material Assets	Material Assets Traffic and Transportation	Chapter 11 Chapter 4
Landscape	Landscape	Chapter 14
Population & Human Health	Population and Human Health	Chapter 5
Cultural Heritage	Archaeology & Cultural Heritage Architectural Heritage	Chapter 12 Chapter 13
Biodiversity	Biodiversity	Chapter 6
Water	Groundwater Aquatic Environment	Chapter 8 Chapter 8
Lands & Soils	Lands and Soils	Chapter 7
Air & Climate	Air and Climate	Chapter 9
Noise & Vibration	Noise and Vibration	Chapter 10

1.0.12 Each of the subject sections (e.g. biodiversity, cultural heritage, etc) firstly reviews the existing situation (baseline), predicts the effects of the development on the particular aspect (impact) and outlines measures to reduce or remove any significant negative impacts (mitigation).

1.0.13 Baseline information was collected for each of the subject areas listed above from a combination of existing literature, consultations and site surveys. This information forms the basis on which the assessment of the environmental impact of the proposed development is carried out.

1.0.14 Where adverse effects were identified, appropriate mitigation has been put forward. Modifications were made to the layout of the development to accommodate environmental constraints. In addition, in areas where opportunities for environmental enhancement have been identified, suitable measures have been put forward.

1.0.15 Notwithstanding the presentation of information under individual headings, a number of aspects do interact with one another. Interactions between aspects are considered within the relevant section. A summary of interactions, cumulative impacts and a schedule of environmental commitments are also provided in Chapters 15 and 16 of the EIAR respectively.

1.0.16 No difficulties were encountered in the assembly of the information in this environmental impact study which have precluded the ability to assess the potential significant impacts of the development.

1.1 Environmental Impact Team

1.1.1 Table 1.2 below identifies the environmental team members who prepared this EIAR and their contribution to individual sections, including Chapters 15 and 16.

Table 1.2 Environmental team members.

Discipline	Years Experience	Consultant	Qualifications
EIAR Project Management	30+	Michael O'Sullivan CHE Ltd	BSc(Hons), MSc(cum laude), Dip EIA Mgt, HDip Env Eng, DLAW, BCL(Hons), MIEMA, CEnv
Traffic & Transportation	30+	Pat Davis Clifton Scannell Emerson Associates	DipEng, MIEI BSc Civil Engineering, MIEI
	40+	Geoff Emerson Clifton Scannell Emerson Associates	BE, CEng, MICE, MASCE, MCIWEM, FConsEI
Landscape	30+	Neil Chapman Architectural Landscape Consultant	dipLA, MLI
Population & Human Health	20+	Craig Bullock Optimize	PhD, MSc, BA, DipEIA
Archaeology & Cultural Heritage	30+	Sheila Lane, Lane Purcell Archaeology	BA, HDip, MA
	20+	Avril Purcell Lane Purcell Archaeology	BA, MA, MIAI

Discipline	Years Experience	Consultant	Qualifications
Architectural Heritage	20+	Anna-Maria Hajba Architectural Heritage Consultant	MSc, MA Cultural History, MA English, BA Art History
Land & Soil Water (Groundwater)	15+ 30+	Áine McElhinney IE Consulting Jer Keohane IE Consulting	BSc, MSc, MIAH, IAEG BSc, MSc, FCIWEM, C.Geol, MIEI
Water (Aquatic Environment)	30+	Ger Morgan Aquatic Services UCC	BSc, MSc
Material Assets (Agronomy)	40+	Con Curtin Curtin Agricultural Consultants Ltd	BAgrSc
Biodiversity (Terrestrial Habitat)	25+	Mary O'Connor Ecological Consultant	BSc(Hons), PhD
Biodiversity (Birds & Mammals)	20+	Gavin Fennessy Ecology Ireland	BSc, PhD, MIEEM, MESAI
Air & Climate	20+	Edward Porter AWN Consulting	C Chem MRSC MIAQM MIEnvScc
Noise & Vibration	20+	Damian Kelly AWN Consulting	BSc(Hons), MSc, MIOA

1.2 Stakeholder Consultation

1.2.1 As part of the process for the construction of the proposed development, Fingal County Council hosted a public consultation in February and March 2014, at which the proposed development was presented for discussion and comment to the public. Statutory consultees together with local interest groups in Malahide, Donabate and Swords were contacted and notified of the event. The exhibition was open to the public from 14th February 2014 to 14th March 2014 inclusive and ran concurrently in three venues:

- Malahide Public Library.
- Donabate/Portrane Community Centre.
- Fingal County Hall.

1.2.2 Representatives of Fingal County Council, design staff from Clifton Scannell Emerson Associates Ltd, and environmental specialists from Creagh House Environmental Ltd were in attendance during open evenings on 25th February in Malahide and on 5th March in Donabate.

1.2.3 Public display drawings showing the route options and the emerging preferred route were on display at all three locations. A public consultation brochure and questionnaire was also available.

1.2.4 One hundred and one questionnaires were returned to Fingal County Council by the stated deadline of 28th March 2014. In addition, 30 written submissions were received from interested parties. See Volume 4B-Chapter 9-Non-Statutory Public Consultation for review.

1.3 Constraints and Route Options

1.3.1 The study area of c. 12km^2 is as outlined in red in Volume 4A (Appendix J-Figure 1). The key parts of the study area include Malahide Demesne, Malahide village, the railway causeway across Malahide Estuary, Kilcrea townland, and Newbridge Demesne. Each of these parts has been described appropriately in the Constraints Report for each of the environmental constraint elements (Volume 4A).

1.3.2 A number of route options were identified within Malahide village (existing hardtop area) and Kilcrea townland (agricultural area) (see Volume 4B-Appendix H-Figures 2, 3, 4 and 5B). The routing in the other parts of the scheme is reasonably fixed; however, design options were also considered for these (Volume 4B). A summary of the environmental appraisal of options is presented in Chapter 2 of this EIAR.

1.4 Flood Risk Assessment

1.4.1 A flood risk assessment report is included in Volume 4C-Appendix 17. Eighty-six percent of the proposed scheme lies within Flood Risk Zone B and C. Fourteen percent of the scheme lies within Flood Risk Zone A. Zone A locations are in the vicinity of Bissets Strand and at Kilcrea. The Broadmeadow Way has been classified as 'less vulnerable development' for the purposes of the Flood Risk Assessment. The design approach has been to align to near or at existing ground levels in the Flood Zone A locations. The preliminary design of crossings of the River Pill have utilised best available information and allowed for climate change. A Section 50 application has been submitted to the OPW with respect to the bridge crossings of the River Pill and the Council will comply with OPW requirements in this regard.

1.4.2 Fingal County Council as part of its adverse weather emergency preparation has in place arrangements to receive early weather warnings from Met Éireann and put in place controls to mitigate hazards when operating during adverse/inclement weather. These controls consist of a major emergency plan; a severe weather plan; flood emergency response plan; risk assessment for working in adverse/inclement weather; and winter service plans. Risk assessment registers are contained in the relevant ancillary safety statement.

1.4.3 The design of the route, the implementation of adverse weather emergency responses by the Council and the alignment of the scheme that facilitates users to return to their starting point will ensure the safety of users of the proposed Broadmeadow Way.

1.5 Malahide Railway Viaduct

1.5.1 The viaduct carries part of the main Dublin to Belfast rail line across Malahide Estuary in north Co. Dublin. The rail bridge is approximately 180m in length with the remainder of the crossing constructed on embankment. The line carries around ninety trains, including commuter services and heavy freight, each day.

1.5.2 The present rail bridge is the third such structure at this site. The first was a timber-built construction for the Dublin and Drogheda Railway in 1844. This bridge was replaced in 1860 due to safety concerns with a new structure of wrought iron spans on masonry piers. Larger locomotives and rolling stock required significant bridge strengthening in the 1930s. Corrosion of the wrought iron was such that the spans were fully replaced from 1966-1968 when the modern concrete structure was constructed.

1.5.3 The eleven piers of the Malahide viaduct were constructed on top of the 18th century stone weir. The integrity of the weir is therefore vital to the stability of the bridge and also performs a key function in maintaining the water levels and the ecological conservation value of the inner estuary.

1.5.4 On the 21st August 2009 part of the rail bridge crossing the Malahide Estuary collapsed. Scouring of the pier-bases, caused by the strong tidal flows through the viaduct, led to the sudden collapse of a pier together with the two adjacent bridge spans. The design of the viaduct meant that the piers did not go down to the bedrock but instead joined with an underlying man-made causeway. The causeway between Piers 4 and 5 was particularly badly eroded. The replacement Pier 4 was constructed on piles and the remaining piers were retrofitted with piles. To facilitate bridge reinstatement, works and maintenance, an access route was constructed from Bissets Strand at Malahide to the weir. The rock armouring to the northeastern boundary of the railway causeway across the estuary was also reinforced.

1.5.5 At the time, Irish Rail commissioned an extensive programme of water level and water flow surveying (i.e. hydrographical surveying) to provide ongoing information on the estuary bed levels close to the weir, and on the weir itself while works were being carried out. This survey work extended to the M1 motorway bridge at the western end of Malahide Estuary. Specialist tidal modelling was carried out post works (to weir, embankments and safety access track) to inform and control the water levels in the inner estuary across the entire tidal range to maintain its ecological conservation value (McKeogh & Bekic, 2010, 2011 and 2012).

1.5.6 Given the open rock armour nature of the weir, and extremely high velocities of flood and ebb tides through each span of the viaduct, there is a need for continuous monitoring and inspection of the weir structure. Consequently, to meet the needs of the Railway Safety Act 2005, there is a requirement to continue the use of the weir maintenance track from Bissets Strand for inspection, routine maintenance and repair.

1.5.7 Detailed ecological monitoring has been carried out at Malahide Estuary commencing shortly after the bridge collapse and continuing throughout and in the aftermath of the remedial works on the viaduct. Regular surveys of the bird numbers and distribution in Malahide Estuary have continued from 2009 to 2018. These surveys have generated a large quantity of high resolution data that describes in detail the usage of both the inner and outer estuary by waders and wildfowl throughout the year.

1.5.8 The Broadmeadow Way would utilise the Irish Rail weir maintenance access track between Bissets Strand and the weir. The route would bridge the weir on the existing bridge piers to the west of the rail viaduct and continue northwards on the northwestern shoulder of the railway causeway to Kilcrea.

1.6 Risk of Major Accident and/or Disasters

1.6.1 An assessment of the likely significant adverse effects on the environment arising from the vulnerability of the proposed project to risks of major accidents and/or natural disasters is considered in detail in Volume 4C-Appendix 18 of this EIAR.

2.0 Policy Background and Alternatives

2.1 Introduction

2.1.1 This chapter considers the development plan policy objectives which support the proposed development and provides a summary of the options and alternatives considered in the design of the proposal.

2.2 Planning and Amenity Context

2.2.1 There is a clear planning policy context for the proposed cycle/walkway (Greenway) at national level to local level.

National Level

National Planning Framework (NPF)

2.2.2 National Policy Objective 22 encourages cycle networks through the facilitation of the development of a National Greenways/Blueways Strategy which prioritises projects on the basis of achieving maximum impact and connectivity at national and regional level. The development of a greenway between Malahide Demesne and Newbridge Demesne Regional Parks will facilitate a wider network of greenways and provide access between rural and urban areas for both tourist related activities and commuting.

2.2.3 National Policy Objective 27 facilitates healthy communities through the provision of alternative means of transport to the car and states:

> "Ensure the integration of safe and convenient alternatives to the car into the design of our communities, by prioritising walking and cycling accessibility to both existing and proposed developments, and integrating physical activity facilities for all ages."

2.2.4 The NPF notes that countries with extensive cycle infrastructure report higher levels of cycling and lower rates of obesity. Healthy places in turn create economic value by appealing to a skilled workforce and innovative companies.

2.2.5 The NPF also indicates that Ireland's future homes will be located in places that can support sustainable development 'places which support growth, innovation and the efficient provision of infrastructure, are accessible to a range of local services, can encourage the use of public transport, walking and cycling, and help tackle climate change'. The contribution to a cleaner environment, including air quality, of cycling is recognised.

2.2.6 Cycling is recognised as part of smart growth, enhanced regional accessibility, sustainable mobility and an enhanced urban amenity which are all targeted national strategic outcomes of the NPF. Building centres of scale is intended to be achieved through Metropolitan Area Strategic Plans formulated through the new Regional Spatial and Economic Strategies. The NPF outlines high-level and long term strategic development issues for the MASPs areas including:

- physical development patterns and strategic growth areas.
- strategic infrastructure, particularly in the transportation and water services areas.
- large scale regeneration and the location of housing and employment.
- metropolitan scale amenities such as regional parks and walking and cycling networks.

2.2.7 It is intended that MASPs will align with and inform national-level sectoral investment plans to guide and coordinate investment within the metropolitan areas, coordinating land use planning and strategic infrastructure.

Our Sustainable Future – A Framework for Sustainable Development for Ireland

2.2.8 The Framework for Sustainable Development in Ireland, which was launched in June 2012, identifies some 70 measures to be implemented across Government and tasks a High-Level Inter-Departmental Group with ensuring that the vision set out in the policy document is translated into clear and effective action. One of the key areas of focus is transport. The 2015 Progress Report, charting the progress of the measures, noted that cycling in Dublin is increasing year on year with a near 50% increase in cycling journeys between 2012 and 2015 observed in the Dublin City Centre Cycle Count carried out by DCC in May each year.

Sustainable Residential Development in Urban Areas (2009)

2.2.9 These section 28 guidelines outline the approach to be taken to sustainable residential development and prioritise walking, cycling and public transport, and the need to minimise the use of cars as a shared goal. The guidelines encourage developers to design in public transport, walking and cycling, making places more friendly to people movement rather than vehicle movement.

Smarter Travel – A Sustainable Transport Future: A New Transport Strategy for Ireland 2009-2020

2.2.10 In February 2009, the Smarter Travel Policy document for achieving a sustainable transport system for Ireland was published, this document outlines a number of policies to encourage a modal shift away from private car use and promoting public transport, walking and cycling.

National Cycle Policy Framework 2009-2020

2.2.11 In April 2009, Ireland's first National Cycle Policy Framework (NCPF) was issued; the vision of the policy is:

> "All cities, towns, villages and rural areas will be bicycle friendly. Cycling will be a normal way to get about, especially for short trips".

2.2.12 The aim of this framework is to encourage a culture of cycling to the extent that by 2020, some 10% of all trips will be completed by bicycle.

Strategy for the Development of Irish Cycle Tourism, 2007

2.2.13 Fáilte Ireland's document highlights the need for renewing the popularity of cycling in Ireland and how tourism generated through this sector can increase visitor spending in rural and urban areas. Guidance is also given on the types of roads suitable for a national cycle network along with the provision for facilities which support and encourage cycling as a mode. In the context of developing cycling infrastructure and to make Ireland a more attractive destination for cycling, key objectives include the provision of safe and attractive cycling routes with associated services and facilities.

Irish Trails Strategy

2.2.14 The Irish Trails Strategy was launched in January 2007 and aims to develop a world class recreational trail system in Ireland for all Irish citizens and visitors to the country to enjoy. This strategy lead to the establishment of a National Trails Advisory Committee (NTAC) and the setting up of a National Trails Office within the Irish Sports Council. The NTO have published a number of publications setting out the requirements and standards for trail development in Ireland. Relevant documents include, A 'Guide to Planning and Developing Recreational Trails in Ireland', 'Classification and Grading for Recreational Trails' and 'Management Standards for Recreational Trails'. The NTO website includes a register of a wide range of trails on offer throughout the country from strategic to local level trails. Trails which fully meet NTO standards are NTO accredited trails.

Climate Action and Low Carbon Development Act, 2015

2.2.15 The Act establishes the national objective of transitioning to a low carbon economy, climate resilient and environmentally sustainable economy. It includes the preparation of five yearly National Low Carbon Transition and Mitigation Plans. Agriculture, transport, energy and the built environment are the main targets for mitigation effort. Local Authority climate change adaptation and mitigation strategies will also be required which, when completed, will form part of county development plans.

Regional Policy

Regional Spatial and Economic Strategy (RSES) & Metropolitan Area Strategic Plan (MASP)

2.2.16 The RPGs are due to be replaced by the new Regional Spatial and Economic Strategies for the regions during 2019. At the time of writing, the Eastern & Midland Regional Assembly RSES was at public display of material amendments stage. The new regional plan for the region which will set out a long term strategic planning and investment strategy for the Dublin area and surrounding counties and Midlands area to 2031 and beyond. Included in this draft RSES is a 12 year horizon Metropolitan Area Strategic Plan (MASP) for Dublin, which will give greater analysis and detail of how the overall objectives and policies of the NPF and RSES will be implemented. The MASP identifies key strategic residential and employment development corridors, large scale regeneration areas, linked to quality public transport with key services infrastructure investment required to support growth and key investments in amenity and community resources, to create sustainable compact communities.

2.2.17 Section 5.6 of the MASP identifies cycling and walking as a key element in promoting and creating healthier places, mitigating climate change and facilitating tourism and metropolitan scaled amenities such as strategic cycling networks having regard to the NTA Greater Dublin Area Cycle Network Plan. Specifically, the MASP promotes the development of a Metropolitan Greenway Network, a strategic network of connected greenways for cycling and walking to enable access to key environmental assets within the Metropolitan area, including coastal areas, while having regard to the environmental sensitivities of the area.

Regional Planning Guidelines for the Greater Dublin Area 2010-2022 (due to be replaced by RSES)

2.2.18 This document provides the development strategy for the Dublin and Mid-East regions over the plan period. It emphasises the role of the capital city in future economic growth of the region and the need to ensure it is an attractive, vibrant location for industry, commerce, recreation and tourism. Development in the GDA (Greater Dublin Area) shall be directly related to investment in high quality public transport and focused on achieving a compact urban form.

2.2.19 The strategy considers that a minimum of 10% of all trips should be by bicycle by 2020. It emphasises the integration of cycle routes and infrastructure into new development and communities as key component of the delivery of greener transport travel patterns. Programmes to support this objective and create a culture of cycling should be pursued as well as promoting the tourism benefits of improved cycle networks within the GDA.

2.2.20 Specifically, the RPGs fully support the development of coastal paths along the east coast of the GDA. Section 7 'Green Infrastructure, Heritage and Environment' seeks to:

- Increase opportunities and ease of access to countryside and areas of interest for residents, wildlife and biodiversity, with focus on promoting river corridors, Natura sites, nature preserves and other distinctive landscapes and regionally important green spaces as focal features for linkages between natural, semi -natural and formalised green spaces.
- Development of targeted walkways and cycleways, integrated as part of opportunities for other projects such as river restoration, biodiversity enhancement as part of process of strengthening connectivity between green spaces and strategic linkages between urban settlements and countryside.
- Promote and facilitate the development of coastal paths along the east coast of the GDA, joining up with existing recreational paths, creating new linkages between and extensions to existing facilities where feasible. Development Plans should include a goal to facilitate the development over time of a coastal path for the entire GDA which would include a habitat impact assessment and the need to avoid negative impacts on Natura 2000 sites, and careful route selection, linking and expanding into adjoining Regional Authority areas and integrated into future coastal zone management plans for the area.
- Encourage development of green bridges over existing physical transport barriers and require their inclusion in future infrastructure investments. Retrofitting projects should be phased and prioritised to repair fragmentation caused by grey infrastructure.

2.2.21 These objectives and particularly the latter are of particular relevance to the development of the proposed greenway along this stretch of coastal corridor where the majority of the route is aligned with the Dublin-Belfast railway line.

Transport Strategy for the Greater Dublin Area, 2016-2035

2.2.22 This document was published by the National Transport Authority in 2016 with its purpose being:

> "...to contribute to the economic, social and cultural progress of the Greater Dublin Area by providing for the efficient, effective and sustainable movement of people and goods."

2.2.23 The plan provides the transport strategy for the Greater Dublin area to 2035. It highlights the need to integrate land use and transport planning in achieving a consolidated urban area supported by non-private vehicle movement. The environment for pedestrians and cyclists needs to be improved to encourage a much greater proportion of trips to be made on foot, by bicycle or public transport. Dublin is to become a recognised walking and cycling city-region with a street environment that is attractive, safe and pedestrian/cyclist orientated in design.

Greater Dublin Area Cycle Network Plan

2.2.24 The Greater Dublin Area Cycle Network Plan was published by the NTA in 2013 and sets out the proposed cycle network in the Greater Dublin Area. The proposed route is identified as a greenway route FG1 and a strategic route intercounty N5-Future East Coast Trail. This results in the proposed route needing to cater for both commuter and leisure users with a design that can accommodate both in a satisfactory manner. The NTA Cycle Manual 2011 set outs the required standards for cycleway facilities.

Fingal County Development Plan 2017-2023

2.2.25 A coastal walk is a long standing objective of Fingal County Council. The County Development Plans 2011-2017 and 2017-2023 fully support the development of a greenway between Malahide and Donabate called the Broadmeadow Way.

Map Objective 39

2.2.26 Seek the provision of a public walkway/cycleway on land west side of the train line in Donabate and along the existing embankment across the Malahide Estuary, in consultation with Iarnród Éireann within the lifespan of the Development Plan.

Map Objective 43

2.2.27 Completion of the Broadmeadow Way between Malahide and Donabate to be prioritised during the lifetime of the Development Plan.

Objective MT13

2.2.28 Promote walking and cycling as efficient, healthy, and environmentally-friendly modes of transport by securing the development of a network of direct, comfortable, convenient and safe cycle routes and footpaths, particularly in urban areas.

Objective MT14

2.2.29 The Council will work in co-operation with the NTA and adjoining Local Authorities to implement the *Greater Dublin Area Cycle Network Plan* subject to detailed engineering design and the mitigation measures presented in the SEA and Natura Impact Statement accompanying the NTA Plan.

Objective GI28

2.2.30 Provide attractive and safe routes linking key green space sites, parks and open spaces and other foci such as cultural sites and heritage assets as an integral part of new green infrastructure provision, where appropriate and feasible.

2.3 Route Option Analysis

Introduction

2.3.1 The project is a proposed pathway/cycleway (greenway) between Malahide Demesne and Newbridge Demesne in Fingal (see Volume 4B-Route Options Report Figure 1).

2.3.2 Baseline environmental information and key constraints for the study area are identified in the Constraints Report for this project (see Volume 4A-Constraints Report).

2.3.3 The approach to the Route Options Report is broadly in line with TII (formerly NRA) planning guidance on road developments, both in terms of documents prepared and individual sectoral guidance notes.

Study Area

2.3.4 The study area of c. 12km^2 is as outlined in red on Figure 1. The key parts of the study area include Malahide Demesne, Malahide village, the railway causeway across Malahide Estuary, Kilcrea townland, and Newbridge Demesne. Each of these parts has been described appropriately in the Constraints Report for each of the environmental constraint elements.

2.4 Preliminary Options

2.4.1 A preliminary examination was conducted on the potential for the greenway to link Malahide Castle and Newbridge House via Swords along the southern and northern edges of the Malahide Estuary, respectively. This route was discounted at an early stage of the assessment, for the following reasons:

- A greenway routed through Swords, rather than across the estuary, would double the proposed length from 5.5km to 11.5km.
- Provision of a 4m wide greenway along Caves Road and the Old Yellow Walls Road would not be possible due to the inability to widen these roads at either side.
- The access road from Spittal Hill Road to the Kilcrea Road on the northern side of the estuary is tidal (i.e. the access link is under water at high tide).
- The Kilcrea Road is a narrow public road with a number of private houses on both sides and an equestrian centre at its southern end. The level of traffic on the road would preclude the road being used as a shared car/pedestrian/cycle route. Spatial restrictions on either side would also make the widening of the road difficult and expensive.
- An option would be to continue along the northern estuary to the railway line. Again, this would require greenway construction on the bank above the shingle beach to the railway line. This option would add 2.0km to the route for no advantage.

2.5 Options

2.5.1 There are a number of route options within Malahide village (existing hardtop area) and Kilcrea townland (agricultural area) (see Volume 4B-Route Options Report Figures 2, 3, 4 and 5 also reproduced below for ease of reference as Text Figure 2.1 to Text Figure 2.5). The routing in the other parts of the scheme is reasonably fixed; however, design options are considered for these also. For presentation purposes, the route

options at Malahide and Kilcrea are considered separately. The framework for the route option assessment is set out below.

Reporting Framework for Options

Section 1 – Malahide Demesne

2.5.2 This includes Options 1 to 6, on existing pathways (see Volume 4B-Route Options Report Figure 3). All options commence at the main car park at Malahide Castle and end at the Malahide-Dublin Road. The routes are physically fixed; however, options exist as to detailed design of greenway surface and signage.

Section 2 – Malahide-Dublin Road

2.5.3 This includes Options 1 to 5 (see Volume 4B-Route Options Report Figure 3). This section extends from the junction of the Malahide-Dublin Road with Yellow Walls Road to the west to its junction with Old Street to the east. To the north and south it is defined by boundary walls adjacent to existing footpaths.

Section 3 – Malahide Village

2.5.4 This includes Options 1 to 5, all existing hardtop options (see Volume 4B-Route Options Report Figure 3). All options commence on the north side of the Malahide-Dublin Road and end at Bissets Strand. Regardless of option, signage would be provided from Malahide railway station and railway bus stop to the greenway.

Section 4 – Railway Causeway

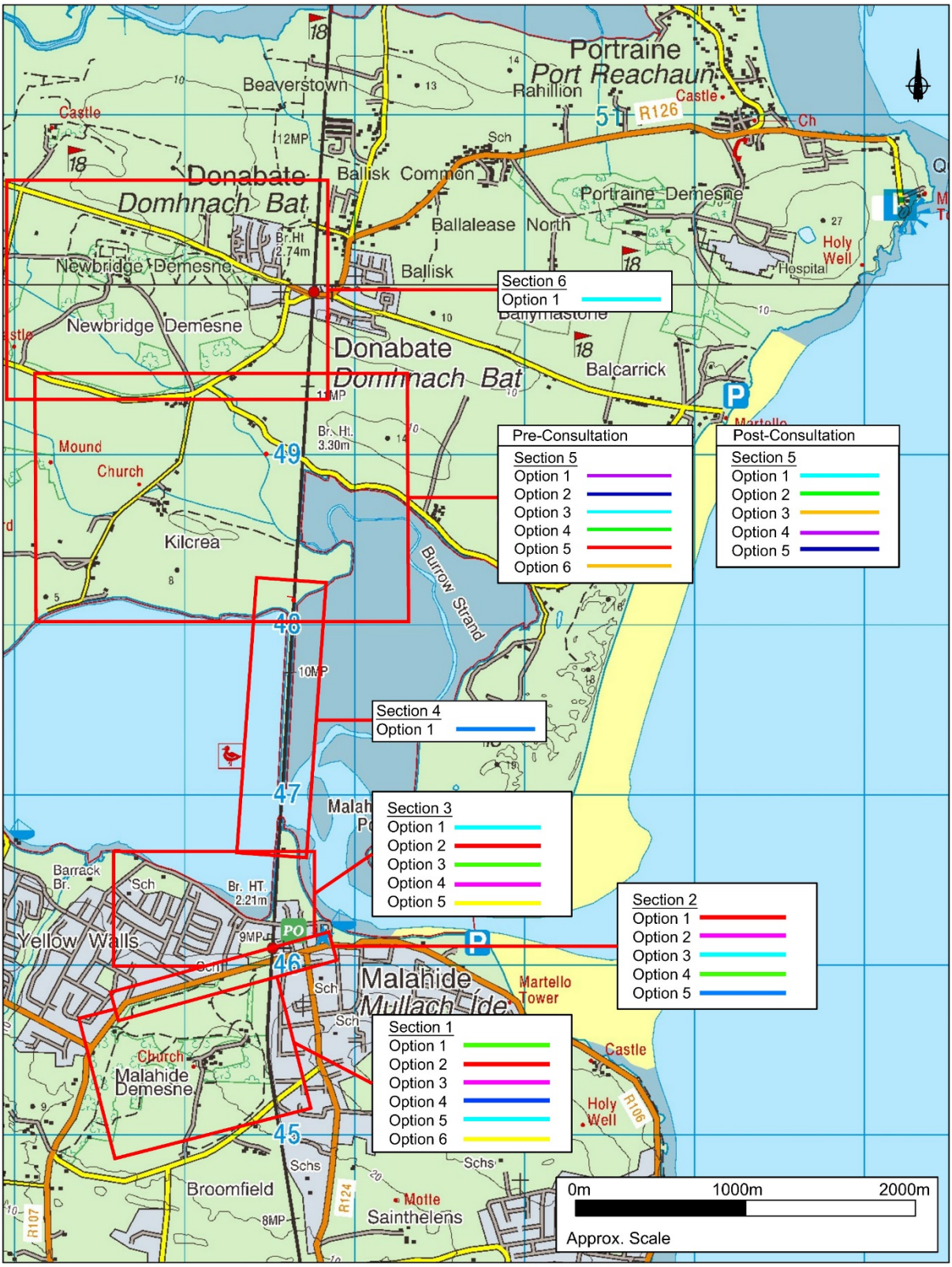
2.5.5 All options follow the existing western embankment of the railway causeway across Malahide Estuary and make use of the existing piers at the causeway weir (Volume 4B-Route Options Report Figure 4). This route is physically fixed; however, options exist as to detailed design of greenway surface and any barriers to protect the greenway on its western and eastern margins.

Section 5 – Kilcrea Townland

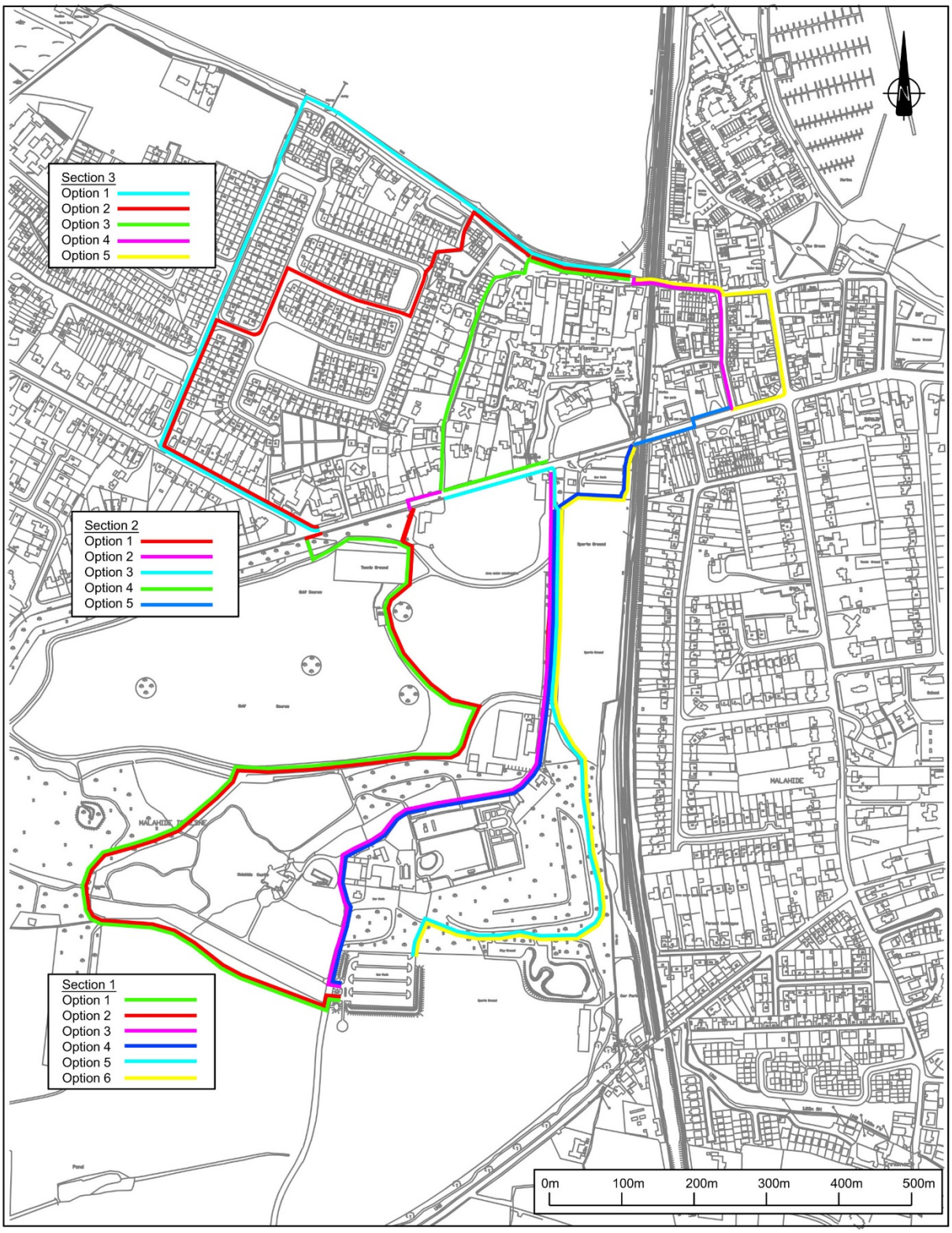
2.5.6 This is the only “new build” section of the route across agricultural land. There are six options here (Volume 4B-Route Options Report Figure 5A). The options commence on the northern shore. The options terminate at the gate of Newbridge Demesne. The Options Report considers the greenway in the absence of the proposed Donabate bypass; however, detailed design has included the integration of the bypass with the greenway at this location. Environmental route analysis was carried out on six routes through Kilcrea (see Volume 4B). The emerging preferred route was presented at public consultation stage. As an outcome of the public consultation it was agreed that route options would be reviewed to minimise severance for landowners. As a consequence, five routes were examined from an environmental perspective post public consultation (Volume 4B-Route Options Report Figure 5B).

Section 6 – Newbridge Demesne

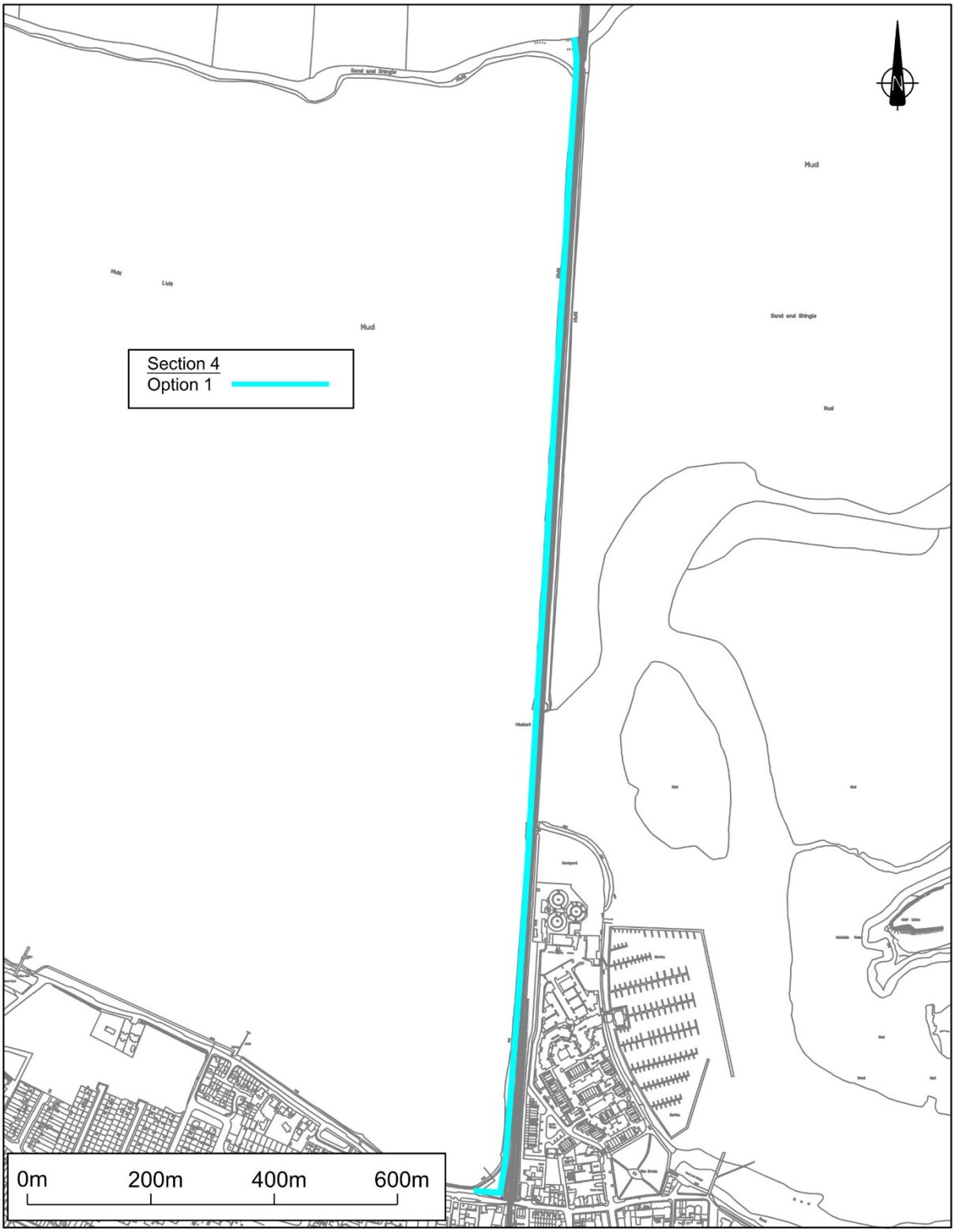
2.5.7 This is the most northerly section of the project. The principal route ends at the car park in front of Newbridge House (Volume 4B-Route Options Report Figure 5A). A subsidiary link is provided within the demesne to the railway station in Donabate. As per Section 4 – Railway Causeway, there are no physical options here; however, there are design issues to be considered.



Text Figure 2.1. Key Plan for Sections 1 to 6.



Text Figure 2.2. Sections 1, 2 and 3.



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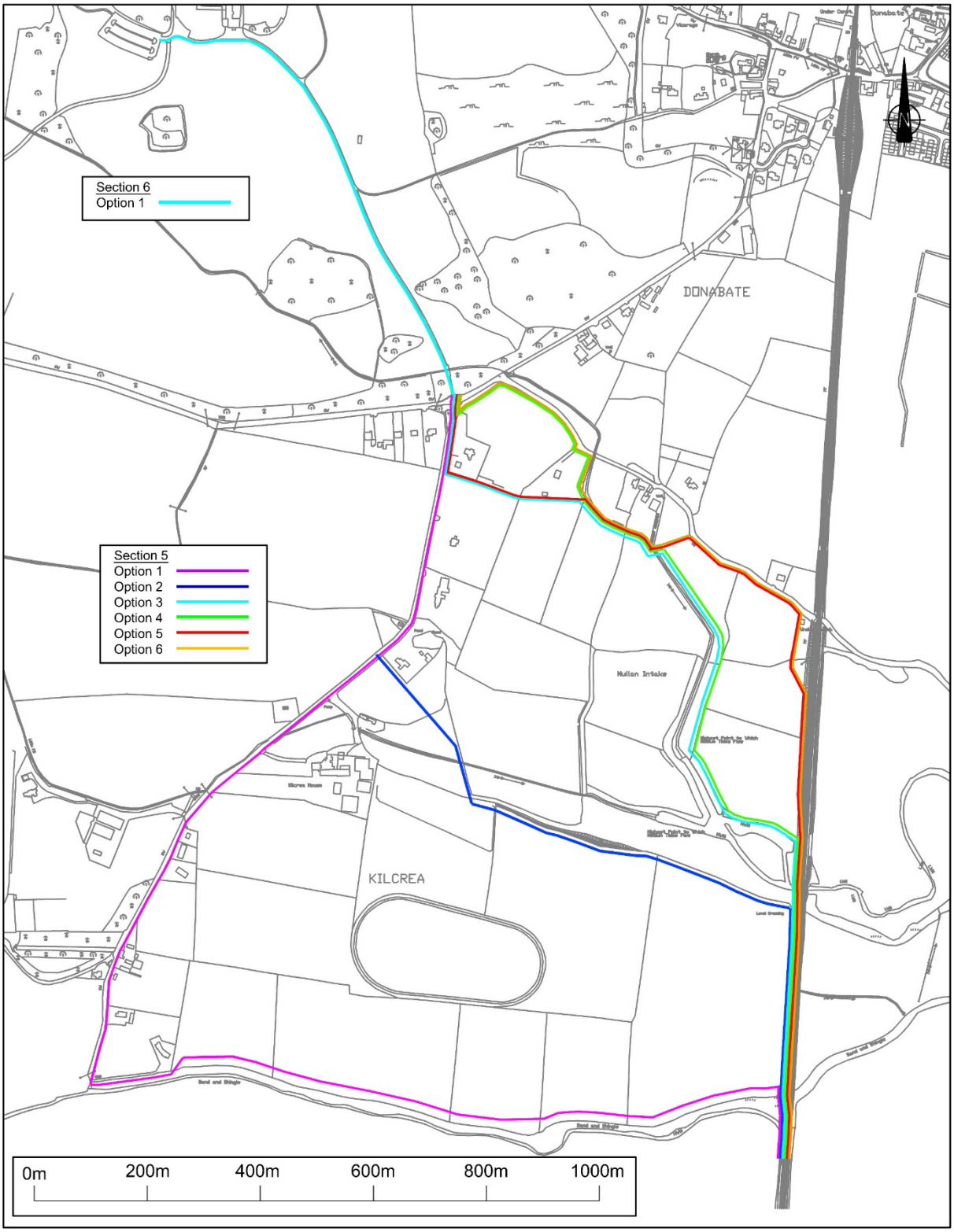

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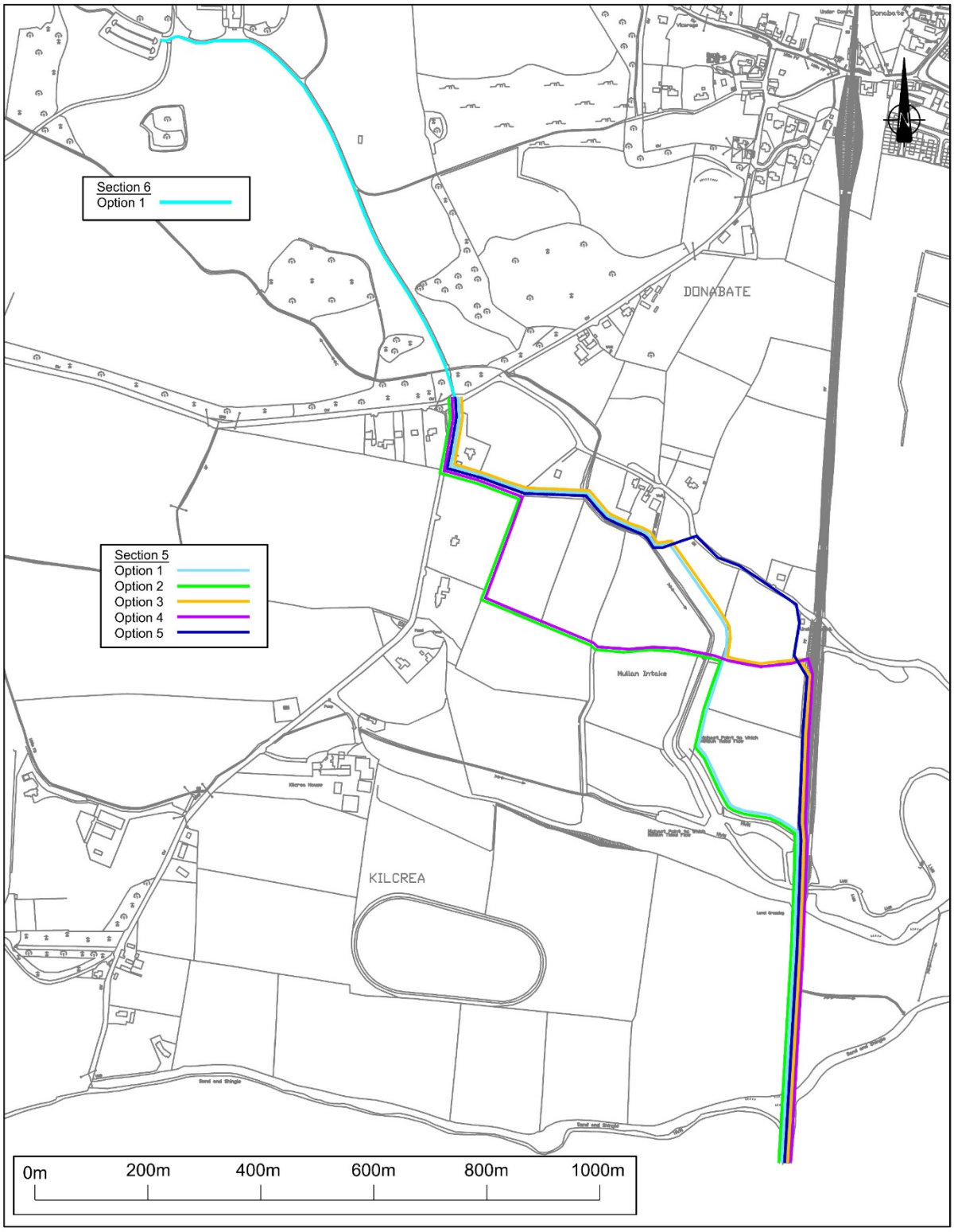


Text Figure 2.5. Sections 5 and 6 Post-Consultation.

Environmental Elements

2.5.8 The route options and implications for a suite of environmental topics are considered in Volume 4B-Route Options Report. The number of environmental topics considered for each section is identified in Table 2.1 below. Section 12 of the Route Options Report considers a summary of the option analysis and indicates a rank order of option preference (see also Table 2.1 to Table 2.13 below).

Table 2.1 The number of options and relevant environmental topics.

Section	Number of Options	Number of Environmental Topics
1	6	9
2	5	7
3	5	9
5	5	11

Environmental Preferences

2.5.9 In assessing preference of options, each contributor has utilised the framework as outlined in Table 2.2 below.

Table 2.2

Preference Type	Single Option	Multiple/All Options
Most Preferred	An option which is considered to have a positive or no material negative effect on environmental attribute.	If multiple/all options have a positive or no material negative effect upon an environmental attribute, then multiple/all options should be identified as most preferred.
Preferred	An option which is considered to have a minor negative effect upon an environmental attribute.	If multiple/all options have a minor negative effect upon an environmental attribute, then multiple/all options should be identified as preferred.
Acceptable	An option which is considered to have a moderate negative effect upon an environmental attribute.	If multiple/all options have a moderate negative effect upon an environmental attribute, then multiple/all options should be identified as acceptable.
Least Acceptable	An option which is considered to have a potentially significant negative effect upon an environmental attribute.	If multiple/all options have a potentially significant negative effect upon an environmental attribute, then multiple/all options should be identified as least acceptable.

Summary of Option Analysis

2.5.10 Each contributor has utilised the preference framework as set above. The summary of preferences in Table 2.3 reflects this approach. The preference order is based on the summation order given to the environmental topic assessments. The ultimate emerging preferred route is highlighted in yellow in all tables.

Table 2.3 Summary Table of Preferences (N/A = Not Applicable).

	Landscape	Population and Human Health	Architectural Heritage	Archaeology & Cultural Heritage	Land, Soils and Groundwater	Surface Water	Material Assets Agronomy	Biodiversity – Habitat and Botanical	Biodiversity – Birds and Mammals	Air Quality and Climate	Noise and Vibration
Section 1 – Malahide Demesne											
Option 1 – Green	Preferred	Acceptable	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Option 2 – Orange	Preferred	Acceptable	Preferred	Most Preferred	Most Preferred	N/A	N/A	Preferred	Most Preferred	Most Preferred	Most Preferred
Option 3 – Pink	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Option 4 – Blue	Most Preferred	Most Preferred	Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Option 5 – Cyan	Preferred	Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Option 6 – Yellow	Preferred	Preferred	Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Section 2 – Malahide-Dublin Road											
Option 1 – Orange	Most Preferred	Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	N/A	N/A	Most Preferred	Most Preferred
Option 2 – Pink	Most Preferred	Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	N/A	N/A	Most Preferred	Acceptable
Option 3 – Cyan	Most Preferred	Acceptable	Preferred	Most Preferred	Most Preferred	N/A	N/A	N/A	N/A	Most Preferred	Acceptable
Option 4 – Green	Most Preferred	Acceptable	Preferred	Most Preferred	Most Preferred	N/A	N/A	N/A	N/A	Most Preferred	Acceptable
Option 5 – Blue	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	N/A	N/A	Most Preferred	Acceptable

	Landscape	Population and Human Health	Architectural Heritage	Archaeology & Cultural Heritage	Land, Soils and Groundwater	Surface Water	Material Assets Agronomy	Biodiversity – Habitat and Botanical	Biodiversity – Birds and Mammals	Air Quality and Climate	Noise and Vibration
Section 3 – Malahide Village											
Option 1 – Blue	Preferred	Acceptable	Most Preferred	Most Preferred	Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Option 2 – Orange	Preferred	Acceptable	Most Preferred	Most Preferred	Preferred	N/A	N/A	Most Preferred	Preferred	Most Preferred	Acceptable
Option 3 – Green	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	N/A	N/A	Most Preferred	Preferred	Most Preferred	Most Preferred
Option 4 – Pink	Most Preferred	Preferred	Most Preferred	Most Preferred	Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Most Preferred
Option 5 – Yellow	Most Preferred	Preferred	Most Preferred	Most Preferred	Preferred	N/A	N/A	Most Preferred	Most Preferred	Most Preferred	Acceptable
Section 4 – Causeway											
Option 1 – Green	Detailed assessment at EIAR stage.										
Section 5 – Kilcrea Townland											
Option 1 – Light Blue	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Preferred	Acceptable	Acceptable	Acceptable	Most Preferred	Most Preferred
Option 2 – Green	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Preferred	Preferred	Acceptable	Least Acceptable	Most Preferred	Most Preferred
Option 3 – Yellow	Most Preferred	Preferred	Most Preferred	Most Preferred	Most Preferred	Preferred	Acceptable	Acceptable	Acceptable	Most Preferred	Acceptable
Option 4 – Purple	Most Preferred	Preferred	Most Preferred	Most Preferred	Most Preferred	Preferred	Preferred	Acceptable	Least Acceptable	Most Preferred	Acceptable
Option 5 – Dark Blue	Most Preferred	Acceptable	Most Preferred	Most Preferred	Most Preferred	Preferred	Acceptable	Preferred	Preferred	Most Preferred	Acceptable
Option 1 – Light Blue	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Most Preferred	Preferred	Acceptable	Acceptable	Acceptable	Most Preferred	Most Preferred
Section 6 – Newbridge Demesne											
Option 1 – Cyan	Detailed assessment at EIAR stage.										

Preference Order

Introduction

2.5.11 The proposed development has been divided into six sections for the purpose of environmental assessment. As options are not presented in Sections 4 and 6, Sections 1, 2, 3 and 5 are considered below. The number of options and relevant environmental topics are listed in Table 2.4.

Table 2.4 The number of options and relevant environmental topics.

Section	Number of Options	Number of Environmental Topics
1	6	9
2	5	7
3	5	9
5	6	11

2.5.12 The preference order is based on the summation of the number of most preferred, preferred, acceptable, and least acceptable topic assessments for each option (see tables below). The preference order for each option is then ranked as shown in Table 2.5.

Table 2.5 The preference order for each option.

Preference Order	Option Preference
1st	Most Preferred
2nd	Preferred
3rd	Preferred
4th	Acceptable
5th	Least Acceptable
6th	Least Acceptable

Section 1 – Malahide Demesne

Table 2.6 Summary of Preferences.

	Least Acceptable	Acceptable	Preferred	Most Preferred
Option 1 – Green	–	1	1	7
Option 2 – Orange	–	1	3	5
Option 3 – Pink	–	1	–	8
Option 4 – Blue	–	1	1	7
Option 5 – Cyan	–	1	2	6
Option 6 – Yellow	–	1	3	5

Table 2.7 Preference Order.

	Order	
Option 1 – Green	2=	Preferred
Option 2 – Orange	4=	Acceptable
Option 3 – Pink	1	Most Preferred
Option 4 – Blue	2=	Preferred
Option 5 – Cyan	3	Preferred
Option 6 – Yellow	4=	Acceptable

Section 2 – Malahide-Dublin Road

Table 2.8 Summary of Preferences.

	Least Acceptable	Acceptable	Preferred	Most Preferred
Option 1 – Orange	–	–	1	6
Option 2 – Pink	–	1	1	5
Option 3 – Cyan	–	2	1	4
Option 4 – Green	–	2	1	4
Option 5 – Blue	–	1	–	6

Table 2.9 Preference Order.

	Order	
Option 1 – Orange	1	Most Preferred
Option 2 – Pink	3	Preferred
Option 3 – Cyan	4=	Acceptable
Option 4 – Green	4=	Acceptable
Option 5 – Blue	2	Preferred

Section 3 – Malahide Village

Table 2.10 Summary of Preferences.

	Least Acceptable	Acceptable	Preferred	Most Preferred
Option 1 – Blue	–	2	2	5
Option 2 – Orange	–	2	3	4
Option 3 – Green	–	–	1	8
Option 4 – Pink	–	–	2	7
Option 5 – Yellow	–	1	2	6

Table 2.11 Preference Order.

	Order	
Option 1 – Blue	4	Acceptable
Option 2 – Orange	5	Least Acceptable
Option 3 – Green	1	Most Preferred
Option 4 – Pink	2	Preferred
Option 5 – Yellow	3	Preferred

Section 4 – Causeway

2.5.13 There is only one route alignment. Detailed assessment is included in this EIAR and the associated NIS.

Section 5 – Kilcrea Townland

Table 2.12 Summary of Preferences.

	Least Acceptable	Acceptable	Preferred	Most Preferred
Option 1 – Light Blue	-	3	1	7
Option 2 – Green	1	2	2	7
Option 3 – Yellow	–	4	2	5
Option 4 – Pink	1	2	3	5
Option 5 – Dark Blue	–	3	3	5

Table 2.13 Preference Order.

	Order	
Option 1 – Light Blue	2	Preferred
Option 2 – Green	1	Most Preferred
Option 3 – Yellow	3	Preferred
Option 4 – Pink	5	Preferred
Option 5 – Dark Blue	4	Preferred

Section 6 – Newbridge Demesne

2.5.14 Route alignment through Newbridge Demesne utilises existing pathways. Detailed assessment is included in this EIAR and the associated NIS.

Engineering Elements

2.5.15 Volume 4B contains full details of the Route Options Report. A summary overview is provided here for completeness. A detailed assessment of all the route options was carried out using the following criteria:

Table 2.14 Engineering Route Assessment Criteria

	Criterion Elements
Technical	Comparison of technical merits in terms of: • Greenway level of service offered: - Surface quality/comfort; - Gradient; - Continuity of route. • Directness (waiting times at signals, detours). • Accessibility (mobility impaired).
Safety	Comparison of level of safety offered in terms of: • Interaction with live traffic and nature of traffic control facilities offered. • Personal security, levels of public lighting and surveillance offered.
Integration	Comparison of level of integration and inter-connectivity offered in terms of: • Connectivity of public transport (bus and rail). • Connectivity to wider cycle network. • Inter-connectivity of adjacent residential communities (existing and planned). • Provision of car parking areas at access points/key amenity areas. • Connectivity to adjacent recreational and amenity areas (existing and planned).
Construction Impact	Comparison on level of impact on the environment from a construction perspective.

2.5.16 Each route options was assessed using the above criteria and a rating was assigned to each route option. The ratings are:

Table 2.15 Preference Rating.

Preference Type	Single Option	Multiple/All Options
Most Preferred	An option which is considered to have a positive or not material negative effect.	If multiple/all options have a positive or no material negative effect, then multiple/all options should be identified as most preferred.
Preferred	An option which is considered to have a minor negative effect.	If multiple/all options have a minor negative effect, the multiple/all options should be identified as preferred.
Acceptable	An option which is considered to have a moderate negative effect.	If multiple/all options have a moderate negative effect, then multiple/all options should be identified as acceptable.
Least Acceptable	An option which is considered to have a potentially significant negative effect.	If multiple/all options have a potentially significant negative effect, then multiple/all options should be identified as least acceptable.

2.5.17 The engineering preference order for the route options is given in Table 2.16 below. A budget cost analysis was also carried out (see Volume 4B). The results of all three analyses were combined to determine the emerging preferred route.

2.5.18 The emerging preferred route was identified :

- Section 1 – Option 3 – Pink.
- Section 2 – Option 4 – Green.
- Section 3 – Option 3 – Green.
- Section 4 – Causeway.
- Section 5 – Option 5 – Dark Blue.
- Section 6 – Newbridge Demesne existing pathways.

2.5.19 The emerging preferred route was arrived at following detailed analysis as outlined in EIAR Volume 4A and Volume 4B and was informed by the public consultation undertaken by the Council.

Table 2.16 Engineering Preference Order.

	Most Preferred	Preferred	Acceptable	Least Acceptable	Rank	Engineering Preference
Section1						
Option 1 – Green	-	2	1	1	2nd	Preferred
Option 2 – Orange	-	1	1	2	3rd	Acceptable
Option 3 – Pink	1	3	-	-	1st	Most Preferred
Option 4 – Blue	-	2	1	1	2nd	Preferred
Option 5 – Cyan	-	2	1	1	2nd	Preferred
Option 6 – Yellow	-	1	1	2	3rd	Acceptable
Section 2						
Option 1 – Orange	-	-	3	1	5th	Least Acceptable
Option 2 – Pink	-	3	1	-	3rd	Preferred
Option 3 – Cyan	2	1	-	1	2nd	Preferred
Option 4 – Green	3	-	-	1	1st	Most Preferred
Option 5 – Blue	-	2	-	2	4th	Acceptable
Section 3						
Option 1 – Blue	-	-	3	1	3rd	Preferred
Option 2 – Orange	-	-	2	2	4th	Acceptable
Option 3 – Green	1	3	-	-	1st	Most Preferred
Option 4 – Pink	-	1	1	2	2nd	Preferred
Option 5 – Yellow	-	-	2	2	4th	Acceptable
Section 5						
Option 1 – Light Blue	2	1	1	-	2nd	Preferred
Option 2 – Green	1	2	1	-	4th	Least Acceptable
Option 3 – Yellow	1	3	-	-	3rd	Acceptable
Option 4 – Purple	1	3	-	-	3rd	Acceptable
Option 5 – Dark Blue	3	1	-	-	1st	Most Preferred

3.0 Project Description

3.1 Overview Description of the Proposed Greenway

3.1.1 As indicated in Chapter 1, Fingal County Council proposes to develop the Broadmeadow Way, a new greenway (shared footpath and cyclepath between Malahide Demesne and Newbridge Demesne) via the railway causeway across the Malahide Estuary (see Volume 3-Figure 1). The requirements of the proposed scheme are to deliver a safe, high quality shared footpath. The proposed greenway would be c. 6km in length.

3.2 Main Elements of Scheme

3.2.1 The proposed development would extend from the grounds of Malahide Demesne to the R106 Dublin Road, O'Hanlon's Lane and Bissets Strand in Malahide, cross Malahide Estuary, cross the agricultural land at Kilcrea and terminate at Newbridge Demesne, Donabate. A section of the proposed development would utilise the existing weir maintenance access track on the western railway embankment between Bissets Strand and the weir estuary, a new cycle/footpath bridge adjacent to the existing railway bridge, and the shoulder of the western embankment of the northern railway causeway. The proposed development would continue close to the western margin of the railway line through the townland of Kilcrea. Aside from road surfaces, much of the proposed greenway base is already in place by way of the weir maintenance access track, which runs from Bissets Strand to the southern abutment of the railway bridge, the shoulder of the northern causeway to the northern estuary bank, and an access track from the River Pill to the Corballis Cottages Road.

3.2.2 The proposed development will include the following:

- Use of c. 900m of existing pathways within Malahide Demesne, extending from the main car park located southeast of Malahide Castle to the Hogan's Gate entrance on the R106, Dublin Road, including new route signage and bicycle parking facilities.
- Approximately 140m of new footpath construction at Bridgefield car park and new ramp/access upgrade works at the existing pedestrian entrance leading to the R106 Dublin Road.
- Reconfiguration of c. 220m of the R106 Dublin Road between Bridgefield car park and O'Hanlon's Lane to facilitate the provision a new off-road shared pedestrian and cyclist facility along the northern side of the road, and a new signal controlled crossing.
- Approximately 135m of road resurfacing, 230m of shared surface road markings, signage and boundary hedge trimming along O'Hanlon's Lane.
- The reconfiguration of the junction of Bissets Strand and O'Hanlon's Lane.
- Two signal controlled crossings and new traffic signals at the railway bridge on Bissets Strand.

- The construction of approximately 260m of off-road shared pedestrian and cyclist facilities and associated landscaping and ancillary works on Bissets Strand.

- Works to facilitate a new greenway some 615m in length along the existing weir maintenance access track on the western embankment of the Dublin-Belfast railway causeway, extending north from Bissets Strand into Malahide Estuary, to include new surfacing, fencing, boundary walls, local stone fill, route lighting and signage, and a viewing area.

- Provision of a new 12-span pedestrian/cycleway bridge deck of approximately 180m in length on the existing piers located alongside the Dublin-Belfast railway bridge situated on the weir in Malahide Estuary.

- Works to facilitate a new greenway of approximately 1,000m in length along the shoulder of the western embankment of the Dublin-Belfast railway causeway, from the railway bridge on the weir in Malahide Estuary extending as far as the northern shoreline of Malahide Estuary at Kilcrea, to include new surfacing, fencing, boundary walls, local stone fill, route lighting and signage.

- Provision of c. 910m of new greenway along the western side of the Dublin-Belfast railway through agricultural lands in Kilcrea on the north side of the estuary, between the northern shore of Malahide Estuary and the L-6165-0 Coast Road/Corballis Road, with works to include new surfacing, fencing, route lighting and signage, and a new three span bridge over the Pill River of 50m in length constructed in timber and concrete.

- Provision of c. 230m of new greenway along the southern side of the L-6165-0 Coast Road/Corballis Road, Kilcrea to include to include surfacing, fencing, route lighting and signage.

- Upgrading and re-alignment along c.450m of the L-6165-0 Coast Road/Corballis Road adjacent to the Dublin-Belfast railway bridge, including the installation of signal-controlled pedestrian and cyclist crossing points.

- Provision of c. 370m of new greenway, including a single span (12m) bridge crossing, constructed in concrete and timber, of the Pill River through agricultural lands in Kilcrea and along the southern bank of the Pill River.

- Crossing of the newly constructed Donabate Distributor Road and the pedestrian lights for same.

- Resurfacing works along c. 140m of the existing L-6135-0 Kilcrea Road north to the R126 Hearse Road.

- Reconfiguration of the junction of the L-6135-0 Kilcrea Lane and the R126 Hearse Road to facilitate pedestrian and cyclist access to Newbridge Demesne.

- Use of approximately c. 900m of existing pathways including new route signage and bicycle parking at Newbridge Demesne.

- Ancillary works along the route including drainage works, provision of fencing, boundary treatments, agricultural accesses, noise barrier (close to the Donabate Distributor Road), public lighting, landscaping and other minor works.

3.2.3 The proposed greenway will typically be c. 4m in width, other than sections where the proposed greenway is utilising existing public roads, tracks and pathways. It will be finished with a macadam surfacing to ensure comfort and safety for cyclists, pedestrians and mobility-impaired users. The route will utilise existing paths at Malahide Demesne and Newbridge Demesne. A 2.4m high security fence will line the eastern edge of the proposed greenway where it runs adjacent to the Dublin-Belfast railway line, to prevent access to the railway. This security fence will be put in place by Irish Rail in advance of any proposed development work on the greenway to ensure the safety of the railway line.

3.2.4 Permanent fencing will prevent egress to the agricultural lands and small number of residential properties at Kilcrea and to the northern shore of Malahide Estuary. The project will not involve a connection to the eastern embankment of the railway line at any point. Where not already provided, low-level illumination will be provided along the scheme for user comfort and safety.

3.2.5 As set out in Section 1.0.3, any works adjacent to the foreshore line (high water mark) require statutory permission by way of an application to the OPW for a foreshore licence or foreshore lease prior to any work progressing. The proposed development crosses the foreshore line in a number of locations along the railway causeway and across the Pill River. Fingal County Council will seek, in parallel with the planning application, a foreshore lease for these works, via their specialist consultants.

3.2.6 For ease and clarity of reporting and assessment the project has been divided into six sections as follows:

- Section 1 – Malahide Demesne.
- Section 2 – R106 Dublin Road, Malahide.
- Section 3 – R106 Dublin Road to Bissets Strand.
- Section 4 – Bissets Strand to the North Shore of Malahide Estuary.
- Section 5 – North Shore of Malahide Estuary to R126 Hearse Road.
- Section 6 – Newbridge Demesne.

3.2.7 The full extent of the proposed greenway is shown on the Design Drawings in Volume 3. See also Figures 1-36 in Volume 3. Also refer to Plates 1-12 in this section (see below). Descriptions of Sections 1 to 6 follow below (see Section 3.3 to 3.8).

Plate 1. Existing Paths within Malahide Demesne.

Plate 2. O'Hanlon's Lane at R106.

Plate 3. O'Hanlon's Lane.

Plate 4. O'Hanlon's Lane.

Plate 5. O'Hanlon's Lane at Bissets Strand.

Plate 6. Green Area at Bissets Strand prior to construction of Irish Rail Site Compound.

Plate 7. Bissets Bridge (view from east side).

Plate 8. Existing hardcore maintenance access track on embankment to South of Viaduct.

Plate 9. Stone Embankment to North of Viaduct looking North.

Plate 10. Agricultural Lands at Kilcrea looking North.

Plate 11. View from Pill River Viewing Area.

Plate 12. Newbridge House.

3.3 Section 1 – Malahide Demesne

3.3.1 The proposed development starts/finishes at the main car park in Malahide Demesne which has c. 228 spaces with an overflow car park which has capacity of c. 240 spaces. The development comprises signage, new cycle parking and new footpath/cycle path facilities in this section. No major resurfacing of existing footpaths, or other significant interventions are proposed, outside of the specific locations listed below. The proposed development utilises the existing paths within the Demesne and continues north past the Malahide Castle retail area along the existing paths as far as Hogan's Gate. The existing paths vary in width from 2.5m to 3.8m wide (see Design Drawings 12-160-240 to 12-160-268 in Volume 3).

3.3.2 Cycle parking is currently located to the rear of the retail centre in the coach car park. It is proposed to provide additional defined cycle parking on the existing grass verge on the northern boundary of the car park.

3.3.3 An information board for the proposed development will be provided adjacent to the existing information board along with wayfinder and directional signage. Such signage will be provided along the proposed development at various locations (see Design Drawings 12-160-240 to 12-160-268 in Volume 3). Detailed design on the signage will be agreed with the management boards of Malahide and Donabate Demesnes.

Link to Malahide Village

3.3.4 A link between the proposed development and the footpaths leading to Malahide village and Malahide railway station will run along the southern and eastern side of Bridgefield car park.

3.3.5 A proposed pedestrian/cycle ramp and steps will be constructed, to replace the existing ramp. This will be constructed in the green area to the east of the car park and will require the removal of some adjacent planting and trees. Suitable compensation planting will be provided.

3.3.6 The existing pedestrian entrance at this location will be widened to allow access to the existing pedestrian bridge on the south side of the Dublin Road railway bridge which links to the footpaths leading to Malahide train station and village.

3.4 Section 2 – R106 Dublin Road, Malahide

3.4.1 It is proposed to provide a new controlled crossing adjacent to the Hogan's Gate entrance to Malahide Demesne which crosses the R106 Dublin Road (see Design Drawings 12-160-240 to 12-160-268 in Volume 3).

3.4.2 The proposed greenway continues west on the northern side of the R106 Dublin Road from Hogan's Gate to O'Hanlon's Lane on a new 3.2m wide shared surface which will be provided in place of the existing footpath at this location. To accommodate the increased width pedestrian and cycle facility, the existing carriageway will be reduced from 7.2m to 6.5m. Existing services including lamp standards will be re-located as required. These works would be carried out within the existing road reservation and will not impact on existing private boundaries.

3.4.3 There are a number of existing entrances to private properties which will be maintained including access roads to the Casino apartment complex and the Malahide Presbyterian Church.

3.4.4 It is proposed to realign the existing kerbs at the entrance to the Casino apartment complex, reduce the entrance kerb radii and narrow the overall width at the mouth of the junction providing a safer crossing point for pedestrians and cyclists in accordance with current standards. This junction realignment will involve removing the existing kerbs, relaying new kerbs, scarifying the existing surface, relaying a new road surface, and relaying the new shared surface to tie into the existing levels and existing private entrances. The existing drainage system will not be altered except for the relocation of a number of gullies along the northern kerb line.

3.4.5 Existing overhead services along this section will be relocated to the back of the new proposed shared surface and undergrounded where possible. Existing manholes will be strengthened and lids adjusted as required.

3.4.6 A yellow box will be provided adjacent to the entrance to O'Hanlon's Lane to aid vehicular access from O'Hanlon's Lane to Dublin Road.

3.5 Section 3 – R106 Dublin Road to Bissets Strand

3.5.1 O'Hanlon's Lane is a cul-de-sac with bollards installed mid-way to restrict general through traffic. There are 14 existing entrances onto this section of O'Hanlon's Lane. O'Hanlon's Lane comprises of:

- 140m of 3.5m wide pedestrian, cyclist and vehicular shared street;
- 110m of 7.5m wide cyclist and vehicular shared street with footpaths on both sides;
- 100m of 5m wide pedestrian, cyclist and vehicular shared street;
- driveway entrances to private residential properties at various locations.

3.5.2 Users of the proposed development will be directed along O'Hanlon's Lane as the volume and speed of vehicular traffic at this location is low, due to the residential nature of the road, and narrow road widths.

3.5.3 There are a number of sections where the width available to traffic is restricted by hedge growth from private properties onto the public road. It is proposed to trim such hedges which impede upon O'Hanlon's Lane to maximise the available width (see Design Drawing 12–160–254 in Volume 3).

3.5.4 Where the road widens to 7.5m it is proposed to use the existing footpath for pedestrians, and cyclists would share the carriageway with vehicles. No major civil infrastructure interventions are proposed here and works to this section will include appropriate signage and road markings as required.

3.5.5 It is proposed to resurface the narrow northern part of the lane as there is some damage to the existing road surface here. It is also proposed to install road markings and signage, in accordance with the *National Cycle Manual* (NTA, June 2011).

3.5.6 It is proposed to upgrade and realign the junction of O'Hanlon's Lane and Bissets Strand (see Design Drawing 12–160–256 in Volume 3).

3.5.7 The existing junction layout is relatively wide here (13m wide at the narrowest location) with no facilities for pedestrians or cyclists. There are a number of private entrances including the entrance to St. Ive's apartments utilising this junction.

3.5.8 The southern kerb line is proposed to be realigned to reduce the carriageway width to 6.5m wide, allow the formation of a new entrance and provide space to construct new pedestrian and cyclist facilities, including a controlled crossing (see Design Drawing 12–160–256 in Volume 3).

3.5.9 A new controlled crossing will be installed on Bissets Strand Road to access the green area on the northern side of Bissets Strand Road. It is also proposed to extend the existing car park facilities on the northern side of Bissets Strand Road.

3.5.10 The proposed development will continue east along the green area by way of a new shared surface to be constructed on the existing grassed area, as far as the existing Irish Rail compound where a new landscaped area will be provided. This will include various surface types and finishes including raised planting areas, seating, cycle parking, signage and fencing/railing and will be a viewing area for the proposed greenway. These works link with the Malahide Public Realm Strategy proposals as incorporated into the 2017-2023 Fingal County Development Plan. An access point which includes a dropped kerb is proposed to allow access for emergency and railway maintenance vehicles at this location as shown on Design Drawing 12–160–256 (see Volume 3).

Link to Malahide Village

3.5.11 A link between the proposed development and Malahide village and the railway station will be facilitated through the provision of a signalised shuttle system at Bissets Strand Road where it passes under the railway. A signal-controlled shuttle system is required here as the existing widths are insufficient to safely accommodate pedestrians and cyclists alongside two-way vehicular traffic. This bridge is a protected structure and cannot be widened. An informal two-way shuttle system on a courtesy basis is currently operating here, with no accidents recorded on the RSA road collision database.

3.5.12 The proposed signalised shuttle system at the Bissets Strand Road underbridge would also improve cyclist safety. The signals will operate at an on-demand basis for both cyclists and vehicles. The traffic signals and road markings will be designed to accommodate all existing private entrances.

3.5.13 Pedestrians will access Malahide village using a controlled pedestrian crossing and ramp to link with the existing raised pedestrian footpath on the southern side of Bissets Strand bridge, to be provided as part of the proposed development. It is also proposed to provide resident only parking and a bin collection area on the south side of Bissets Strand Road (see Design Drawing 12–160–256 in Volume 3).

3.5.14 The segregated footpath continues under the railway bridge and connects with the existing footpath on the southern side of Strand Court Road on the eastern side of the underbridge.

3.6 Section 4 – Bissets Strand to the North Shore of Malahide Estuary

3.6.1 This section of the proposed greenway extends from the south shore to the north shore of Malahide Estuary along the west side of the existing railway causeway that carries the main Dublin-Belfast rail line.

3.6.2 In advance of any works, security fencing will be installed by Irish Rail along the entire length of this section (minimum 3m from the existing railway tracks). This will separate the proposed development from the railway tracks.

3.6.3 A protective stone wall (c. 1.4m high) will be provided on the western side of the proposed greenway across the estuary. This will also minimise any potential effect upon birds in the estuary.

3.6.4 The proposed development will run north from a proposed new urban landscaped area at Bissets Strand, along the existing weir maintenance track which is used by Irish Rail for access to inspect and maintain the railway viaduct. This is located at the bottom of the rail embankment, running parallel to the west side of the railway tracks. The access will be maintained for Irish Rail requirements and will also allow emergency vehicles access along the length of the proposed greenway. A removable bollard will be provided at the start of this section to restrict unauthorised vehicle access.

3.6.5 The proposed greenway and wall will be constructed on top of the existing surface (with no excavation of the existing causeway) to the levels specified in the design drawings (see Volume 3). The greenway will be sloped toward the railway embankment to allow for surface drainage into the causeway rock armour. The full width of the existing weir maintenance access track will be utilised to provide the maximum width along this section (with a minimum width of 4m).

3.6.6 The proposed development includes a new 180m-long pedestrian/cycle bridge that will run parallel to the existing railway viaduct. The new bridge will be a 12-span concrete bridge structure located on existing piers with the bridge soffit at a minimum of 3.8mOD above the high spring water level of 2.1mOD that flows across the weir at this location. It will provide a 4m wide shared path as shown on Design Drawing 12–160–258 (see Volume 3). It includes ramps at both ends to tie into the proposed development along the causeway.

3.6.7 A viewing area will be provided on the southern side of the pedestrian bridge which will include seating. A section of removable/demountable fencing will also be provided at this location to allow Irish Rail access to the weir for inspection and maintenance purposes.

3.6.8 North of the bridge, the proposed development continues along the top of the existing causeway at approximately the same level as the railway tracks with the stone wall 1.4m protective barrier to the west and security fencing on the east (railway) side. This stoned area was installed by Irish Rail to protect the existing causeway. The proposed development will be constructed on top of the existing armour shoulder (with no excavation of the existing causeway) to the proposed levels as shown in the design drawings (see Volume 3). The greenway will be sloped toward the railway embankment to allow for surface drainage into the causeway rock armour. The full width of the remainder of the causeway will be utilised to provide the maximum width along this section (with a minimum width of 3m).

3.6.9 The existing raised stone area stops short of the north shore of Malahide Estuary. It is proposed to continue the proposed greenway at the same level as the railway tracks as far as the agricultural lands on the north shore of the estuary by extending the rock armour as far as the raised agricultural lands on the north shore of the estuary.

3.6.10 There is an existing drainage ditch at this location that will be culverted under the proposed extended rock armour.

3.7 Section 5 – North Shore of Malahide Estuary to R126 Hearse Road

3.7.1 The proposed development continues north through agricultural lands. At first it runs parallel to the railway tracks on the western side of an existing hedge and drainage ditch as far as the Pill River. It will be 4m wide with a timber post and rail fence on both sides at this location.

3.7.2 There is an existing agricultural railway crossing as shown on Design Drawing 12–160–261 (see Volume 3). A corresponding agricultural crossing of the proposed greenway will be provided at this location to allow access to the agricultural lands to the eastern side of the railway line.

3.7.3 The proposed development crosses the Pill River with a new 50m span bridge (Bridge No. 1) to be constructed using concrete bridge piers and steel beam structure, wooden clad, as shown on Design Drawing 12–160–261 (see Volume 3). Parapets will be provided on both sides of the bridge and includes ramps at both ends to link to the proposed greenway north and south of the proposed bridge and to take account of the difference in existing ground levels.

3.7.4 The concrete piers will be exposed concrete finish with a cladding detail. The steel structure will be treated for long life span and low maintenance by using both galvanising and painting. The surface finish will be a suitable non-slip finish.

3.7.5 A viewing area will be provided at this location by widening the northern ramp structure.

3.7.6 The proposed development will be constructed on top of the existing railway maintenance access track to the required levels north of the River Pill. The existing ditch at the bottom of the railway embankment to the east of the proposed greenway will be maintained.

3.7.7 The route continues north to Corballis Cottages Road and diverts around the boundary of a private dwelling. A boundary treatment will be provided here including suitable landscaping and post and wire fencing.

Link to Donabate Village

3.7.8 The upgrade works required at Corballis Cottages Road will allow for a potential future link to Donabate Village. The construction of the link into Donabate Village will be carried out as part of the development of zoned lands within the Local Area Plan for Donabate.

3.7.9 It is proposed to realign a section of the Corballis Cottages Road on both sides of the existing railway bridge and provide a signalised shuttle system at the railway

underbridge. This will include the reduction of the width of the existing carriageway to a single lane and the provision of a 2m wide path under the railway bridge.

3.7.10 The shuttle system is required at this location as the existing underbridge widths are insufficient to safely accommodate pedestrians and cyclists alongside two-way vehicular traffic. The realignment will also provide adequate sight distances under the bridge which are currently not available.

3.7.11 The proposed signalised shuttle system at the underbridge would improve cyclist safety. The signals will operate at an on-demand basis for both cyclists and vehicles.

3.7.12 Controlled crossings would be provided on both sides of the railway bridge providing a safe route for pedestrians.

3.7.13 Existing roadside hedging would be removed and replaced as required.

3.7.14 The proposed greenway development continues west inside the existing hedgerow on the southern side of the realigned Corballis Cottages Road through agricultural lands inside the new hedging and fencing. The existing agricultural entrances from the public road will be maintained providing an agricultural crossing point across the proposed development and sufficient space for a vehicle to pull off the road safely.

3.7.15 The proposed development progresses in a southwest direction towards the southern side of a private dwelling and farm buildings through open agricultural lands with post and rail fencing with sheep wire on both sides. Access to the agricultural lands on both sides of the proposed greenway will be maintained.

3.7.16 The proposed development crosses the Pill River again where a proposed 12m span pedestrian/cycle bridge (Bridge No. 2) is proposed. The bridge will be constructed using steel beam structure, wooden clad, as shown on Design Drawings 12-160-240 to 12-160-268 (see Volume 3).

3.7.17 The proposed development runs along the southern side of the private dwelling and farm buildings through agricultural lands. The proposed development is separated from the dwelling by the existing hedgerow and watercourse.

3.7.18 There is an agricultural entrance between the farm buildings and the agricultural lands to the south which will be maintained. New boundary treatments and landscaping will be installed.

3.7.19 The proposed development continues on the southern side of an existing private property fence line and hedgerow through agricultural lands towards Kilcrea Road. New boundary treatments and landscaping will be installed.

3.7.20 The proposed development continues on the southern side of an existing property fence line and hedgerow parallel to the boundary of a private dwelling and continues to the Donabate Distributor Road (under construction). The proposed development will parallel the Donabate Distributor Road along a widened section of footpath and cycle way on the southern side of the road until the junction with the Kilcrea Road where a pedestrian crossing will be installed as part of the road construction works.

3.7.21 The proposed development joins the Kilcrea Road from the pedestrian crossing and continues along the Kilcrea Road running north as far as the junction with the Hearse

Road on the western side of Kilcrea Road. Kilcrea Road will be a cul-de-sac with no through access for traffic as shown on the drawings (see Volume 3). Kilcrea Road serves only one private dwelling so traffic speeds and volumes are sufficiently low to allow this road to become a shared surface for access to the house and for cyclists and walkers. It is proposed to resurface this section of the Kilcrea Road as the existing surface is poor and also to install road markings and signage in accordance with the National Cycle Manual (June 2011).

3.7.22 The junction of Kilcrea Road and R126 Hearse Road will be upgraded. This will include the realignment of the existing kerb line southwards and re-grading of the existing junction and the provision of a new controlled crossing. The realignment will include relaying a new kerb on the northern side of the junction and the tightening of the entrance radii onto Kilcrea Road to provide the required sightlines at this location (see Design Drawing 12–160–266 in Volume 3). It also includes scarifying the existing surface and relaying a new wearing course, adjustment to the existing drainage system, proposed new line markings and signage and public lighting at this junction.

3.7.23 Advance notice of the proposed new crossing on either side of the junction on the Hearse Road by way of a new kerb, signage and public lighting, will slow traffic as it approaches the junction and give warning of the controlled crossing. This section of road currently has a speed limit of 60kph. It is proposed to extend the existing 50kph speed limit which presently extends from Donabate Village to 100 metres before the Corballis Cottages junction, to include the revised junction at Kilcrea Road.

3.8 Section 6 – Newbridge Demesne

3.8.1 On the northern side of the Hearse Road/Kilcrea Junction the entrance to Newbridge Demesne will be left unchanged save for upgrade of macadam surfacing and line marking.

3.8.2 Existing hedges along the demesne boundary on both sides of the Hearse Road/Kilcrea Road junction will be trimmed back.

3.8.3 The proposed greenway enters Newbridge Demesne via the Kilcrea gates and runs north through a wooded area. Outside of the works listed above and some signage installations, no building works are proposed within the curtilage of the Demesne as part of the proposed development. The gates and piers form part of the boundary to Newbridge Demesne and are protected structures.

3.8.4 The path crosses the Pill River (Turvey River) over an existing 2.0m wide bridge. The route continues north on the existing 2.0m wide paths as far as Newbridge House. The existing path is designated as a shared pedestrian and cycle path within the demesne.

3.8.5 It is proposed to utilise the existing path between the gravelled area in front of Newbridge House as far as the existing estate road and main car park. A safe crossing point will be provided across the existing driveway towards the main car park along with greenway signage and additional cycle parking.

3.8.6 Donabate Village can be accessed via Newbridge Avenue which connects users of the proposed greenway and Newbridge Demesne to the village, railway station and bus services.

3.9 Construction

3.9.1 The proposed development will be c. 4m in width, other than sections where the development utilises existing public roads, tracks and pathways. It will be finished with a macadam surfacing to ensure comfort and safety for cyclists, pedestrians and mobility-impaired users. The route will utilise existing paths at Malahide Demesne and Newbridge Demesne. A 2.4m high security fence will line the eastern edge of the proposed greenway where it runs adjacent to the Dublin-Belfast railway line, to prevent access to the railway. This security fence will be put in place by Irish Rail in advance of any proposed development work on the greenway to ensure the safety of the railway line.

3.9.2 Two site construction compounds are proposed. One at Bissets Strand and one south of Corballis Cottages Road (see Volume 3 Design Drawings 12-160-246 and 12-16-247). The environmental controls associated with these compounds are outlined in Section 3.13-Construction Environmental Management Plan (CEMP).

Broadmeadow Way Bridge

3.9.3 Two spans of the railway viaduct collapsed on the 21st August 2009. The spans were re-constructed and the line was re-opened on the 16th November that year.

3.9.4 The eleven masonry piers and the two abutments of the railway viaduct across Malahide Estuary are constructed on top of a stone weir, which was constructed off the original sea bed. The integrity of the weir is essential for the structural stability of the railway viaduct. The integrity of the weir is also important in maintaining the existing status of the inner estuary, its habitats and species.

3.9.5 Scouring of the weir had caused the collapse of the two spans. Initial repairs were carried out to make the weir safe and re-open the railway line. Over the following two years significant strengthening works on the weir were then carried out. The pedestrian bridge sub-structure, including piled foundations and piers were constructed in conjunction with the weir strengthening works at that time.

3.9.6 The following works are required to complete development of the proposed greenway and the provision of the pedestrian bridge: temporary enabling works to the weir to facilitate access to the worksite; minor works to the concrete piers; the installation of precast concrete capping padstones on each pier; the installation of precast concrete bridge deck beams; construction of an approach ramp to the north and south of the bridge; and finishing-off works, including railings, lighting, and surfacing.

3.9.7 Each of these elements is considered separately below and is presented in the order in which the works will be carried out.

Site Access and Work Site Areas

3.9.8 A weir maintenance access track, extending north from Bissets Strand to the southern abutment of the railway viaduct, was constructed in September 2009 to allow for remedial and maintenance works necessary to the weir and viaduct. The access track was constructed of stone fill material, bounded by rock armour along the water's edge. The finished road level is at an elevation of approximately 2.1m OD, approximately 4.0m below track level and slightly above the high spring tide level. It is proposed to use this existing access track to draw plant, equipment and materials to the worksite.

3.9.9 It is proposed that the site compound will be located at the entrance to the Irish Rail lands at Bissets Strand. The site compound and boundary is shown in Volume 3 Desgn Drawings 12-160-246 and 12-160-247.

Enabling Works – Temporary Alterations to the Weir

3.9.10 The weir will be used as a means of access across the estuary to each of the 12 spans. Temporary alterations to the weir crest are necessary to facilitate the movement of plant and equipment across the top of the weir.

3.9.11 The weir crest has been constructed to facilitate the tidal flow and to ensure that the maximum flows and velocities are channelled to the centre of each of the 12 spans. The channel crest and trough levels are 1.00m OD and 0.60m OD respectively, the weir level being 400mm lower at the centre span position in the channel troughs.

3.9.12 The tidal range at Malahide is approximately 4.8m, from a spring high tide of 2.1m OD to a spring low tide of -2.7m OD. (Derived from Dublin Port Tide Tables with typical high and low spring tides of 4.6m and 0.2m Chart Datum respectively.)

3.9.13 It is proposed to temporarily raise the weir crest level across each ope to 1.15m OD. This will result in slightly elevated water levels (at low water) in the inner Malahide Estuary for a period of eight weeks maximum. This will have a temporary effect of reducing the inter-tidal exposure of the mud-flats area at the western end of the estuary. (Refer to report by Dr E McKeogh of Fluvio R&D Limited: "Malahide Viaduct Reinstatement, Temporary Works, Computer modelling for Environmental Analyses", July 2015 (see Volume 4C-Appendix 16)).

Preparation Works to Footbridge Piers

3.9.14 With the temporary weir crest in place, the *in situ* steel reinforcement projecting from the top of each existing greenway bridge pier will be removed. The exposed ends of the piers will be coated with a protective coating before new precast concrete capping padstones are placed on top of the piers, laid on a mortar bed. The precast capping padstones will be transported and installed using an excavator travelling across the weir. When the capping padstones have been placed, grouted stainless steel dowel bars will be installed to structurally connect them to the concrete piers.

Installation of Footbridge Deck and the Northern Ramp

3.9.15 The new footbridge deck will be constructed using precast bridge deck spans laid on the existing concrete piers. This, for reasons of economy and speed but also to minimise works carried out over water.

3.9.16 All pre-cast concrete units required for the new footbridge will be cast off-site in a manufacturer's yard and transported to the site as and when required.

3.9.17 The installation of the precast bridge deck units is constrained by two separate factors, the safety requirements of Irish Rail and the tidal effect

3.9.18 Works in the vicinity of any railway line will be managed in such a manner that there is no risk to railway operations or infrastructure. Consequently, the lifting-in of precast units using a crane would be restricted to night time working, when trains are not operating and the track can be taken under possession by the Irish Rail Engineer. Night

time track possession on this line is only available for 4.5 hours on Monday to Friday nights and 6.0 hours on Saturday nights.

3.9.19 The tidal range will restrict the movement of plant and equipment to those periods when the tide is sufficiently low to permit vehicles to cross the weir. In periods of high spring tide the inner estuary is filled and there is insufficient time for the water to flow back out to sea before the incoming tide fills the inner estuary again. The effect is that there is nearly always water flowing across the weir during the period of spring tides.

3.9.20 Combining the requirement for track possessions with this tidal constraint means that night time possessions might not coincide with low tide conditions. Consequently, to deal with these constraints a self-propelled multiaxle transporter (SPMT) will be used rather than a crane to lift-in the bridge deck units as they can be placed in this manner without risk to the railway. As a result there will be no requirement for track possessions at night and work may be carried out during the day. Refer to Drawing No. SADS-16-BROAD-PRE-003 which describes the operation of the SPMT (see Volume 3).

3.9.21 The installation sequence will involve using a mobile crane to load the bridge deck unit onto the transporter at Bissets Strand. The SPMT will travel along the weir maintenance track and across the weir to place each of the pre-cast bridge deck units into position.

3.9.22 The works will progress from north to south. The weir will be re-profiled sequentially to match the existing V-shaped channel profile as the bridge deck spans are fitted into place.

Construction of Southern Approach Ramp

3.9.23 The work on the southern causeway ramp will not involve any works over the water. The proposed ramp will comprise of two retaining walls (refer to Drawing No. SADS-16-BROAD-PRE-004 in Volume 3). Both walls will be constructed using off-site precast concrete units to minimise the on-site works.

3.9.24 The works will commence with local foundation excavation of the existing railway embankment and causeway followed by preparation of the formation level for the pre-cast retaining wall units. Forty-four precast concrete units will be offloaded from the delivery truck and lifted in to position using a crane.

3.9.25 It will be necessary to construct the outer retaining wall first. As the precast wall units are lifted into position, backfilling of the wall with imported granular fill material will commence. Once all of the outer retaining wall precast units are installed and backfilled, the inner wall will then be lifted into place and backfilled when complete.

Transportation Requirements

3.9.26 The construction of the footbridge will necessitate the importation of c. 1,500 tonnes of stone, approximately 75 truck loads, to alter the surface profile of the weir. The material will comprise 900 tonnes of 150mm/100mm clean stone to fill the V-shaped channels and 600 tonnes of 50mm clean stone surface finish material over the length of the weir. There will be no requirement to disturb the installed rock armour forming the weir.

3.9.27 This material will be sourced from a licensed facility and transported to the site over a five day period. Due to the height and width restriction at the railway over-bridge on Bissets Strand these trucks will be routed via Yellow Walls Road and Sea Road to the works site.

3.9.28 On completion of the bridge construction all 1,500 tonnes of this imported material will be removed from site and the weir profile will be restored to its present profile and level. The existing weir stone will not be disturbed when the excess material is being removed.

3.9.29 The following is a schedule of transportation needs:

- 1500 tonnes of stone;
- 75 lorries of stone fill drawn in to the site at the commencement of the works, taking five days to lay all stone. Maximum of 15 lorries per day;
- 12 pre-cast capping padstones;
- 6 lorries will be used to transport the padstones to site. Maximum of 2 lorries per day;
- 13 pre-cast bridge deck units, starting with Span 1(A);
- 13 lorries will be used to transport the units to site. Maximum of 3 lorries per day;
- 18 pre-cast outer retaining walls;
- 9 lorries will be used to transport the retaining wall units to site. Maximum of 3 lorries per day;
- 26 pre-cast inner retaining walls;
- 13 lorries will be used to transport the retaining wall units to site. Maximum of 3 lorries per day.
- The maximum number of lorries/trucks to site will be when the stone fill is being drawn in to the site, 15 lorries each day for five days. There will be no other materials drawn in to the site during these five days. After that the maximum number of lorries to site on any day will be 3 per day as the pre-cast concrete units are drawn to site.

Duration of Activity

3.9.30 It is planned that all of these construction works will be completed in 16 weeks. The works being carried out directly over the water will be completed in eight weeks. In the first week of the eight-week period the weir will be levelled off. By the end of the eight weeks the weir crest will have been restored to its original profile. It is planned that the works will be carried out between May and September. The on-site works will include placing the stone fill in the weir, erecting pre-cast bridge deck units, constructing the northern and southern ramps, removing the stone fill and re-profiling the weir, erecting handrails, lighting, surfacing, etc.

Bridge Design

3.9.31 The Broadmeadow Way bridge is designed for pedestrian/cycle loading with an allowance for occasional vehicular traffic (emergency ambulance access and minor maintenance works).

3.10 Malahide Works

3.10.1 There are three separate work areas on the Malahide section of the proposed greenway:

- Works in Malahide Demesne, the R106 Dublin Road and the south end of O'Hanlon's Lane.
- Works at the north end of O'Hanlon's Lane, Bissets Strand Road and the public area.
- Works to the weir maintenance access track on the southern railway causeway.

3.10.2 It is proposed to locate a site compound, vehicle compound and welfare facilities at the fenced area beside the Bissets Strand Bridge (see Volume 3-Figure 4). This area is used by Irish Rail for maintenance works to railway structures on the causeway. It will also be used by the works main contractor for the construction of the pedestrian bridge and other works scheduled for the Malahide area. The area is stoned and will require minimum upgrade works for the temporary site setup. Access to the area is restricted due to the height and width restrictions at the railway over-bridge adjacent to the site. Consequently, all deliveries to the works will be routed via Yellow Walls Road and Sea Road.

3.10.3 Deliveries to the work areas and the site compound will be regulated to a 'just in time' delivery schedule. The contractor will operate a 'rolling' timescale for the works in each area. This will minimise the possibility of accidental discharges into the area and will also allow the contractor to optimise the utilisation of the site compound.

Resource Requirements

3.10.4 The construction of the Malahide section of the works will be divided into three distinct sections of work, though there will be significant cross over in terms of men and machinery dependant on the different work stages. The anticipated quantities of the import and export materials is presented in the table below. All construction wastes arising will be recycled and re-used as appropriate to the scheme. Any residual waste arising will be disposed of by licensed contractor.

3.10.5 The surface of the greenway will be in dense bitumen macadam (DBM). On the southern railway causeway this will be installed on a prepared formation of compacted stone (clause 804) (c. 100/150mm) laid onto the existing stone fill. Two layers of bitumen (total 100/150mm) will be placed on the prepared stone using a mini paviour. The causeway stone wall (of limestone rubble) will be laid on a 100mm bed of concrete on a compacted layer of stone. Greenway surface works will follow completion of wall construction.

3.10.6 Batch loads of concrete will be delivered, on an as needed basis, to concrete storage silos in each construction compound. Small batch concrete loads will be delivered to specific construction locations by mini dumper.

Table 3.1 Materials Arising and Required.

	Works in Malahide Demesne, Bridgefield Car Park and the R106 and including the South End of O'Hanlon's Lane	Works at the North End of O'Hanlon's Lane, Bissets Strand Road and the Public Area	Works to the Maintenance Access Track to Construct the Proposed Greenway and Wall Along this Section
Excavation			
Subsoil	37.5m^3	200m^3	0m^3
Tarmac	75m^3	0m^3	0m^3
Footpaths and kerbs	550m^3	0m^3	0m^3
Importation			
Stone fill	460m^3	200m^3	1450m^3
Tarmac	150m^3	80m^3	500m^3
Concrete	40m^3	-	115m^3
Wall stone	-	-	500m^3

Transportation Requirements

3.10.7 Deliveries to site will be on a 'just in time' basis. This will ensure a minimum number of deliveries in any one day which will reduce the traffic impact during the construction period. The assessment of vehicular movements has been carried out on this section of the works as 'one project', notwithstanding the fact that it is unlikely that the same work process will occur at two different areas at the same time, i.e. the contractor is unlikely to schedule concrete pours in two different areas at the same time.

3.10.8 There will be a requirement to transport the following materials to site during the construction period.

Table 3.2 Delivery Type and Number of Trucks.

Delivery Type	Number of Trucks
Hardcore	145 trucks
Tarmac	70 trucks
Concrete	20 trucks
Wall Stone	25 trucks

3.10.9 There will be a requirement to transport materials off site during the construction period. All excess material will be disposed of to a suitable licensed facility.

Table 3.3 Removal Type and Number of Trucks.

Removal Type	Number of Trucks
Subsoil	16/20 trucks
Hardcore	2 trucks
Vegetation	2 trucks
Tarmac	40 trucks

3.10.10 The maximum number of deliveries to site will be for the tarmac finish to the carriageway on the R106. The construction of this road will be phased to allow for continuous access to Malahide village. Deliveries, temporary road closures and construction activity will be subject to compliance with the relevant statutory processes and approval from the operations department of Fingal County Council. These

restrictions and work practices will be part of an application to the Council by the contractor for construction licences and will be monitored and overseen on an ongoing basis by the consultant/local authority.

3.10.11 The remainder of the removal/deliveries will be spread evenly over the contract period (see below). The concrete required for the construction of the walls for the new ramp in Bridgefield car park will be no greater than two deliveries ($16m^3$) in any one pour. Similar deliveries will be required for the installation of the foundations for the wall along the causeway.

3.10.12 Hardcore quantities for the construction of the proposed greenway on Bissets Strand will likely be no more than 10 deliveries in any one day.

Duration of Activity

Table 3.4 Duration of Activity – R106.

R106 and Associated Areas	Duration
Commencement and set up	2 weeks
R106 construction works (slow because of the traffic volumes, traffic management and possible restrictions on working hours)	12 weeks
Construction of ramp and greenway in Bridgefield car park (concurrent with R106)	6 weeks
Total construction time	14 weeks

Table 3.5 Duration of Activity – Bissets Strand.

Bissets Strand	Duration
Commencement and set up	2 weeks
Works to Bissets Strand Road	6 weeks
Works to weir maintenance track (causeway wall and greenway)	12 weeks
Construction of landscape area (Bissets Strand)	6 weeks
Completion of works (lining and signing, etc)	2 weeks

3.10.13 There will be an overlap of the works on the R106 and the Bissets Strand area which will shorten the total time for the works in this area by four to six weeks, giving a total time from commencement to completion for the works in Malahide of c. 28 weeks. Works will not be weather dependant and the contractor will continue with the construction of each area with the same crew working in different areas as required.

3.11 Donabate Works

3.11.1 There are five separate work areas on the Donabate side of the project.

- Upgrade of the section of the Corballis Cottages Road at the railway bridge.
- Construction of the bridge (no. 1) at the Pill River.
- Construction of the proposed greenway along the existing northern railway causeway.
- Construction of the proposed greenway in the agricultural lands at Kilcrea including bridge no. 2 across the Pill River.
- Works at the entrance to Newbridge Demesne and Kilcrea Road.

The main site compound, vehicle compound and welfare facilities will be located at the open area beside the Corballis Cottages railway bridge (see Volume 3-Figure 5 for location). This area has a stoned access track parallel to the railway line as far as the Pill River.

3.11.2 The surface of the greenway will be in dense bitumen macadam (DBM). On the northern railway causeway this will be installed on a prepared formation of compacted stone (clause 804) (c. 100/150mm) laid onto the existing stone fill. Two layers of bitumen (total 100/150mm) will be placed on the prepared stone using a mini paviour. The causeway stone wall (of limestone rubble) will be laid on a 100mm bed of concrete on a compacted layer of stone. Greenway surface works will follow completion of wall construction.

3.11.3 Works on the north side of the River Pill will be accessed from the Corballis Cottages Road. Works on the south side of River Pill will be accessed from Bissets Strand. Crossing of the River Pill is not contemplated as part of these construction works.

3.11.4 Batch loads of concrete will be delivered, on an as needed basis, to concrete storage silos in each construction compound. Small batch concrete loads will be delivered to specific construction locations by mini dumper.

3.11.5 For much of the scheme in Kilcrea the contractor will only remove topsoil along the line of the new greenway. This topsoil will be re-used within the scheme. There will be a small amount of subsoil arising from the installation of fencing posts. This subsoil will be taken off site as it is removed to a licensed waste facility. There will be a minimum requirement (less than $100m^3$) for temporary storage of subsoil/topsoil on site within site compounds.

3.11.6 Surplus topsoil removed from the agricultural lands at Kilcrea will be stockpiled and re-used in the construction of a grassland area on the old line of the Corballis Cottages Road to the east of the railway road bridge.

3.11.7 The proposed Pill River bridge immediately west of the railway embankment (bridge no. 1) is a three span timber bridge (see Design Drawing 12-160-261 in Volume 3 for plan and section layouts). The bridge is to be laid at a slope of 1/34 from a concrete abutment at the existing ground level on the south side of the river to a concrete abutment at a marginally raised level on the north side of the river and onto two concrete piers built off a piled base between the abutments. The abutments will be built in concrete on the existing ground. These abutments will be constructed from reinforced concrete, one each side of the river, with holding down bolts for the steel bridge support beams. Concrete pours, concrete delivery and related construction methodology will be agreed with the contractor. Attention will be paid to the support and integrity of form work to avoid leakages or spills of concrete during the pouring process (see also CEMP in Section 3.13).

3.11.8 The construction of the piers on the south side will be on a piled base with the piers constructed from reinforced concrete. None of these piers will be within the wetted width of the Pill River and the flow of the river will not be obstructed at any time during the construction process. Construction access will be from the south side for the specialist contractor to install the steel driven piles and this temporary access will be used by the piling contractor and by the main contractor to install the concrete piers. The platform for the piling rig will be made of clean crushed rock with the base ringed by silt fences to minimise any wash-out of fines or sediment during the piling. The

disturbed area will be reinstated on completion. The piers will be built off the piles with holding down bolts for the steel bridge support beams. Concrete pours, concrete delivery and related construction methodologies will be part of the procedure agreed with the contractor to mitigate any possibility of spillage or contamination of the local environment. Particular attention will be paid to the support and integrity of form work in order to avoid leakages or spills of concrete during the pouring process (see also CEMP in Section 3.13).

3.11.9 On completion of the construction of the piers and the abutments, the main contractor will commence the construction of the bridge deck. Steel bridge beams will be installed using a small hoist. A timber bridge deck will be placed directly onto the steel beams. The design of the fixings for the timber members will be agreed with the main contractor prior to commencement. The construction of this bridge deck will not entail the use of concrete (see also CEMP in Section 3.13).

3.11.10 Bridge no. 2 crossing the Pill (12m) will be formed using concrete abutments on each side of the stream spanned with a wooden clad steel beam deck. The abutments will be formed one at a time with a four faced concrete finish. On completion, the bridge deck will be installed onto the abutments using a small crane.

3.11.11 The contractor's construction methodology will require the use of precast elements where practical; the use of secondary protection shuttering for concrete pours; all pours to be carried out in dry weather conditions; and that all trucks be cleaned prior to leaving respective depots. The contractor will be required to use experienced operators for the work; provide an appropriate level of continuous monitoring during any concrete pours by experienced management; and have method statements approved by the client prior to commencing works. Works will be carried out using recommendations from current guidance and relevant codes of practise.

3.11.12 Construction works will also require a method statement from the main contractor to include:

- Netting under all work areas to ensure that no construction materials fall from the work area into the estuary.
- No fuel fill of any machinery allowed in the work area. All machinery to be filled in designated construction compounds.
- Existing flora and fauna to be protected from damage at all times.
- Reinstatement of any access routes to be agreed prior to commencement.
- All work practises to be part of the construction method statement agreed prior to commencing construction (see also CEMP in Section 3.13).

Resource Requirements

3.11.13 The construction of the Donabate section of the works will be divided into five distinct sections of work, though there will be significant cross over in terms of men and machinery dependant on the different work stages.

Table 3.6 Resource Requirements Excavation and Importation.

	Works to Upgrade the Section of the Corballis Cottages Road, Construction of the Bridge at the Pill River, and Construction of the Greenway along the Railway Causeway
Excavation	
Subsoil	750m^3
Hardcore/Stone	1,050m^3
Tarmac	750m^3
Vegetation	50m^3
Importation	
Hardcore	3,775m^3
Tarmac	1,250m^3
Concrete	550m^3
Wall stone	850m^3

Transportation Requirements

3.11.14 Deliveries to site will be on an 'as needed' basis. The assessment of vehicular movements has been carried out as 'one project', notwithstanding that it is unlikely that the same work process will occur at two different areas.

3.11.15 Access to the site compound and to the site will be via the Hearse Road and the Corballis Cottages Road. The Hearse Road is the main access to Donabate Village and has the ability to carry the additional traffic generated by this section of the project. The Corballis Cottages Road is a narrow country road with poor sight lines in areas but has the capacity for the additional traffic generated by this project. Because of the narrow nature of the road, restrictions will be placed on the contractor in relation to large deliveries, particularly deliveries of bridge beams for the construction of the Pill River bridge and the like. The timing of these deliveries will be agreed with the road section of Fingal County Council as part of the approvals for access prior to the commencement of the project.

3.11.16 There will be a requirement to transport the following materials to site during the construction period.

Table 3.7 Delivery Type and Number of Trucks.

Delivery Type	**Number of Trucks**
Hardcore	250 trucks
Tarmac	85 trucks
Concrete	70 trucks
Wall Stone	60 trucks

3.11.17 There will be a requirement to transport the following materials off site during the construction period. All excess material will be disposed of to a suitable licensed facility.

Table 3.8 Removal Type and Number of Trucks.

Removal Type	Number of Trucks
Subsoil	50 trucks
Hardcore	70 trucks
Vegetation	5 trucks
Tarmac	50 trucks

Table 3.9 Resource Requirements Excavation and Importation.

	Works to Construct the Proposed Greenway in the Agricultural Lands, Works at the Entrance to Newbridge Demesne and Kilcrea Road
Excavation	
Subsoil	50m^3
Hardcore/Stone	70m^3
Tarmac	60m^3
Vegetation	15m^3
Importation	
Hardcore	2,000m^3
Tarmac	800m^3

3.11.18 Deliveries for the construction of the proposed greenway in the agricultural lands will be from two directions: off the Kilcrea Road (or Donabate Distributor Road if completed) and off the Corballis Cottages Road. It is unlikely that this section of the work will commence until the other major sections of work are completed.

3.11.19 There will be a requirement to transport the following materials to/from site during the construction period.

Table 3.10 Delivery Type and Number of Trucks.

Delivery Type	Number of Trucks
Hardcore	140 trucks
Tarmac	10 trucks
Concrete	70 trucks

Table 3.11 Removal Type and Number of Trucks.

Removal Type	Number of Trucks
Subsoil	4 trucks
Hardcore	5 trucks
Vegetation	2 trucks
Tarmac	4 trucks

Duration of Activity

Table 3.12 Duration of Activity – Corballis Cottages Road and Associated Areas.

Corballis Cottages Road and Associated Areas	Duration
Upgrade of the section of the Corballis Cottages Road	12 weeks
Construction of the bridge at the Pill River	14 weeks
Construction of the proposed greenway along the railway causeway	12 weeks
Construction of the proposed greenway in the agricultural lands	6 weeks
Works at the entrance to Newbridge Demesne and Kilcrea Road	4 weeks
Completion of works (lining and signing etc)	2 weeks

3.11.20 There will be an overlap of the works on the Corballis Cottages Road, the Pill River bridge and the construction of the bridge across the causeway which will shorten the total time for the works in this area. The total time from commencement to completion for the works in Donabate is estimated at 28 weeks. The construction of the proposed greenway in the agricultural lands and the upgrade works at the entrance to Newbridge Demesne and the Kilcrea Road upgrade works will be carried out using two smaller crews with very little overlap.

3.11.21 None of the works will be weather dependant and the contractor will progress the construction of each area with the same crew working in different areas as required.

3.12 Project Schedule

3.12.1 See Table 3.13 below for overall scheduling of works.

Table 3.13 Overall Scheduling of Works.

	Week No.																											
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Broadmeadow Way Bridge																												
Weir reprofiling works																												
Erection of precast units																												
Removal of fill and geotextile for weir																												
Bridge completion works																												
Donabate																												
Upgrade of the section of the Corballis Cottages Road																												
Construction of two bridges at the Pill River																												
Construction of the proposed greenway along railway causeway																												
Construction of the proposed greenway in the agricultural lands																												
Works at entrance to Newbridge Demesne & Kilcrea Road																												
Completion of works (lining and signing etc)																												
Malahide – R106 and Associated Areas																												
Commencement and set up																												
R106 construction works																												
Construction of ramp & greenway in Bridgefield car park																												
Malahide – Bissets Strand																												
Commencement and set up																												
Works to Bissets Strand Road																												
Works to weir maintenance track																												
Construction of landscape area (Bissets Strand)																												
Completion of works (lining and signing, etc)																												

3.13 Construction Environmental Management Plan (CEMP)

3.13.1 A preliminary construction environmental management plan (CEMP) has been prepared to manage the impacts of construction activities associated with the development project (see Table 3.14 below). Fourteen sub-plans will be implemented by the appointed project contractor. Details of the proposed construction methodology are provided in Section 3.9 to Section 3.11 above.

Table 3.14 Sub-Plans for Managing Construction Activities.

Reference	Procedure
CEMP-1	Site Environmental Training and Awareness Procedure.
CEMP-2	Environmental Emergency Response Plan.
CEMP-3	Concrete Control Procedure.
CEMP-4	Fuel and Oil Management Plan.
CEMP-5	Protection of Water Resources.
CEMP-6	Construction Traffic Management Plan.
CEMP-7	Management of Excavation, Spoil, Demolition.
CEMP-8	Waste Management Plan.
CEMP-9	Construction Noise Management Plan.
CEMP-10	Construction Dust Management Plan.
CEMP-11	Materials Handling and Storage Plan.
CEMP-12	Monitoring and Auditing Procedure.
CEMP-13	Environmental Accidents, Incidents and Corrective Actions Procedure.

3.13.2 The construction environmental management plan sets out the principles to be adhered to and outlines measures that will be implemented during the construction of the proposed development to ensure that potential environmental impacts and disturbance will be minimised or eliminated.

3.13.3 It will be the contractor's responsibility to update and add (where required) specific control measures relevant to the environmental management plan and procedures. The control measures will be amended by improvement with regards to environmental protection and will take cognisance of additional environmental commitments arising from planning conditions or technical investigations carried out as part of the pre-construction stage.

3.13.4 Fingal County Council will oversee the process through appointment of the contractor, resident engineer staff and oversight from the planning and strategic infrastructure project team.

Sub-Plans for Managing Construction Activities

CEMP-1: Site Environmental Training and Awareness Procedure

3.13.5 An initial site environmental induction and ongoing training will be provided to communicate the main provisions of this environmental plan to all site personnel.

3.13.6 Two-way communication will be encouraged to promote a culture of environmental protection.

3.13.7 The following outlines the information which must be communicated to site staff:

- Environmental procedures of the CEMP.
- Environmental buffers and exclusion zones.
- Housekeeping of materials and waste storage areas.
- Environmental emergency response plan.
- Environmental training records are to be retained in the site office.

CEMP-2: Environmental Emergency Response Plan

3.13.8 In the event of an environmental emergency, all personnel will react quickly and adhere to this procedure (to be finalised by contractor). The following outlines the information, on the types of emergency, which must be communicated to site staff:

- Release of hazardous substance – fuel or oil spill.
- Concrete spill or release of concrete.
- Flood event – extreme rainfall or sea level event.
- Environmental buffers and exclusion zones breach.
- Housekeeping of materials and waste storage areas breach.
- Stop work orders due to environmental issue or concern (e.g. threat to ecological feature).
- Fire on site (cross reference site safety emergency plan as appropriate).

CEMP-3: Concrete Control Procedure

3.13.9 Concrete will be used for wall and fence foundations, wall forming structures and grouting of precast concrete units. The following measures will be implemented to prevent concrete entering watercourses:

- Batch loads of concrete will be delivered, on an as needed basis, to the concrete storage silos in each of the construction compounds.
- Small batch concrete loads will be delivered to the specific construction locations by mini dumper.
- Trucks that deliver concrete to site will be washed out at the supplier's facilities and not on site.
- A designated trained operator experienced in working with concrete will be employed during concrete pouring from storage silos.
- Concrete pours at the River Pill bridge crossings (no. 1 and no. 2) will only be conducted in dry weather and subject to secondary protection (see also Section 3.11).

CEMP-4: Fuel and Oil Management Plan

3.13.10 The appointed contractor will implement a fuel management plan which will incorporate the following elements:

- Mobile bowsers, tanks and drums stored in a secure, impermeable storage area, away from drains and open water in the construction compounds.
- Fuel containers stored within a secondary containment system, e.g. bund for static tanks or a drip tray for mobile stores in the construction compounds.

- Ancillary equipment such as hoses, pipes contained within the bund.
- Taps, nozzles or valves fitted with a lock system.
- Fuel and oil stores including tanks and drums regularly inspected for leaks and signs of damage.
- Designated trained operators authorised to refuel plant on site, and emergency spill kits present at equipment for all refuelling events.
- Procedures and contingency plans set up to deal with emergency accidents or spills.
- Emergency spill kit with oil boom, absorbers, etc kept on site in the event of an accidental spill.

CEMP-5: Protection of Water Resources

(A) SILT

- Excavations: Water will be prevented from entering local excavations by way of cut-off drains. Personnel and/or plant will not disturb water in a local excavation. The means of dewatering excavations in the event there is ingress will include settlement tanks or a silt buster stream if required to ensure that any dewaterings do not increase background suspended solids levels in the environment.
- Spoil heaps: Small (<100m^3) topsoil/subsoil heaps will be located, protected and stabilised in the contractor compounds in a way that will avoid the risk of contamination of drainage systems and local watercourses.
- Site roads will be kept free from dust and mud deposits. In dry weather dust suppression measures will be utilised.
- Dealing with very silty water: Water containing silt will not be pumped directly into watercourses or surface water drains. Adequate provision for dealing with very silty water will be put in place (see "Excavations" above).

(B) CONCRETE

3.13.11 In the event of a spillage on site, the material will be contained (using an absorbent material such as sand or soil or commercially available booms). All spillages will be reported to the project manager who will inform the relevant authorities in the event of a significant occurrence.

(C) DELIVERIES

- Special care will be taken during deliveries, especially when fuels and hazardous materials are being handled.
- All liquid deliveries will be supervised by a responsible person to ensure that (1) storage tank levels are checked before delivery to prevent overfilling and (2) the product is delivered to the correct tank.
- Contingency plans will be agreed and suitable materials available to deal with any incident.
- All employees will be briefed on the actions required in the event of a spillage.

- Spillages will be recorded and advised to the project manager who will inform local authorities if they deem it significant.

(D) REFUELLING

- Mobile plant will be refuelled in the construction compounds, on an impermeable surface away from any drains or watercourses. A spill kit will be available at this location.
- Hoses and valves will be checked regularly for signs of wear and turned off and securely locked when not in use.
- Generators, diesel pumps and similar equipment will be placed on drip trays to collect minor spillages. These will be checked regularly, and any accumulated oil removed for disposal.

(E) STORAGE

- All fuel, oil and chemical storage will be sited on an impervious base within a bund and secured within the construction compounds.
- The base and bund walls will be impermeable to the material stored and of an adequate capacity.
- Leaking or empty oil drums will be removed from the site immediately and disposed of via a licensed waste disposal contractor.
- The contents of any tank will be clearly marked on the tank, and a notice displayed requiring that valves and hoses be locked when not in use.
- All valves and hoses will be protected from vandalism and unauthorised interference and turned off and securely locked when not in use.
- Any tanks or drums will be stored in a secure container or compound, which is to be kept locked when not in use.
- Bowsers will be stored within site security compounds when not in use.

CEMP-6: Construction Traffic Management Plan

3.13.12 The appointed contractor will prepare a detailed traffic management plan in response to the requirements set out in this plan and prior to the works commencing.

- The plan will include provision for liaison with the community, the local authority and the Gardaí where required.
- Details of site access and any site traffic rules will be identified, including security, parking, loading, unloading, and required speed.
- Details of equipment delivery will be provided.
- Site operating hours (including delivery) to be outlined.

CEMP-7: Management of Excavation and Spoil

3.13.13 For the management of excavation and spoil, the contractor will:

- Erect all protective fencing.

- Implement the surface water management plan (including the installation of drainage infrastructure) prior to excavation and include areas dedicated to spoil storage with the drainage infrastructure.
- Ensure all spoil and excavated materials will be stored in the construction compounds.
- Ensure stockpiles and adjacent features of drainage infrastructure will be monitored and maintained appropriately.
- Ensure that all suitable topsoil and subsoil excavated at Kilcrea is re-used in new habitat creation at Corballis Cottages Road.

CEMP-8: Waste Management Plan

3.13.14 The following wastes may be generated during the construction of the project:

- Construction waste (materials, concrete, stonework, blockwork, timber, steel, etc.)
- Waste fuels; oil/diesel.
- Paper/cardboard.
- Non-hazardous office and canteen waste.
- Wastewater from office and welfare facilities.

3.13.15 Wastes will be segregated and stored in allocated tanks, bins, skips or areas within the construction compounds. The appointed contractor will finalise all storage areas and employ licensed contractors for the appropriate waste collections. The appointed contractor will ensure all permits and licences are in place and maintain relevant copies in the site office. Wastewater from holding tanks will be collected by an appropriate licensed contractor. Construction materials will be stored and managed in a way which promotes waste minimisation, including segregating materials for re-use.

CEMP-9: Construction Noise Management Plan

3.13.16 The appointed contractor will ensure that impacts from noise are minimised. The following measures will be communicated to all staff on site:

- All plant and machinery will be maintained to ensure noise emissions are negated and in line with relevant standards.
- Construction personnel will not leave plant and machinery running unnecessarily or operating outside of agreed operational hours.

CEMP-10: Construction Dust Management Plan

3.13.17 The appointed contractor will ensure that impact from dust is minimised. The following measures will be communicated to all staff on site:

- All plant and machinery will be maintained to ensure that dust and air emissions are negated and in line with relevant standards.
- Construction personnel will not leave any plant and machinery running unnecessarily or operating outside of agreed operational hours.
- Aggregate of not less than 5mm grade will be used in construction materials for the on-site road network.

- Dust suppression measures will be implemented in prolonged, dry and windy periods.

CEMP-11: Materials Handling and Storage Plan

3.13.18 The appointed contractor will ensure that the handling of materials and their storage meets regulatory and site requirements.

3.13.19 The plan will include:

- Layout proposal for the construction compounds including the location of contractor cabins, site offices, storage containers and open-air laydown areas.
- Adherence to safety and storage of equipment and materials.
- Safe transfer and placement of equipment in accordance with approved handling methods, and will be subject to a method statement.

CEMP-12: Monitoring and Auditing Procedure

3.13.20 Checklists for daily environmental monitoring will include (but are not limited to) confirmation that fuel is stored appropriately, that management rules are adhered to, all environmental buffers are maintained, sediment and erosion control measures of the surface water management plan are in place and functioning.

3.13.21 All environmental records, including completed checklists, will be retained at the site office.

CEMP-13: Environmental Accidents, Incidents and Corrective Actions Procedure

3.13.22 Environmental accidents and incidents occurring on site during the works will be reported, recorded and investigated. Corrective actions will be put in place and expeditiously closed out.

3.13.23 This procedure will be updated (by the appointed contractor) to include the relevant personnel responsibilities and reporting structure and the finalised procedure will be communicated to all personnel.

3.13.24 Environmental accidents and incidents may include but are not limited to:

- Accidents involving a spill of fuel or concrete from delivery truck (emergency response required).
- Spills of fuel and oil (minor).
- Waste or rubbish not in dedicated waste areas.
- Breach of any buffers (archaeological, ecological, watercourse).
- Failure of any control measures (e.g. silt fences collapsed in a storm).
- Unplanned vehicle movement off the access tracks.
- Unplanned vehicle movement within a buffer zone.

3.13.25 See also the risk of major accident and/or natural disaster assessment in Volume 4C-Appendix 18 in Volume 4C of this EIAR.

4.0 Traffic and Transportation

4.1 Introduction

4.1.1 This chapter aims to assess the impact of the proposed development on the receiving environment in terms of traffic conditions, transport routes and facilities, and general traffic safety.

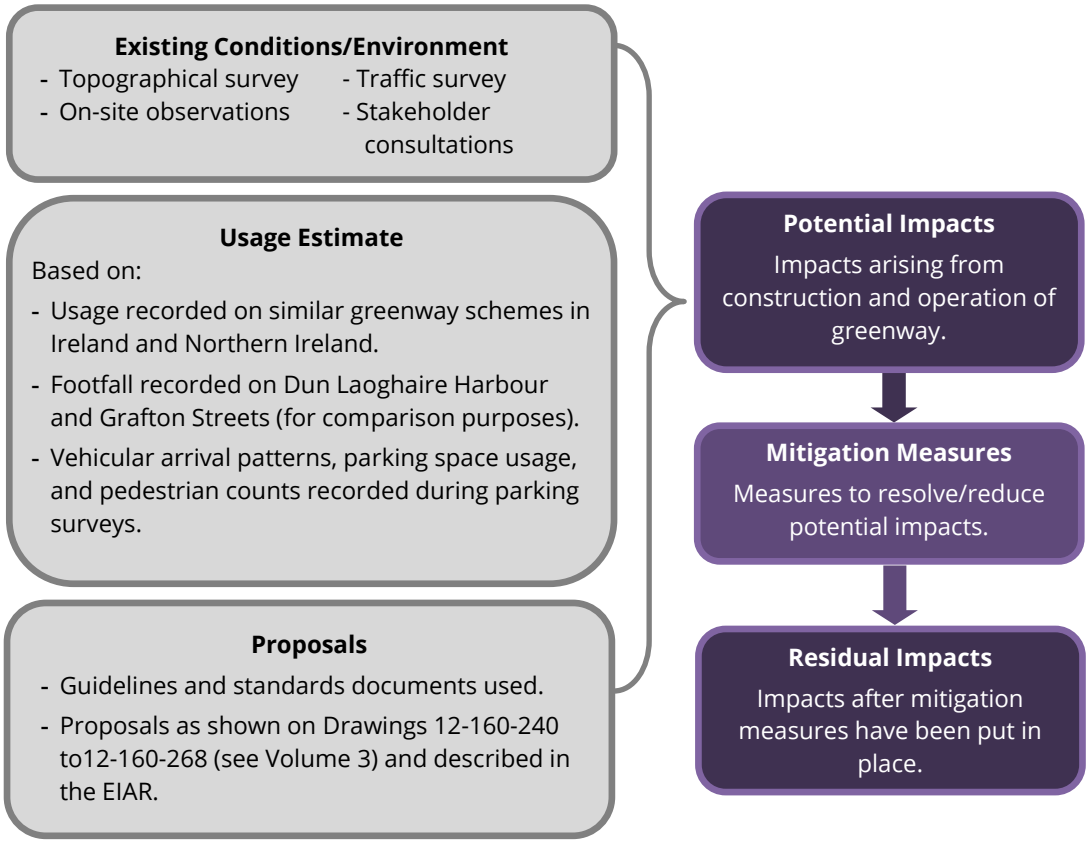
4.1.2 The assessment will identify and address:

- sections of the existing road network temporarily affected during the construction of the scheme;
- sections of the existing road network permanently affected by the proposals; and potential impacts of the various stages of the proposal on existing transport infrastructure and users.

4.1.3 Solutions and mitigation measures will aim to:

- minimise pollution and spillage during construction;
- ensure the safety of workers and general public during construction;
- ensure the safety of users and general public during the operation of the proposed greenway; avoid or minimise impact on existing transport infrastructure, e.g. roads, railways, bridges, etc; and
- minimise permanent impact on existing green spaces.

4.2 Methodology



Existing Conditions/Environment

4.2.1 A review of the existing transport infrastructure along the proposed route was undertaken in order to establish a baseline environment for the traffic assessment. This included:

- Topographical survey along the whole length of route;
- Traffic surveys at selected locations (see Table 4.1);
- On-site visual observations along length of route; and
- Stakeholder consultations.

Table 4.1 Traffic Survey Locations.

Day/Time	Junction Surveys	Parking Surveys
Thursday 28th September and Saturday 30th September 2017 07:00–19:00	(1) R106 Malahide Road/Yellow Walls Road (2) O'Hanlon's Lane/Bissets Strand. (3) R126/Kilcrea Road/Corballis Cottages Road.	(i) Malahide Castle main car park. (ii) Bridgefield car park (off R106 Dublin Road). (iii) Newbridge House car park.
Tuesday 27th May 2014 07:00–19:00	(4) R126/Hearse Road/pedestrian stairs to Donabate train station eastern car park. (5) R126/Hearse Road/vehicular access to Donabate train station western car park.	
Thursday 29th May and Sunday 1st June 2014 07:00–19:30		(iv) Donabate Train Station Car Park.

Usage Estimate

4.2.2 A comparison of pedestrian and cyclist usage along similar greenways, i.e. walking/cycling routes, operating in Ireland is used to estimate the number of users that can be expected upon completion of the proposed development.

Table 4.2 Similar Walking/Cycling Routes for Comparison of Usage.

Location	Characteristics
(a) Cork City: Greenway along disused Passage West railway line between Blackrock and Mahon.	3km length; urban catchment; recreational route, and commuting route only during longer daylight times.
(b) Cork City: Blackrock/Mahon coastal greenway/amenity route.	3km length; urban catchment; recreational route.
(c) Cork County: Passage West to Rochestown Greenway.	5km length; urban catchment on both ends; recreational route and commuting route.
(d) Dun Laoghaire: The Metals Walkway pedestrian and cyclist route between Dun Laoghaire and Dalkey.	3.5km length including 10 traffic junctions; urban catchment; recreational route and commuting route.
(e) Dun Laoghaire: Dun Laoghaire Harbour east pier.	1.2km length; urban catchment; recreational route; popular tourist attraction.
(f) Dublin City: Grafton Street pedestrianised street.	City centre pedestrian street; retail environment; popular tourist attraction.

Location	Characteristics
(g) Co. Mayo: Great Western Greenway between Mulranny-Newport.	18km length; scenic rural environment; recreational route, popular with cyclist-tourists, with commuter usage.
(h) Northern Ireland: Comber Greenway between Comber and centre of East Belfast.	7 miles length; urban catchment; recreational route, and commuting route only during longer daylight times.
(i) Northern Ireland: Lagan & Lough Cycleway along Lagan canal towpath between Union Locks in Lisburn and Stranmillis Weir in Belfast.	11 miles length; scenic rural environment; recreational route.

4.2.3 The modal split among potential users is estimated based on the NTA's National Household Travel Survey of 2012. This survey indicates the proportion of leisure/sport trips that were taken using the following modes:

- Car/van.
- Taxi/hackney.
- Bus.
- Train/DART.
- Luas.
- Bicycle.
- Walking.

4.2.4 In the case of the proposed development, the Luas would not be relevant because there is no Luas service to Malahide or Donabate. However, the proposed development will be well serviced by DART and train services in both Malahide and Donabate. Hence in this case, mode share for the Luas is recategorised and combined with mode share for the train/DART.

Guidance Documents

4.2.5 The proposed development has been developed in accordance with the following guidance documents and design standards:

- *The National Cycle Manual*, National Transport Authority;
- *Traffic Management Guidelines*, DoELG, DoT, DTO;
- *Traffic Signs Manual*, DoELG;
- *Design Manual for Urban Roads and Streets*, DoELG;
- *A Guide to Planning and Developing Recreational Trails in Ireland*, National Trails Office;
- *Management Standards for Recreational Trails*, National Trails Office; and
- *Classification and Grading for Recreational Trails*, National Trails Office.

4.3 Existing Environment

4.3.1 For ease and clarity of reporting and assessment the study area has been divided into six sections as follows:

- Section 1 – Malahide Demesne.
- Section 2 – R106 Dublin Road, Malahide.
- Section 3 – R106 Dublin Road to Bissets Strand Road (O'Hanlon's Lane).
- Section 4 – Bissets Strand Road to the North Shore of Malahide Estuary.
- Section 5 – North Shore of Malahide Estuary to R126 Hearse Road.
- Section 6 – Newbridge Demesne.

Section 1 – Malahide Demesne

4.3.2 The existing pedestrian/cyclist shared paths within the Malahide Demesne grounds are between 2.5-3.8m in width. These paths are in good condition and are well used for recreational purposes, especially during weekends and holidays. Public lighting is provided along most of this section.

4.3.3 Although the widths of some of the shared paths are less than 3m, pedestrian and cyclist movements appear to be sufficiently catered for, due to low cyclist speeds, high proportion of pedestrians, and the availability of green spaces on both sides of the shared paths.

4.3.4 The existing main car park located just south of Malahide Castle has capacity for up to 523 cars. Parking surveys at this car park indicated occupancy rates of up to 29% on a normal weekday, and up to 84% on a normal weekend.

4.3.5 The existing Bridgefield car park located off the R106 Dublin Road has capacity of up to 119 cars. Parking surveys at this car park indicated occupancy rates of up to 100% on a normal weekday, and up to 92% on a normal weekend.

Section 2 – R106 Dublin Road, Malahide

4.3.6 Proposals along the R106 Dublin Road involve a 190m length section between Hogan's Gate entrance to Malahide Demesne and O'Hanlon's Lane. It is also proposed to provide an upgraded link to Malahide village along the southern and eastern side of Bridgefield car park including the upgrade of the existing steps and ramps and widening of the existing pedestrian entrance to Malahide Demesne.

4.3.7 AADT estimated along this section of the R106 Dublin Road is 15,300 vehicles, based on traffic counts of September 2017 at the junction of R106 Dublin Road and Yellow Walls Road (see Location 1 on Text Figure 4.1 below).

4.3.8 Existing public roadway on the section between Hogan's Gate and O'Hanlon's Lane comprises a 7.2m-width single carriageway with footpaths of approximately 2.2m-width along the northern side and 1.8m width along the southern side. There is also a line of public lighting poles located close to the road edge along the northern footpath.

4.3.9 Between Hogan's Gate entrance and the Dublin Road railway bridge, the carriageway width narrows to 6.2m, and the footpath widths narrow to 1.8m along the northern side and 1.1m along the southern side on the approach to the railway bridge.

4.3.10 At present, there are no pedestrian crossings across the R106 Dublin Road between Malahide railway bridge and the junction to O'Hanlon's Lane.

4.3.11 Access to O'Hanlon's Lane (which is a cul-de-sac) is located on the northern side of the R106 Dublin Road. There are also a number of entrances to private properties on the northern side of the road including access roads to the Casino apartment complex and the Malahide Presbyterian Church.

Text Figure 4.1 Traffic Survey Locations.

4.3.12 The entrances to Malahide Cricket Club and Bridgefield car park are located on the southern side of the road.

4.3.13 There are two existing bus stops along this section of the R106 Dublin Road. Bus stop no. 3584 is located on the northside of the road near Malahide Presbyterian Church; bus stop no. 3635 is located on the southside of the road near Malahide Cricket Club. These bus stops are served by Dublin Bus no. 32X, 42, 42D, 102, 142. The no. 42 has the highest frequency service – every 30 minutes during normal hours and 20 minutes during peak hours.

Section 3 – R106 Dublin Road to Bissets Strand

4.3.14 O'Hanlon's Lane is a cul-de-sac with bollards installed halfway along the lane (190m from the southern end and 160m from the northern end) to restrict general through traffic.

4.3.15 AADT estimated on the northern end of O'Hanlon's Lane is 63 vehicles, and on Bissets Strand Road is 4,950 vehicles, based on traffic counts of September 2017 at the junction of O'Hanlon's Lane and Bissets Strand Road (see Location 2 on Text Figure 4.1 above). Traffic volume on O'Hanlon's Lane is low because the lane is a cul-de-sac serving low-density residential properties.

4.3.16 Existing public roadway/cul-de-sac along O'Hanlon's Lane comprises:

- 140m length of 3.5m-width pedestrian, cyclist and vehicular shared street with six driveway entrances to private residential properties on both sides along the southernmost end.
- 110m length of 7.5m-width carriageway and 1.7m-width footpaths, with seven driveway entrances to private residential properties on both sides along the centre section.
- 100m length of 5m-width pedestrian, cyclist and vehicular shared street along the northernmost end.
- Entrances to private properties (including St. Ives apartments) at the junction to Bissets Strand on the northernmost end of the lane.

4.3.17 Existing public roadway along Bissets Strand Road comprises:

- 170m length of 6m-width carriageway between O'Hanlon's Lane and Bissets Strand railway underbridge on the eastern end, with no dedicated cycling facilities.
- 35m length of 0.9m-width segregated footpath along the southern side of the road, ramped between an access road serving adjacent residences (Strand Cottage) and the railway underbridge on the eastern end of Bissets Strand Road.
- Five marked on-street parking spaces along the north side of the road, and five unmarked on-street parking spaces along the south side.

4.3.18 Traffic speeds along O'Hanlon's Lane are low, due to the residential nature of the road and to the narrow road widths along its northern and southern sections.

4.3.19 The speed limit for Bissets Strand Road is 50kph. However, vehicular operating speeds are likely to be lower on the approaches to this section of the road, due to narrow road

widths at the underbridge location (approaching from the eastern end), and to the left bend in the road alignment on approach to O'Hanlon's Lane junction (western end).

4.3.20 The existing junction layout at O'Hanlon's Lane/Bissets Strand Road is wide (13m-width at the narrowest location), with no facilities for pedestrians or cyclists.

4.3.21 There is an existing unofficial walking trail in the green area along the north side of Bissets Strand Road.

4.3.22 On the eastern end of Bissets Strand Road at the railway underbridge, the carriageway width narrows to 3.4m. At present, a two-way traffic system is operating at this location, with drivers giving way to opposing traffic on a courtesy basis.

4.3.23 The 0.9m-width segregated footpath along the southern side of Bissets Strand Road ramps down from a height of approximately 1.2m at Strand Cottage, continues along the railway underbridge, and connects (levelled) with footpaths along the southern side of Strand Court on the eastern side of the underbridge.

Section 4 – Bissets Strand Road to Malahide Estuary North Shore

4.3.24 The total length of this section is approximately 1,885m, extending from the south shore (at Bissets Strand Road) to the north shore of Malahide Estuary, running along the western side of the existing railway viaduct across the estuary. The Malahide Estuary is part of the Natura 2000 (European Sites) network as it has been identified as a Special Area of Conservation (SAC), and Special Protection Area (SPA). The estuary is also identified as a Proposed Natural Heritage Area (pNHA).

4.3.25 The route along the western side of the existing railway viaduct comprises:

- Southern end of the viaduct (near Bissets Strand Road): 605m length of existing 4.5m-width of stoned and parallel to the existing railway line, at a level lower than the railway tracks. This existing access track must be retained to provide access to the railway viaduct and weir for maintenance purposes by Irish Rail.
- Centre section of the viaduct: New 180m length pedestrian/cycle bridge providing 4m-width paths will be constructed on existing bridge piers. The new bridge will be a 12-span bridge structure, with a soffit at a minimum of 3.8mOD.
- Northern section of the viaduct: 1,100m length along existing raised stoned area (approximately 3.0-3.5m wide) parallel to and along the western side of the existing railway line, at the same level as the railway tracks. The raised stone area stops 70m short of the north shore, and then continues at a lower level.

Section 5 – Malahide Estuary North Shore to R126 Hearse Road

4.3.26 This section of the route is located on existing agricultural lands, linking with Kilcrea Road and crosses the R126 Hearse Road. It is also proposed to provide a link to the eastern side of the railway line at the railway crossing on Corballis Cottages Road as shown on the design drawings in Volume 3.

4.3.27 AADT estimated on the northwestern end of Corballis Cottages Road is 1,000 vehicles, on Kilcrea Road is 265 vehicles, and on the R126 Hearse Road is 9,786 vehicles, based

on traffic counts of September 2017 at the junction of the R126 Hearse Road/Corballis Cottages/Kilcrea Road (see Location 3 on Text Figure 4.1 above).

4.3.28 Corballis Cottages Road is a 5m-width carriageway with no dedicated walking or cycling facilities. Where the road crosses under the railway bridge, the 5m underbridge width is presently sufficient for only a single vehicle to pass through. Vehicular speeds here are limited by narrow carriageway widths and the winding nature of the road. Traffic volumes are low along this road as it is serving mostly agricultural lands, private residences, and recreational facilities, including three golf courses, along Balcarrick beach.

4.3.29 The existing public roadway on Kilcrea Road comprises carriageway of approximately 3m width which widens to 6m width on the approach to R126 Hearse Road junction; and approximately 14m length of 1.7m-width footpath along the western side on approach to the R126 Hearse Road. The signposted speed limit on this road is 80kph. Traffic volumes are low along this road as it is serving mostly agricultural lands and private residences.

4.3.30 The existing public roadway on this section of the R126 Hearse Road comprises 5.8m-width carriageway; and a section of 1.7m-width footpath on the southern side, west of Kilcrea Road junction. The signposted speed limit on this road is 60kph. There is presently no public lighting along this section of the R126. The road alignment is a curve at the entrance to Newbridge Demesne and at the junction with Kilcrea Road.

4.3.31 There are two existing bus stops serving the R126 Hearse Road. Bus stop no. 3745 is located on the westbound side of the R126 Hearse Road west of Kilcrea Road junction, and bus stop no. 3718 is located on the eastbound side of the R126 east of Newbridge Demesne entrance. Both stops are served by Dublin Bus no. 33B between Portrane and Swords, at 30 minute frequencies; and no. 33D between Portrane and city centre, once a day.

4.3.32 The Donabate Distributor Road is currently under construction across Kilcrea Road. It is expected to be completed and opened prior to the implementation of this scheme.

Section 6 – Newbridge Demesne

4.3.33 Existing pedestrian/cyclist shared paths within the Newbridge Demesne grounds are approximately 2m wide. These are in good condition and are well used for recreational purposes, especially during weekends and holidays. There is presently no public lighting along these paths.

4.3.34 Although the widths of the shared paths are less than 3m, pedestrian and cyclist movements appear to be sufficiently catered for, due to low cyclist speeds, high proportion of pedestrians, and the availability of green spaces on both sides of the shared paths.

4.3.35 The existing main car park located just southwest of Newbridge House has capacity for up to 197 cars. Parking surveys at this car park indicated occupancy rates of up to 21.8% on a normal weekday, and up to 98.5% on a normal weekend.

4.3.36 An overflow car park is located adjacent to the main car park, with capacity for approximately 500 vehicles. This overflow car park is used when demand for parking is high, e.g. during peak season weekends. During these occasions, the overflow car park

area is often used for picnics as well – hence the actual operating capacity may be lower (than 500).

4.4 Usage Estimates

Trips Recorded on Other Existing Walking/Cycling Routes

4.4.1 Pedestrian and cyclist counts recorded along a number of existing greenways and similar walking/cycling facilities in Ireland were used as references to estimate the average daily trips on the proposed development (Table 4.3).

4.4.2 Locations (a), (b), (c), (g), (h), and (i) are considered most similar to the proposed development in terms of walking/cycling facilities, environment, catchment, and potential trip purposes.

4.4.3 Location (d) represents a section of the Metals Walkway which is less busy because it is located further away from the coast and is less scenic. Locations (e) and (f) represent walkways that are very wide, scenic, and popular with locals as well as domestic and international tourists.

Baseline and Assumptions Used

Baseline

4.4.4 The baseline used is the recorded car park usage and number of pedestrians exiting the car parks at Malahide Castle main car park, Bridgefield car park, and Newbridge House main car park, during surveys carried out on Thursday 28th and Saturday 30th September 2017.

Adjustment for Weather

4.4.5 The weather on Thursday 28th and Saturday 30th September 2017 at Malahide and Newbridge was recorded as cloudy when car park surveys were conducted. As such, no adjustment for weather has been applied in these calculations.

Weekday/Weekend Ratio

4.4.6 To determine the different levels of usage on a single weekday and a single weekend within the same week, a weekday/weekend ratio has been calculated by comparing the recorded number of pedestrians exiting car parks at Malahide Demesne and Newbridge Demesne during car park surveys conducted on a weekday (Thursday 28th September) versus surveys conducted on a weekend (Saturday 30th September 2017).

Table 4.3 Trips Recorded along Similar Pedestrian and Cyclist Routes.

Location	Type of Count	Annual Users	Average Daily Trips	Peak Season Daily Trips
(a) Cork City: Greenway along former Passage West railway line between Blackrock and Mahon.	12-hour pedestrian/cyclist counts between 7am-7pm on 27th February 2014.	-	∑=**1180** Ped=1027 Cyc=153	-
(b) Cork City: Blackrock/ Mahon coastal greenway/ amenity route.	12-hour pedestrian/cyclist counts between 7am-7pm on 27th February 2014.	-	∑=**1202** Ped=1127 Cyc=75	-
(c) Cork County: Passage West to Rochestown Greenway	12-hour pedestrian/cyclist counts between 7am-7pm on 27th February 2014.	-	∑=**1223** Ped=1084 Cyc=139	-
	12-hour pedestrian/cyclist counts between 7am-7pm on 7th August 2013.	-	-	∑=**1286** Ped=796 Cyc=490
(d) Dun Laoghaire: The Metals Walkway pedestrian and cyclist route between Dun Laoghaire and Dalkey	Daily counts recorded by automatic counters located near Glenageary train station, 1st January to 31st October 2014.	-	∑=**493** Ped=284 Cyc=209	636 (90th percentile[1])
(e) Dun Laoghaire: Dun Laoghaire Harbour east pier.	Weekly footfall counts recorded by automatic counters located on the east pier, from first week in 2012 to 48th week in 2013.	**1,510,341** (2012); **1,004,926** (2013, previous year counts assumed for weeks 49-52)	24,185 per week (29,045/wk in 2012; 19,326/wk in 2013)	44,628 per week (90th percentile[1]) over two years 2012 and 2013
(f) Dublin City: Grafton Street pedestrianised street.	Daily footfall counts in 2013 recorded by automatic counters located at M&S shop.	**27,081,896**	74,197	90,383 (90th percentile[1])
(g) Co. Mayo: Great Western Greenway between Mulranny and Newport.	2013 annual pedestrian and cyclist numbers according to automatic counters located 2km from Mulranny.	**289,000** (80% cyclists, 20% pedestrians)	600–1,000	1,000+
(h) Northern Ireland: Comber Greenway between Comber and centre of East Belfast.	Extract from Dodder Greenway Economic Appraisal Report (refer to Volume 4C-Appendix 4)	∑=**377,769** Ped=178,117 Cyc=199,652	∑=1,035 Ped=488 Cyc=547	-
(i) Northern Ireland: Lagan & Lough Cycleway along Lagan canal towpath between Union Locks in Lisburn and Stranmillis Weir in Belfast.	Extract from Dodder Greenway Economic Appraisal Report (refer to Volume 4C-Appendix 4)	∑=401,440 Ped=217,515 Cyc=183,925	∑=1,100 Ped=596 Cyc=504	-

∑: Sum

Ped: Pedestrian Counts.

Cyc: Cyclist Counts.

(1) A percentile, not to be confused with percentage, is a statistical measure of distribution. For a given set of data, it is the level below which a certain percentage of the data falls. In this case, the 90th percentile was identified from the lowest-highest distribution of the recorded counts, and represents the level at which 90% of all recorded counts fall under, i.e. only 10% of the recorded counts are higher than these levels. This 10% would represent occasions with exceptionally high usage, e.g. special events and summer bank holidays with good weather.

Table 4.4 Recorded Number of Pedestrians Exiting Car Parks at Malahide Demesne and Newbridge Demesne.

Survey Date	Malahide Demesne			Newbridge Demesne Main Car Park	Both Ends
	Main Car Park	Bridgefield Car Park	Total		
Weekday (Thursday 28/09/2017	994	1,089	2,083	306	2,389
Weekend (Saturday 30/09/2017)	2,465	1,481	3,946	1,084	5,030

Weekday Pedestrians:Weekend Pedestrians = 2,389:5,030 = **1:2.1 (Weekday:Weekend Ratio)**

Single weekday trips = [7 * Daily Trips] * $\left[\frac{1}{1*5\text{ weekdays}+2.1*2\text{ weekends}}\right]$ = **Weekly Trips * 1/9.2**

4.4.7 Single weekend trips = [7 * Daily Trips] * $\left[\frac{2.1}{1*5\text{ weekdays}+2.1*2\text{ weekends}}\right]$ = **Weekly Trips * 2.1/9.2**

Peak Season Factor

4.4.8 To determine usage during peak seasons, e.g. summer school holidays and weekends with good weather, a peak season factor has been calculated by comparing the 90th percentile of weekly trips at Dun Laoghaire Harbour east pier in 2012 and 2013 against the average weekly trip in 2012 and 2013.

4.4.9 The 90th percentile represents the level at which 90% of all number of trips would fall under, i.e. only 10% of the number of trips would be higher than this level. This 10% would represent occasions with exceptionally high usage, e.g. special events or bank holiday weekends with good weather.

4.4.10 In the case of the proposed development, exceptionally high usage is assumed to occur on five weeks per year, including three weeks with summer bank holidays and two weeks with special events.

$$\frac{\textbf{Peak season weekly trips at Dun Laoghaire Harbour east pier (90th percentile)}}{\textbf{Average weekly trips at Dun Laoghaire Harbour east pier}} = \frac{44{,}628}{24{,}185} = \textbf{1.85 (Peak Season Factor)}$$

4.4.11 This peak season factor is used to estimate the number of people potentially using the proposed development during peak season, based on the assumption that the proportionate increase in users during school holidays and weekends would be similar to Dun Laoghaire Harbour's east pier.

Trip Origin Proportions

4.4.12 The proportion of users potentially accessing the proposed development from the southern end of the proposed greenway (Malahide) and from the northern end (Donabate) has been calculated by comparing the recorded number of pedestrians exiting Malahide Demesne main car park and Newbridge Demesne main car park during car park surveys of September 2017.

Table 4.5 Recorded Number of Pedestrians Exiting Malahide Demesne Main Car Park and Newbridge Demesne Main Car Park.

Survey Date	Malahide Demesne Main Car park	Newbridge Demesne Main Car park
Weekday (Thursday 28/09/2017)	994	306
Weekend (Saturday 30/09/2017)	2,465	1,084
Total (Both dates)	**3,459**	**1,390**

Pedestrians at Malahide:Pedestrians at Donabate = 3,459:1,390 = **0.71:0.29 (Malahide:Donabate Ratio)**

Estimated Number of Trips

4.4.13 Pedestrian and cyclist counts recorded along a number of existing greenways and similar walking/cycling facilities in Ireland were used as references to estimate the average daily trips on the proposed development.

4.4.14 Taking into consideration the usage recorded on similar greenway and walking/cycling routes (refer to Table 4.3 above: Locations (a), (b), (c), (g), (h), and (i)), the usage estimated for the proposed development is an average of 1,200 trips per day, in both directions (aggregated for both directions, i.e. not in each direction).

4.4.15 Estimated Average Usage on the proposed development = 1,200 trips/day, in both directions.

4.4.16 To estimate the number of trips during weekdays and weekends: Based on the number of pedestrians exiting car parks on a normal weekday and a normal weekend, the ratio of users during weekdays and weekends is estimated as 1:2.1. This ratio is applied to average weekly usage (7x average daily usage) to estimate the number of users during weekdays and weekends.

4.4.17 To estimate the number of trips during peak seasons: To estimate usage during peak seasons, the peak season factor of 1.85 is applied to estimated average weekday and weekend trips.

4.4.18 The estimated usage (trips) for the proposed development is summarised in Table 4.6.

Table 4.6 Estimated Potential Trips on the proposed development.

	Total Trips
Average daily trips *(x) x*	1,200
Average weekly trips *(w) 7 * x*	8,400
Average weekday trips *(y) w * 1/9.2*	913
Average weekend trips *(z) w * 2.1/9.2*	1,917
Peak season weekday trips *1.85 * y*	1,689
Peak season weekend trips *1.85 * z*	3,546
Annual number of trips *365 * x*	438,000

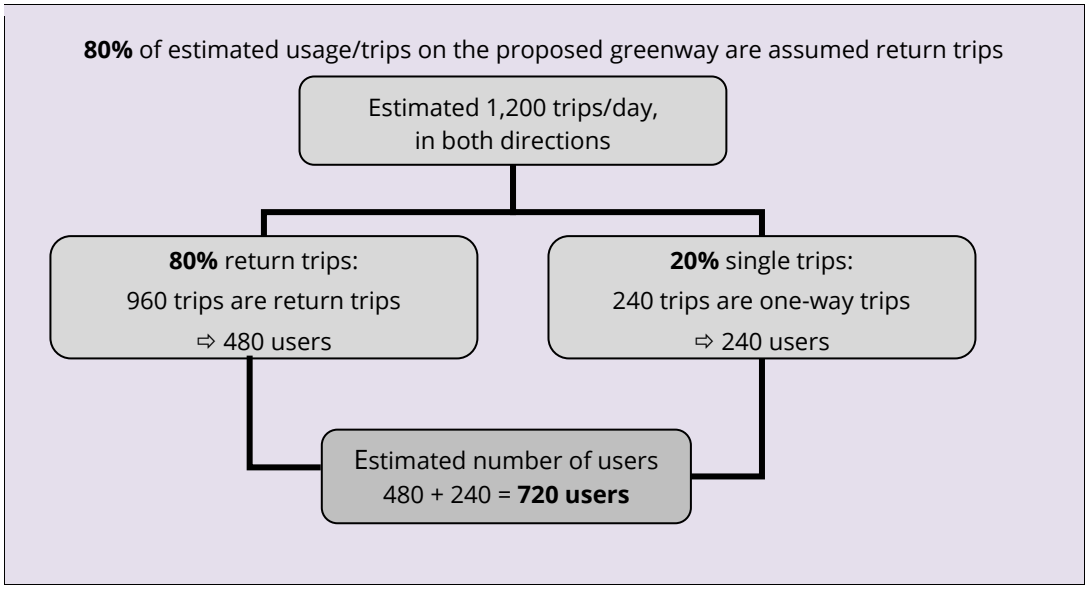
Estimated Number of Users

4.4.19 Using the estimated number of trips on the proposed development (Table 4.6 above), the number of potential users can be estimated as follows:

To Identify the Number of Potential Users

4.4.20 The proposed development is linear, i.e. not looped; hence it is very likely that nearly all users would be making return trips, i.e. the number of potential users can be estimated as approximately half the number of estimated trips.

4.4.21 However, in this case, not all trips have been assumed to be return trips, because the length of the proposed greenway (each way 6.8km: 76 minutes walking, 27 minutes cycling) and the availability of train/DART stations at both ends would mean that one-way trips are also an option for greenway users. As such, only 80% of the estimated trips will be assumed as return trips (Text Figure 4.2).



Text Figure 4.2 Estimated Number of Users on the Proposed Greenway.

4.4.22 It should be noted that if a lower percentage of trips on the proposed greenway have been assumed as return trips, the resulting number of users will effectively be higher than if a higher percentage were assumed. This will have a knock-on effect on the demand for parking, i.e. the demand for parking will also be higher. For example, by assuming that only 80% of the 1,200 trips/day are return trips using the proposed greenway instead of 100%, the number of users is 720 instead of 600.

To Identify How Many Users are Accessing the Proposed Greenway from Each End

4.4.23 Based on the number of pedestrians exiting car parks at Malahide Demesne and Newbridge Demesne, the proportion of users accessing the proposed development from Malahide and from Donabate are estimated as 79% from Malahide and 21% from Donabate.

4.4.24 The estimated number of people potentially using the proposed development is summarised in Table 4.7.

Table 4.7 Estimated Number of Potential Users on the proposed development.

	Total Users	via Malahide (79% of Total Users; 0.79 * x_1)	via Donabate (21% of Total Users; 0.21 * x_1)
Average daily users *(x_1)* x_1	720	511	209
Average weekly users *(w_1)7* x_1	5,040	3,578	1,462
Average weekday users *(y_1)* w_1 * *1/9.2*	548	378	170
Average weekend users *(z_1)* w_1 * *2.1/9.2*	1,150	794	357
Peak season weekday users *1.85 * y_1*	1,013	770	243
Peak season weekend users *1.85 * z_1*	2,128	1,468	660
Annual number of users *365 * x_1*	262,800	186,588	76,212

Modal Splits

4.4.25 Mode share for leisure/sport trips indicated by the 2012 NTA National Household Travel Survey has been used as a reference to estimate the modal splits of users arriving at the proposed development.

Table 4.8 Modal Splits.

	Modal Splits for Leisure/Sport Trips as per NTA National Household Travel Survey of 2012(1)	Modal Splits Assumed for the Proposed Development
Car/Van	71%	67%
Taxi/Hackney	1%	–
Bus	5%	5%
Train/DART/Luas	1%	5%
Bicycle	4%	5%
Walking	18%	18%

(1) Extracted from 2012 NTA National Household Travel Survey.

4.4.26 The modal splits indicated by the National Household Travel Survey have been adjusted to suit the proposed development:

- Modal split for cars/vans has been reduced to 67%, as there are good public transport services to both Malahide and Donabate.
- Modal split for taxi/hackney is considered negligible, as both Malahide and Donabate are well served by other modes of public transport that are reliable and more economical.
- Modal split for train/DART has been increased to 5%, as there are good train and DART services to both Malahide and Donabate.
- Modal split for bicycle has been increased to 5%, as the proposed greenway will be a quality cycling route expected to attract cyclist users who would also arrive by bicycle.

4.4.27 Using modal splits shown in Table 4.8 above, the mode share among people potentially using the proposed development is estimated in Table 4.9 (overall users), Table 4.10 (users accessing via Malahide), and Table 4.11 (users accessing via Donabate).

Table 4.9 Mode Share for Potential Users the proposed development (Overall).

	Total Users	Car/Van (67%)	Bus (5%)	Train/DA RT (5%)	Bicycle (5%)	Walking (18%)
Average daily mode share	720	482	-	36	36	36
Average weekly mode share	5,040	3,377	-	252	252	252
Average weekday mode share	548	367	-	27	27	27
Average weekend mode share	1,150	771	-	58	58	58
Peak season weekday mode share	1,013	679	-	51	51	51
Peak season weekend mode share	2,128	1,425	-	106	106	106
Annual mode share	262,800	176,076	-	13,140	13,140	13,140

Table 4.10 Mode Share for Potential Users Accessing via Malahide.

	Users via Malahide	Car/Van (67%)	Bus (5%)	Train/DA RT (5%)	Bicycle (5%)	Walking (18%)
Average daily mode share	511	343	-	26	26	26
Average weekly mode share	3,578	2,398	-	179	179	179
Average weekday mode share	378	253	-	19	19	19
Average weekend mode share	794	532	-	40	40	40
Peak season weekday mode share	770	516	-	39	39	39
Peak season weekend mode share	1,468	984	-	73	73	73
Annual mode share	186,588	125,014	-	9,329	9,329	9,329

Table 4.11 Mode Share for Potential Users Accessing via Donabate.

	Users via Donabate	Car/Van (67%)	Bus (5%)	Train/DA RT (5%)	Bicycle (5%)	Walking (18%)
Average daily mode share	209	140	10	10	10	38
Average weekly mode share	1,462	979	73	73	73	263
Average weekday mode share	170	114	8	8	8	31
Average weekend mode share	357	239	18	18	18	64
Peak season weekday mode share	243	163	12	12	12	44
Peak season weekend mode share	660	442	33	33	33	119
Annual mode share	76,212	51,062	3,811	3,811	3,811	13,718

Estimated Parking Demand

Parking Locations

4.4.28 At the Malahide end of the proposed greenway, car park surveys have been carried out at the Malahide Demesne main car park and Bridgefield car park. In addition to these locations, parking spaces are also available at an overflow car park adjacent to the Malahide Demesne main car park, two car parks off Back Road (east and west), and an overflow car park adjacent to the Back Road west car park.

4.4.29 At the Newbridge/Donabate end of the proposed greenway, in addition to the main car park at Newbridge House, there is a nearby green area which serves as an overflow car

park when demand is high, and often also as a picnic area during busy summer weekends.

Post-Opening Demand

4.4.30 The demand for vehicular parking spaces generated by the scheme is estimated based on car/van mode share during weekends, as shown in Table 4.9, Table 4.10 and Table 4.11.

4.4.31 The following assumptions are used:

Table 4.12 Car Park Usage Assumptions.

Car occupancy rates:	2.5 (i.e. 2.5 passengers per car)
Arrival patterns:	As observed during car park surveys of September 2017.
Parking occupancy duration assumed:	4 hours
Critical days:	Weekends

4.4.32 These assumptions can be considered conservative because:

- Car occupancy rates are likely to be higher during weekends when families arrive together by car; and
- 2017 car parking surveys indicate that 90% of the cars are parked for 3 hours or less.

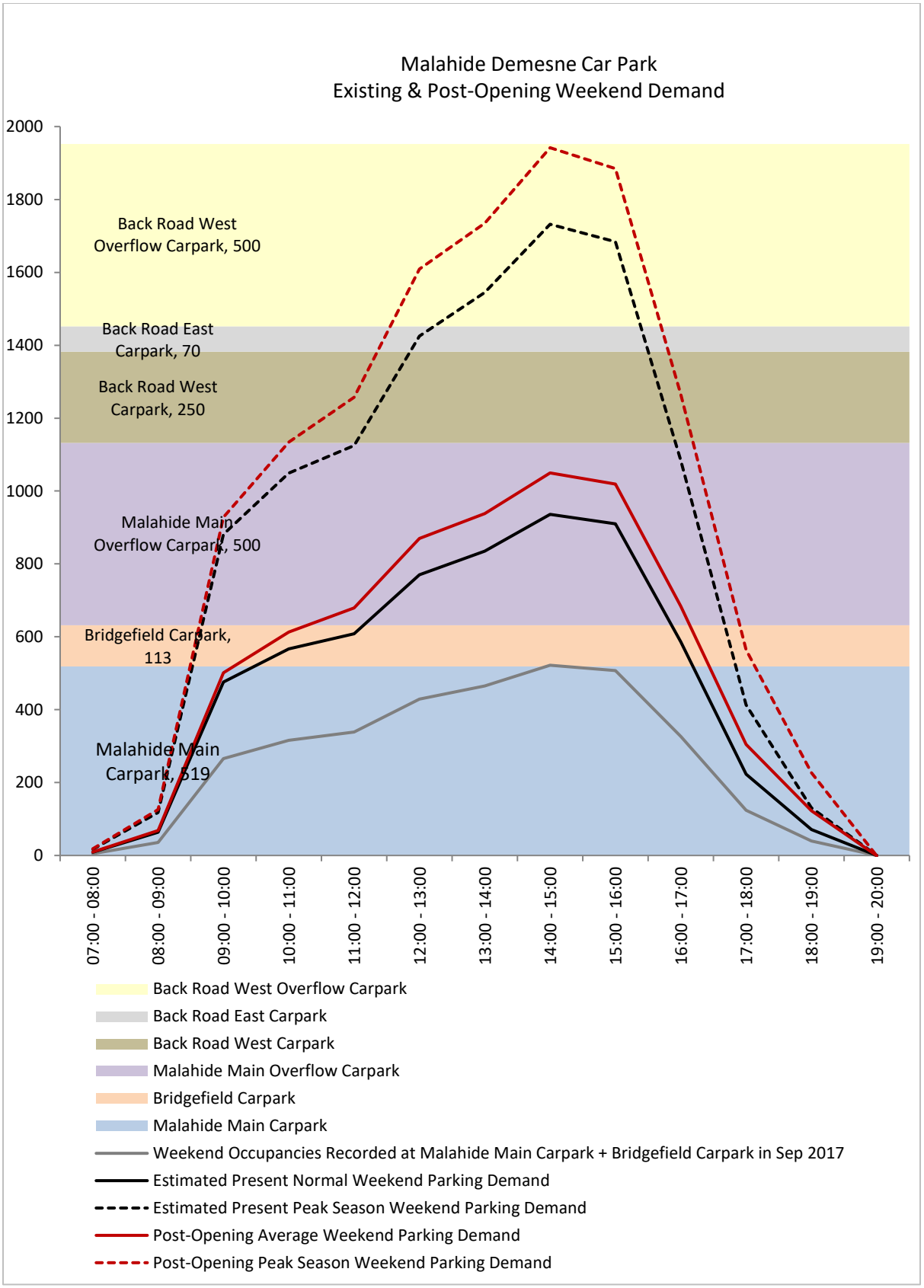
4.4.33 Using the above information, the post-opening estimated demand for parking on normal weekends and on peak season weekends has been calculated, and shown for both ends of the proposed greenway in Malahide Demesne and Newbridge Demesne in Table 4.13.

Table 4.13 Estimated Post-Opening Weekend Parking Demand.

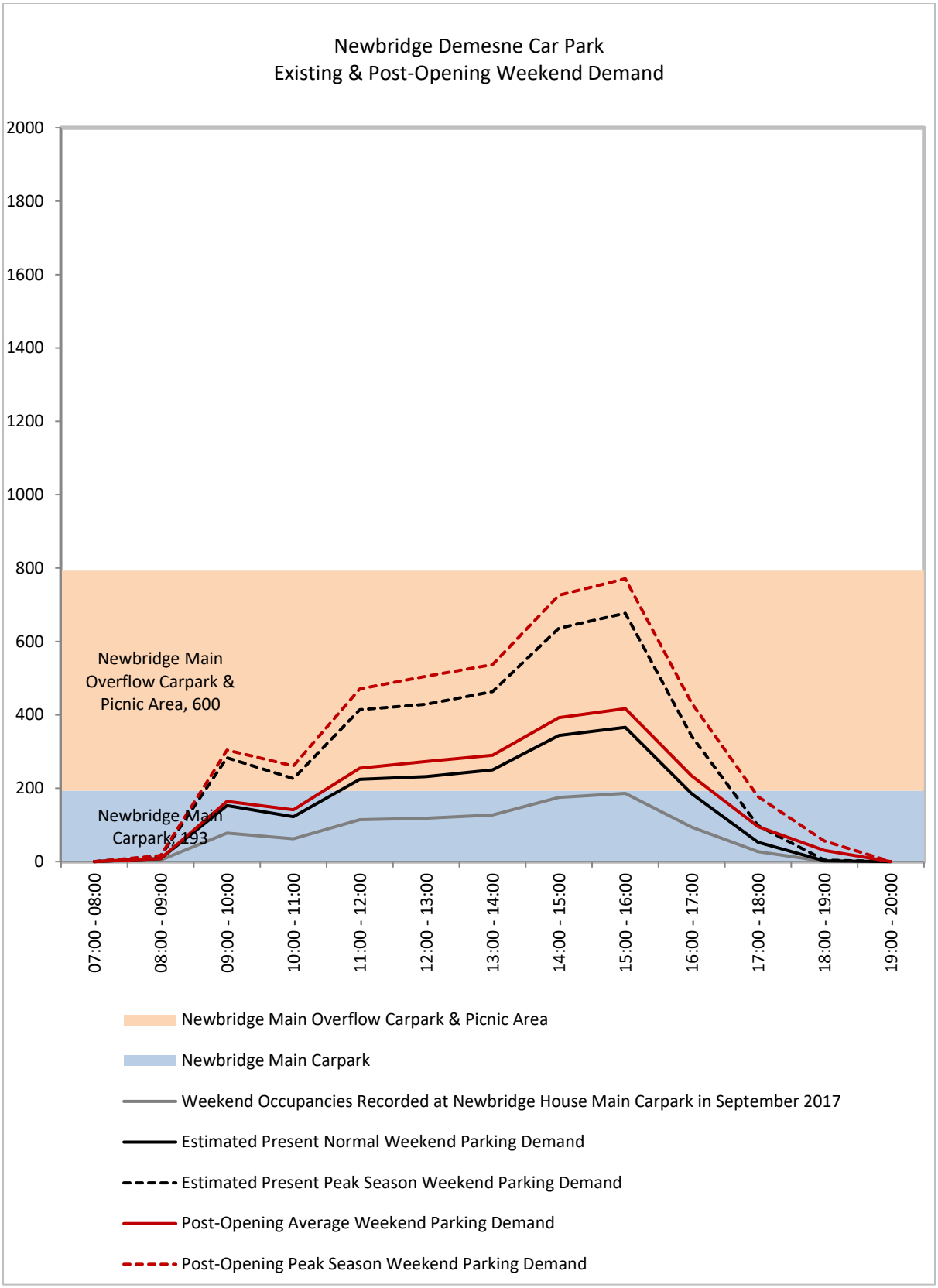
	Users via Malahide	Users via Donabate	Total
Average weekend car/van mode share (persons)	532	239	771
Average weekend parking demand (cars)	213	96	309
Peak season weekend car/van mode share (persons)	984	442	1,426
Peak season weekend parking demand (cars)	394	177	571

4.4.34 The total demand for parking spaces between 07:00hrs to 19:00hrs on normal and peak season weekends at both ends of the proposed greenway in Malahide and Donabate/Newbridge is plotted in Text Figure 4.3 and Text Figure 4.4 below.

	Weekend parking occupancies recorded during car park surveys of September 2017 (baseline)
	Present normal weekend parking demand: ***For Malahide Demesne*** **Occupancies** recorded during car park surveys of Saturday 30th September 2017 + car park occupancies estimated at Back Road east and west car parks, assuming similar level of usage as Malahide Demesne main car park and Bridgefield car park + car park occupancies estimated at Malahide Demesne main overflow car park, assuming up to 30% of the car park is utilised during normal weekends + car park occupancies estimated at Back Road West overflow car park ***For Newbridge Demesne*** **O**ccupancies recorded during car park survey of Saturday 30th September 2017 + car park occupancies estimated at Newbridge House main overflow car park, assuming up to 30% of the car park is utilised during normal weekends
	Present peak season weekend parking occupancies, estimated by applying the Peak Season factor of **1.85** to present normal weekend parking demand
	Number of parking spaces available at each end of the proposed greenway, including estimated number of spaces available in areas used for overflow parking.
	Post-opening demand for parking during average weekends.
	Post-opening demand for parking during peak season weekends.



Text Figure 4.3 Existing and Post-Opening Demand for Parking at Malahide Demesne.



Text Figure 4.4 Existing and Post-Opening Demand for Parking at Newbridge Demesne.

Trips Purposes

Commuter Trips

4.4.35 Information on the number and travel modes of commuters travelling to work/school between Donabate and Malahide/Portmarnock/Kinsaley has been extracted from the CSO's 2011 POWSCAR information. Text Figure 4.5 below shows the areas defined for Donabate, Malahide, Portmarnock, and Kinsaley; as well as summaries of existing and potential commuter trips between the northern and southern ends of the proposed greenway.

4.4.36 The proportion of workers and students potentially using the proposed development for commuting purposes by walking/cycling has been estimated as 10% of those travelling to work/school between Donabate and Malahide/Portmarnock/Kinsaley, as these trips would be within reasonable commuting distances of either 2km by walking or 30 minutes/7.5km by cycling.

4.4.37 Because the number of commuters between the northern and southern ends of the proposed greenway are low (124 southbound; 20 northbound), the number of commuter trips that could be expected on the proposed greenway is also low – an estimated 12 southbound commuters could potentially shift to walking/cycling mode (24 trips) and 2 northbound commuters (4 trips), i.e. 28 potential commuter trips a day.

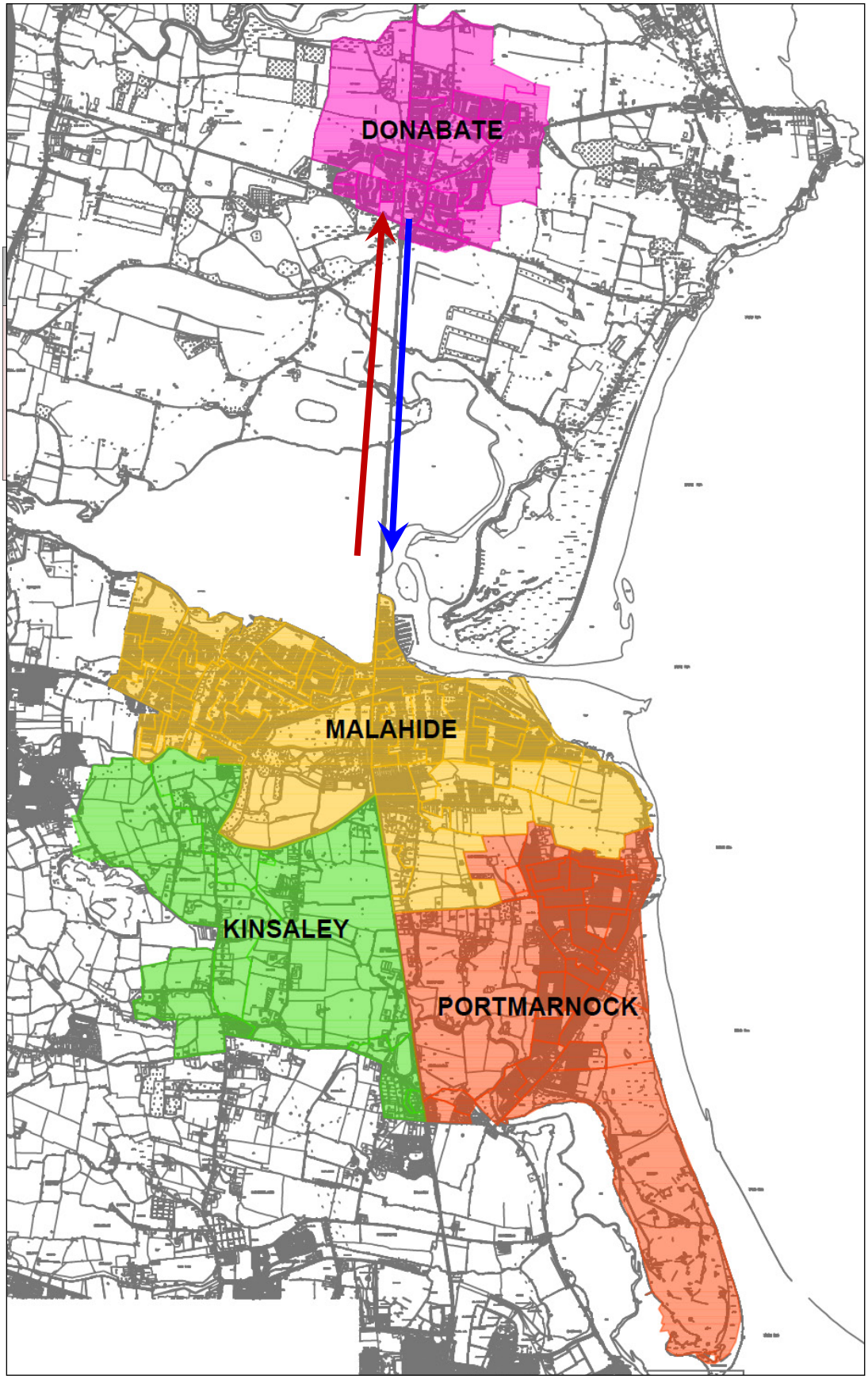
4.4.38 As such, the demand for parking among people using the proposed greenway for commuting purposes by walking/cycling is expected to be very low.

Recreational Trips

4.4.39 The proposed development has been identified by the NTA's Greater Dublin Area Cycle Network Plan as a greenway in South Fingal (FG1). As a scenic greenway, the proposed development is expected to be used mostly by recreational users, including families, local visitors, and overseas tourists.

Table 4.14 Expected Trips Purposes on the proposed development.

Estimated Average Usage on the Proposed Development	Commuter Trips	Recreational Trips
1,200 trips/day	28 trips/day (2%)	1,172 trips/day (98 %)



Text Figure 4.5 Existing and Potential Commuter Travel between Donabate and Malahide/Kinsaley/Portmarnock.

4.5 Potential Impacts

New Signalised Shuttle Systems

4.5.1 Two-way signalised shuttle systems are proposed at two locations:

(1) Bissets Strand Road railway underbridge.
(2) Corballis Cottages railway underbridge.

4.5.2 Shuttle systems are necessary at these locations because the existing underbridge widths are insufficient to safely accommodate pedestrians and cyclists alongside two-way vehicular traffic. This bridge is a listed structure and therefore cannot be widened.

Bissets Strand Railway Underbridge

4.5.3 At Bissets Strand Road, two-way traffic is already operating as a shuttle system on a courtesy basis. This is normally safe for most vehicles (no accidents recorded on the RSA road collision database). However, some drivers less familiar with this location could assume that the 3.4m-width carriageway under the bridge is able to safely accommodate both a car and a cyclist. It would be potentially dangerous if a driver decides to pass an oncoming cyclist at the underbridge, as this would leave the cyclist with less than 1m width to manoeuvre between a wall and the oncoming vehicle. Occasionally there are bridge strikes by vehicles which can delay railway services.

4.5.4 The proposed signalised shuttle system at the Bissets Strand Road underbridge would improve cyclist safety. The signals will operate at an on-demand basis. Additional delays due to new signals at this location will be minimal because traffic is already operating on a two-way shuttle system at present.

4.5.5 Five resident parking spaces will be formalised along the southern side of Bissets Strand Road, immediately west of the railway underbridge, for the sole use of residents living in the adjacent properties (Strand Cottages). These parking spaces are located within the signalised shuttleway on Bissets Strand Road; hence residents manoeuvring in/out of these parking spaces will be obstructing the shuttleway and withholding traffic from clearing the shuttleway. This could inconvenience other road users on the shuttleway, particularly those who are unable to clear the shuttleway within given green-times while residents are trying to manoeuvre in/out of the spaces. However, this sort of obstruction would be infrequent (only five vehicles are actually permitted to use these spaces); and traffic in both directions has a clear view of the whole shuttleway so can safely stop as necessary to allow residents to manoeuvre in/out of the spaces and to allow withheld oncoming traffic to clear the shuttleway.

Corballis Cottages Railway Underbridge

4.5.6 At Corballis Cottages, two-way traffic is currently operating at the railway underbridge location although its current 5m width can accommodate two small cars or a car and a cyclist. At present, there are no pedestrian or cyclist facilities at this location. As part of providing a future connection for pedestrians and cyclists between the proposed development and Donabate village, a 4m-width shared surface is identified in the Donabate LAP on the eastern side of the railway line, linking with the proposed greenway at the underbridge location via a toucan crossing on the western side of the bridge and along a shared surface on the northern side of the road and under the railway bridge as shown on the design drawings in Volume 3.

4.5.7 To accommodate the proposed shared surface on the northern side of Corballis Cottages, the existing carriageway width under the railway bridge will need to be narrowed from 5m to 3m, and a signalised shuttle system that works in conjunction with the toucan crossings will be necessary. The signals will operate at an on-demand basis. Delays due to new signals at this location will be minimal because vehicular traffic volumes here are low and post-opening pedestrian/cyclist crossing demand at this location is not expected to be high.

4.5.8 To further ensure the safety of all road users at the Corballis Cottage underbridge location, the Corballis Cottages carriageway will be realigned to remove short bends and to improve sight distances for drivers approaching the signals under the bridge from both the eastern and western sides.

4.5.9 There is a private vehicular entrance to a private residence (Sham Wary) located immediately west of the railway underbridge, within the signalised shuttleway on Corballis Cottages. While vehicles entering the property should have no difficulties doing so, vehicles exiting the property may find it difficult to decipher current traffic flow directions on the shuttleway. If a vehicle exiting the property erroneously travels against traffic flow on the shuttleway, it could cause confusion to other road users and would pose a safety hazard to oncoming traffic. A traffic signal head will be proposed at this private entrance in order to inform exiting vehicles of current traffic flow directions on the shuttleway.

Car Parking Demand

4.5.10 Demand for car-parking spaces is expected to increase on both ends of the proposed greenway in Malahide Demesne and in Newbridge Demesne.

Malahide Demesne

4.5.11 It is expected that the increase in demand for car-parking at the Malahide Demesne end of the proposed greenway could be catered for by the existing car-parking spaces at Malahide Castle's main car park, Bridgefield car park, two car parks off Back Road, and overflow car parks adjacent to the castle's main car park and adjacent to the western car park off Back Road (see Text Figure 4.4 above).

Newbridge Demesne

4.5.12 It is expected that the increase in demand for car-parking at the Newbridge Demesne end of the proposed greenway could be catered for by the existing car-parking spaces at Newbridge House's main car park and overflow car park area (see Text Figure 4.5).

Bissets Strand Road

4.5.13 Although Malahide Demesne and Newbridge Demesne are the NTO-defined ends of the proposed greenway, the section across Malahide Estuary between Bissets Strand Road and the estuary's north shore (Section 4) is most likely to attract a high level of new traffic because it will be a new scenic route which is not currently available (as opposed to sections in Malahide Demesne and Newbridge Demesne which are already existing).

4.5.14 Demand for parking is expected to increase along Bissets Strand Road, as this is the location closest to the estuary where cars could drive to and park.

4.5.15 The number of on-street parking spaces along the north side of Bissets Strand Road between O'Hanlon's Lane and the railway line will be increased from five to twelve. These spaces will operate on a resident-permit and pay-and-display system with maximum 3hrs of paid parking allowed.

4.5.16 Five existing on-street parking spaces along the southern side of Bissets Strand Road (west of the railway underbridge) will be formalised and reserved for the sole use of residents living in the adjacent properties (Strand Cottage).

4.5.17 The marginal increase of parking spaces along Bissets Strand Road is unlikely to be sufficient to cater to the increase in demand for car-parking on the Malahide end of the proposed greenway. There is limited scope for provision of new parking spaces due to space constraints and the loss of protected green spaces adjacent to the estuary.

4.5.18 However, it should be noted again that Malahide Demesne and Newbridge Demesne are the two ends of the NTO-defined greenway, and that the existing arrangements for provision of car parking at these locations will meet the average and high-season post-opening weekend demands for parking spaces.

New Pedestrian and Cyclist Crossings

4.5.19 New controlled and uncontrolled crossings are proposed at six locations. Brief descriptions of these crossings, as well as their impact on surrounding traffic, are shown in Table 4.15 below.

Shared Streets

O'Hanlon's Lane

4.5.20 The whole 350m length of O'Hanlon's Lane will operate as a shared street where cyclists and pedestrians will take precedence over vehicular traffic. While it is anticipated that the number of cyclists and pedestrians on O'Hanlon's Lane will increase, their impact on vehicular traffic is expected to be minimal because traffic speeds and volumes are already low on this road as it is a cul-de-sac serving a small number of properties.

Kilcrea Road

4.5.21 The 150m section of Kilcrea Road between Donabate Distributor Road and Hearse Road will operate as a shared street. The number of cyclists and pedestrians along this road is expected to increase; however their impact on vehicular traffic is expected to be minimal because this section of Kilcrea Road will become a cul-de-sac serving two private property access (from Hearse Road) upon completion of Donabate Distributor Road.

Traffic Calming

Carriageway Narrowing on R106 Dublin Road

4.5.22 A 150m section of the R106 Dublin Road carriageway, between Hogan's Gate entrance to Malahide Demesne and O'Hanlon's Lane, will be narrowed from 7.45m to 6.50m. This is to facilitate widening of footpath to minimum 1.8m along the southern side; and to accommodate a 3.4m wide pedestrian/cyclist shared path along the northern side.

Table 4.15 New Pedestrian and Cyclist Crossings.

Locations	Controlled	At Junction	Impact on Pedestrians	Impact on Cyclists	Impact on General Traffic
R106 Dublin Road	✓	✓ Priority junction: R106 Dublin Road/Malahide Demesne/ Casino Apartments	Improved safety	Improved safety	Low: Delays will be experienced by traffic from all directions only when toucan crossing is in demand. Toucan crossing phase is approximately 10.5 sec and could be synchronised with traffic signals at the railway bridge (see next location).
Bissets Strand Road	✓	✓ Priority junction: O'Hanlon's Lane/Bissets Strand Road	Improved safety	Improved safety	Low: Delays will be experienced by traffic from all directions only when toucan crossing is in demand. Toucan crossing phase is approximately 10.5 sec, and could be synchronised with traffic signals at the railway bridge (see next location).
Bissets Strand Road	✓	✓ West of proposed two-way signalised shuttle system under railway bridge	Improved safety	Improved safety	Low: Traffic is currently operating on an uncontrolled two-way shuttle system at the underbridge location. Additional delays will be experienced by traffic from both directions when pedestrian crossing is in demand. Pedestrian crossing phase is approximately 10.5 sec, and could be synchronised with the toucan crossings at O'Hanlon's Lane junction (see previous location).
Corballis Cottages (2 no.)	✓	✓ On both approaches to proposed two-way signalised shuttle system under railway bridge	Improved safety	Improved safety	Low: Traffic volumes are low on this road, and traffic is currently operating on an uncontrolled two-way shuttle system at the underbridge location. Additional delays will be experienced by traffic from both directions when toucan crossings are in demand. Toucan crossing phase is approximately 11.5 sec.
Donabate Distributor Road[1]	✓	✓ Priority junction: Donabate Distributor Road/R126 Hearse Road	Improved safety	Improved safety	Low: Some delays will be experienced by traffic from both directions only when toucan crossing is in demand. Toucan crossing phase is approximately 14sec in the opening year; and 19sec in the distributor road's design year of 2028. Summary of traffic analyses is attached in Volume 4C-Appendix 5.
R126 Hearse Road	✓	✓ Priority junction: Donabate R126 Hearse Road/Kilcrea Road	Improved safety	Improved safety	Low: Some delays will be experienced by traffic from all directions only when toucan crossing is in demand. Toucan crossing phase is approximately 10.5 sec.

[1]Construction of Donabate Distributor Road commenced at the end of 2017, and is due for completion prior to the opening of the proposed development. Initially the Donabate Distributor Road will be a two-lane single carriageway; and as traffic volumes increase, it will be upgraded to four-lanes (two lanes in each direction).

4.5.23 The delay to general traffic as a result of this particular measure is expected to be minimal, as the carriageway width (6.5m) is sufficient to cater to the speed (50kph) and volume of traffic on this road.

Junction Realignment at Bissets Strand/O'Hanlon's Lane

4.5.24 The existing junction between Bissets Strand and O'Hanlon's Lane will be realigned and its minor arm carriageway width narrowed to 7.0m, to improve safety for pedestrians and cyclists.

4.5.25 New shared surface for pedestrians and cyclists is proposed on the western side of the junction, which will lead to proposed new toucan crossings across Bissets Strand (see paragraph 4.5.19) on new pedestrian and cyclist crossings); whereas kerbing and landscaping is proposed on the eastern side of the junction.

4.5.26 Comparison between the existing junction layout and proposed layout is shown in Text Figure 4.6 below.

Text Figure 4.6 Bissets Strand/O'Hanlon's Lane Junction - Comparison of Existing and Proposed.

Carriageway Narrowing and Realignment of Hearse Road

4.5.27 As part of the proposal for a new toucan crossing on the Hearse Road (outside the entrance to Newbridge Demesne), a 75m length curved section of the Hearse Road at the junction of Kilcrea Road, opposite the entrance to Newbridge Demesne, will be realigned to provide the necessary sightlines for vehicles exiting Newbridge and Kilcrea Road.

4.5.28 Traffic calming on both approaches to the curve is proposed in the form of localised carriageway narrowing. Short 10.2m-length sections of the road will be narrowed from 6m to 5.6m, approximately 80m west of and 40m east of the proposed realigned section of the Hearse Road.

4.5.29 These measures aimed at enhancing cyclist and pedestrian safety at the toucan crossing by reducing vehicular speeds on this straight section of Hearse Road, and calming of general traffic approaching the toucan crossing. The delay to general traffic as a result of this particular measure is expected to be minimal, as it is only meant to prevent excessive speeds.

50kph Zone on Hearse Road

4.5.30 At present, the entrance to Newbridge Demesne is located within a 60kph zone on Hearse Road. The speed limit on Hearse Road is reduced to 50kph as it approaches Donabate, approximately 180m east of entrance to Newbridge Demesne.

4.5.31 As part of this scheme, the existing 50kph zone will be extended by approximately 350m westwards, up till 50m west of the narrowed 10.2m-length section of carriageway mentioned in previous section. This is a road safety measure which will place the Newbridge Demesne entrance, and the proposed toucan crossing between Kilcrea Road and Newbridge Demesne, within a 50kph environment that is more suited for pedestrian and cyclist crossing movements.

4.5.32 This measure is expected to result in delays of up to 4.2 seconds per vehicle, 9,786 vehicles per day travelling on the Hearse Road (based on AADT calculated using traffic counts of September 2017). However, the number of vehicles on the Hearse Road is expected to decline when the Donabate Distributor Road is completed.

Public Transport

4.5.33 The demand for public transport (buses and train/DART) is estimated to increase by up to 187 trips on weekends during peak season. This represents 10% of the overall trips estimated for the proposed development (5% buses, 5% train/DART; see paragraphs 4.4.25 to 4.4.27 on modal splits).

4.5.34 While this estimated proportion of train/DART use (5%) is already higher than the national average for leisure trips (1%; see Table 4.8 above), it could still be considered conservative in the context of this scheme, given the close proximity of DART stations on both ends of the proposed greenway. In the Greater Dublin Area, landmark recreational areas that are served by train/DART services, such as Dun Laoghaire and Howth, have been observed to generate high demands for DART services during weekends and peak seasons.

4.5.35 Similarly, the demand generated by the proposed development for train/DART services to Malahide and Donabate, particularly during weekends and peak season, could potentially be higher than the assumed modal split of 5%. This increase in demand may warrant additional train/DART services during busy weekends and peak season.

Construction

4.5.36 The potential impacts on the road and traffic network resulting from construction works for the proposed development are outlined in Table 4.16. It should be noted that these impacts would be temporary, and are not expected to result in significant residual impact.

Table 4.16 Potential Impacts during Construction Stage.

Activities	Potential Impact
Transportation of site machinery and materials	**Moderate**: Delay and inconvenience to general traffic on the road network. Noise/disturbance to residents.
Temporary road closures, diversions, or traffic controls (including realignment works to the Dublin Road in Malahide).	**Moderate**: Delay and inconvenience to general traffic on the road network.

4.6 Mitigation Measures

New Signalised Shuttle Systems

4.6.1 Detector loops will be installed on all approaches to the proposed signals. Vehicle arrival and queuing information will be fed to an intelligent traffic system (e.g. MOVA) which would optimise the timings on the signals according to varying traffic demand and conditions.

4.6.2 On Bissets Strand, traffic signals for the proposed signalised shuttle system/toucan crossing at Bissets Strand railway underbridge will be linked with the proposed toucan crossing at O'Hanlon's Lane junction, so that traffic signal sequencing and timings can be optimised in order to reduce delays and vehicle stopping time between these two locations.

4.6.3 On Corballis Cottages, an additional traffic head will be provided at private residence Sham Wary's vehicular access, to inform exiting vehicles of current traffic flow directions on the Corballis Cottages railway underbridge shuttleway. This is so that vehicles exiting the private residence can safely do so without causing confusion to other road users.

Car Parking

4.6.4 Existing parking and overflow provisions at both Malahide Demesne and Newbridge Demesne will cater for anticipated increases in demand for parking on both ends of the proposed greenway.

4.6.5 A car park monitoring regime will be formalised at both Malahide Demesne and Newbridge Demesne to ensure that use of the overflow areas is optimised, particularly during weekends and peak season.

Pedestrian and Cyclist Crossings

4.6.6 All crossings will be fitted with push-buttons so that these are activated only when in demand. Green times for vehicles can be set to a minimum, e.g. 7sec, so that vehicles are not stopped continuously or too frequently when demand for crossings is high.

4.6.7 On Bissets Strand, traffic signals for the proposed toucan crossing at O'Hanlon's Lane junction will be linked with the proposed signalised shuttle system/toucan crossing at Bissets Strand railway underbridge, so that traffic signal sequencing and timings will be optimised to reduce delays and vehicle stopping time between these two locations.

Traffic Calming

4.6.8 Extension of this 50kph zone will place Newbridge Demesne entrance, and proposed toucan crossing between Kilcrea Road and Newbridge Demesne, within a lower-speed environment that is more suited for pedestrians and cyclists crossing movements.

Construction

4.6.9 Transportation of site machinery and materials will take place only during non-peak traffic hours, and not between the hours of 19:00hr–07:00hr, in order to minimise impact on the road network and disturbance to residents.

4.6.10 Construction stage traffic management plans will be developed in close consultation with Fingal County Council. Adequate public notices will be put in place to inform both residents and road users.

Public Transport

4.6.11 Demand for train/DART services will be monitored during the operational phase of the greenway. The need to increase train/DART services to these locations during peak times will be kept under review by Irish Rail.

4.7 Residual Impacts

Car Parking

4.7.1 Demand for additional parking on the Bissets Strand/Malahide end of the proposed greenway can be catered for by existing parking spaces available in Malahide Demesne, Bridgefield, and Back Road. Alternatively, vehicles can redistribute to the other end of the proposed greenway at Newbridge, or mode-shift to either cycling or public transport.

4.7.2 However, as is usual with places of high recreational value, such as Dun Laoghaire, Howth and Malahide, there could be exceptionally high demand for parking during weekends and peak seasons, which would not normally be catered for in terms of permanent parking spaces.

Traffic Calming

4.7.3 The extension of existing 50kph zone on Hearse Road by 350m westwards may result in delays of up to 4.2 seconds per vehicle, for 9,786 vehicles per day (based on AADT calculated from counts in September 2017). However the number of vehicles is expected to decline when Donabate Distributor Road opens.

Public Transport

4.7.4 Demand generated by the proposed development for train/DART services to Malahide and Donabate may be higher during busy weekends and peak seasons. This increase in demand may warrant additional train/DART services during busy weekends and peak seasons.

Construction

4.7.5 Some delays and inconvenience may be experienced by road users during non-peak hours when machinery and materials are being transported. However, these are expected to be temporary (construction stage only).

5.0 Population and Human Health

5.1 Introduction

5.1.1 This chapter of the EIAR addresses the potential impacts on human beings and human health due to the construction and operation of the proposed development. Actual and perceived effects of the proposed scheme on human beings may arise from various aspects.

5.1.2 The chapter initially sets out the methodology used for the assessment, then describes the receiving environment, sets out the predicted impacts of the proposed scheme, describes the mitigation measures to be incorporated in the scheme and details any residual impacts. The section also outlines any difficulties encountered in compiling information and finally any cumulative impacts and interactions.

5.2 Data and Methodology

5.2.1 An assessment of population and human health requires that an understanding of the community is built up through background research, site visits and discussions with local people and community representatives where necessary. Specifically, in the case of this study, data has been collected by means of:

- Drawings of the proposed scheme.
- Maps and aerial photographs of the surrounding area, including Ordnance Survey 1:50,000 maps.
- Environmental Route Options Report for the Proposed Broadmeadow Way (see Volume 4B).
- Broadmeadow Pedestrian and Cycle Trail Feasibility Report, Fingal County Council.
- Broadmeadow Way Public Consultation Report, May 2014.
- Primary data sources (e.g. demographic data from Census 2016 produced by the Central Statistics Office).
- Other relevant environmental assessments undertaken for this EIAR, especially specialisms where there are likely to be interactions with population and human health, i.e. traffic, ecology, landscape and visual.
- A review of relevant planning documentation including the Fingal Development Plan 2017-2023; the Malahide Public Realm Strategy, the Donabate Local Area Plan 2016; and the NTA GDA Cycle Network Plan.
- Observation of local settlement, travel patterns and weekday and weekend levels of park use along with identification of community facilities.

5.2.2 The purpose of the assessment of effects on population and human health is to identify the likely significant effects that might arise from the proposed development during the construction and operational phases.

Construction Phase

5.2.3 Impacts on human beings during the construction phase that are potentially relevant to an assessment of population and human health include:

- Potential impacts due to construction traffic on journey or general amenity.
- Potential impacts on amenity use of the environment or on residential amenity.
- Construction employment and local expenditure by construction workers.

Operational Phase

5.2.4 Potential impacts during the operational phase fall into the following key categories, namely:

- Amenity and social activity arising from the use of the proposed greenway.
- Residential and journey amenity.
- Economic effects on businesses and employment.
- Health and safety.

5.2.5 It usually follows that impacts on human beings of a socio-economic nature are a function of the:

- Location and character of the local environment.
- Sensitivity of the local population and its capacity to absorb change.
- Nature of the environmental effect.
- Scale or extent of the effect in terms of area or population affected.
- Duration and frequency of an effect.
- Probability of an impact's occurrence.

5.2.6 The assessment generally addresses impacts at a community level rather than for individuals or identifiable properties. Impacts are summarised in Section 5.4 below. Impacts will be of varying duration (momentary to permanent) and of varying probability (likely, indeterminable to worst case). They will be of varying magnitude which may follow from the duration, but also the extent, frequency and context. Extent accounts for the proportion of a population affected as well as the size of the area and the number of locations where impacts are experienced.

5.3 Existing Environment

Introduction

5.3.1 The immediate footprint of the proposed development falls within the Electoral Divisions (EDs) of Malahide and Donabate. There are longer term proposals for a greenway, north through Rush, Skerries and Balbriggan, and south from Malahide to Sutton, the centrepiece of a strategic trail network in the county extending up the coast and inland towards urban centres such as Swords. An assessment of the receiving environment is necessary to predict the likely significance of the impacts of the proposed scheme which forms one section of a potential wider network. Demographic data published by the Central Statistics Office (CSO) identifies the nature of the population in the vicinity of the proposed scheme that could be impacted during either the construction or operational phases.

Context

5.3.2 Table 5.1 shows the population of the main settlements in the overall study area, indicating the relative size of Malahide, Donabate and Swords and the significant increase in population experienced by these three towns since the last Census in 2011.

Table 5.1 Population settlements (Central Statistics Office).

Settlement	2016	2011	Percent Change
Malahide	16,550	15,846	4.4%
Donabate	7,443	6,778	9.8%
Swords	39,248	36,924	6.3%
Portrane	1,236	1,372	-9.9%
Portmarnock	9,466	9,285	2.0%

5.3.3 Table 5.2 below provides data on the respective population of the Electoral Divisions (EDs) in the central study area which together have a combined population of 22,977 while the wider study area has a total population of 121,946, of which the combined coastal area from Sutton to Balbriggan has a population of 100,025. However, the proposed development will be accessible to people living in Fingal and in Dublin, particularly Dublin City/North Dublin, as well as from elsewhere in Leinster and outside.

Table 5.2 Population Electoral Divisions (Central Statistics Office).

Electoral Division	2016	2011	Percent Change
Donabate	9,399	8,733	*7.6%*
Malahide West	6,149	6,273	*-2.0%*
Malahide East	7,429	6,879	*8.0%*
Core Study Area	**22,977**	**21,885**	***5.0%***
Baldoyle	7,524	7,050	*6.7%*
Sutton	5,680	5,609	*1.3%*
Portmarnock North	4,109	4,118	*-0.2%*
Portmarnock South	3,621	3,465	*4.5%*
Kinsaley (Swords)	9,621	8,475	*13.5%*
Swords Village	2,674	2,581	*3.6%*
Swords Seatown	7,003	6,539	*7.1%*
Swords Forrest	15,153	13,894	*9.1%*
Swords Lissenhall	10,447	9,667	*8.1%*
Lusk	9,623	8,814	*9.2%*
Rush	9,921	9,196	*7.9%*
Holmpatrick	3,458	3,224	*7.3%*
Skerries	8,501	8,333	*2.0%*
Balbriggan Rural	16,495	15,140	*8.9%*
Balbriggan Urban	8,116	7,555	*7.4%*
Wider Study Area	**121,946**	**113,660**	***7.3%***
Fingal	**296,020**	**273,991**	***8.0%***
Dublin City & Suburbs	**1,173,179**	**1,110,627**	***5.6%***

Source: CSO Census of Population 2016 and Census 2011.

5.3.4 Fingal has a young and growing population with the highest birth rate in the state (HSE Health Profile, Fingal, 2015). The population has increased by 8.0% since the preceding Census in 2011 and large areas have been zoned for new residential development, for

example in Fingal Lissenhall. This development is likely to sustain the population increase for some years to come as young couples and families move into the area. Table 5.3 below presents population age categories for Fingal, Malahide (East and West), Donabate, and Dublin City and Suburbs, revealing that Donabate too has a high proportion of residents in the 0-15 year category consistent with recent residential growth. By comparison, Malahide has a more established population with a high proportion of people of retirement age. Family size is indicated by the data for households in Table 5.4. There are 96,812 households in Fingal, an increase of 3.9% on 2011.

Table 5.3 Age Profile.

	0-15 years	15-20 years	20-35 years	35-45 years	45-65 years	>65 years
Malahide	2,684	803	2,240	2,113	3,537	2,271
	19.7%	*5.9%*	*16.4%*	*15.5%*	*25.9%*	*16.6%*
Donabate	2,469	701	1,450	1,715	2,387	677
	26.3%	*7.5%*	*15.4%*	*18.2%*	*25.4%*	*7.2%*
Fingal	76,613	17,750	60,122	55,012	63,488	27,035
	25.5%	*5.9%*	*20.0%*	*18.3%*	*21.2%*	*9.0%*
Dublin City	83,212	28,781	164,240	87,582	118,383	72,355
	15.0%	*5.2%*	*29.6%*	*15.8%*	*21.3%*	*13.0%*

Table 5.4 Households.

	1 person	2 persons	3 persons	4 persons	5 persons	6 persons	>6 persons
Malahide	*18.5%*	*32.7%*	*16.6%*	*19.2%*	*9.7%*	*2.8%*	*0.5%*
Donabate	*18.5%*	*24.0%*	*18.5%*	*21.9%*	*12.8%*	*3.4%*	*0.8%*
Fingal	*15.8%*	*26.9%*	*19.7%*	*21.5%*	*10.8%*	*3.8%*	*1.4%*
Dublin	*28.3%*	*32.0%*	*17.1%*	*13.2%*	*6.2%*	*2.2%*	*1.0%*

5.3.5 Table 5.5 below provides information on the socio-economic status of households in Fingal. It also illustrates differences between the social class composition of Malahide and Donabate, the two communities that would be connected by the proposed development. Donabate has a relatively high proportion of residents in the manual skilled and semi-skilled categories, but both Donabate and Malahide also have relatively high proportions of people in the professional social classes, although this is especially so for Malahide. Vehicle ownership (Table 5.6 below) is similar to the wider county and Dublin, but there are comparably few households in either Malahide or Donabate which have no car.

Table 5.5 Socio-economic Status of Households.

	Higher Professional	Lower professional	Non-manual	Manual skilled	Semi-skilled	Unskilled	Others Employed
Malahide	*43.2%*	*16.8%*	*16.7%*	*3.8%*	*2.5%*	*1.2%*	*15.7%*
Donabate	*30.0%*	*17.5%*	*18.8%*	*6.1%*	*6.5%*	*2.1%*	*19.2%*
Fingal	*27.4%*	*13.8%*	*21.3%*	*7.6%*	*6.7%*	*2.7%*	*30.7%*
Dublin	*23.5%*	*13.1%*	*20.3%*	*6.8%*	*6.9%*	*4.1%*	*25.4%*

5.3.6 Table 5.7 below gives a breakdown of reported health. Fingal has one of the lowest proportions of people who report their health as being bad or very bad. Deaths from heart disease and stroke, for which low levels of exercise are one causal factor, are relatively low overall with a Health Service Executive (HSE) health profile indicator of

169.1 (all ages) compared with a national average of 182.8. However, for under 65s, the rate is quite high relative to the levels of other counties at an index of 36.2 compared with 32.7 (HSE Health Profile, Fingal, 2015).

Table 5.6 Vehicle Ownership.

	None	One	Two	Three	Four or more	Not stated
Malahide	*7.4%*	*40.9%*	*41.6%*	*6.7%*	*1.7%*	*1.7%*
Donabate	*8.7%*	*42.3%*	*39.1%*	*4.4%*	*1.2%*	*4.4%*
Fingal	*12.2%*	*43.4%*	*37.1%*	*5.8%*	*1.5%*	*1.9%*
Dublin	*33.7%*	*40.5%*	*16.8%*	*2.6%*	*0.6%*	*5.7%*

Table 5.7 Health.

	Very Good	Good	Fair	Bad	Very Bad	Not Stated
Malahide	*68.6%*	*23.4%*	*5.2%*	*0.7%*	*0.2%*	*2.0%*
Donabate	*65.3%*	*24.3%*	*6.2%*	*1.0%*	*0.2%*	*3.1%*
Fingal	*64.0%*	*26.5%*	*5.9%*	*0.9%*	*0.2%*	*2.5%*
Dublin	*55.6%*	*27.2%*	*8.5%*	*1.7%*	*0.4%*	*6.7%*

Character, Significance and Sensitivity

Malahide

5.3.7 Malahide is a planned town with a compact village centre. The first housing estates to be built around the village core date back to 1964, but the settlement experienced its strongest building boom between 1971 and 1990 during which period 41% of its existing housing stock was built. Malahide is a self-contained town with a vibrant commercial centre, but it is also a commuter town. One quarter of the population commutes by train or bus. The town is served by the train/DART service from Dublin Connolly and onward stations south to Greystones, and by Dublin Bus services 32x, 42, 102 and 142.

5.3.8 The town has a range of retail and commercial services, most of which are located in the centre, particularly on Main Street, New Street and the Diamond. It has a diverse range of retail facilities supported by a largely affluent population. These include cafés and restaurants, boutique clothing outlets and gourmet food shops. There are also solicitors' offices, chartered accountants and financial service businesses. Like Howth to the south, the town is popular for day trips using the train/DART service, but overnight and weekend stays occur too and are catered for by a number of guesthouses and the 150-room Grand Hotel.

5.3.9 There is a range of community facilities that include pre-schools and Montessori, four primary and one secondary school, Malahide Community School with 1,200 pupils. Malahide School of Music is based at St. Oliver Plunkett National School. The Irish College of English on Church Road provides language courses for adults and summer camps for children and teenagers.

5.3.10 Malahide has two Roman Catholic parishes, a Roman Catholic contemplative centre in Seapark and a Church of Ireland parish. A Presbyterian Church is located on Church

Road opposite the Malahide Castle Gates. The Malahide Health Care Centre is located on New Street. There are nursing homes on Kinsaley Lane and Estuary Road.

5.3.11 The town has more than twenty community organisations, many of which work through the Malahide Community Forum. There are a variety of local clubs and societies, several of which hold meetings in Malahide Library. There are also active sports clubs for rugby, soccer, GAA, hockey, basketball, cricket, tennis and golf.

Donabate

5.3.12 Donabate is located on the peninsula between the Malahide Estuary and Rogerstown Estuary. The smaller community of Portrane is located on the coast to the northeast. Donabate has grown considerably in recent years, particularly in the period 2006-2011 when the population grew by 23%. The town is connected to the M1 motorway and the R132 Swords Road via the R126 Hearse Road which is busy with commuting traffic in the morning and afternoons. Like Malahide, Donabate is connected by the train/DART service and by Dublin Bus, namely services 33b and 33d.

5.3.13 The centre of Donabate has several retail outlets, including food stores, service stations and hardware stores. However, the retail offering is much more limited than Malahide. This is not atypical for commuting towns, suggesting that most residents do the bulk of their shopping in nearby towns such as Swords. Tourism is not a feature of Donabate. There is little or no guest accommodation in the town itself, but there are a couple of cafés and day trippers regularly stop on the way to Donabate Beach 2km to the east where there are holiday cottages, caravan parks and the 35-room Waterside Hotel.

5.3.14 The young age profile of the town is evident in the number of crèches and Montessori schools. There are three primary schools and one secondary school, Donabate Community College. There is a Roman Catholic parish and a Church of Ireland parish. The Presbyterian community meets at Donabate Portrane Community Centre. There is a Family Medical Centre and a small number of private practices. St. Michael's House is a residential and respite home catering for people with intellectual disabilities.

5.3.15 There are a number of community associations, including the Donabate and Portrane Community Council, a Chamber of Commerce, and Donabate Tidy Towns. Donabate Portrane Community Leisure Centre contains a gym and offers various fitness, dance and indoor sports. St. Patrick's GAA Club is one of the largest local clubs with almost 800 members. There is also a local hockey club.

5.3.16 The adjoining townland of Kilcrea is located on the north side of the estuary and would be crossed by the proposed greenway. It is rural in character and dominated by agricultural land use, but includes individual residences along Kilcrea Road and Corballis Cottages Road.

Outdoor Amenities

5.3.17 The 116 acre Malahide Castle demesne is an important feature of Malahide and was acquired as a public park by Dublin County Council in 1976. The park is one of a number of regional parks serving the wider population within Fingal and beyond and is managed by the Council. It is a key element in the Council's tourism strategy and receives approximately 120,000 visitors each year. As well as landscaped and wooded areas, paths and picnic spots, there is a children's playpark, lawn tennis and basketball

courts, a boules area, pitches for rugby, soccer and GAA, a 9-hole par 3 golf course, an 18-hole pitch-and-putt, and a cricket ground and stadium. A large Avoca food hall, gift shop and café opened in 2012. Malahide Castle is located in the demesne and is a protected structure that is open to the public for tours and certain events.

5.3.18 Newbridge Demesne is a similar facility to the north of the Malahide Estuary in the townland of Kilcrea. Newbridge House, a Georgian villa, in the ownership of Fingal County Council, is surrounded by 370 acres of parkland that offers walks and includes a busy children's adventure playground and a traditional working farm with old animal breeds.

5.3.19 The coastline is an important element that provides a sense of place and coastal amenity. Malahide has an attractive location facing onto the Malahide Estuary which covers an area of 3.3km^2. The construction of the railway viaduct in the 1940s resulted in the estuary having a more limited tidal exchange. The estuary is important for wintering wildlife and holds an internationally important population of Brent Geese. It is popular for birdwatching, particularly the tidal mudflats along the coastal road on the north side of the estuary and at the entrance of the Broad Meadow River, a location that is also popular with families. Access to this latter location is via Spittal Hill from Seatown on the edge of Swords to the east of the M1 motorway viaduct. There is no easy public access around the estuary itself, but Corballis Cottages Road (the narrow coast road) offers views of the estuary and is accessible from the R126 and Donabate. Kilcrea Equestrian Centre is located to the east off Kilcrea Road and offers a livery service, lessons and trekking along the estuary.

5.3.20 Malahide has a marina for coastal-bound craft. There is also a sailing school and a Sea Scout Group. Malahide inner estuary is the most popular single location in Ireland for windsurfing with launches occurring mostly from the Malahide side of the estuary.

5.3.21 Coastal walking is a very popular local activity. The Malahide to Portmarnock walk is c. 4km in length and can be extended to include Portmarnock beach or trails into the 90-acre Robswall Park. To the west of Malahide, a 7km footpath continues along the estuary into Seatown and on to Swords. Donabate is located 1km from the sea, but is connected via New Road to the small community of Eagan's Field and Donabate beach, a popular seaside destination where there are several caravan parks, holiday cottages and three golf clubs, including the Island Golf Club at Corballis. A footpath cuts across the links course to the coastal dunes. It is also possible to circuit right around the coastal spit back to the Corballis Cottages Road.

5.3.22 In a survey of local residents in Swords and neighbouring communities undertaken in 2015 for the EU OPERAs[1] project, 14% of local residents claimed to visit the coast at least once per week, while 49% did so once per month and 32% less frequently. Around 33% went on a coastal walk, 25% went to the beach, but just 4% visited estuary areas. Most people, i.e. 54%, undertook a walk, 9% were on a family seaside trip, and the remainder engaged in a range of other activities, including 1.6% whose interest was wildlife or bird watching. Coastal paths for walking and a continuous coastal path received an average rating of respectively 5.3 and 5.0 on a Likert scale from 1 (not important) to 7 (critical) of 41 coastal attributes.

[1] www.operas-project.eu. Responses from 189 residents.

5.3.23 Visitors to the public exhibition of the plans for the proposed development were asked about their potential use. The figures are not necessarily representative of the community as the sample size is small (c. 95) and the exhibition would have been visited by people with an interest (positive or negative) in the proposals. Nevertheless, they provide an indication of possible patterns of use. Of these respondents, 98% expected to be users of the proposed greenway with 85% expecting to use the facility at least weekly. Twenty-three percent expected to use the proposed greenway as a pedestrian and 12% as a cyclist, but 65% expected to both walk and cycle. Most use was expected to be for leisure at 80% and most people expected to use the full length of the proposed greenway (60%).

Sensitivity

5.3.24 The Fingal Development Plan 2017-2023 foresees a need to strengthen the self-sustainability of Malahide by maintaining its character and the provision of a range of facilities. Traffic management and parking are issues in the town identified by the Malahide Public Realm Strategy (April 2014) which aims to increase pedestrian activity in the town for which it identifies social, economic and health benefits. Consultation with the public and schools led to proposals for improved branding and marketing of the town, signage and themed walks, an improved public space, a coastal promenade and new cycle lanes and pedestrian/cycle facilities on Main Street, Church Street and New Street.

5.3.25 The Donabate Local Area Plan 2016 similarly contains proposals for managing traffic and enhancing the environment for walking and cycling. The LAP contains proposals for a network of pedestrian and cycle routes and for traffic relief measures. It observes that locations, such as the Donabate entrance to Newbridge Demesne, are busy with pedestrians, but have either no or inadequate footpaths. It contains proposals for a new distributor road from Corballis West to the Portrane Road avoiding the centre of Donabate, new pedestrian/cycle facilities and looped greenways, pedestrian crossing points, and a pedestrian bridge across the railway integrating with amenities and new development lands at Corballis and Turvey. On the basis of data in Census 2016, the current level of cycling activity in Donabate is very low. The town's geographical isolation contributes to levels of commuter cycling of just 1.9%, although this is still higher than for Malahide where the figure is 1.4%.

5.3.26 The Fingal Development Plan 2017-2023 identifies the role of place and natural heritage in the quality of life for residents and in attracting tourism. The tourism strategy includes objectives to attract visitors into towns and village centres, and to create an integrated pedestrian and cycle infrastructure. Malahide Estuary is a distinctive landscape feature that provides visitors and residents with an amenity from which to view wildlife and water-based activities. However, it also presents significant physical severance between Malahide and communities to the north. The estuary is an integral part of the County's Green Infrastructure strategy given its relevance to amenity, biodiversity and water quality. It is a Special Protection Area (SPA) and a Special Area of Conservation (SAC), status that is of direct interest for wildlife viewing, both dedicated and informal activity. Protection from disturbance is needed, but can potentially be balanced with the evident public demand for access to the coast and enhancement of coastal facilities.

5.4 Potential Impacts

Construction

5.4.1 Construction activity will include the widening of pathways and preparation of dedicated cycle lanes. There will be a need to provide safer entry and egress to some routes such as O'Hanlon's Lane and widening of a section of the Corballis Cottages Road. The principal works programme will occur over a period of 28 weeks, but most individual works will be of a short and finite duration rather than continuous and are not expected to significantly affect normal traffic flow. A slight negative amenity impact will apply to residents living beside these works (see Chapter 11 (Material Assets) and Chapter 4 (Traffic and Transportation)), for example at O'Hanlon's Lane and Bissets Strand. No significant impacts on the access or use of either Malahide or Newbridge Demesne are expected (see Table 5.8 for summary of impacts).

5.4.2 Impacts associated with the construction works on the causeway into the Malahide Estuary and at the bridge are addressed elsewhere in this EIAR. These works will occur at a distance from residences and community centres and so do not present significant impacts for local residents. The works here will require an estimated 75 round trip truck deliveries of stone via Yellow Walls Road and Sea Road/Caves Strand in Malahide as well as 24 deliveries of precast bridge beams. At a maximum of 25 trucks each day for three days, this will present a slight negative amenity impact for local residents. Additional deliveries of materials will be needed for construction of sections of the proposed greenway elsewhere in Malahide and Kilcrea, but will entail a lower number of truck movements (see Chapter 3 (Section 3.9-Construction)).

5.4.3 On the northern side of the estuary, the delivery of construction materials will occur via Hearse Road and the Corballis Cottages Road. Although there are some poor sightlines on the latter road, it is judged to have the capacity to handle this traffic, although restrictions will be placed on the timing of deliveries of larger objects (see Chapter 3 (Section 3.9-Construction)).

Operational

Amenity and Social Activity

5.4.4 The proposed greenway is projected to be used by 720 people daily for around 1,200 trips on average (see Chapter 4). The activity will provide tourism and positive public health benefits as described under the headings below, but also social and well-being benefits. There are now four developed greenways in the Republic of Ireland with proposals for several additional routes.[2] The proposed development is likely to be used by local people, day-trippers from Dublin and elsewhere in Leinster, and by visitors from overseas typically as part of a trip to Dublin. Of four cycle/walking trails studied in Northern England,[3] 26% of users were on brief trips, 17% on day trips, and 23% were "tourist users". However, the proposed development will inevitably have its own particular combination influenced by the large adjacent urban population, Dublin's attraction to tourism, the distinct character of the Fingal coast, and the absence of competing facilities.

[2] www.irishgreenways.com

[3] Downward, P., Lumsdon., L. and Weston, R (2009). Visitor Expenditure: The Case of Cycle Recreation and Tourism, *Journal of Sport & Tourism*, 14 (1), pp25-42.

Table 5.8 Impacts Summary.

Location	Nature of Impact	Population Subsets	Impact of the Proposed Development	Significance	Extent	Interactions	Mitigation Proposed	Residual Impact
CONSTRUCTION								
Residential properties along proposed greenway, e.g. at O'Hanlon's Lane and Bissets Strand.	Residential amenity	Residents	Noise, construction works.	Slight-moderate negative	Medium	Traffic	Adherence to CEMP. Avoidance of noisy or disruptive works at sensitive times.	Slight negative
Residential properties along proposed greenway, e.g. at Yellow Walls Road, Sea Road, Corballis Cottages.	Residential amenity	Residents	Construction traffic	Slight-moderate negative	High		Avoidance of high volumes or movement of larger objects at peak times.	Slight negative
OPERATION								
Malahide and Donabate	General amenity	Local residents	Amenity value for walking and cycling.	Very significant positive	Very high	Traffic, landscape, ecology	n/a	Very significant positive
Malahide and Donabate	Reduction in severance	Local residents	Reduction in physical severance (walking/cycling possible).	Significant positive	High	Traffic	n/a	Significant positive
Greenway	General amenity	Users from wider study area and elsewhere	Amenity value for walking and cycling.	Significant positive	Very high	Traffic, landscape, ecology	n/a	Significant positive
O'Hanlon's Lane	Increased cyclist and pedestrian activity	Local residents	Noise from users at peak times. But providing passive surveillance.	Slight negative	Medium	Design, traffic	Improved access from Bissets Strand. Signage.	Neutral

Location	Nature of Impact	Population Subsets	Impact of the Proposed Development	Significance	Extent	Interactions	Mitigation Proposed	Residual Impact
Dublin Road, Bissets Strand and Hearse Road.	Journey amenity	Drivers	Slight delays at peak times due to signalised crossings.	Slight negative	Very high	Traffic	Considered timing of lights to minimise inconvenience.	Slight negative
Railway underbridge at Bissets Strand	Journey amenity	Drivers and cyclists	Safer on-demand light sequence shuttle system	Slight positive	High	Traffic	n/a	Slight positive
Railway underbridge at Corballis Cottages Road	Journey amenity	Drivers, cyclists and pedestrians	Safer on-demand light sequence shuttle system	Moderate positive	Medium	Traffic	n/a	Moderate positive
Greenway	Health	Users, especially local people	Opportunity for increased exercise and outdoor activity	Significant positive	High	Planning	Complement with signage and additional cycle/walking links	Significant to very significant positive
Local and wider area, esp. Malahide	Economic	Local businesses	User spending on food, gifts, accommodation	Significant positive	High	Planning	Complement with signage and public realm development	Significant to very significant

5.4.5 For local people, the proposed greenway will provide a very significant positive impact in terms of its amenity value for cycling, walking (both casual and active) and for birdwatching of the estuary. In addition, the proposed greenway will remove some of the physical severance between Malahide and Donabate, one consequence of which is likely to be a small amount of commuting use, especially once the proposed greenway is formally connected to Donabate. This will allow some people living in this community to cycle to employment in Malahide as an alternative to the circuitous journey via Swords. The development proposed here connects to Newbridge Demesne from where it is possible to walk or cycle into Donabate using Newbridge Avenue and Turvey Road or Hearse Road. These roads have footpaths, although Hearse Road is too narrow to encourage cycle use by families or less experienced cyclists. Alternative option for access to Donabate will be provided by the Donabate Distributor Road proposed in the LAP through lands zoned for development or by a proposed new pedestrian bridge across the railway.

5.4.6 For people living in Dublin and Leinster, the amenity provided by the proposed greenway is a significant positive impact as no similar facility exists close to the capital. The immediate development that is the subject of this EIAR is likely to appeal mainly to casual users and especially to families given the connection with both Malahide and Newbridge Demesnes. A walking/cycle connection between Malahide, Portmarnock and Sutton is being actively progressed and will provide a connecting link to major population areas for people seeking active longer distance cycling and walking exercise. There are pedestrian bridge crossings of the R132 at the Estuary and Seatown roundabouts and an existing gravel path along the estuary section of Estuary Road, but no connecting cycle paths at present.

5.4.7 A high proportion of users will be from other parts of Ireland, often as part of a visit to Dublin, as well as other EU and overseas visitors. At present, many of these people use the train/DART service to travel to Howth or to Bray and Greystones where there is seaside amenity and walking opportunities. Malahide attracts a smaller proportion of visitors, but would certainly attract many more once the facility is operational. Other proposed developments within the Malahide Public Realm Strategy would be complementary in this respect. There may be some transference of visits from other locations, but the proposed greenway would be a unique facility that will attract new additional visits.

5.4.8 Users will have the options of arriving by bike, car, public transport, including local bus or from the nearby DART station. Users arriving by car will be able to park in the car parks at either end of the proposed development. People arriving by bicycle can cycle directly to Malahide, especially once connecting cycle facilities have been realised in the wider Sutton to Malahide greenway scheme. Cycle journeys direct to Newbridge from Swords are currently deterred by the unfavourable traffic conditions. Many people will also use the train/DART and this could, in time, support the provision of extra cycle facilities on the service. Cycle hire is already available in Malahide Demesne. The rail, bus and cycle lane connections to the proposed greenway will provide a social benefit by facilitating accessibility to the coast, countryside and facilities of the two demesnes (including the playgrounds) to people and families without private transport.

Residential and Journey Amenity

5.4.9 The proposed greenway will be a very significant positive amenity for both residents of Malahide and for users. Even for non- or infrequent users, there will be prospective

benefits in terms of sense of place and place attachment. Some inconvenience may arise from higher pedestrian levels in the centre of Malahide, especially on summer weekends. This can be mitigated through implementation of aspects of the Public Realm Strategy which includes proposals for traffic calming. Some inconvenience will also be placed on local drivers by signalised crossings, namely at the R106 Dublin Road and on Hearse Road, noting the high level of projected use. However, a proportion of users will arrive via Bissets Strand Road and so omit the former crossing. The proposed signalised shuttle system for the railway underbridge here is on-demand and so will introduce only slight delays for drivers. Rather, this arrangement will provide a slight positive impact for drivers, and cyclists, due to the improved safety, including people cycling generally and not specifically for the proposed greenway. The same arrangements apply at Corballis Cottages Road, together with some realignment of the carriageway and will benefit pedestrians too. These will provide a moderate positive amenity impact for all road users compared with the safety of the existing situation.

5.4.10 O'Hanlon's Lane is a public laneway. There will be an increased flow of pedestrians and cyclists utilising this laneway. It may be perceived that this additional activity may lead to a minor negative impact by way of inconvenience to vehicle access to private properties in the southern and central sections of the road. However, it may also be said that there will be an amenity benefit by way of direct connection to the proposed greenway and its linkages. An increased level of passive surveillance will also be introduced by the higher level of use of the lane and changes to the junction with Bissets Strand to improve access and safety. Signage may also be erected asking users to respect residents' privacy. Consequently, as a result an overall neutral residual impact is anticipated here.

Health

5.4.11 The proposed greenway will provide indirect health benefits by encouraging more cycling and walking. Many instances of heart disease, type-2 diabetes, breast cancer and colon cancer can be avoided by maintaining a moderate level of activity for 30 minutes each day. There is also evidence that outdoor exercise is beneficial to psychological well-being.[4] Around 60% of adults in Ireland take insufficient physical activity and 16% are classed as inactive. Only 51% of boys and 38% of girls are believed to take the amounts of exercise recommended by the Health Service Executive (HSE). By the age of 15 these figures fall to 27% and 13%.[5]

5.4.12 A lack of accessible recreational facilities is a deterrent to physical activity. The proposed greenway will allow people to exercise and enjoy the outdoors. The incorporation within the design of safe cycle/walking facilities and crossings is essential for a positive health impact to be realised. This will encourage use by families with children and by people who currently cycle infrequently. This, in turn, will provide an opportunity for significant health benefits especially for those who currently exercise inadequately, but will require a change of habits. The most positive impact will be realised by local people who fall within this category and who start using the proposed greenway on a regular basis. However, the facility will also be an encouragement to cycle or walk by the people who use it just occasionally. These health benefits will have a significant positive impact on the quality of life of that proportion of people who are encouraged to exercise more often as well as supplying public and private good benefits in terms of healthcare

[4] For example, see Bize *et al*. (2007), Lee *et al*. (2012,) and Ulrich (1983).
[5] See HSE (2008) Health Status of the Population in Ireland.

expenditure. This positive health impact will be strengthened by proposed extensions to the proposed greenway that could encourage more active exercise.

Economic

5.4.13 At national level, Fáilte Ireland estimate that, in 2011, 285,000 tourists engaged in cycling during their visit, spending €200 million.6 By 2016, this number had risen to 399,000.7 The experience of the Great Western Greenway in County Mayo provides the principal source of evidence in Ireland of the potential economic benefits. The total expenditure in 2011 associated with this amenity was estimated at €7.24 million, of which local people spent just under €1 million, domestic tourists €3.5 million, and non-domestic visitors €2.75 million. Of this expenditure, 53% is considered to be additional to other tourist activities that might have been undertaken in the county in the absence of the proposed greenway. The net additional income to the local economy was estimated at €2.8 million per year.8 In 2012, daily trips were 400 in the summer, but averaged 100 in the winter months.9 In 2014, the average expenditure per user was estimated to be €62 (including accommodation) which, it is estimated, has supported 37 new jobs.10 Family users of greenways are known to spend more than other categories.5

5.4.14 The proposed development will attract its own combination of visitor types given its specific characteristics and the nature of its catchment. Day trip spending on food is likely to be the largest element. Some of this will occur in the demesne cafés at either end, but Malahide's collection of cafés, restaurants and pubs will also attract much of this spending. Newsagents and grocer shops will also attract spending and additional expenditure will occur in clothes and craft shops in the town. Transport will account for significant expenditure, specifically the train/DART service. There is likely to be some expenditure on accommodation in Malahide and nearby locations. While visitors from elsewhere in Ireland will mostly be on longer trips, the proposed greenway will often account for the principal activity of the day and, therefore, a principal reason for an extra night's stay.

5.4.15 Assuming that families comprise 50% of the projected 720 daily users, total food-related expenditure could amount to €2.96 million per year. Public transport spending could amount to €65,000 per year by train/DART and over €54,000 by bus.[11] On top of these sums, would be significant non-food spending in local shops. The related accommodation spend could total €4.2 million per year were it to be allocated principally to the proposed greenway. However, only a small proportion of the accommodation spend would be local and much can be expected to have occurred in any case. However, displaced expenditure from other activities will likely be low as the uniqueness of the proposed greenway will attract new net spending. The net economic benefit, including also indirect impacts across the economy, represents a significant positive impact at local

[6] Fáilte Ireland (July 2011) Profile of overseas visitors who cycled in 2011.
[7] Fáilte Ireland (June 2017) Tourism Facts 2016 (Preliminary).
[8] Fitzpatrick Associates (2011). Great Western Greenway Economic Impact Study. Dublin.
[9] Deenihan, G., Caulfield., B. & O'Dwyer (2013). Measuring the Success of the Great Western Greenway in Ireland, *Tourism Management Perspectives*, 7, pp73-82.
[10] Browne, L., Bullock, C., O'Tuama, D., Murphy, W. & Black, M. (2016) A Feasibility Study on the Development of a Major Cycling Destination in the Midlands of Ireland.
[11] Based on half of families averaging four persons spending between €20 and €80 in food, i.e. €1.64m. Half of other adults averaging €20 per trip (€1.31m). Assume 5% of users arrive by train/DART (from Connolly) and 5% by bus from Swords (same share of adults and children).

level. Most expenditure is expected to occur in Malahide given the existing range of facilities and the projection that 84% of users will commence their trip from this location.

5.5 Mitigation Measures

5.5.1 During construction, the Construction Environmental Management Plan (CEMP) will provide for interaction between residents and the construction team to minimise potential impacts on local people who could be affected by the timing of works or construction transport. On operation, measures such as directional and advisory signage, and road marking, will be needed to minimise disruption from noise or nuisance in the vicinity of existing properties and landholdings alongside the proposed development and to facilitate ease of movement by cyclists and walkers travelling in two directions. As well as the waymarking signage on the route, signage at other locations can help users find their way to sections of the proposed greenway or to car parking from the road network and public transport nodes. Signage can also complement the experience of users with information of local natural and cultural heritage.

5.6 Residual Impact

5.6.1 The proposed development represents a key local and national amenity. During the construction and operation phases, there is the potential for impacts of slight negative magnitude, but these can be mitigated through careful management and design. The residual impact of the proposed development will have significant to very significant positive impacts in terms of amenity, the local economy and health. These impacts can be maximised if integrated with other proposals to enhance the public realm and cycling and walking network.

5.7 Cumulative Impacts

5.7.1 The proposed development will have a significant positive amenity, health and economic impact. As the population of Fingal is growing rapidly, the extent of this positive impact will be reinforced over time. For full benefits to be realised it will be important to provide complementary infrastructure. This includes aspects of the public realm strategies for both Malahide and Donabate to encourage people to find and use local facilities such as cafés, shops and cycle hire, and to enjoy other sites of interest in town and along the coast. The new transport and pedestrian/cycle infrastructure proposed in the Donabate LAP, including the Donabate Distributor Road and a new railway crossing, will permit more direct connections with the town. Combined with the proposed northward extension of DART services, this will allow Donabate to share more in the economic and amenity benefits from the proposed greenway. The linking of the proposed greenway into the wider walking and cycle network will maximise use of the proposed greenway and encourage users to arrive by bicycle or foot, reducing car dependency and minimising impacts on existing traffic. With this complementary infrastructure in place the proposed development will have a very significant net positive cumulative impact.

6.0 Biodiversity

6.1 Introduction

6.1.1 This chapter considers the biodiversity aspects of the proposed development. In particular the aspects of habitat, flora, fauna, and ornithology are considered. As the proposed development will cross two European sites a summary statement from the separately conducted Natura Impact Assessment is provided here in advance of an assessment of biodiversity along the length of the scheme.

6.2 European Sites

6.2.1 Malahide Estuary is designated as part of the Malahide Estuary SPA (Site Code 004025) under the Birds Directive (2009/147/EC) because of its importance for migratory wintering waterfowl. The area is also a Special Area of Conservation (SAC) (Site Code 000205) and proposed Natural Heritage Area (pNHA). It comprises a coastal habitat with a restricted tidal range on the western side of the railway viaduct and embankment, and the outer estuary to the east of the railway, together with areas of salt meadow and sand dune habitat on Malahide Point, and an area of shallow coastal water. See Volume 4C-Appendix 13 for site synopsis sheets.

6.2.2 The outer part of the estuary is mostly cut off from the sea by a large sand spit, known as “the island”. The outer estuary drains almost completely at low tide, exposing sand and mud flats. Much of the interior of the spit is taken up by a golf course (The Island/Corballis), though there are a number of rough areas and slacks. The inner stony shore has frequent Sea-holly (*Eryngium maritimum*). Well-developed saltmarshes occur at the tip of the spit. The inner estuary does not drain at low tide apart from the extreme inner part. The estuary is an important wintering bird site. The Brent Goose population is of international importance. The typically high numbers of diving birds reflect the habitat nature of the inner estuary. The head of the estuary, at Seatown, traditionally known as Swords Estuary, holds a large flock of Mute Swans. The inner part of the estuary is heavily used for water sports. A section of the outer estuary has been developed as a marina and dock.

6.2.3 The proposed development in part crosses the Malahide Estuary SAC and Malahide Estuary SPA on the western side of the existing railway causeway. Works to ensure the safety of the railway were carried out to the embankments and weir by Irish Rail between 2002 and 2012. The proposed development is situated on top of the western railway embankment and related structures. The railway causeway lies largely outside both the SAC and SPA (see Design Drawings 12-160-256 to 12-160-260 in Volume 3). The greenway on the western embankment of the southern arm of the causeway lies within the SAC and SPA. The greenway crosses the SAC/SPA at the weir. The greenway on the western embankment on the northern arm of the causeway lies largely outside the SAC and SPA. Taking a precautionary approach, for the purpose of appropriate assessment, it is presumed that the proposed development lies within the Malahide Estuary SAC and SPA in its entirety in that part which follows the railway causeway across the estuary. This is because there is aerial and hydraulic continuity across the causeway from the inner estuary to the outer estuary and *vice versa*. Similarly, the zone of potential influence is taken broadly as the Malahide SAC area, the Malahide SPA area and adjacent relevant coastal and estuarine SPAs on the east coast.

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6.2.4 Detailed knowledge of the operation of the weir beneath the railway bridge is presented in the NIS. Arising from the viaduct collapse in 2009, detailed and certain working knowledge has been generated which demonstrates the close relationship between weir crest height and water levels in the inner estuary. All of this knowledge has been brought to bear in designing temporary works for the greenway bridge deck positioning which will not result in a permanent change to the inner estuary water levels.

6.2.5 With the application of the mitigation proposals, particularly those proposed for temporary works to the weir, the assessment concludes that there will be no adverse impacts on the Malahide Estuary SAC.

6.2.6 Detailed bird surveys have shown that the permanently inundated waters close to the crossing of the inner estuary generally hold a relatively low diversity and abundance of bird species. Typically there is very little usage of the areas within 500m of the crossing by any of the qualifying interests of the SPA. Occasional flocks of loafing Brent Geese and Gull species are recorded in the waters close to the causeway. Waterbirds moving between feeding and roosting sites in the area regularly overfly the existing railway embankment and there is no reason to anticipate that the construction or operation of the proposed development will impact upon these commuting flights.

6.2.7 The use of screening to minimise the visual disturbance to waterbirds is a well-established wildlife management technique (e.g. Hockin, 1992; Borgmann, 2011). The proposed solid wall screening will be effective in breaking up the outline of users of the walkway and minimising visual disturbance to birds present on the adjacent parts of the inner estuary. Similarly, the lighting design minimises the risk of disturbance to birds. The LED segmented dimming lamp-arrays are designed to light the greenway surface only during the periods when the greenway will be in active use. Light spill to the inner estuary will be insignificant and the design will ensure that there are prolonged periods of darkness throughout the night-time period.

6.2.8 There is a wealth of information on the usage of the site by birds, and the estuary is already a busy amenity area, crossed by a main rail line, and the inner estuary is a popular watersport area.

6.2.9 With the application of the mitigation measures there will be no adverse impact on the Malahide Estuary SPA.

6.2.10 There will be no long-term impacts on the key relationships that define the structure or function of the European sites considered in this NIS. The integrity of Malahide Estuary SPA and Malahide Estuary SAC will not be adversely affected by the proposed development in terms of wholeness or soundness of their conservation objectives.

6.3 Habitats

Data and Methodology

6.3.1 Site visits to identify the habitat and floral composition of the site were made over the period 2012-2019. The site was evaluated according to the methodology outlined by TII (formerly NRA) 2009. The ecological value of the site was assessed for the most part as low value, locally important, i.e. comprised principally of artificial or highly modified

habitats with low species diversity and low wildlife value. Areas of habitat within a designated European Site, Malahide Estuary SAC, are evaluated as of international importance. Some smaller areas of habitat are defined as high value and moderate value, locally important, i.e. areas of the site containing some natural or semi-natural habitat in the study area (see Volume 3-Figures 44, 45 and 46).

Rare or Protected Flora

6.3.2 There are a number of known rare and protected plant species records from the 10km square in the vicinity of the proposed development. These include historic records dating from the late nineteenth century as well as some more recent records.

6.3.3 These include:

- Basil Thyme (*Acinos arvensis*) recorded from Portmarnock in 1840, 1893 and 1903;
- Lesser Centaury (*Centaurium pulchellum*) recorded from Portmarnock Point in 1991;
- Red Hemp Nettle (*Galeopsis angustifolia*) recorded from Donabate in 1902 and from Malahide in 1794;
- Meadow Barley (*Hordeum secalinum*) recorded from Portmarnock in 1866 and 1991;
- Oyster Plant (*Mertensia maritima*) from an unknown location in 1831;
- Round Prickly-headed Poppy (*Papaver hybridum*) recorded from Baldoyle to Portmarnock in 1836 and 1892, from Portmarnock in 1894, and from Malahide in 1985;
- Tufted Salt-marsh Grass (*Puccinellia fasciculata*) recorded from Baldoyle in 1990 and 1993;
- Meadow Saxifrage (*Saxifraga granulata*) recorded from Baldoyle to Portmarnock in 1824 and 1890, and from Baldoyle Racecourse in 1885 and 1902;
- Annual Knawel (*Scleranthus annuus*) recorded from Baldoyle in 1846;
- Hairy Violet (*Viola hirta*) recorded from Feltrim Hill in 1869 and 1904, from Portmarnock in 1869 and 1989 and from Baldoyle in 1895.

6.3.4 Notwithstanding, there are currently no known records of any rare or protected flora from the railway causeway or weir at Malahide (NPWS database records); neither was any rare, protected or scarce plant species found within the site during the walkover surveys (Curtis & McGough, 1988; Whilde, 1993; Neff, 1996-2000).

6.3.5 Over time, with the ingress of blown sand and sediments which have lodged in the interstices of the stonework, parts of the railway embankment have been colonised by plants from the surrounding areas. This is reflected in a mix of species, which includes ruderal communities, terrestrial grassland, and maritime species associated with salt marsh and sand dunes. The northern railway causeway is bounded to both the east and west by the open waters of the Malahide Estuary and is sheltered from the Irish Sea to the east by the sand hills of Corballis, on which the Island Golf Course has been developed. The railway track on the southern embankment is bounded to the east by large marina and housing development which adjoins a stone wall to the east of the track and to the west by the open waters of the Malahide Estuary.

6.3.6 None of the vegetation present conforms to any of the EU Annex II habitat types for which the adjacent Malahide Estuary SAC has been designated. Since installation these areas have been recolonised by a variety of plants. No species protected under the Flora Protection Order 2015 has been recorded from the footprint of the proposed development.

Baseline Data

6.3.7 The site was divided into four areas for evaluation purposes (no habitats in Sections 2 and 3). Focus was made particularly on Sections 4 and 5, as the proposed development follows metalled pathways in Section 1 – Malahide Demesne and Section 6 – Newbridge Demesne.

- Section 1 – Malahide Demesne/Village.
- Section 4 – Railway Causeway.
- Section 5 – Kilcrea/Corballis.
- Section 6 – Newbridge Demesne.

Section 1 – Malahide Demesne/Village

6.3.8 To the south of the causeway the area is principally dominated by built land and is of very low habitat value. Only a few areas of modified semi-natural habitat occur – these are amenity grassland and treelines. These are of low and moderate local value respectively. Within Malahide Demesne, the proposed development follows the metalled pathway from the car park past the castle and outbuildings and to the north gate. At no point are ecological habitats part of the scheme (see habitat plan in Volume 3-Figure 44).

Table 6.1 Habitat Types and Conservation Value Along Route of the Proposed Greenway at Malahide Demesne – Vicinity of Development.

Habitat Type	Conservation Value
Amenity Grassland (GA2)	Low
Treelines (WL2)	Moderate
Mixed Broadleaved Woodland (WD1)	Moderate-High
Scattered Trees & Parkland (WD5)	Moderate

Section 4 – Railway Causeway

6.3.9 The habitats of the site are principally dominated by artificial constructions, the causeway/trackway being the most obvious. This habitat type is defined under the Fossitt (2000) habitat type (Sea walls, piers and jetties CC1). This coastal construction which abuts the railway causeway to the east and the impounded estuary to the west also supports areas of regenerating and regenerated habitat such as Recolonising bare ground ED3, Dry meadows and grassy verges GS2 and Scrub WS1. All these habitats show species indicative of disturbance and have a maritime element (see Table 6.2 below).

6.3.10 The habitats of the site are summarised below:

- Sea Walls, Piers and Jetties CC1*:* At Bissets Strand the weir maintenance access track and adjacent rock armour support species typical of maritime rocky shores Sea Beet (*Beta vulgaris*), Stags head Plantain (*Plantago coronopus*), Sea Plantain (*P. maritima*), Sea Mayweed (*Tripleurospermum maritimum*), Silverweed (*Potentilla anserina*), Red Fescue grass (*Festuca rubra*), Curly Dock (*Rumex crispus*), and Cleavers (*Galium aparine*). Together with alien species typical of ports and harbours such as Ribbed Melilot (*Melilotus officinalis*). This habitat type defined by Fossitt (2000) is used for all coastal constructions that are partially or totally inundated by sea water at high tide, or subject to wetting by sea spray or wave splash. It includes sea walls,

piers, jetties, slipways, causeways and other structures associated with ports and docks in urban or rural areas.

- Mosaic Spoil and Bare Ground ED2/Recolonising Bare Ground ED3*:* Areas of the site which have not yet become fully revegetated after weir reconstruction (2009) but where some revegetation is in evidence comprises a mosaic of Spoil and bare ground ED2/Recolonising bare ground ED3. Vegetation cover varies from almost bare to greater than 50% cover in some areas. Most of the typical colonisers are ruderals, or weed plants. Species include some species indicative of the maritime habitat such as Stags head Plantain (*Plantago coronopus*), Sea Plantain (*P. maritima*), Sea Mayweed (*Tripleurospermum maritimum*). Other common species include Silverweed (*Potentilla anserina*), Greater Plantain (*P. major*), Curly Dock (*Rumex crispus*), Colt's Foot (*Tussilago farfara*), Clover species (*Trifolium* spp.), Cudweed (*Gnaphilum uliginosusm*), Nettle (*Urtica dioica*), Dandelion (*Taraxacum* spp.), willow-herbs (*Epilobium* spp.) and ragworts (*Senecio* spp.). Grasses are also present and include Red Fescue (*Festuca rubra*), False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*) but are not dominant in the barer areas.

- Dry Meadows and Grassy Verges GS2*:* Along the fringes of the bare ground areas of grassy verge occur dominated by tall, coarse and tussocky grasses such as False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*) with red fescue and common couch grass also common. The broadleaved herb component is characterised by a range of species that either grow tall, such as Hogweed (*Heracleum sphondylium*), Common Knapweed (*Centaurea nigra*), and Meadow Vetchling (*Lathyrus pratensis*) and Silverweed. Grassy verges may support other smaller broadleaved herbs such as Creeping Cinquefoil (*Potentilla reptans*) and clovers (*Trifolium* spp.). The maritime influence at the site is in evidence with the occurrence of Common Fleabane (*Pulicaria dysenterica*) and Sea Mayweed (*Tripleurospermum maritimum*). Occasional Reeds (*Phragmites australis*) occur at the fringe of this vegetation along drainage channels near entrance to causeway.

- Scrub WS1*:* Fringes of the higher established railway embankment have become overgrown with brambles. Common components include spinose plants such as Bramble (*Rubus fruticosu*s agg.) and Gorse (*Ulex europaeus*) with occasional Hawthorn (*Crataegus monogyna*) and some stunted trees, in particular the weedy sycamore. Along the fringes of the scrub and amongst the limestone rock armour an abundance of the introduced species Red Valerian (*Centranthus ruber*) occurs. The habitat grades to Dry meadows and grassy verges GS2 along the fringes of the scrub.

Table 6.2 Habitat Types and Conservation Value Along Route of the Proposed Greenway at the Railway Causeway – Vicinity of Development.

Habitat Type	Conservation Value
Sea Walls, Piers and Jetties CC1	Low
Mosaic Spoil and Bare Ground ED2/Recolonising Bare Ground ED3	Low
Dry Meadows and Grassy Verges GS2	Moderate
Scrub (WS1)	Low-Moderate

Section 5 – Kilcrea

6.3.11 The principal conservation interest of the site lies in areas of the site subject to periodic inundation by brackish or freshwater. These include a narrow strip of Shingle and Gravel Shores (LS1) and a small area of Saltmarsh Marsh-Wet Grassland (CM2/GS4) and a Tidal Channel (CW2) on the most downstream part of the River Pill adjacent to the railway embankment. These CM2/GS4/CWS habitats, west of the railway embankment, are separated from the intertidal habitats of the outer estuary by way of a non-return flap on the outlet carried beneath the railway line. These habitats are representative of habitats annexed under Annex I of the EU Natural Habitats Directive. Tidal channels correspond approximately to the annexed habitat, 'estuaries (1130)' and Saltmarsh Marsh-Wet Grassland (CM2/GS4) corresponds to 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimae*) (1330)' and the shingle shore to the annexed habitat 'perennial vegetation of stony banks (1220)' (see Table 6.3 below).

6.3.12 These habitats provide feeding habitat for a variety of birdlife in particular wader species such as Curlew and Oystercatcher. The habitats are linked to the adjacent Malahide SAC but with the exception of a very small area of Shingle and Gravel Shores (LS1) are outside the SAC. The habitats outside the SAC are of high value local significance (see habitat plan in Volume 3-Figure 45).

HEDGEROWS WL1 – KILCREA

6.3.13 The hedgerows that occur along the field margins in Kilcrea are generally good examples of their habitat types supporting a variety of shrub and tree species and providing a network of wildlife corridors at the site.

6.3.14 Hedgerows here are typical of the general locality and are very much dominated by Hawthorn (*Crataegus monogyna*) and some Elder (*Sambucus nigra*). In addition Blackthorn (*Prunus spinosa*), Gorse (*Ulex europaeus*), Holly (*Ilex aquifolium*), Dog-rose (*Rosa canina*), Bramble (*Rubus fruticosus* agg.), and willows (*Salix* spp.). The hedgerows also support climbing plants such as Ivy (*Hedera helix*), Honeysuckle (*Lonicera periclymenum*), Hedge Bindweed (*Calystegia sepium*), Cleavers (*Galium aparine*) and Bush Vetch (*Vicia sepium*). Tall grasses occurring along the hedgerow fringe, include False Oat grass (*Arrhenatherum elatius*), and Cock's-foot grass (*Dactylis glomerata*). The Harts Tongue Fern (*Phyllitis scolopendrium*) is also common at the base of the hedgerows. This habitat is not protected but is of some conservation value locally providing habitat for passerine bird species and small mammals.

6.3.15 Some introduced species also occur as occasional plantation species in the hedgerow along the route these include, Butterfly bush (*Buddleja davidii*) and Fuchsia (*Fuchsia magellanica*).

HEDGEROWS WL1/SCRUB WS1 – CORBALLIS COTTAGES ROAD

6.3.16 Species composition varies very little along the route, however short sections of exotic planted hedgerow species are found in the vicinity of dwelling houses where the dominant species are exotics such as New Zealand Privet (*Griselinia littoralis*), Red-flowering Currant (*Ribes sanguineum*) and Periwinkle (*Vinca minor*). However in general along the Corballis Cottages Road, hedgerows commonly support a high proportion of native spinose plants such as Hawthorn (*Crataegus monogyna*), Blackthorn (Prunus spinosa), Dog-rose (*Rosa canina*) or Bramble (*Rubus fruticosus* agg.), in addition to many

other trees and shrubs including, for example, Ash (*Fraxinus excelsior*), Sycamore (*Acer pseudoplatanus*), Hazel (*Corylus avellana*), Elder (*Sambucus nigra*), Common Privet (*Lingustrum vulgare*) and Willows (*Salix* spp.). The hedgerows also support plants such as Ivy (*Hedera helix*), Hedge Bindweed (*Calystegia sepium*), Cleavers (*Galium aparine*) and Bush Vetch (*Vicia sepium*). Tall grasses, including False Brome (*Brachypodium sylvaticum*), ferns, and woodland herbs. The fringes of the established railway embankment have become overgrown with bramble scrub (WS1). Common components include spinose plants such as Bramble (*Rubus fruticosus* agg.) and Gorse (*Ulex europaeus*) with occasional Hawthorn (*Crataegus monogyna*) and some stunted trees in particular the weedy sycamore. Along the fringes of the scrub and amounts the limestone rock armour an abundance of the introduced species Red Valerian (*Centranthus ruber*) occurs. The habitat grades to Dry meadows and grassy verges GS2 along the fringes of the WS1 scrub.

IMPROVED AGRICULTURAL HABITATS (GA1 AND BC1)

6.3.17 Improved agricultural habitats, i.e. areas of improved Agricultural Grassland (GA1) and Arable Crops (BC1), along the proposed greenway route are not of high conservation importance. The improved grassland fields support the ubiquitous species assemblage of Rye-grasses (*Lolium* spp.), clovers (*Trifolium repens, T. repens*) and Yorkshire-fog grass (*Holcus lanatus*). Among the more frequently occurring 'agricultural' herbs are Dandelion (*Taraxacum* spp.), Creeping Buttercup (*Ranunculus repens*), plantains (*Plantago* spp.), Nettle (*Urtica dioica*), thistles (*Cirsium arvense, C. vulgare*) and docks (*Rumex* spp.). A large cereal field (BC1) also occurs along the route.

SCRUB WS1

6.3.18 Gorse scrub occurs in patches along the proposed greenway route. This scrub is dominated by European Gorse (*Ulex europaeus*), which gives almost total shade and thus suppresses the growth of ground flora species beneath. Other scrub species, which occur in the gorse scrub, include Hawthorn (*Crataegus monogyna*), Blackthorn (*Prunus spinosa*), Elder (*Sambucus nigra*), Bramble (*Rubus fruticosu*s agg.), Willow *(Salix repens*) and the potentially invasive exotics Butterfly Bush *(Buddleja davidii*) and Travellers Joy (*Clematis vitalba*).

DRY MEADOWS AND GRASSY VERGES GS2 – KILCREA

6.3.19 Along the trackside fringes, along field boundaries and in some areas of light grazing the habitat Dry Meadow/Grassy Verge is encountered. This habitat is dominated by the tussocky grasses False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot grass (*Dactylis glomerata*). Other grasses include Couch grass (*Elymus repens*), Timothy grass (*Phleum pratense*), Yorkshire-fog (*Holcus lanatus*), Smooth Meadow-grass (*Poa pratensis*), and occasionally Red fescue (*Festuca rubra*). The tussock grass (*Deschapsia caespitosa*) and Creeping bent grass (*Agrostis stolonifera*) occur occasionally in damper patches. The herb component is dominated by tall species such as Hogweed (*Heracleum sphondylium*), Nettle (*Urtica dioica*), Yarrow (*Achillea millefolium*), Ox eye daisy (*Leucanthemum vulgare*) and Common Knapweed (*Centaurea nigra*). Scrambling plants also occur commonly in the grassy margin and include Bush Vetch (*Vicia sepium*), Meadow Vetchling (*Lathyrus pratensis*) and Hedge Bindweed (*Calystegia sepium*). Grassy verges may support other smaller broadleaved herbs such as Creeping Cinquefoil (*Potentilla reptans*), Silverweed (*P. anserina*) and clovers (*Trifolium* spp.). Other species found in the grassy verge habitat along the railway embankment include Hedge Woundwort (*Stachys sylvatica*), willow herb

species (*Epilobium hirsutum*), chickweeds (*Stellaria* spp.), and yellow compositae (*Hieracium* spp. *Hypochoeris radicata, Taraxacum officinale* inter alia). The agricultural weeds Sow thistles (*Sonchus* spp.), Ragwort (*Senecio jacobaea*) and Groundsel (*S. vulgaris*) are also abundant and of note is some Oxford Ragwort (*Senecio squalidus*) occurring in more disturbed patches. Indicators of the proximity of the coastal influence at the site is indicated by the occurrence of species such as Carrot (*Daucus carota*), Fleabane (*Pulicaria dysenterica*) and Teasel (*Dipsacus fullonum*).

6.3.20 The occasional occurrence of rush and sedge species such as the Rushes *Juncus effuses, J. inflexus, J. acutiflorus,* and *J. articulatus,* and sedges *Carex nigra* and *C. otrubae* etc. indicated the damp nature of the grassy verge habitat at the site.

DRY MEADOWS AND GRASSY VERGES GS2 – CORBALLIS COTTAGES ROAD

6.3.21 Along the roadside verges, along the field margins and associated with developing scrub at the site the habitat Dry meadows and grassy verges GS2 occurs on its own or in mosaic with scrub. Here the habitat is dominated by grasses and associated tall herbs. The habitat supports a high proportion of tall, coarse and tussocky grasses False Oat-grass (*Arrhenatherum elatius*) and Cock's-foot (*Dactylis glomerata*). Other grasses include Timothy grass (*Phleum pratense*), Meadow Foxtail (*Alopecurus pratensis*), Yorkshire-fog (*Holcus lanatus*), Smooth Meadow-grass (*Poa pratensis*) and Red Fescue (*Festuca rubra*). The broadleaved herb component is characterised by a range of species: Hogweed (*Heracleum sphondylium*), Nettle (*Urtica dioica*), Common Knapweed (*Centaurea nigra*), Ox Eye Daisy (*Leucanthemum vulgare*), Silverweed (*Potentilla anserina*), Cow parsley (*Anthriscus sylvestris*), Alexanders (*Smyrnium olustrum*), Cleavers (*Galium aparine*), Bush Vetch (*Vicia sepium*), and Clovers (*Trifolium* spp.). Grassy verges may support other smaller broadleaved herbs such as Creeping Cinquefoil (*Potentilla reptans)* and clovers (*Trifolium* spp.). The maritime influence at the site is in evidence with the occurrence of Common Fleabane (*Pulicaria dysenterica*) and Sea Mayweed (*Tripleurospermum maritimum*). Occasional Reeds (*Phragmites australis*) occur at the fringe of this vegetation along drainage channels near entrance to the causeway. On the fringes of this vegetation some garden escapes can also be found such as Hoary Stock (*Matthiola incana*) and Sweet Alyssum (*Lobularia maritima*). Woodland fringe species also occur in the verges and include Ivy (*Hedera helix*), Herb Robert (*Geranium robertianum*), and the grass *Brachypodium sylvaticum*. An exotic woody species growing in the grassy verge in the Corballis Cottages Road area includes Periwinkle (*Vinca minor*).

SALTMARSH MARSH-WET GRASSLAND (CM2/GS4)

6.3.22 This vegetation community is characteristic of permanently moist and sometimes inundated meadows and typically occurs on periodically tidally flooded sites as is the case here. At the site the vegetation bordering the tidal channels is transitional to a lower salt marsh community classifiable within the *Elymo-Rumicion crispi* (Westhoff and Den Held 1969) described below. Transitional areas of the meadow contain species representative of both the *Holco-Juncetum effusi* and the *Elymo-Rumicion crispi*.

6.3.23 The low lying part of the meadow supports an area of brackish Atlantic salt meadow which is transitional to the fresh water rush pasture of the higher ground or Upper saltmarsh CM2. This community may be best described as representative community of the *Elymo-Rumicion crisp*i (Westhoff and Den Held 1969) and appears to be a community closely related to the *Festuca rubra-Agrostis stolonifera-Potentilla anserina* grassland (Rodwell 1992). This community may be considered as a 'high marsh' CM2

community which is tolerant of brackish conditions but is not tolerant of inundation by highly saline waters. The community supports a sward of Red Fescue (*Festuca rubra*) (a typical upper salt-marsh species) with Creeping Bent (*Agrostis stolonifera*), Curled Dock (*Rumex crispus*), and Silverweed (*Potentilla anserina*). The community contains a frequency of salt-marsh species such as Orache (*Atriplex hastata*), Saltmarsh Rush (*Juncus gerardi*), Sea Milkwort (*Glaux maritima*), Sea Blite (*Suaeda maritima*), more normally associated with species assemblages of the *Glauco-Puccinellietali*a or alliance representative of typical Atlantic salt-meadows, Silverweed (*Potentilla anserina*), Common couch grass (*Elymus repens*) and Sea arrow grass (*Triglochin maritimum*). There are also occasional records for Marsh Willowherb (*E. palustris*), and the sedges (*Carex otrubae* and *C. distans*) associated with this vegetation community.

6.3.24 Where the brackish influence becomes lesser the grassy sward supports Fleabane (*Pulicaria dysenterica*), Marsh Horsetail (*Equisetum fluviatile*), Creeping Buttercup (*Ranunculus repens*), Lesser Spearwort (*R. flammula*) Red Bartsia (*Odontites verna*), Forget-me-not (*Myosotis scorpioides*), and Curled Dock (*Rumex crispus*). Rushes are an important component of the flora of the surrounding wet grassland GS4 which is transitional to a grassland where Hard Rush (*Juncus inflexsus*) is dominant. Grasses (*Agrostis stolonifera, Holcus lanatus, Anthoxanthum odoratum, Elymus repens, Poa pratensis* and *Festuca rubra*) make up the sward in damper areas. The associated forbs of damp areas include Chickweeds (*Stellaria* spp.), Mouse-eared Chickweed (*Cerastium fontanum*), Silverweed (*Potentilla anserina*), Marsh Willowherb (*Epilobium palustre*), Sorrel (*Rumex acetosa*), Marsh Ragwort (*Jacobaea aquatica*), Lesser Spearwort (*Ranunculus flammula*), Creeping Buttercup (*R. repens*), Clovers (*Trifolium* spp.), Greater Bird's foot (*Lotus uliginosus*), Fleabane (*Pulicaria dysenterica*), Curly Dock (*Rumex crispus*), Fool's water-cress (*Apium nodiflorum*), Ladies Smock (*Cardamine pratensis*), Mint (*Mentha aquatica*), Marsh Bedstraw (*Galium palustre*), and Meadowsweet (*Filipendula ulmaria*). Sea Club-rush *(Bolboschoenus maritimus*), and sedges (*Carex otrubae, C. nigra* and *C. distans*) occur scattered through this vegetation. This community is also classifiable within the *Holco-Juncetum effusi* (Page 1980), rush-pasture.

6.3.25 In drier areas the following grass species become abundant: False oat grass (*Arrhenatherum elatius*), Couch grass (*Elymus* repens) and Cock's foot grass (*Dactylis glomerata*). Associated forbs include Willowherb (*Epilobium hirsutum*), and Ragwort (*Senecio jacobaea*) classifiable within the dry meadow habitat (GS2).

6.3.26 There is correspondence between this category and the annexed habitats, 'Atlantic salt meadows (Glauco-Puccinellietalia maritimae) (1330)'.

TIDAL CHANNEL CW2

6.3.27 Canalised sections of channel occur at the site. These channels run alongside the railway embankment at the site. These drains and channels have a tidal influence at the site and so support tall emergents such as Sea club rush (*Bolboschoenus maritimus*) and up channel with lesser tidal influence species such as Water-cress (*Rorippa nasturtium-aquaticum*), the sedge *C. riparia* and Reed canary grass (*Phalaris arundinace*a) occur.

6.3.28 Bordering the lower channel species associated with saltmarsh habitat occur, i.e. Sea Blite (*Suaeda maritima*), the Common Saltmarsh Grass (*Puccinellia maritima*), and Cord grass (*Spartina* sp.). Other widespread species are Sea milkwort (*Glaux maritima*), Thrift (*Armeria maritima*), Common scurvy grass (*Cochlearia officinalis*), Orache (*Atriplex* species),

Autumnal hawkbit (*Leontodon autumnalis*), Greater sea-spurrey (*Spergularia media*), Sea Aster (*Aster tripolium*) Sea plantain (*Plantago maritima*), Red fescue (*Festuca rubra*), and Sea arrow grass (*Triglochin maritimum*).

SHINGLE AND GRAVEL SHORES LS1

6.3.29 A small area of strandline occurs at the fringe of the Malahide Estuary characterised by open communities of terrestrial vascular plants including Annual Sea-blite (*Suaeda maritima*), oraches (*Atriplex* spp.), Sea Beet (*Beta vulgaris*), Sea Mayweed (*Tripleurospermum maritimum*), Herb-robert (*Geranium robertianum*) and Cleavers (*Galium aparine*). Species such as sow thistles, hogweed dandelions and ragworts are also common.

6.3.30 Links with Annex I: This category may contain examples of the annexed habitat, 'annual vegetation of drift lines (1210)'.

DISTURBED GROUND (RECOLONISING BARE GROUND ED3)

6.3.31 As with most transport infrastructure intermittent work along the trackway and in the vicinity of the trackway causes disturbance to the ground. Here typical species assemblages include Nettle (*Urtica dioica*), Docks (*Rumex* spp.), Colt's Foot (*Tussilago farfara),* Butterbur, Buttercups (*Ranunculus repens*), Nettle (*Urtica dioica*), Bindweed (*Calystegia sepium*), Dandelion (*Taraxacum* spp.), Willow-herbs (*Epilobium* spp.) and ragworts (*Senecio* spp.). Grassed (*Arrhenatherum elatius, Elymus repens, Dactylis glomerata*) are also present. *Brassica* species are also common.

6.3.32 Alien exotic plants are often associated with such areas of disturbance adjacent to railway lines, e.g. wild liquorice.

6.3.33 A number of agricultural fields are intensively managed and cultivated for the production of arable crops, i.e. cereals (wheat, barley). These fields demonstrate a very managed use of herbicides and clean seed leading to a species poor crop without many natural weed species.

Table 6.3 Habitat Types and Conservation Value Along Route of the Proposed Greenway at Kilcrea/Corballis.

Habitat Type	Conservation Value
Hedgerows (WL1)	Moderate
Improved Agriculture Habitats (GA1/BC1)	Low
Scrub (WS1)	Moderate
Dry Meadows and Grassy Verges (GS2)	Moderate
Saltmarsh Marsh-Wet Grassland (CM2/GS4)	High
Tidal Channel (CW2)	High
Shingle and Gravel Shores (LS1)	High
Disturbed Ground (ED3)	Low

Section 6 – Newbridge Demesne

6.3.34 The site consists of a parkland area, with relict parkland trees and shrubs, a mosaic of meadow and wet grassland traversed by a series of metalled paths and roads. Here, scattered trees, standing alone or in small clusters, cover less than 30% of the total area under consideration but are a prominent structural feature of the site (see Table 6.4).

6.3.35 The parkland occurs in mosaic with rank and mown grassland which comprises a mosaic of meadow and wet grassland, depending on the moisture content of the underlying soil at the site. This habitat comprises a sward that is now not fertilised but is regularly mown. Tall trees which occur in a parkland planting are, for example, Oak (*Quercus* sp.), Ash (*Fraxinus excelsior*), Birch (*Betula* sp.), Beech (*Fagus sylvatica*) and Sycamore (*Acer pseudoplatanus*).

6.3.36 As with Malahide Demesne, the proposed development follows a metalled pathway from the southern gate to Newbridge House and main car park. At no point are ecological habitats part of the scheme (see habitat plan in Volume 3-Figure 46).

Table 6.4 Habitat Types and Conservation Value Along Route of the Proposed Greenway at Newbridge Demesne – Vicinity of Development.

Habitat Type	Conservation Value
Dry Meadows and Grassy Verges (GS2)	Moderate
Mixed Broadleaf Woodland (WD1)	Moderate-High
Scattered Trees & Parkland (WD5)	Moderate

6.4 Birds and Mammals

Data and Methodology

6.4.1 A desktop review was undertaken of available sources of species of fauna occurring in the vicinity of the route of the proposed greenway, including NPWS historical records of protected species and records held by the National Biodiversity Data Centre (www.biodiversityireland.ie). This desktop review was used to determine what rare or protected species have been previously recorded in the relevant grid square (O24) The terrestrial habitats north of the estuary, at Kilcrea, are made up of improved grassland, and tillage with some areas of rank grassland. The Pill River, which flows through lands at Kilcrea, joins the outer estuary east of the railway embankment. Particular data sources used in this appraisal of the baseline ecology along the terrestrial parts of the proposed greenway include:

- Ecological Field Surveys 2011-2014: field surveys conducted from July 2011 to March 2014, including detailed mammal surveys, bat surveys, bird surveys in the vicinity of the proposed greenway.
- Summer and Winter bird survey reports of lands surrounding the Malahide Estuary carried out for Fingal County Council (Roe & Lovatt, 2009).
- Winter bird survey of Malahide Estuary & surrounding lands carried out for Fingal County Council (Lewis & Butler, 2017).
- Avian surveys of Malahide Estuary 2009-2011 (Mayes 2010, 2011).
- Bird surveys of Malahide Estuary by Ecology Ireland in the Winter of 2017/2018 – surveys led by Dr. Olivia Crowe.
- Mammal surveys of the lands at Kilcrea, including deployment of mammal trail cameras and a passive bat detector in May-June 2018.
- Natura Impact Statement on the Remedial Works on the Malahide Viaduct (CHE, 2010).
- I-WeBS subsite counts and BirdWatch Ireland site synopses (Crowe, 2005).
- GIS data on designated conservation sites (www.npws.ie).
- Site synopses and conservation objectives for European sites (www.npws.ie).
- Online web-resources, e.g. www.biodiversityireland.ie; http://data.nbn.org.uk/imt/.

Overall Estuary Bird Data

6.4.2 This chapter provides detail on the overall estuary counts as well as analysing the bird species diversity and abundance of the inner and outer estuary. Table 6.5 below outlines the peak numbers of the bird species recorded at Malahide Estuary from July 2011 to March 2012.

6.4.3 Table 6.6 below details the peak numbers of the birds recorded at Malahide Estuary from October 2012 to March 2013 and Table 6.7 below shows the peak numbers of birds recorded in the area from October 2013 to March 2014.

July 2011 to March 2012

6.4.4 In total, 53 species and four additional species groups were observed in Malahide Estuary during this survey period. The most abundant species recorded at the site were Light-bellied Brent Geese (*Branta bernicla hrota*), Lapwing (*Vanellus vanellus*), Golden Plover (*Pluvialis apricaria*) and Oystercatcher (*Haematopos ostralegus*). Fifteen species were present on all 17 surveys between July 2011 and March 2012, with only seven species recorded on a single survey occasion. The majority of species were frequently recorded throughout this survey period with 34 of the 57 taxa present on 9 or more of the 17 survey visits.

6.4.5 Two species were recorded with peak numbers in excess of the threshold for international importance from July 2011 to March 2012: Light-bellied Brent Geese and Black-tailed Godwit (*Limosa limosa*) (Table 6.5 below). In addition, six further species were present in nationally important numbers during this survey period: Shelduck (*Tadorna tadorna*), Red Breasted Merganser (*Mergus serrator*), Redshank (*Tringa totanus*), Pintail (*Anas acuta*), Oystercatcher and Greenshank (*Tringa nebularia*).

6.4.6 Malahide Estuary is one of Ireland's most important wintering sites for Light-bellied Brent Geese (Crowe, 2005; Boland & Crowe, 2012) with winter peaks of approximately 2,000 individuals recorded annually. Black-tailed Godwits were also recorded internationally important peak numbers (478; Table 6.5 below). The site has held internationally important numbers of this species in the past (1996/97-2000/01) but has been demoted in status to national importance for Black-tailed Godwits in recent years (Boland & Crowe, 2012).

6.4.7 The peak counts of Oystercatcher, Red-breasted Merganser, Redshank and Shelduck all easily exceeded the threshold for national importance. A peak count of 39 Pintail is notable – almost double the threshold for national importance. Several other species had peak counts that approached the threshold for national importance: Curlew 539 (550), Golden Plover 1501 (1700), Lapwing 1587 (2100), Dunlin 685 (880), Great Crested Grebe 46 (55) and Little Grebe 19 (25).

6.4.8 A number of birds of prey were recorded during the estuary counts. Buzzard, Kestrel and Sparrowhawk were all observed hunting over the estuary. Red Kite – part of a number released as Newbridge Demesne as part of a reintroduction plan – were observed over the estuary during one of the survey visits. A male Merlin (*Falco columbarius*) was observed hunting in fields just north of the study area on 21st February 2012. Several uncommon bird species were recorded during the estuary surveys. Iceland Gull and Ring-billed Gull are uncommon nationally and Ruff is relatively scarce even on passage.

Table 6.5 The peak and median counts for each of the taxa observed at Malahide Estuary from July 2011 to March 2012 is shown in this table. The table also shows the threshold for National and International Importance from Boland & Crowe (2012).

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Bar-tailed Godwit	*Limosa lapponica*	74	30	160	1200
Black-headed Gull	*Larus ridibundus*	891	448		20000
Black-tailed Godwit[I]	*Limosa limosa*	478	185	140	470
Buzzard	*Buteo buteo*	2	0		
Common Guillemot	*Uria aalge*	1	0		
Common Gull	*Larus canus*	243	53		16000
Common Sandpiper	*Actitis hypoleucos*	1	0		17500
Cormorant	*Phalocrocorax carbo*	46	15	140	1200
Curlew	*Numenius arquata*	539	238	550	8500
Dunlin	*Calidris alpina*	685	174	880	13300
Godwit species		277	3		
Golden Plover	*Pluvialis apricaria*	1501	61	1700	9300
Goldeneye	*Bucephala clangula*	23	0	95	11500
Great Black-backed Gull	*Larus marinus*	62	16		4800
Great-crested Grebe	*Podiceps cristatus*	46	16	55	3600
Greenshank[N]	*Tringa nebularia*	25	9	20	2300
Grey Heron	*Ardea cinerea*	18	12	30	2700
Grey Plover	*Pluvialis squatarola*	28	3	65	2500
Gull species		3	0		
Herring Gull	*Larus argentatus*	106	71		5900
Hooded Crow	*Corvus cornix*	18	6		
Iceland Gull	*Larus glaucoides*	1	0		2000
Kestrel	*Falco tinnunculus*	1	0		
Knot	*Calidris canutus*	51	2	190	4500
Lapwing	*Vanellus vanellus*	1587	298	2100	20000
Lesser Black-backed Gull	*Larus fuscus*	31	6		4500
Light-bellied Brent Goose[I]	*Branta bernicla hrota*	1971	395	260	260
Little Egret	*Egretta garzetta*	23	3		1300
Little Grebe	*Tachybaptus ruficollis*	19	1	25	4000
Mallard	*Anas platyrhynchos*	155	97	380	2000
Mediterranean Gull	*Larus melanocephalus*	1	0		6600
Moorhen	*Gallinula chloropus*	6	2	20	20000
Mute Swan	*Cygnus olor*	82	53	110	
Oystercatcher[N]	*Haematopus ostralegus*	1371	507	680	10200
Pintail[N]	*Anas acuta*	39	1	20	600
Red Kite	*Milvus*	2	0	n/a	n/a
Red-breasted Merganser[N]	*Mergus serrator*	118	4	35	1700
Redshank[N]	*Tringa totanus*	517	272	310	3900
Ring-Billed Gull	*Larus delawarensis*	1	0		20000
Ringed Plover	*Charadrius hiaticula*	43	10	150	730
Ruff	*Philomachus pugnax*	4	0		12500
Sanderling	*Calidris alba*	3	0	65	1200
Sandwich Tern	*Sterna sandvicensis*	88	0		
Scaup	*Aythya marila*	1	0	45	3100
Shag	*Phalacrocorax aristotelis*	26	0		2000
Shelduck[N]	*Tadorna tadorna*	335	115	150	3000
Shoveler	*Anas clypeata*	8	0	25	400
Small Wader sp.		2	0		

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Snipe	*Gallinago gallinago*	2	0		20000
Sparrowhawk	*Accipiter nisus*	1	0		
Starling	*Sturnus vulgaris*	20	0		
Teal	*Anas crecca*	66	10	450	5000
Tern species		3	0		
Tufted duck	*Aythya fuligula*	48	0	370	12000
Turnstone	*Arenaria interpres*	55	29	120	1500
Whimbrel	*Numenius phaeopus*	20	0		6800
Wigeon	*Anas penelope*	115	26	820	15000

I – Internationally Important Numbers; N – Nationally Important Numbers.

Table 6.6 The peak and median counts for each of the taxa observed at Malahide Estuary from October 2012 to March 2013 is shown in this table. As above, this table also shows the threshold for National and International Importance from Boland & Crowe (2012).

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Bar-tailed Godwit[N]	*Limosa lapponica*	233	62	160	1200
Black-headed Gull	*Larus ridibundus*	707	331		20000
Black-tailed Godwit[N]	*Limosa limosa*	447	218	140	470
Buzzard	*Buteo buteo*	2	0		
Common Guillemot	*Uria aalge*	1	0		
Common Gull	*Larus canus*	155	60		16000
Cormorant[N]	*Phalocrocorax carbo*	200	11	140	1200
Curlew	*Numenius arquata*	402	214	550	8500
Dunlin	*Calidris alpina*	309	150	880	13300
Godwit species		80	1		
Golden Plover	*Pluvialis apricaria*	1110	319	1700	9300
Goldeneye	*Bucephala clangula*	28	13	95	11500
Great Black-backed Gull	*Larus marinus*	56	23		4800
Great-crested Grebe	*Podiceps cristatus*	26	12	55	3600
Greenshank	*Tringa nebularia*	14	7	20	2300
Grey Heron	*Ardea cinerea*	23	15	30	2700
Grey Plover	*Pluvialis squatarola*	58	29	65	2500
Gull species		20	0		
Herring Gull	*Larus argentatus*	64	40		5900
Hooded Crow	*Corvus cornix*	14	6		
Iceland Gull	*Larus glaucoides*	1	0		2000
Jack Snipe	*Lymnocryptes minimus*	1	0		
Knot	*Calidris canutus*	38	12	190	4500
Lapwing	*Vanellus vanellus*	998	802	2100	20000
Lesser Black-backed Gull	*Larus fuscus*	25	12		4500
Light-bellied Brent Goose[I]	*Branta bernicla hrota*	1270	534	260	260
Little Egret	*Egretta garzetta*	11	5		1300
Little Grebe	*Tachybaptus ruficollis*	9	5	25	4000
Little Gull	*Larus minutus*	1	0		1230
Mallard	*Anas platyrhynchos*	107	76	380	2000
Moorhen	*Gallinula chloropus*	3	2	20	20000
Mute Swan	*Cygnus olor*	77	49	110	
Oystercatcher	*Haematopus ostralegus*	534	394	680	10200
Pintail[N]	*Anas acuta*	38	4	20	600
Red Kite	*Milvus milvus*	2	0	n/a	n/a
Red-breasted Merganser[N]	*Mergus serrator*	63	36	35	1700

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Redshank[N]	*Tringa totanus*	440	233	310	3900
Red-throated Diver	*Gavia stellata*	1	0	20	3000
Ringed Plover	*Charadrius hiaticula*	63	26	150	730
Ruff	*Philomachus pugnax*	2	0		12500
Sanderling	*Calidris alba*	6	0	65	1200
Sandwich Tern	*Sterna sandvicensis*	5	0		
Shag	*Phalacrocorax aristotelis*	18	0		2000
Shelduck[N]	*Tadorna tadorna*	268	150	150	3000
Shoveler	*Anas clypeata*	4	0	25	400
Small Wader sp.		6	0		
Snipe	*Gallinago gallinago*	1	0		20000
Sparrowhawk	*Accipiter nisus*	1	0		
Teal	*Anas crecca*	51	22	450	5000
Tufted duck	*Aythya fuligula*	9	0	370	12000
Turnstone	*Arenaria interpres*	59	27	120	1500
Water Rail	*Rallus aquaticus*	1	0		
Whimbrel	*Numenius phaeopus*	30	0		6800
Wigeon	*Anas penelope*	99	49	820	15000

I – Internationally Important Numbers; N – Nationally Important Numbers.

Table 6.7 The peak and median counts for each of the taxa observed at Malahide Estuary from October 2013 to March 2014 is shown in this table. As above, this table also shows the threshold for National and International Importance from Boland & Crowe (2012).

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Bar-tailed Godwit[N]	*Limosa lapponica*	161	12.5	160	1200
Black-headed Gull	*Larus ridibundus*	1118	368.5		20000
Black-tailed Godwit[N]	*Limosa limosa*	248	119	140	470
Buzzard	*Buteo buteo*	2	0		
Common Gull	*Larus canus*	202	116.5		16000
Cormorant	*Phalocrocorax carbo*	18	5.5	140	1200
Curlew	*Numenius arquata*	289	143	550	8500
Dunlin	*Calidris alpina*	229	22	880	13300
Golden Plover[N]	*Pluvialis apricaria*	1800	22	1700	9300
Goldeneye	*Bucephala clangula*	78	21	95	11500
Great Black-backed Gull	*Larus marinus*	17	7		4800
Great-crested Grebe	*Podiceps cristatus*	43	20	55	3600
Great Northern Diver	*Gavia immer*	2	0.5	20	50
Greenshank	*Tringa nebularia*	11	5	20	2300
Grey Heron	*Ardea cinerea*	14	10.5	30	2700
Grey Plover	*Pluvialis squatarola*	6	0	65	2500
Common Guillemot	*Uria aalge*	1	0		
Herring Gull	*Larus argentatus*	79	52.5		5900
Hooded Crow	*Corvus cornix*	6	0		
Kingfisher	*Alcedo atthis*	1	0		
Knot	*Calidris canutus*	45	6.5	190	4500
Lapwing	*Vanellus vanellus*	700	358	2100	20000
Lesser Black-backed Gull	*Larus fuscus*	8	4		4500
Light-bellied Brent Goose[I]	*Branta bernicla hrota*	1618	368.5	260	260
Little Egret	*Egretta garzetta*	6	4		1300

Common Name	Scientific Name	Peak Count	Median	Nat. Imp.	Intl. Imp.
Little Grebe[N]	*Tachybaptus ruficollis*	29	14.5	25	4000
Mallard	*Anas platyrhynchos*	145	64.5	380	2000
Mute Swan	*Cygnus olor*	59	47	110	
Oystercatcher[N]	*Haematopus ostralegus*	855	477	680	10200
Pintail[N]	*Anas acuta*	35	1	20	600
Pochard	*Aythya ferina*	2	0	380	3500
Red-breasted Merganser[N]	*Mergus serrator*	117	20.5	35	1700
Redshank	*Tringa totanus*	133	74.5	310	3900
Ringed Plover	*Charadrius hiaticula*	58	3	150	730
Scaup	*Aythya marila*	2	0	45	3100
Shag	*Phalacrocorax aristotelis*	7	1.5		2000
Shelduck[N]	*Tadorna tadorna*	358	233.5	150	3000
Shoveler	*Anas clypeata*	4	2	25	400
Snipe	*Gallinago gallinago*	4	0.5		20000
Sparrowhawk	*Accipiter nisus*	2	0.5		
Teal	*Anas crecca*	319	101.5	450	5000
Turnstone	*Arenaria interpres*	25	20	120	1500
Whooper Swan	*Cygnus cygnus*	1	1	130	210
Wigeon	*Anas penelope*	161	70	820	15000

I – Internationally Important Numbers; N – Nationally Important Numbers.

OCTOBER 2012 TO MARCH 2013

6.4.9 In all, 52 species and two additional species groups were recorded in Malahide Estuary between October 2012 and March 2013. The three most abundant species recorded were once again, Light-bellied Brent Goose, Golden Plover and Lapwing. Eighteen species were present on all 11 complete surveys carried out between October 2012 and March 2012. Nine species were recorded on a single survey occasion: Buzzard (*Buteo buteo*), Common Guillemot (*Uria aalge*), Iceland Gull (*Larus glaucoides*), Little Gull (*Larus minutus*), Red Kite (*Milvus milvus*), Red-throated Diver (*Gavia stellata*), Snipe (*Gallinago gallinago*), Sparrowhawk (*Accipter nisus*), and Water Rail (*Rallus aquaticus*). However, the majority of taxa were present across the winter months with 34 of 54 taxa recorded on seven or more of the 11 survey occasions.

6.4.10 Of the 52 species observed, only one species was recorded in internationally important numbers. Light-bellied Brent Geese were once again present well in excess of the threshold for a site of international importance (Table 6.6 above). However, the peak counts of Black-tailed Godwits recorded were just below the threshold for international importance, although numbers observed were regularly in excess of the threshold for national importance. Four of the species recorded in nationally important numbers in the previous winter were once again observed in nationally important numbers – Pintail, Red-breasted Merganser, Redshank and Shelduck. Two additional species were present in this period in nationally important numbers: Bar-tailed Godwit (*Limosa lapponica*) and Cormorant (*Phalocrocorax carbo*) (Table 6.6 above).

OCTOBER 2013 TO MARCH 2014

6.4.11 In all, 44 species were recorded in Malahide Estuary between October 2013 and March 2014. The three most abundant species recorded were once again, Light-bellied Brent Goose, Golden Plover and Black-headed Gull.

6.4.12 As in the previous winter period, only one species, Light-bellied Brent Goose, was recorded in internationally important numbers (Table 6.7 above). There were 8 species recorded in nationally important numbers, including both Godwit species, Golden Plover, Little Grebe, Oystercatcher, Pintail, Red-breasted Merganser and Shelduck.

NOVEMBER 2017 TO APRIL 2018

6.4.13 Bird numbers and distributions at Malahide Estuary were monitored during the winter of 2017/2018. In total, 13 low and high-tide counts were undertaken between November 2017 and April 2018 (six high-tide and seven low-tide counts). Separate totals were collected for the inner and outer parts of the estuary (to the west and east of the embankment respectively). Additionally, separate counts were collected for the area bordering the western edge of the embankment in three distance bands (100m, 101-300m and 301–500m).

6.4.14 The total number of waterbirds recorded ranged between 1,353 (high-tide count, 08/04/18) and 5,944 (high-tide count 11/02/18). High-tide counts were higher than low-tide counts in all months other than in April. In total, 42 waterbird species were recorded, including 18 species recorded during most counts (in at least 12 out of 13 counts). Light-bellied Brent Goose was recorded in numbers of international importance and a further 14 species were recorded in numbers of national importance.

6.4.15 In total, 24 species were recorded within 500 metres of the embankment on the west side. A fairly high proportion of the diving bird species such as Red-breasted Merganser (*Mergus serrator*), Little Grebe (*Tachybaptus ruficollis*) and Great Crested Grebe (*Podiceps cristatus*) were recorded feeding within 500m of the embankment. On occasion, good numbers of Light-bellied Brent Geese and Oystercatchers were present, especially around the weir area of the embankment. There were several occasions where flocks of waders and Brent Geese were recorded in the northeast corner of the inner estuary and along the northern shoreline within 500m of the embankment.

6.4.16 When compared with other recent surveys relating to the embankment, there has been considerable interannual variation. Most notable of the trends have been the increases shown in Little Grebe and Goldeneye in the inner estuary, the decline in Light-bellied Brent Goose in the outer estuary and increases shown in Knot, Grey Plover, Black-tailed Godwit, Shoveler and Oystercatcher in the outer estuary.

OTHER DATA SOURCES

6.4.17 There are several other sources of counts of overwintering species from I-WeBS (Irish Wetland Bird Survey) reports and from data made available from NPWS. The contemporary data from the NPWS commissioned report "Collection of baseline waterbird data for Irish coastal Special Protection Areas 2011/2012" (Cummins & Crowe, 2012) is useful in providing a context for the diversity and abundance of birds recorded during the same winter period. However, the areas encompassed by both I-

WeBS and BirdWatch Ireland in their Malahide Estuary counts are substantially larger than the count areas defined by Mayes (2010, 2011) and repeated in this survey. For instance, the Malahide Estuary site used by Cummins & Crowe (2012) includes several terrestrial fields and relatively large intertidal strips northeast and southeast of the areas counted in the present study. From a GIS calculation the Cummins & Crowe site is 70% larger than that defined by Mayes and used in the current study. It is also similar in area to the I-WeBS count area of Broadmeadow (Malahide) Estuary at over 940ha. The Mayes study area is similar in size to the SPA at just over 550ha.

6.4.18 I-WeBS counts also differ from the methodology used in the current study in that I-WeBS counts are carried out during periods of high water when congregations of birds at roost sites are more easily counted. Mayes (2010) used a combination of low and high water counts before deciding that low water counts provided more valuable data in her 2011 report. The current study (2011-2014) concentrated efforts in counting the inner estuary, in particular, when the tide was at its lowest on a given survey visit. The estuary was counted twice per month to take in a variety of Spring and Neap tidal states. Cummins & Crowe (2012) also concentrated effort on the low water period but they do include data collected from one high water survey.

6.4.19 Table 6.8 below shows the peak count data for bird species that have been recorded in internationally or nationally important numbers in Malahide Estuary in the recent survey seasons. For the majority of the species there is good agreement in the peak numbers reported by Cummins & Crowe (2012) and the peak counts from the concurrent 2011/2012 winter survey. For instance, Greenshank had the same peak count (25) in both studies and Pintail, Red-Breasted Merganser and Great Crested Grebes were recorded in similar numbers. As predicted by Mayes (2010 & 2011) the relatively high numbers of Great Crested Grebes observed in the inner estuary in the winter of 2009/10 may have been related to the increase in the water level following the initial weir and bridge works. Similarly, Mayes (2010) recorded relatively few Golden Plover and this number was substantially higher during the winter of 2011/12, when the water level in the inner estuary was considerably lower as a result of the second phase of the weir profiling works. Cummins & Crowe (2012) recorded a peak count of 261 Turnstone (much larger numbers than recorded in the current study). This probably reflects the presence of good numbers of feeding or roosting Turnstone in the intertidal areas counted by BirdWatch Ireland outside of the study area.

Table 6.8 Peak count data for bird species recently recorded in nationally or internationally important numbers in Malahide Estuary.

	I-WeBS 1996-2000	I-WeBs 2003-2008	2012 (NPWS/BWI)[A]	2013-2014 (Overall)[B]	2012-13 (Overall)[B]	2011-12 (Overall)[B]	2009-10 & 2010-2011 (Mayes)[C]
International							
Light-bellied Brent Goose	940	1,962	1,350	1,618	1,270	1,971	937
Black-tailed Godwit	429	339	404	248	447	478	991
National							
Shelduck	423	422	280	358	268	335	405
Pintail	55	64	36	35	38	39	69
Goldeneye	170	137	58	78	28	23	85
Red-breasted Merganser	83	59	137	117	63	118	110
Great Crested Grebe	59	66	51	43	26	46	76

	I-WeBS 1996-2000	I-WeBs 2003-2008	2012 (NPWS/BWI)[A]	2013-2014 (Overall)[B]	2012-13 (Overall)[B]	2011-12 (Overall)[B]	2009-10 & 2010-2011 (Mayes)[C]
Oystercatcher	1,543	1,232	1,699	855	534	1,371	1,251
Golden Plover	1,281	3,206	1,900	1,800	1,110	1,501	830
Grey Plover	203	166	71	6	58	28	48
Knot	645	504	80	45	38	51	350
Dunlin	1,745	713	381	229	309	685	582
Bar-tailed Godwit	192	207	108	161	233	74	205
Redshank	583	639	390	133	440	517	728
Greenshank	48	50	25	11	14	25	26
Turnstone	144	198	261	25	59	55	38
Cormorant	126		97	18	200	46	76

A. Cummins & Crowe (2012) - Collection of baseline waterbird data for Irish coastal Special Protection Areas 2011/2012. BWI, Report Commissioned by NPWS.

B. Data collected by Ecology Ireland 2011-12; 2012-2013, 2013-2014.

C. Data collected in the winters of 2009-10 and 2010-2011 by Mayes & Porter.

6.4.20 As would be expected with highly mobile waterbird species there is a good deal of interannual variation between the peak numbers recorded. For several of the species this may not indicate any significant change in the numbers of birds wintering locally, merely highlight that these birds are capable of exploiting different resources at other nearby sites. For instance, Brent Geese move between intertidal and grassland areas to feed and can be observed in large numbers field-feeding during any part of the tidal cycle (pers. obs.). Mayes reported very high numbers of Black-tailed Godwit in the estuary in consecutive winters. These numbers were much higher than recorded in other surveys of the site in recent years. It is possible that these winters, both amongst the coldest winters on record, led to an influx of continental birds. Certainly, very high numbers of Black-tailed Godwits were also recorded in the winter 2010/2011 in the UK (http://www.bto.org/news-events/press-releases/mixed-fortunes-wintering-waterbirds).

6.4.21 A contemporary source of detailed winter counts of the estuary is presented in Lewis & Butler (2017). The estuarine study area was divided according to the subsites used during the NPWS Waterbird Survey Programme (NPWS 2013). One species was regularly recorded in internationally important numbers with a peak count of Light-bellied Brent Geese of 1,524 birds recorded during a low water count in the winter of 2016/2017. All of the other special conservation interest species were recorded in nationally important numbers in the survey area, apart from Golden Plover which rarely occurred in the area during the winter counts (peak count of 470 birds).

Inner Estuary Bird Data

6.4.22 The main concentration of birds in the inner estuary is around Seatown at the extreme west of the study area. A series of grassy islands at this location are important high water roosts and occasional feeding sites for several species and it is a preferred loafing and roosting area for Mute Swan and Black-headed Gull in particular. Waterbirds are fed by the public, especially at Seatown North. At low water – though substantially after low tide in the outer estuary – some intertidal mudflat becomes exposed at Seatown. The extent of the exposure is highly variable and was not always as expected from tidal models (www.easytide.co.uk). On occasions where a good deal

of intertidal area became exposed the numbers of wading birds present were greatest with several thousand birds concentrated in a relatively small area.

6.4.23 The species recorded in the inner estuary are thus a mixture of diving ducks that used the eastern portion of the inner estuary and wading birds and wildfowl that were typically concentrated within a few hundred metres of Seatown.

JULY 2011 TO MARCH 2012

6.4.24 Table 6.9 below shows the species recorded in the inner estuary and the peak count of each species observed between July 2011 and March 2012. During this period 45 species and two additional species groups (Godwit species; Gull species) were recorded in the inner estuary. The numbers of birds recorded in the inner estuary increased considerably from October to November with peak numbers observed between November and the end of January.

6.4.25 Even within this study area which is much smaller than the I-WeBS count area (and the SPA), numbers of Brent Geese regularly exceeded internationally important Numbers with a peak count of 1,098 individuals recorded on 24th January 2012. Three additional species were observed in the inner estuary in nationally important numbers: Black-tailed Godwit, Red-Breasted Merganser and Redshank.

6.4.26 Several dead and dying Mute Swans were seen throughout the winter at Seatown in the winter of 2010-2011. Feeding, particularly hand-feeding the swans at this location is popular but should be discouraged for several reasons, including public health and safety and animal welfare.

6.4.27 As shown in Volume 3-Figure 43 birds observed close to the railway embankment in the inner estuary were recorded according to the distance band in which they were first seen. The number of birds typically close to the embankment was relatively low with a peak number of 80 birds observed within 100m of the embankment on 31st July 2011 and a cumulative peak of 121 birds within 500m recorded on 16th January 2012. The daily percentage of the total number of birds recorded in the inner estuary that was found within 500m of the embankment ranged from 2-16%. During the busiest period (November-January) the birds recorded within 500m of the embankment only make up a very small percentage (<6%) of the total number of birds present in the inner estuary. Regularly recorded species within 500m of the embankment included several of the gull species and the diving ducks – Red Breasted Merganser and Great Crested Grebe. On a small number of occasions Brent Geese were recorded loafing on the water close to the northern shore within 500m of the embankment. Small numbers of Oystercatcher, Curlew and Turnstone were regularly recorded foraging along the edge of the embankment.

Table 6.9 Peak Counts of Bird Species Recorded Within the Inner Estuary at Malahide, July 2011 to March 2012.

Species	Peak Count
Bar-tailed Godwit	34
Black-headed Gull	596
Black-tailed Godwit	307
Brent Goose	1098
Buzzard	2
Common Gull	87
Common Sandpiper	1
Cormorant	10
Curlew	26
Dunlin	108
Godwit sp.	255
Golden Plover	1501
Goldeneye	23
Great Black-backed Gull	17
Great-crested Grebe	41
Greenshank	9
Grey Heron	14
Grey Plover	2
Gull species	1
Herring Gull	68
Hooded Crow	5
Iceland Gull	1
Kestrel	1
Knot	3
Lapwing	1587
Lesser Black-backed Gull	11
Little Egret	2
Little Grebe	17
Mallard	104
Moorhen	6
Mute Swan	82
Oystercatcher	83
Pintail	3
Red Kite	2
Red-breasted Merganser	71
Redshank	357
Ruff	4
Sandwich Tern	4
Scaup	1
Shag	26
Shelduck	21
Sparrowhawk	1
Starling	20
Teal	65
Tufted duck	2
Turnstone	11
Wigeon	27

OCTOBER 2012 TO MARCH 2013

6.4.30 Table 6.10 below lists the species recorded in the inner estuary and the peak count of each species observed between October 2012 and March 2013. As expected, given the more seasonally restricted survey season, the species diversity recorded was somewhat less than in the previous survey period. During this winter 38 species and one additional species groups (Gull species) were recorded in the inner estuary. The peak numbers of birds in the inner estuary were recorded in February, with over 2,000 birds present on each survey occasion from early January to early March.

6.4.31 Light-bellied Brent Geese were observed in internationally important numbers within the inner estuary on several occasions and the peak numbers of Bar-tailed Godwit, Black-tailed Godwit and Red-breasted Merganser all exceeded the threshold for a site of national importance.

6.4.32 As in the previous survey period the number of birds close to the embankment was relatively low throughout the winter of 2012-2013. A peak number of 60 birds were present within 100m of the railway embankment during the surveys of the inner estuary. The cumulative peak of birds recorded within 500m of the railway embankment was 242, observed on 1st January 2013 – representing 11% of the birds present within the entire inner estuary. Regularly recorded species within 500m of the embankment once again included several of the gull species and the diving ducks – Red Breasted Merganser and Great Crested Grebe. Brent Geese were observed moving to and from the grassland south of the inner estuary, close to the Yacht Club. On occasion, small flocks of Brent Geese were observed loafing on the water within 500m of the railway embankment.

OCTOBER 2013 TO MARCH 2014

6.4.33 Table 6.11 below lists the species recorded within the inner estuary and the peak count of each species observed between October 2013 and March 2014. The diversity of birds recorded was similar to previous winters with 41 species noted during counts of the inner estuary. The peak number of birds in the inner estuary was recorded earlier than in previous winters with a total of 3,749 birds present in the inner estuary in November 2013.

6.4.34 Light-bellied Brent Geese were observed in Internationally important numbers within the inner estuary from December to February (peak count 1,215 individuals) and the peak numbers of Black-tailed Godwit, Golden Plover and Red-breasted Merganser all exceeded the threshold for a site of national importance.

6.4.35 As in the previous survey period the number of birds close to the embankment was relatively low throughout the winter of 2012-2013. A peak number of 58 birds were present within 100m of the railway embankment during the surveys of the inner estuary. The total number of birds observed within 100m of the embankment on each survey occasion ranged from 6 to 58 individuals. The cumulative seasonal peak of birds recorded within 500m of the railway embankment was 168, observed in February 2014 – representing 6% of the birds present within the entire inner estuary on that survey occasion.

6.4.36 As in previous winter seasons, the bird species regularly recorded within 500m of the embankment once again included several of the gull species and the diving ducks – Red Breasted Merganser and Great Crested Grebe. The peak count of birds within 100

metres of the embankment was largely made up of a flock of Light-bellied Brent Geese (44 individuals) recorded on the water near the northern shore of the inner estuary.

WINTER 2016/2017

6.4.37 Detailed bird surveys were carried out on behalf of Fingal County Council, covering the entire SPA across the winter of 2016/2017 (Lewis & Butler 2017). The survey utilised the I-WeBS subsite count sections and in total there were six High Water and three Low Water counts of the entire area. Subsites OUL17 and OUL18 closely equate to the inner estuary survey area counted by Mayes in 2010/2011 and Ecology Ireland in 2011/2012, 2012/2013 and 2013/2014.

6.4.38 OUL17 is the inner portion of the inner estuary between Seatown and Prospect Point and OUL18 is the largely subtidal section east of Prospect Point to the railway bridge.

6.4.39 Forty-two bird species were recorded in OUL17 around Seatown. There was a peak count of Light-bellied Brent Goose in this subsite in February 2017 (787 individuals), which exceeded the threshold for International Importance. The peak count of Black-tailed Godwit (557 birds) was in excess of the threshold for National Importance. Golden Plover was exclusively recorded in this subsite during the 2016/2017 winter surveys. The winter surveys highlighted the intertidal areas as important for a range of waterbird species, with 10 of the 14 SCI species of the SPA recorded foraging in these areas. The supra-tidal areas in this subsite are also important for a fairly wide range of waterbird species, consistent with the results of previous surveys at this site.

6.4.40 The OUL18 Prospect Point subsite also included the intertidal habitat of Cave's Marsh. In total 38 bird species were recorded in this subsite, including 12 of the 14 SCI species of the SPA. None of the birds were present in this area in internationally or nationally important numbers. Goldeneye were exclusively recorded in this subsite and Great Crested Grebe and Red-breasted Mergansers were most regularly recorded in this part of the survey area. The Cave's Marsh area was the part of this subsite which accounted for many of the records of roosting waders.

Table 6.10 Peak Counts of Bird Species Recorded Within the Inner Estuary at Malahide, October 2012 to March 2013.

Species	Peak Count
Bar-tailed Godwit	233
Black-headed Gull	342
Black-tailed Godwit	431
Brent Goose	715
Buzzard	2
Common Gull	29
Cormorant	4
Curlew	14
Dunlin	201
Golden Plover	966
Goldeneye	27
Great Black-backed Gull	34
Great-crested Grebe	24
Greenshank	6
Grey Heron	12
Grey Plover	1
Gull species	20
Herring Gull	58
Hooded Crow	3
Knot	4
Lapwing	998
Lesser Black-backed Gull	6
Little Egret	4
Little Grebe	6
Mallard	51
Moorhen	3
Mute Swan	77
Oystercatcher	357
Red Kite	1
Red-breasted Merganser	63
Redshank	214
Ringed Plover	8
Ruff	2
Shag	8
Shelduck	21
Teal	22
Tufted duck	1
Turnstone	10
Wigeon	43

Table 6.11 Peak Counts of Bird Species Recorded Within the Inner Estuary at Malahide, October 2013 to March 2014.

Species	Peak Count
Bar-tailed Godwit	6
Black-headed Gull	930
Black-tailed Godwit	214
Brent Goose	1215
Buzzard	2
Common Gull	133
Cormorant	5
Curlew	38
Dunlin	20
Golden Plover	1800
Goldeneye	78
Great Black-backed Gull	10
Great Crested Grebe	43
Great Northern Diver	2
Greenshank	11
Grey Heron	11
Grey Plover	2
Herring Gull	67
Kingfisher	1
Knot	45
Lapwing	700
Lesser Black-backed Gull	5
Little Egret	4
Little Grebe	20
Mallard	65
Moorhen	8
Mute Swan	59
Oystercatcher	95
Pochard	2
Red Breasted Merganser	100
Redshank	52
Scaup	2
Shag	5
Shelduck	43
Shoveler	2
Snipe	4
Sparrowhawk	1
Teal	157
Turnstone	15
Whooper Swan	1
Wigeon	28

NOVEMBER 2017 TO APRIL 2018

6.4.43 Bird numbers and distributions at Malahide Estuary were monitored during the winter of 2017/2018. With the exception of Light-bellied Brent Geese and Black-tailed Godwit, which occurred in internationally and nationally important numbers respectively both in the inner and outer parts of the estuary, all other species showed concentrations in one or other section. Goldeneye, Red-breasted Merganser, Little Grebe and Great Crested Grebe occurred in significant numbers in the inner estuary.

6.4.44 The exposed intertidal areas at Seatown were the most important areas for feeding waders and the area also had by far the greatest concentration of roosting birds.

Outer Estuary Bird Data

6.4.45 The outer estuary is strongly tidal and is a preferred feeding area for many species including Oystercatcher, Curlew and Dunlin. It is a large area with a variety of feeding and roosting habitats. At the southern end of the estuary the area is dominated by the marina and along the southeastern shore by recreational use (e.g. dog walkers) from Malahide.

JULY 2011 TO MARCH 2012

6.4.46 Table 6.12 below shows the peak counts of bird species recorded (49 taxa, 45 species and 4 species groups) in the outer estuary between July 2011 and March 2012. The outer estuary held internationally important numbers of Brent Geese (988) and peak counts that exceeded the threshold of national importance for six additional species: Pintail, Red-breasted Merganser, Black-tailed Godwit, Shelduck, Oystercatcher and Redshank. Two further species had peak counts which closely approached the threshold for national importance – Curlew and Greenshank. Northeast of the vantage point, close to the Island Golf Club, there were frequently mixed flocks of roosting waders. Grey Herons and Little Egret also roosted nearby amongst the taller grasses.

OCTOBER 2012 TO MARCH 2013

6.4.47 Table 6.13 below displays the peak counts of the 49 bird taxa (48 species and one species group) recorded in the outer estuary between October 2012 and March 2013. The peak count of Brent Geese (944) was well in excess of the threshold for a site of international importance. Five species were observed in numbers of national importance: Redshank (419), Shelduck (268), Black-tailed Godwit (237), Cormorant (200) and Pintail (38). Both Curlew and Oystercatcher were also present in the outer estuary in good numbers throughout the winter period.

6.4.48 Two species recorded in the outer estuary had not been observed at the site in recent winters. Jack Snipe was recorded in the outer estuary on two consecutive visits on 21st February and 4th March 2013. A single Little Gull was present in the area on 2nd January 2013.

Table 6.12 Peak and Median Counts for the Bird Species Recorded in the Outer Estuary, Malahide from July 2011 to March 2012.

Species	Peak Count	Median
Bar-tailed Godwit	71	14
Black-headed Gull	544	113
Black-tailed Godwit	171	49
Brent Goose	988	295
Common Gull	234	48
Common Sandpiper	1	0
Cormorant	42	13
Curlew	536	238
Dunlin	685	165
Godwit species	55	0
Golden Plover	412	17
Goldeneye	2	0
Great Black-backed Gull	45	13
Great-crested Grebe	5	0
Greenshank	18	7
Grey Heron	12	4
Grey Plover	28	3
Guillemot	1	0
Gull species	3	0
Herring Gull	57	38
Hooded Crow	14	6
Knot	51	0
Lapwing	509	8
Lesser Black-backed Gull	28	4
Little Egret	22	2
Little Grebe	6	0
Mallard	107	45
Mediterranean Gull	1	0
Mute Swan	1	0
Oystercatcher	1344	495
Pintail	39	1
Red-breasted Merganser	88	0
Redshank	427	194
Ring-Billed Gull	1	0
Ringed Plover	43	10
Sanderling	3	0
Sandwich Tern	88	0
Shag	14	0
Shelduck	327	113
Shoveler	8	0
Small Wader	2	0
Snipe	2	0
Sparrowhawk	1	0
Teal	49	1
Tern species	3	0
Tufted duck	48	0
Turnstone	55	27
Whimbrel	20	0
Wigeon	88	26

Table 6.13 Peak and Median Counts for the Bird Species Recorded in the Outer Estuary, Malahide from October 2012 to March 2013.

Species	Max	Median
Bar-tailed Godwit	54	7
Black-headed Gull	466	90
Black-tailed Godwit	237	49
Brent Goose	944	318
Common Gull	137	32
Cormorant	200	10
Curlew	397	214
Dunlin	268	113
Godwit species	80	1
Golden Plover	179	22
Goldeneye	5	0
Great Black-backed Gull	28	18
Great-crested Grebe	2	0
Greenshank	12	3
Grey Heron	16	5
Grey Plover	9	0
Gull species	2	0
Herring Gull	64	39
Hooded Crow	14	6
Iceland Gull	1	0
Jack Snipe	1	0
Knot	38	12
Lapwing	352	169
Lesser Black-backed Gull	21	6
Little Egret	7	2
Little Grebe	4	0
Little Gull	1	0
Mallard	88	34
Oystercatcher	512	368
Pintail	38	4
Red Kite	1	0
Red-breasted Merganser	23	4
Redshank	419	202
Red-Throated Diver	1	0
Ringed Plover	55	26
Sanderling	6	0
Sandwich Tern	5	0
Shag	10	0
Shelduck	268	148
Shoveler	4	0
Small Wader	6	0
Snipe	6	0
Sparrowhawk	1	0
Teal	42	8
Tufted duck	9	0
Turnstone	57	26
Water Rail	1	0
Whimbrel	30	0
Wigeon	93	49

Table 6.14 Peak and Median Counts for the Bird Species Recorded in the Outer Estuary, Malahide from October 2013 to March 2014.

Species	Max	Median
Bar-tailed Godwit	161	17
Black-headed Gull	225	70.5
Black-tailed Godwit	125	51
Brent Goose	835	491.5
Common Gull	92	50
Cormorant	13	3
Curlew	262	138
Dunlin	229	24.5
Golden Plover	41	41
Great Black-backed Gull	8	4
Great Crested Grebe	2	1
Great Northern Diver	1	1
Greenshank	2	2
Grey Heron	7	5
Grey Plover	4	2.5
Guillemot	1	1
Herring Gull	25	10.5
Hooded Crow	6	6
Knot	16	14.5
Lapwing	83	7
Lesser Black-backed Gull	5	3
Little Egret	2	2
Little Grebe	9	3.5
Mallard	80	27
Oystercatcher	798	450.5
Pintail	35	11
Red Breasted Merganser	17	8.5
Redshank	89	48
Ringed Plover	58	30
Shag	2	1
Shelduck	315	233.5
Shoveler	4	2.5
Sparrowhawk	1	1
Teal	248	88.5
Turnstone	23	21
Wigeon	161	56.5

OCTOBER 2013 TO MARCH 2014

6.4.52 Table 6.14 above displays the peak counts of the 36 species recorded in the outer estuary between October 2013 and March 2014. The peak count of Brent Geese (835) was exceeded the threshold for International Importance. Four further species were observed in numbers of National importance: Bar-tailed Godwit (161), Shelduck (315), Oystercatcher (798) and Pintail (35).

WINTER 2016/2017

6.4.53 The outer estuary was counted as part of the winter 2016/2017 of the Malahide Estuary and surrounding lands (Lewis & Butler 2017). The estuarine survey area included outer estuary subsites (OUL26 & OUL28) beyond the areas counted by Mayes 2010/2011 and Ecology Ireland 2011-2014. The subsites OUL23, OUL24, OUL 25 and OUL50 closely approximate the areas of the outer estuary counted by Mayes and Ecology Ireland. OUL23 is approximately 23ha in size and lies in the northern part of the outer estuary and comprise sand to muddy sand and a relatively large area of saltmarsh. A total of 30 birds species were recorded in this area with 10 of the 14 SCI species of the SPA. The peak count of Light-bellied Brent Geese (654 birds) in December 2016 exceeded the threshold for international importance and peak counts of Shelduck (500) and Black-tailed Godwit (264) exceeded the threshold for national importance. This area of the estuary was important for a range of foraging species at low water e.g. Oystercatchers and occasionally Light-bellied Brent Geese. OUL24 (Burrow Strand) is c. 176ha with most of this area exposed at low water. It is the large intertidal area to the west of the Island. A total of 33 bird species were recorded in OUL24 including 12 of the 14 SCI species for the SPA. The peak count of Light-bellied Geese in this subsite (814 birds) exceeded the threshold for sites of international importance and five species Shelduck (231), Red-breasted Merganser (102), Grey Plover (40), Knot (431) and Dunlin (608) were recorded in nationally important numbers on at least one survey occasion. The peak counts of birds recorded roosting in this subsite is consistent with the earlier counts of OUL24 (Lewis & Butler 2017). OUL25 (Malahide Pt.) is c. 36ha in size and lies to the south of the Island in the outer estuary. The subsite comprises intertidal sand to muddy sand, with the tip of the island supporting an area of saltmarsh (Atlantic Salt Meadows). A total of 30 bird species was recorded in this subsite with 11 of the 14 SCI species of the SPA present. The peak monthly count of Oystercatchers exceeded the national threshold of importance in five of the monthly counts and the peak count of Knot in this area exceeded the national threshold in November 2016. The peak counts of Oystercatcher were all associated with roosting birds that were present at a well-known roost at the tip of the Island.

Greenway/Estuary Bird Survey (Winter 2017/2018)

6.4.54 Bird numbers and distributions at Malahide Estuary were monitored during the winter of 2017/2018 to provide up-to-date bird use data (see Text Figure 6.1, and Table 6.15 to Table 6.17 below.

6.4.55 In total, 13 low and high-tide counts were undertaken between November 2017 and April 2018 (six high-tide and seven low-tide counts). Separate totals were collected for the inner and outer parts of the estuary (to the west and east of the embankment respectively). Additionally, separate counts were collected for the area bordering the western edge of the embankment in three distance bands (100m, 101-300m and 301-500m).

6.4.56 The total number of waterbirds recorded ranged between 1,353 (high-tide count, 08/04/18) and 5,944 (high-tide count 11/02/18). High-tide counts were higher than low-tide counts in all months other than in April. In total, 42 waterbird species were recorded, including 18 species recorded during most counts (in at least 12 out of 13 counts). Light-bellied Brent Goose was recorded in numbers of international importance and a further 14 species were recorded in numbers of national importance (Table 6.15 below).

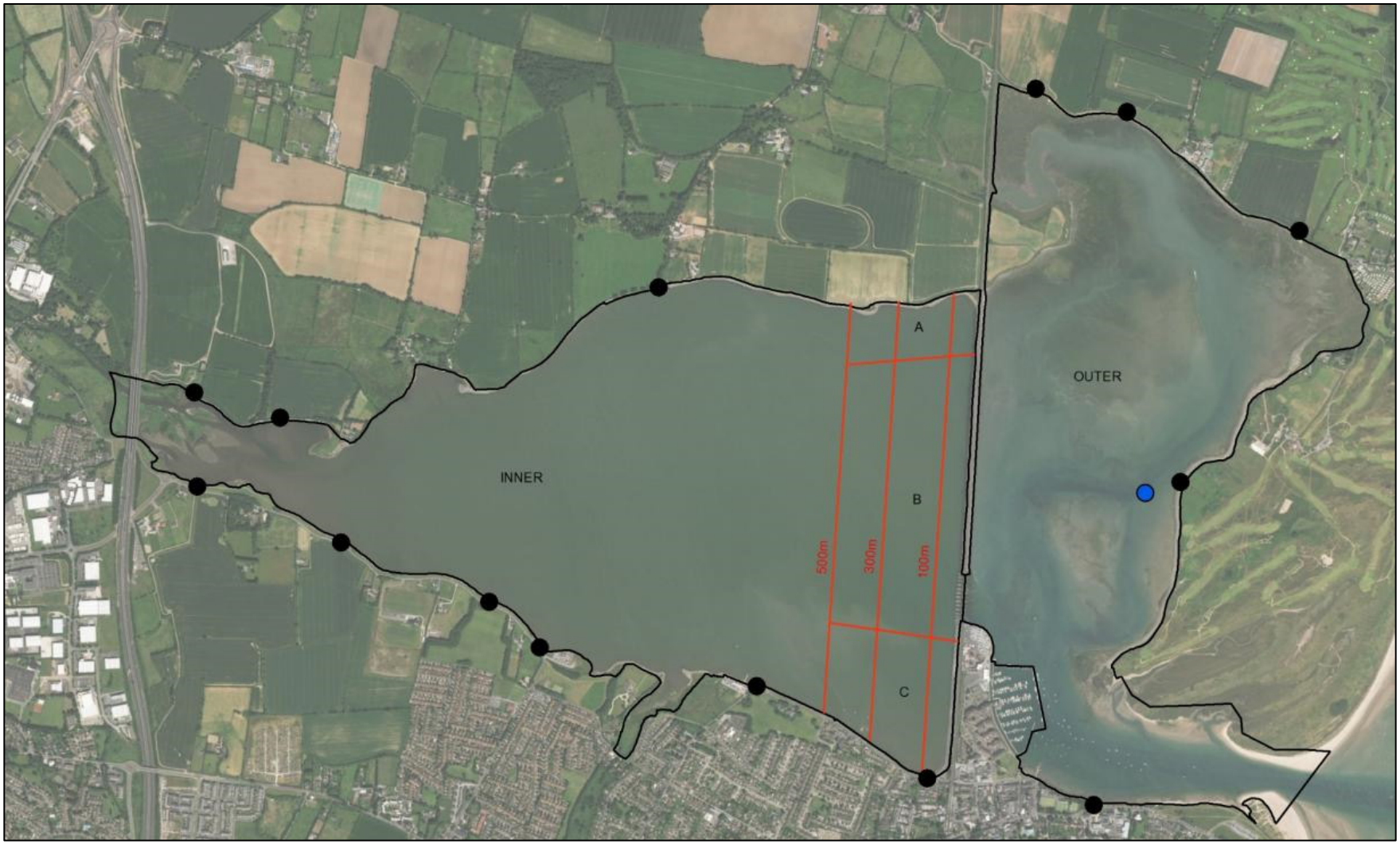
6.4.57 In total, 24 species were recorded within 500 metres of the embankment on the west side. Notable proportions of the inner estuary totals of several species were recorded at times, especially diving species such as Red-breasted Merganser (*Mergus serrator*), Little Grebe (*Tachybaptus ruficollis*) and Great Crested Grebe (*Podiceps cristatus*). Light-bellied Brent Geese and Oystercatchers (*Haematopus ostralegus*) were relatively numerous, especially within the weir area of the embankment. A wader roost was occasionally reported in the northeast corner of the inner estuary (see Table 6.16 and Table 6.17 below).

Birds Recorded in Terrestrial Fields at Kilcrea

6.4.58 Fields at Kilcrea corresponding to Sections E, F and G in Roe & Lovatt (2009) were resurveyed by walkover by a pair of ornithologists on five separate occasions from October to December 2011 (see Text Figure 6.2 below). These fields were included in baseline walkovers of the route options carried out between November 2013 and March 2014.

6.4.59 The fields traversed by the proposed route from south to north were named as E9, F1, G11, G1, G2, G8, G7, G6, and G5.

6.4.60 Roe & Lovatt, (2009) found a relatively low diversity of birds in E9 in winter 2008/09. A peak count of 350 Brent Geese was recorded across four survey visits between January and March 2009. On 16th November 2011 a peak of 92 Brent Geese were recorded in field E9, all of which were roosting in the middle of the large arable field. On that survey, the main concentration of Brent Geese (380) was observed roosting and feeding in a field approximately 750–1,000m west of the embankment. Red Kite, which were reintroduced at Newbridge Demesne in 2011, were observed overflying the fields west of E9 (E7 and E6) in November 2011. The terrestrial lands at Kilcrea were surveyed on nine occasions over the winter of 2016/2017 (Lewis & Butler 2017). These surveys did not record any Light-bellied Brent Geese using field E9 with repeated observations to the west in field E6 with single observations of birds foraging in fields E1 and E7 in March 2017. There were a number of sightings of Lapwing in field E9 in the winter of 2016/2017 with a peak count of 33 birds observed in December 2016 (*loc cit*).



Text Figure 6.1 Coverage at Malahide Estuary, illustrating the two main count sections (inner and outer), the vantage points used (blue = low-tide surveys only), the three distance bands on the inner estuary (100m, 300m, 500m), and the divisions from north (A) to south (C). Note: The blue dot in this figure indicates a supplementary vantage point (VP) used at low tide but (obviously) not accessible at high tide. There were many LW and HW counts using the other VPs.

Table 6.15 **Peak count of each species recorded in the inner and outer sections of the estuary, and at high and low tide. The 1% thresholds for national (Crowe and Holt 2013) and international (Wetland International 2018) importance are also given.**

			INNER		OUTER	
	1%N	1%I	HT	LT	HT	LT
Mute Swan	90		72	78		
Light-bellied Brent Goose		400	550	879	505	399
Shelduck	120	3,000	17	22	614	458
Wigeon	630	15,000			119	103
Gadwall	20	600		2		
Teal	340	5,000	82	46	320	318
Mallard	290	20,000	85	96	22	61
Pintail	20	600	4		70	61
Shoveler	30	400			40	33
Goldeneye	60	11,500	88	119		
Red-breasted Merganser	20	1,700	33	51	16	10
Red-throated Diver	20	3,000				1
Little Grebe	20	4,000	58	30	4	15
Great Crested Grebe	40	3,500	32	40	2	2
Cormorant	120	1,200	8	86	21	17
Shag		2,000		1		5
Little Egret	20	1,300	3	2	3	5
Grey Heron	25	2,700	13	6	1	9
Moorhen		20,000	3	5		
Oystercatcher	690	8,200	383	98	1,480	806
Ringed Plover	100	730			12	77
Golden Plover	1,200	9,300	9		7	
Grey Plover	30	2,500	2	1	41	36
Lapwing	1,100	20,000	627	381	10	126
Knot	280	4,500	2	15	1,895	1,290
Dunlin	570	13,300	370	10	199	352
Snipe		20,000		6		
Black-tailed Godwit	190	610	469	163	259	412
Bar-tailed Godwit	150	1,200		37	149	66
Whimbrel		6,700			1	
Curlew	350	8,400	110	1	359	213
Greenshank	20	2,300	43	14	9	9
Redshank	300	3,900	112	95	125	194
Turnstone	95	1,400	41	20	39	5
Black-headed Gull		20,000	364	471	167	82
Ring-billed Gull		20,000	1		1	
Common Gull		16,400	34	81	140	8
Lesser Black-backed Gull		5,500	43	23	2	6
Herring Gull		10,200	154	207	167	67
Great Black-backed Gull		4,200	34	18	15	8
Sandwich Tern					32	1

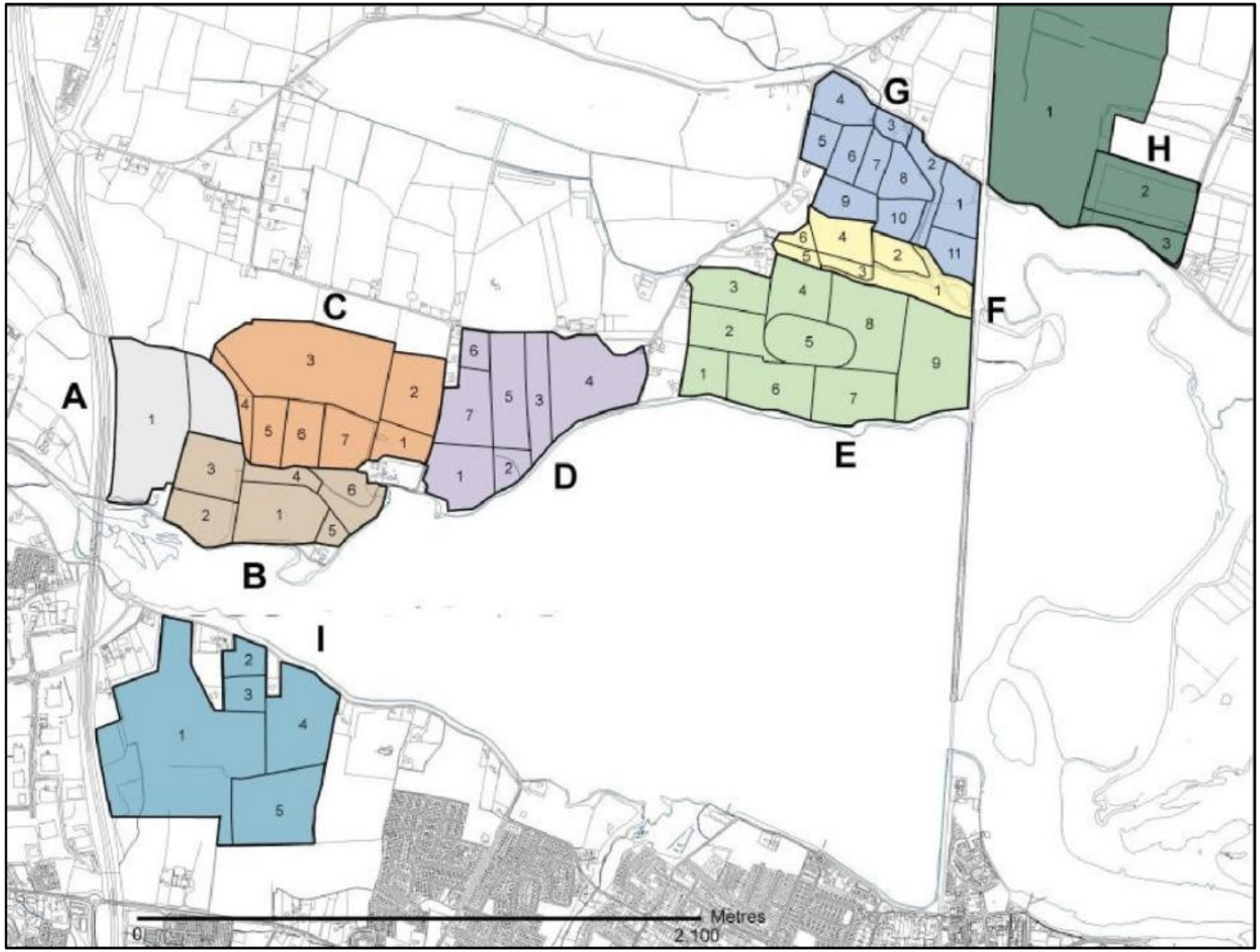
The darker colour highlights when counts were in excess of the threshold for International Importance and the lighter colour highlights counts in excess of the threshold for sites of national importance.

Table 6.16 Total counts of each species recorded within 500 metres of the railway embankment.

Species	20/11	12/12	17/12	29/12	10/01	18/01	26/01	11/02	23/02	09/03	22/03	11/04	18/04	Peak
Mute Swan		3	1					6	1		2	2		6
Light-bellied Brent Goose			4		16	7	19	116	36	25	53	15		116
Mallard				5	5	5	6	3	4	2	1			6
Goldeneye		2		2	4					6				6
Red-breasted Merganser		12	21	5	44	7	36		14	3	8	14		44
Little Grebe	11	14	1		10	3	11	2	4	1	3			14
Great Crested Grebe	4	2	6	5	19	18	27	1	2	22	3		2	27
Cormorant	7	86	4		3	2						1	1	86
Shag		1												1
Little Egret									1					1
Grey Heron										1	1	2		2
Oystercatcher		43	12		9	35	43	199	36	2	5	24		199
Lapwing					51	60								60
Dunlin						219	10	40						219
Black-tailed Godwit	9							28						28
Curlew						110			1					110
Greenshank					3	10	2		2		2			10
Redshank	30			1	22	16	53	10	4		2			53
Turnstone	3				2	2	20	12	2	3				20
Black-headed Gull	2	2	13	6	23	24	20	32	47	9	9	8	1	47
Common Gull		3			9	9	52	21	12	1				52
Lesser Black-backed Gull										2		7	7	7
Herring Gull		2		4	20	8	13	13	46	12	5	16	16	46
Great Black-backed Gull	1	3		2		3			7	4	1	1	6	7

Table 6.17 Peak count of each species within the three distance bands (100, 300, 500m) and in each section A to C, together with the sum of species peaks and a total species recorded. Refer to Text Figure 6.1 above for definition of these boundaries.

Species	A	B	C	100	300	500
Mute Swan	2		6	6	2	1
Light-bellied Brent Goose	115	41	4	45	10	115
Mallard	2		6	6	5	1
Goldeneye	6	4			2	6
Red-breasted Merganser	44	27	13	13	40	27
Little Grebe	3	14	9	14	2	4
Great Crested Grebe	22	16		14	8	16
Cormorant	86	4		86	1	1
Shag	1				1	
Little Egret			1	1		
Grey Heron	1	2		2		
Oystercatcher	35	185	4	189	5	28
Lapwing	60				60	
Dunlin	219			9	10	210
Black-tailed Godwit	28					28
Curlew	110	1		1		110
Greenshank	10		2	2	10	2
Redshank	52		2	24	22	30
Turnstone	20	3	12	10	10	3
Black-headed Gull	23	21	45	33	20	19
Common Gull	52	9	10	45	21	8
Lesser Black-backed Gull	7	5	2	7		5
Herring Gull	12	16	40	42	10	16
Great Black-backed Gull	3	2	5	5	4	3
Total	913	350	161	554	243	633
Total species	23	15	15	20	19	20



Text Figure 6.2 Colour coded map study sections for lands surrounding the Broadmeadow/Swords Estuary (Roe & Lovatt 2009).

6.4.61 Field F1 is rank grassland and areas of scrubby hedgerow adjoin the Pill River. This field adjoined by a variety of habitats was an area of relatively high species diversity in the 2009 survey and this result was mirrored in the 2011 walkover. Roe & Lovatt, (2009) recorded a mixture of ducks associated with the river (Teal, Wigeon and Mallard), songbirds such as Reed Bunting and Skylark. Kingfisher was recorded on the Pill in 2009 and once again along the Pill River in November and December 2011 and March 2014. In the recent survey of the terrestrial lands at Kilcrea only three of the waterbird SCIs for the SPA were recorded in this area: Shelduck, Black-tailed Godwit and Redshank. Peak counts occurring in field F1 for these species was relatively low: Shelduck (14), Black-tailed Godwit (19) and Redshank (5) and these species were infrequently present with Shelduck present on only one occasion, Black-tailed Godwit recorded on two occasions and Redshank present on four of the nine survey occasions. On occasion, numbers of Teal (peak count 50) and Wigeon (peak count 41) in field F1 were relatively high, associated with the River Pill and adjoining grassland.

6.4.62 Field G1 which is adjacent to the Pill had a peak of 1,600 Brent Geese in September 2009 (Roe & Lovatt, 2009) – but no Brent Geese were present in this field on two of the four (2009) survey visits. No Brent Geese were recorded in this field on 5 survey visits between October and December 2011 and the three walkovers between November 2013 and March 2014. Roe & Lovatt (2009) recorded Brent Geese in fields G7 and G8 but no Brent Geese were recorded in these fields in the surveys carried out between in 2011-2014. A notable difference between the results of the terrestrial survey in winter 2016/2017 (Lewis & Butler 2017) and Roe & Lovatt's earlier survey was the absence of Light-bellied Brent Geese in Section G (Kilcrea North). Indeed, only one of the SCI species of the SPA was recorded in these fields by Lewis & Butler (2017) with one sighting of 22 Redshank observed in G11. Only three waterbird species were recorded in G11, there was one observation of single Curlew recorded in field G1, three waterbird species recorded in low numbers in G2 and G8, one sighting of a Mallard in G7, there were low numbers of six waterbird species recorded in G6 and no waterbirds recorded in field G5. The diversity and abundance of waterbirds recorded in Section G was consistently low throughout the winter months.

6.4.63 Both Roe & Lovatt, (2009) and the 2013-14 survey recorded Brent Geese in several fields – particularly E2, E3, E8 and E9. Results of the 2016/2017 surveys indicated that Field E9 was not being used by Light-bellied Brent Goose (Lewis & Butler 2017).

6.4.64 Roe and Lovatt (2009) showed that the fields and amenity grassland all around the inner estuary are an important resource for a range of wildfowl and waders during the winter months. However, it also illustrated that, a few stand-out counts apart, that the fields along the route of the proposed greenway were not especially important or consistently used by a large proportion of the local population of any species. That result is consistent with the findings of the intensive field surveys carried out in the most recent winter season (Lewis & Butler 2017).

6.4.65 During the summer months the terrestrial lands hold many fewer species and individuals. Breeding Skylark and Linnet were noted and small numbers of passage waders were recorded. Typically, the birds present were common lowland farmland breeding birds. Tree Sparrows breed locally but did not occur along the route of the proposed greenway. Two Tree Sparrows were recorded during November 2011 along with a mixed finch flock of 250 Goldfinch and Linnet moving through fields west of the proposed greenway (Field E7).

Mammal Survey

6.4.66 A mammal survey at Malahide Demesne (Keeley 2006) recorded active Badger and Fox burrows and signs of Stoat (*Mustela erminea*), Rabbit, Rat/Mouse, Hedgehog (*Erinaceus europaeus*), and Grey Squirrel (*Sciurus carolinensis*). Bioblitz 2010 recorded Fox, Grey Squirrel, Brown Rat, Hare and Rabbit at Newbridge Demesne (www.biodiversityireland.ie).

6.4.67 During the walkover surveys of the embankment and at Kilcrea several mammal species were recorded, either directly or by tracks and signs. The vegetation on the west of the railway embankment is generally scrubby and dense and is relatively unmanaged.

6.4.68 Brown Rats (*Rattus norvegicus*) were frequently observed along the proposed route, both on the railway embankment and also in the fields and hedgerows at Kilcrea. Small mammal paths are common throughout and are especially obvious in the rank grassland near the Pill River. Given the available habitats it is likely that several other small mammalian species, such as Field Mouse (*Apodemus sylvaticus*) and Pygmy Shrew (*Sorex minutus*), are widespread and locally common in the area. Fox (*Vulpes vulpes*) scat and scent was recorded at several locations in the fields at Kilcrea and two suspected dens were located in the narrow wooded glen several hundred metres west of the railway embankment at Kilcrea. In the same narrow wooded glen a number of active Badger setts were recorded. These setts were several hundred metres west of the railway embankment. An active Badger sett was recorded at the same location during terrestrial bird surveys in the winter of 2016/2017 (Lewis & Butler 2017). A Badger was recorded on a trail camera deployed near that location from 31st May to 8th June 2018.

6.4.69 Irish Hare were frequently observed in the stubble fields and recently resown tillage fields at Kilcrea.

6.4.70 Otter (*Lutra lutra*) spraints were recorded on three occasions, at the south of Malahide Inner Estuary west of Malahide Yacht Club. A sub-adult Otter was recorded swimming west towards Seatown along the southern shore of the estuary during a low-water estuary survey in September 2011. Several of the land drains at Kilcrea as well as the River Pill all have potential for Otter – the walkover of this area in October 2011 followed a flood event and this may have obscured any regular sprainting sites in these areas of suitable habitat. Spraint was recorded at the southern margin of the railway viaduct in March 2014 and an adult Otter was observed feeding just to the east of the viaduct in the outer estuary on the same survey occasion. Otters were observed on a number of occasions in the outer estuary (during bird surveys). Regular activity was recorded at the northeast of the railway embankment and may indicate the presence of a holt at that location. No holt was recorded on the west of the railway embankment.

6.4.71 Rabbit burrows and droppings were recorded along several field boundaries, particularly at the west of the study area. No burrows or droppings were noted along the route of the railway line. In fact other than infrequent sightings of Brown Rat and fox scats along the railway embankment mammal activity was low. No Badger setts or fox dens were located on, or adjacent to, the proposed route of the proposed greenway. A dead Badger was recorded on the local road near the rail bridge at Kilcrea in December 2011.

6.4.72 Three trail cameras were deployed along the route of the proposed greenway from 31st May to 8th June 2018. One camera was deployed on Corballis Cottages Road from Bissets Strand close to the weir. The other two cameras were deployed on lands at Kilcrea. Very few images of wild mammals were captured. Several night-time shots of Badger were recorded from a camera close to the Pill River. The other cameras recorded a number of photos of domestic pets (cats and dogs).

6.4.73 Non-volant mammals recorded in the 10km grid square (O24) in which the proposed greenway will be located include Hedgehog, Irish Hare, Otter, Badger, Stoat, Rabbit, Grey Squirrel, Pygmy Shrew and Fox (www.biodiversityireland.ie).

Bat Survey

6.4.74 The weather on both active survey nights was mild and generally calm. Foraging bats were observed and recorded on both survey nights although species diversity was low. The route of the proposed greenway was walked and the lanes and local roads were driven (<15km/h) to develop a picture of the activity across the area. No bats were recorded along the route of the proposed greenway or along the Pill River. A single record of Common Pipistrelle (*Pipistrellus pipistrellus*) was picked up on a secondary heterodyne detector by the rail bridge over the local road leading to the northwest of the outer estuary (5th October 2011). There were no records from the shore close to Bissets Strand which was visited on both survey occasions.

6.4.75 The most consistent and active area of bat activity was near Kilcrea Equestrian Centre. The roadway to the shore is tree-lined and there is a large old stone wall with good potential for roosting bats. *Post-hoc* analysis of the bat recordings taken on the nights of the 5th and 27th October 2011 confirmed the presence of two species, Common Pipistrelle and Soprano Pipistrelle (*Pipistrellus pygmaeus*). Near Kilcrea Equestrian Centre there was considerable social calling noted on both survey nights. Common Pipistrelle were especially active in this area and it is a suitable area for foraging and may also be close to a roost site. There have been records of Leisler's Bat (*Nyctalus leisleri*), Brown Long-eared Bat (*Plecotus auritus*) and Soprano Pipistrelle from this 10km square (www.biodiversityireland.ie). Mammal records collected from Newbridge Demesne in May 2010 (Bioblitz 2010; www.biodiversityireland.ie) included Leisler's Bat, and Soprano Pipistrelle. The habitats at both demesnes are attractive for a range of bat species. Given the habitats present it is likely that several bat species occur at both demesnes throughout year.

6.4.76 The results of a deployment of a passive bat detector (Wildlife Acoustics SM4) near the Pill River on lands at Kilcrea from 31st May to 8th June 2018 confirmed the presence of four bat species. *Post hoc* analysis identified Leisler's Bat, Soprano Pipistrelle, Common Pipistrelle and Daubenton's Bat (*Myotis daubentonii*). Leisler's Bat was the most frequently recorded bat at this location (171 registrations), followed by Soprano Pipistrelle (67 registrations) and Common Pipistrelle (44 registrations). There was only one confirmed registration of Daubenton's Bat from this location. Overall, the level of bat activity was relatively low and the pattern of activity was variable from night to night. There was no evidence of bimodal activity indicative of the presence of a nearby bat roost.

6.5 Potential Impacts

6.5.1 Neither the amenity grassland nor the tree lines at Malahide Demesne or Newbridge Demesne would be impacted by the proposed development.

6.5.2 The design of the proposed greenway is sensitive for the potential for disturbance to estuarine habitat and species during and post-construction. A solid 1.4m high stone wall will be provided on the western margin of the proposed greenway across the estuary to minimise potential disturbance impacts on waterbirds from pedestrians and cyclists from Bissets Strand to the new 180m bridge which will run parallel to the existing rail viaduct. A viewing area will be provided at the southern side of the new bridge.

6.5.3 There are currently no known records of any rare or protected flora and fauna from the actual embankments at Malahide or Kilcrea townland (NPWS database records); neither was any rare, protected or scarce plant species found within the site during the recent walkover surveys (Curtis & McGough, 1988; Whilde, 1993; Neff, 1996-2000).

6.5.4 There is a great deal of available data that describes the bird usage of the entire estuary SPA and specific areas within the designated site. In addition, there have been several comprehensive studies of the local avifauna including the use of terrestrial habitats by aquatic and terrestrial species. This establishes the overall importance of the site, especially in winter, for a range of protected waterbirds, e.g. Brent Geese. The inner estuary has a relatively constrained tidal range with small areas of intertidal mudflat exposed at Seatown during low water. Typically numbers and diversity of birds within 500m of the railway embankment is relatively poor whilst the areas around Seatown (west of the inner estuary) holds the majority of birds present within the inner estuary at all times during the winter period. On occasion there have been flocks of roosting/loafing birds recorded within 500m of the embankment, particularly along the northern shore of the inner estuary.

6.5.5 Walkovers of the terrestrial habitats along the proposed route of the proposed greenway indicate that the western embankment and associated scrubby vegetation is not of high ecological value. In terms of terrestrial bird species it is relatively species poor and there is no significant mammal activity associated with the embankment itself. There are several active Fox dens and Badger setts in the wider area but the closest of which is located several hundred metres west of the proposed route of the proposed greenway.

6.5.6 The habitats along the Pill River are varied and hold a good variety of bird species, including Kingfisher (an Annex 1 listed species). The fields further north tend to have less diversity and are dominated by typical farmland bird species, e.g. Blackbird.

6.5.7 Bat activity recorded in the area was relatively low and there was no consistent activity noted in areas close to the proposed greenway. However, given the habitats present at Kilcrea and in particular, at both demesnes, it is probable that bats do regularly forage and commute along portions of the proposed greenway.

6.5.8 The potential impacts on the designated sites, in particular European sites, are considered in detail in a separate Natura Impact Statement.

Habitats and Botanical Species

6.5.9 It is expected that the development will have no significant impact on habitats at Malahide Demesne, Malahide Village, or at Newbridge Demesne as the proposed greenway will for the most part be on existing tracks and metalled surfaces of the demesne and village.

6.5.10 The estuary causeway does not support any habitat of intrinsic conservation interest. It is an artificial structure which may be described as fitting the category Sea Walls, Piers and Jetties (CC1). This category is used for all coastal constructions that are subject to wetting by sea spray or wave splash. It includes sea walls, piers, jetties, slipways, causeways and other structures associated with ports and docks in urban or rural areas. In the littoral and sublittoral zones of sea walls, piers and jetties, the plant and animal communities that develop are similar to those of natural rocky substrata in the marine section of the classification.

6.5.11 The shingle shore habitat within Malahide Estuary SAC is not a habitat of qualifying interest for the SAC but is of conservation interest, together with a small area of Saltmarsh Marsh-Wet Grassland (CM2/GS4) surrounding the short tidal channel of the River Pill at Kilcrea. These areas of natural habitat will not be disturbed or impacted significantly during site works.

6.5.12 At Kilcrea/Corballis the greenway departs from pre-existing artificial surfaces, roads and embankments to traverse improved grassland habitat. There will be two crossing points over the Pill River but terrestrial habitats in the area of the crossings are of low value, i.e. improved agricultural grassland. Wet grassland or terrestrial wetland habitats will not be impacted by the development of trackways which are not coinciding with areas of occurrence at the site.

6.5.13 A potential impact of the development in both the construction and operational phase is the spread of non-native species (e.g. Japanese Knotweed and Himalayan Balsam). The impact to the local ecology and the functioning of local habitats can be highly negative. In the worst cases waterways may become completely choked by a single species destroying the local native biodiversity. In the area of proposed works no invasive alien species were recorded.

6.5.14 Good examples of the other habitats of this area such as hedgerows, dry meadow grassy verge, wet grassland and scrub are of moderate local ecological importance and also occur in the area of site works. It is expected that hedgerow removal at the site will be minimal and not have an overall significant impact on the site. Scrub removal may occur in the area of Corballis Cottages but will not be extensive, and will be a minor negative impact. Some loss of grassland habitats will occur but will be of low areal extent and overall impact to grassland habitats will also not be significant. The other habitats as described are of low value, i.e. improved grassland (GA1) is of low value. Loss of areas of these habitats will not have a significant impact to the site.

Birds

6.5.15 The construction and operation of the proposed greenway has the potential to cause disturbance and displacement impacts to birds, particularly waterbirds. These risks are chiefly associated with Section 4 – Bissets Strand to the North Shore of Malahide Estuary and Section 5 – North Shore of Malahide Estuary to R126 Hearse Road. The

other areas may occasionally hold numbers of roosting or feeding waterbirds, particularly during the winter months. It is worth noting here that the level of background disturbance associated with the movement of trains, road vehicles and recreational users in the vicinity of the proposed greenway is relatively high.

6.5.16 The primary way in which human activity can impact on birds is by altering the ability of individuals to exploit important resources. This can be caused through directly restricting access to resources such as food supplies, nesting sites or roosting sites, or by altering the actual or perceived quality of these sites. Direct restriction of access to resources can occur through birds avoiding areas where humans are present. Changes in the quality of sites as a result of human presence could occur, for example, if predators were attracted to areas with humans, or if the presence of humans reduced the presence of prey species (Gill, 2007). It is well established that different types of potential disturbance can elicit highly variable responses in various bird species. The extent of the impact may be related to many variables such as the intensity and duration of the stimulus, the previous experience of the bird (learning, habituation) and the ecology and behaviour of the species itself (Hill, 1997; Ruddock & Whitfield, 2007). The impact of anthropogenic noise and artificial lighting can have additive or synergistic impacts on bird behaviour (Nordt & Klenke, 2013).

6.5.17 There is a large volume of published information on the effects of disturbance to birds (see reviews by Hockin *et al*. 1992, Carney & Sydeman 1999, Nisbet 2000, Woodfield & Langston 2004). A number of studies have shown a wide range of effects such as taking flight, an increase in heart rate or alertness. However, these negative effects due to disturbance, depending on the intensity of disturbance, may be reduced with time, letting the birds habituate to the presence of humans and their activities (e.g. Walker *et al*., 2006). Many of these studies make a distinction between Alert Distance (AD) and Flight Distance (FID) – the distance at which the bird flushes or otherwise moves away from a disturbance source (Ruddock & Whitfield, 2007). Other studies focus on discerning the required buffer distance to avoid disturbance of birds from a breeding site, e.g. colonial seabird colonies (e.g. Long & Ralph 1998).

6.5.18 The most common method of estimating the minimum approach distance (MAD) is to observe the reactions of subject birds or flocks to the approach of a single disturbance source, e.g. a pedestrian or vehicle (e.g. Agness, 2006). It is reported that more direct and rapid approaches elicit bigger responses or responses at a greater distance. It is also reported in the literature that there are several other factors that can have an effect on the extent to which birds respond to disturbance events, e.g. species, size of flock, nature of disturbance, predictability of disturbance, habituation, importance of the site to birds, activity of the birds etc (e.g. Burger, 1981, 1986, 1991; Burger & Gochfeld, 1998; Blumstein *et al*., 2005; Van der Zande *et al*., 1980; Stillman & Goss Custard, 2002; Bolduc & Guillemette, 2003). There is abundant anecdotal evidence to suggest that birds habituate to repeated disturbance but a relative paucity of experimental studies (Knight & Temple, 1995). This is largely due to the difficulties in structuring this research given the requirement to track the individuals over time and the statistical difficulties in avoiding pseudoreplication and confounding variables.

6.5.19 In the study of disturbance effects on birds by noise, light, and other anthropogenic sources several sources describe the distances at which birds show a marked response in terms of alarm calling and flight. It is a common theme that an approaching disturbance source: human or animal may be perceived as a predator (e.g. Bishop *et al.* 2003) and may elicit a greater response than a static or predictable source of

disturbance (*loc cit*; Kusters & Von Rade, 1986). Indeed, there is a considerable body of evidence to suggest that an approaching human or animal will cause greatest disturbance if the source is unpredictable in nature (e.g. Banks & Bryant, 2007; Kusters & Von Rade, 1986; Bishop *et al.,* 2003). Sources of disturbance often are both visual and auditory, e.g. vehicles, aircraft. Movement of livestock and agricultural activities (sowing, harvesting, fertilising) in the vicinity of bird concentrations have been found to be of lesser disturbance to birds than less predictable sources of disturbance, e.g. dog walkers (Blankestijn I, 1986). Typically, large flocks are more easily disturbed than smaller groups of birds (Zwarts 1972; Kooy *et al.,* 1975). Larger species of waterbirds have longer alert distances and flight distances than smaller species (Blumstein *et al*. 2005). This may be related to the energetic budgets of the species and the more cryptic nature of many smaller species at roost and breeding sites. Burger (1991) and Van der Zande *et al.* (1980) provide evidence that some migratory birds are more sensitive to disturbance than interspecific residents but that habituation effects are quickly observed. Smit & Visser (1993) provide a review of the available literature on the flight distances for many of the waterbird species present in the study area. In a study that examined flight distances for a variety of wading birds feeding on intertidal mudflats the MAD for Oystercatcher was found to be in 80-120m, Bar-tailed Godwit in 101-140m and Curlew in 140-200m (Glimmerveent & Went, 1984). It was found that the distance at which the birds were feeding from the foreshore had an impact on their flight distance with birds feeding furthest from shore reacting at somewhat greater distances from the disturbance source. The crossing of the Malahide Estuary parallel to the rail embankment is not proximate to any area of high usage by waterbirds in the inner estuary. There is no exposed intertidal mudflat immediately west to the crossing of Malahide Estuary and field data confirms that the proportion of birds in the inner estuary present within 500m of the proposed greenway is typically low (5%) although there have been occasional sightings of larger numbers of waders and Brent Geese in this area.

6.5.20 The flight distances reported for wintering Brent Geese in Denmark are in the range of 200-400m (Rudfeld, 1990). This is well outside the range of impact for the most important local areas for this species, e.g. at Seatown, as observed in field studies at this site. It is also noted that there is a hunting season on Brent Geese in Denmark and the flight distance tends to increase towards the upper part of the quoted range during the hunting season.

6.5.21 The response of birds of various species to anthropogenic noise has been studied widely (Ortega, 2012). Some less tolerant species have been shown to avoid noisy areas or to have reduced breeding output in areas with high noise levels. Several studies have compared urban birds with their rural counterparts in quieter surroundings and found that at least some birds can compensate for the masking effect of noise through shifts in vocal amplitude, song and call frequency, and song component redundancies, as well as temporal shifts to avoid noisy rush-hour traffic (*loc cit*.). Many studies on the impact of noise disturbance have examined the impacts of traffic and construction related noise on breeding and passage migrants (e.g. Dooling & Popper, 2007; Parris & Schneider, 2009; Lackey, 2010). Songbirds, in particular, demonstrate a high capacity for habituation to persistent noise (Dong & Clayton, 2008).

6.5.22 Night-time lighting is known to have an impact on resident and migratory bird species. Birds may sing at night (Nordt & Klenke, 2013) and exhaust reserves of energy on

becoming active in response to other birds (conspecifics and other species) responding to night-time lighting. Research has shown that artificial lighting can disturb development, activity patterns, and hormone-regulated processes in birds (Rich and Longcore, 2006). Many bird species are attracted to, and disoriented by, sources of artificial light, particularly during migration, a phenomenon called positive phototaxis (Hutchinson 1989; Poot *et al*., 2008). Especially powerful and unscreened night-time lighting can pose a significant obstacle to migrating birds (e.g. http://goo.gl/w5GQdR). The parts of the proposed greenway located in the lit environment are less vulnerable to marginal increases in night-time lighting associated with the construction or operational phase. The estuary crossing and the agricultural lands at Kilcrea are different in character and more vulnerable to disturbance through addition of light sources. The design of the lighting on the crossing of the inner estuary, in particular, has taken into account the sensitivity of the receiving environment.

Construction Phase

6.5.23 There are a number of potential impacts of the construction phase of the proposed greenway on birds, including habitat degradation, disturbance and collision. The intensive bird surveys carried out at the site have established that the area supports a relatively diverse waterbird and terrestrial bird assemblage. During the winter months the area holds internationally important numbers of Light-bellied Brent Geese and nationally important numbers of a number of wading birds and waterfowl. The geese and wading birds spend a proportion of their time roosting and foraging in terrestrial habitats around the estuary. The construction of the proposed greenway will take in the region of 28 weeks (Chapter 3 above).

6.5.24 The proposed greenway will mostly be constructed on existing paths, tracks and embankments, habitats of no significant value for feeding birds. The embankment has not been used as a regular high water roost by any species. There will be some loss of agricultural land and associated field boundaries, particularly on lands at Kilcrea, although the land-take is relatively small and removed from areas of high resource value for birds. Pollution events (particularly aquatic habitats) associated with accidental environmental damage also have the potential to degrade the habitats and/or directly injure birds present in the affected area.

6.5.25 Construction activities could potentially cause disturbance to birds occurring in the area due to increased human presence and noise. Studies on bird displacement due to disturbance have yielded somewhat inconsistent and inconclusive results (e.g. Kingsley & Whittam 2005). These studies have indicated that the scale of disturbance varies greatly between and within species (*loc cit*, Langston & Pullan, 2003). Disturbance effects can result in reduced numbers of birds within a particular distance from a source of disturbance. Disturbance impacts depend on a range of issues including seasonal bird use, diurnal bird use, location, availability of alternative habitats, bird life cycle, flock size, habituation etc.

6.5.26 Construction of the proposed greenway in the absence of appropriate mitigation would have the potential to cause temporary localised disturbance and displacement to large numbers of birds, including special conservation interests of the SPA. These potential impacts would be related to more widespread impacts such as those related with disturbance and displacement of feeding, roosting and nesting birds and by disruption of commuting routes (flight-lines). The areas of greatest sensitivity for birds

along the proposed greenway route are those along the crossing of the inner estuary and on lands at Kilcrea.

6.5.27 The construction of the proposed greenway will involve a number of separate works areas and associated construction compounds south and north of Malahide estuary. As described above the activities with greatest potential to disturb and displace birds are the construction/upgrade of the proposed greenway on the railway causeway (including erection of new pedestrian/cycleway bridge and temporary modification of weir), the crossing of the River Pill and the removal of field boundary vegetation north of Malahide Estuary. Without appropriate mitigation these works have the potential to cause localised disturbance of the local bird community.

Operational Phase

6.5.28 Operational phase impacts are related primarily to disturbance and displacement. Use of the proposed greenway has the potential to cause disturbance to the bird community through displacement related to increased human presence (pedestrians, cyclists), and associated noise and safety lighting. As described above, impacts depend on a range of issues including seasonal bird use, diurnal bird use, location, availability of alternative habitats, bird life cycle, flock size and habituation.

6.5.29 Without adequate mitigation the use of the proposed greenway has the potential to disturb or displace birds along and adjacent to the route. The areas of greatest sensitivity are again those along the crossing of the inner estuary and on lands at Kilcrea. Users of the proposed greenway could potentially disturb and displace sensitive bird species, especially flocking waterbird species, that occur in close proximity to the proposed greenway route. The period when the greatest numbers of birds are present in the area (October-April) corresponds to the overwintering period for many of the special conservation interests of the SPA and is clearly the time of year when the potential for operational related disturbance is greatest.

Non-Volant Mammals

6.5.30 Several mammal species were found to be present on and in the vicinity of the proposed greenway. However, no breeding sites of protected mammal species were located in close proximity to the proposed greenway route. Sightings and signs of Otter were recorded close to the railway embankment and are likely to occur on the River Pill occasionally.

6.5.31 During the construction phase, there could be a certain amount of localised disturbance to fauna occurring along the route, however this will be temporary in duration, and given the habitats present in the wider environment, the potential for any significant disturbance is of a minor nature.

6.5.32 A small but certain amount of permanent loss of agricultural land and field boundaries will occur. The construction activity has the potential to introduce sources of disturbance and/or attraction for mammal species that in the absence of mitigation could alter the mammal community present.

6.5.33 A pollution event could have a negative impact on the local mammal fauna through mortality and/or degradation of habitat. However, the severity of this impact would depend on the extent and location of such an event. Mammals associated with aquatic habitats (e.g. Otter) in the wider area could potentially be subject to negative impact

through activities associated with the construction phase, such as siltation, run-off and fuel spills.

6.5.34 The opening of the proposed greenway will create a route for mammals to cross the estuary and it is likely that this route will be explored and used by several species e.g. Fox. It will also provide a potential route for domestic animals (dogs and cats) to reach areas not readily accessible at present.

6.5.35 The low-level, and highly directional nature of the proposed operational phase lighting greatly minimises the potential of any appreciable disturbance of non-volant mammals associated with this lighting.

Bats

6.5.36 The habitats at both demesnes are attractive for a range of bat species. Given the habitats present at both demesnes it is likely that several bat species occur in the vicinity of the proposed greenway at these locations throughout year. There was relatively low bat activity along and adjacent to the route of the proposed greenway. Only two species were detected during the active survey – Common Pipistrelle and Soprano Pipistrelle. The 2018 deployment of a passive bat detector near the Pill River at Kilcrea confirmed the presence of two additional species: Leisler's Bat and Daubenton's Bat.

6.5.37 Leisler's Bat and Brown Long-eared Bat have also been recorded in the wider area (www.biodiversityireland.ie).

6.5.38 There was no evidence found of roosting bats on or close to the proposed greenway. The construction phase activities have some potential to disturb or displace the bats that forage and commute along the proposed greenway. It is possible that individual bats or small groups of bats may roost in the field boundaries that will be removed or trimmed as part of the development and, in the absence of mitigation, there is some potential for the disturbance or loss of roosting bats. Many bats commute using linear features such as hedgerows and treelines and the vegetation clearance associated with the construction of the proposed greenway has the potential to disrupt the navigation and movement of bats in the area.

6.5.39 Construction and operational phase lighting has the potential to attract certain bat species and displace others and floodlighting can be a significant source of disturbance for all nocturnal mammal species. Recent studies have indicated that LED lighting, which does not emit in the UV range, does not attract insects and therefore light-tolerant bat species do not concentrate around these lights (Lewanzik & Voigt, 2016). This makes LED lighting preferable to high-pressure sodium, mercury and metal halide lamps which have been shown to attract insects and light-tolerant bat species, but which are avoided by light-sensitive *Myotis* species and Brown Long-eared Bats, *Plecotus auritus* (*loc cit*).

Other Taxa

6.5.40 The construction activities have the potential to impact upon aquatic habitats at and downstream of the route. The construction phase could lead to disturbance of other species such as Common Frog. Frogs occur widely in the area and probably breed across the site.

6.6 Mitigation Measures

6.6.1 Any potential impacts will be minimised by implementing the following mitigation and enhancement measures, such that residual impacts will be negligible in magnitude.

Flora and Habitat

6.6.2 Standard environmental control measures for working near sensitive sites, especially watercourses and areas of wetland saltmarsh and wet grasslands, will be applied (e.g. TII (formerly NRA) *Guidelines on Crossings of Watercourses*; www.tii.ie; CIRIA Guidelines, www.ciria.org) to ensure the risk of significant adverse impacts on the local European sites through pollution or introduction of alien invasive species, contaminants will be minimised. All works adjacent to springs, rivers, drains or seepage areas will be managed as per the CEMP (see Chapter 3-Section 3.13).

6.6.3 Vegetation removal, where necessary, will be effected during spring/early summer to allow vegetation adjacent to springlines to green up, to prevent soil erosion during the later summer months and provide shade to help keep water temperatures cool. Cutting back of woody vegetation will take place outside the bird nesting period March-September. Cut vegetation will be removed from the site to designated composting areas off site away from any water courses, to allow natural composting of the material.

6.6.4 Vegetative removal at the River Pill will be confined to channel bank and will not alter the channel profile or the slope of the channel.

Control of Alien Species

6.6.5 Japanese knotweed has been recorded growing widely in the Malahide/Fingal although not in the immediate area of site works. Construction operation will ensure clean machinery entering the site to prevent the spread of alien species during works. Machinery entering the site is vital to prevent any spread of this species to the site during works.

6.6.6 Food wastes and welfare facilities will be controlled according to standard environmental controls and will not lead to any negative effects upon the local European sites.

6.6.7 The Wildlife Act (1976) and the Wildlife Amendment Act 2000 states that the removal of hedgerows or marginal vegetation will not occur from 1st of March through 31st August.[12] No bankside vegetation will be cut back during this time period. Mature trees within the Pill River corridor will be retained.

6.6.8 Some 200m of hedgerow will be removed along Corballis Cottages Road and c. 720m of hedgerow will be reinstated on this road. Some 340m of hedgerow will also be planted along the western embankment of the railway line in Kilcrea. A further 2km of hedgerow will be planted along the western and southern margins of the greenway through Kilcrea.

[12] The provisions of the Heritage Act 2018 (SI No. 15 of 2018) may also be noted (see Part 3, Section 7).

6.6.9 Replanting of native hedgerow species along the route corridor of the proposed greenway track will occur at appropriate locations and will provide suitable mitigation for any small areas of hedgerow lost as a result of works. It will also serve to improve screening of causeway lighting and movement of users from the surrounding areas.

Birds

6.6.10 Construction operations will take place during the hours of daylight to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species.

6.6.11 Works on the causeway and bridge across Malahide Estuary will be carried out outside of the overwintering period. Construction activities in this area will only be permitted from May until September. Minor works (e.g. maintenance) may be carried out at any time of year.

6.6.12 All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled according to the Construction Environmental Management Plan (CEMP) (see Chapter 3 above). The construction activities will be governed by the CEMP and all environmental control measures will be fully implemented.

6.6.13 A pre-construction baseline ecological survey will be carried out in advance of the establishment of site compounds. A monitoring site ecologist will oversee the clearance and trimming of any field boundaries.

6.6.14 The construction compounds will not be lit at night (with the exception of low-level switchable safety lighting).

6.6.15 The proposed greenway will be illuminated by LED lamps, which will be located 1.8m above the surface of the proposed greenway itself. The design illuminance on the proposed greenway surface is proposed to be 7.5 lux at full illumination with a minimum of 1.5 lux. This illuminance complies with IS EN 13201:2015 Class P3. Light spill onto the water in the estuary had been addressed in two ways. Firstly, each light fitting will have an optic which will direct light onto the proposed greenway surface only. Secondly, the light fitting will be placed such that the rear of the fitting (from which light emission is zero) is facing the estuary). In addition, the LED lighting will dim to 20% of maximum output during periods when no pedestrians or cyclists are present. The lighting circuits will be 'segmented' with a series of lamps fully illuminated as a pedestrian or cyclist approaches, dimming (to 20%) a period after the user of the proposed greenway leaves that portion of the cycle/walkway. In that way only sections of the cycle/walkway in active use will be illuminated. Reflected light from a surface is a function of the reflective properties of that surface. The proposed greenway will generally have a Dense Bitumen Macadam (DBM) surface finish. These finishes are generally dark in colour or black and these finishes have low reflectance values (less than 10%). There will therefore not be any perceptible 'sky glow' from the proposed greenway lighting. The lighting design (Volume 4C-Appendix 6) minimises the illumination spill from the causeway to areas above or adjacent to the causeway. It is envisaged that the lighting of the proposed greenway be switched off automatically at around 12:30am in the winter months (October-March) and not be illuminated again until 05:30am – this is based on predicted usage patterns associated with the current train timetable. However, if a person is detected on the proposed greenway during the

'night' hours, lighting will switch on and function as described above, until such time as no further movement is detected.

6.6.16 Replanting of native hedgerow species along the route corridor of the proposed greenway track will occur at appropriate locations and will provide mitigation for any small areas of hedgerow lost as a result of works. It will also serve to improve screening of causeway lighting and movement of users from the surrounding areas.

6.6.17 A 1.4m high wall will screen the pedestrians and cyclists from fauna present in areas close to the causeway and bridge crossing in the inner estuary. This feature has been incorporated into the design to minimise the potential impacts of disturbance associated with the movement of pedestrians and cyclists along the causeway.

6.6.18 Feeding the birds from the causeway will be discouraged. Signs will be displayed prominently to dissuade members of the public feeding birds, particularly waterbirds. Signs will also instruct users of the proposed greenway of the importance of the general area to wintering birds and request responsible behaviour for all those using the amenity.

6.6.19 Bird numbers and distribution in the estuarine and terrestrial areas in the vicinity of the route will be monitored throughout the construction phase and for two years following the opening of the cycle/walkway.

Mammals and Bats

6.6.20 A pre-construction mammal survey will be carried out immediately before the commencement of vegetation clearance. A bat survey will be carried out in advance of vegetation clearance.

6.6.21 An ecologist will supervise/check areas where tree-felling and vegetation removal will occur prior to and during construction. This will ensure that any site specific issues in relation to wildlife will be highlighted (e.g. unforeseen mammal activity) and appropriate mitigation measures (e.g. TII (formerly NRA) guidelines) are applied.

6.6.22 Construction operations will take place during the hours of daylight to minimise disturbances to nocturnal mammal species.

6.6.23 As described above, the cycle/walkway will be illuminated with low lux LED lamps which will dim or extinguish during periods when the amenity is not in active use. LED lamps do not attract insects and have much less potential to cause disturbance associated with other forms of lighting such as high-pressure sodium, mercury and metal halide lamps. The lighting design will also ensure prolonged periods of darkness during periods when there is no human activity on the cycle/walkway.

6.6.24 Replanting of native hedgerow species along the route corridor of the proposed greenway track will occur at appropriate locations and will provide mitigation for any small areas of hedgerow lost as a result of works. It will also serve to improve screening of causeway lighting and movement of users from the surrounding areas.

6.6.25 All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled according to the CEMP.

6.6.26 A baseline mammal survey will be carried out during the year of construction and for the first two years of the operation of the proposed greenway. A report will be submitted to NPWS and the local planning authority at the end of each annual survey period.

6.6.27 Bat activity will be monitored at the site in the year of construction and for the first two years of operation. A report will be submitted to NPWS and the local planning authority at the end of each annual survey period.

Other Taxa

6.6.28 A pre-construction survey will identify areas along and adjacent to the route of the proposed greenway that have potential for Frogs and their young. If necessary, any Frogs or spawn present will be translocated under licence from NPWS.

6.7 Residual Impacts

6.7.1 With the implementation of the environmental controls and mitigation it is concluded that the residual impacts on birds, mammals (including bats) and other fauna as well as flora and other habitats will be neutral imperceptible.

6.8 Cumulative Impacts

6.8.1 The Malahide Estuary is a well-used local resource with frequent recreational use. Paths around the inner estuary are used by walkers, birdwatchers etc. throughout the day. There is no visual-screening of the existing paths from the inner estuary. The opening of the proposed greenway is likely to result in an increase in the use of the new and existing paths by pedestrians and their pets, as well as cyclists. This greenway will be designed and fenced in such a manner as to restrict the use of informal routes around the estuary.

6.8.2 It is not anticipated that a cumulative impact of significance will arise from the operation of local and regional development plans or projects immediate to this project.

7.0 Land and Soil

7.1 Introduction

7.1.1 This chapter describes the existing environment in terms of the current soils and geology underlying the site, on a regional and local scale. On this basis, the potential impacts of the proposed greenway were identified, as were the measures required to mitigate against any negative impacts on the soils, geology and groundwater environment (see also Volume 4C-Appendix 3).

7.2 Data and Methodology

7.2.1 This assessment has been undertaken in consultation with the requirements and guidelines of the relevant competent authorities (Geological Survey of Ireland) concerning the soils and geological environment.

7.2.2 In order to identify any environmental impacts for the proposed greenway with the respect to the geology and hydrogeology a desk study has been completed using the following relevant information:

- Geology of Meath, Geological Survey of Ireland (GSI) (1999), Sheet 13;
- GSI Online Database – generalised bedrock geology, subsoil, vulnerability and aquifer maps;
- EPA Online Water Quality Mapping;
- GSI well and geotechnical data;
- Geological Survey of Ireland (GSI).

7.3 Existing Environment

7.3.1 This greenway crosses through a variety of geological environments. The age of the underlying Formations ranges from the Ordovician (c. 510 million years ago) to the Quaternary (c. 1.6 million years ago).

7.3.2 A study of the Ordnance Survey Map of Ireland indicates that the area is low-lying and coastal. The main geological features within the study area are small sporadic eskers, rising to a few metres in height.

7.3.3 A number of small streams drain towards the estuary. The modern coastline began to develop after the post glacial sea level stabilised more than 5,000 years ago. The modern beaches of Malahide and Donabate were formed and blown sands collected in the form of sand dunes.

Bedrock Geology

7.3.4 Reference to the 1:100,000 scale map of the Geology of Meath (Sheet 13) (Geological Survey of Ireland, 1995) indicates that the proposed greenway is mostly underlain by the Malahide Formation (Volume 3-Figures 32 to 33). This formation includes all strata between the top of the Donabate Formation (DE), and the base of the younger overlying Waulsortian Limestone. The formation consists of calcareous shales, siltstones and sandstones, and limestone. The most southern part of the proposed route is underlain by the Tober Colleen Formation (TC), which comprises dark grey, calcareous mudstones that are commonly found to be bioturbated with subordinate micrites. Along the western

boundary, a small area has been mapped as Waulsortian Limestones. This formation is described as being pale grey, poorly bedded, pure limestones with thin shale interbeds which are locally present. The most northerly section of the proposed greenway is underlain by the Donabate Formation which is described as red coarse sandstones and conglomerates (see Volume 3-Figures 32 to 35).

Geological Heritage

7.3.5 The Irish Geological Heritage (IGH) Programme identifies and selects a complete range of sites that represent Ireland's geological heritage under sixteen themes ranging from karst features to hydrogeology. The IGH Programme is a partnership between the GSI and the National Parks and Wildlife Service (NPWS) and sites identified as important for conservation are conserved as Natural Heritage Areas (NHA). Datasets are now available online detailing sites of geological heritage. There are no sites of geological heritage within the perimeter of the site boundaries.

7.3.6 According to the GSI, the closest site of interest is located within a 5km radius of the proposed greenway, and is detailed below.

7.3.7 Malahide Point (324018, 247080). A large dune system and beach formed by a long sand and shingle spit. It is designated under IGH 13 Coastal Geomorphology Theme. Coastal geomorphology is the theme that includes all the landforms around the coast of Ireland, which have been created by the power of the sea. The proposed route is not expected to have any impact on the Malahide Point dune system and beach.

7.3.8 Landforms can be of two categories, those formed by erosion and those formed by deposition. Of particular note amongst erosional sites will be such features as sea cliffs, sea stacks and rock arches. Sites where deposition of sand, gravel or boulders occur may include spits, tombolos, barriers, beaches and bars. Finer grained deposits of mud or silt may be found in estuaries and mudflats.

7.3.9 Other landforms may be created by drastic changes of relative sea level. During the Ice Ages, thick sheets of ice depressed the land surface. As the ice melted the land bounced back, and created raised beaches in some localities. In other places the sea level rose with all the ice melt water, and drowned river valleys.

7.3.10 Whilst there are very many practical problems with trying to conserve many of these dynamic landforms, with all the rich heritage of our seascapes it is important to identify key sites for educational understanding and for fair treatment in any attempted coastal zone management. The proposed development is not expected to impact on this geological heritage site.

Solid Geology, Karst Potential, Soils and Subsoils

Section 1 – Malahide Demesne

- *Solid Geology and Bedrock Outcrop:* According to the Bedrock Map Sheet 13, the Malahide Formation (ML) underlies the northern area of the Malahide Demesne. This formation consists of the Malahide Formation (ML), which includes all strata between the top of the Donabate Formation (DE), and the base of the younger overlying Waulsortian Limestone The formation consists of calcareous shales, siltstones and sandstones, and limestone. The southern part of Section 1 is underlain by the Tober Colleen Formation (TC), which comprises dark grey, calcareous mudstones that are

commonly found to be bioturbated with subordinate micrites. Along the western boundary, a small area has been mapped as Waulsortian Limestones. This formation is described as being pale grey, poorly bedded, pure limestones with thin shale interbeds which are locally present.

- *Karst Potential:* The northern area of the section is underlain by a Locally Important Aquifer that would be moderately productive in local zones (Ll). According to GSI mapping there is a small isolated spring located within Section 1 but the risk of karst development is considered to be low. The southern area of the site is underlain by a Poor Aquifer with bedrock which is generally unproductive except for Local Zones (Pl). Similarly to the aquifer identified in the northern area of Section 1, the risk of karst development is considered to be low.

- *Soils and Subsoils:* Man-made ground has replaced the original soils within an area stretching from the northwestern boundary to the central area of this section, the Malahide Demesne. The soil underlying the central area of this section has been mapped as Grey or Brown Podzolic/Brown Earth (Bmin DW). Along the southwestern, southern and eastern boundaries of the section, pockets of surface/groundwater gleys, which are deep poorly drained mineral soil derived from mainly calcareous (limestone), have been identified (Volume 3-Figure 34).
  - The majority of Section 1 has been mapped as limestone derived till (TLs). Man-made ground has replaced the original subsoil within an area stretching from the north western boundary to the central area of Section 1. Within this zone small areas of bedrock outcrop or subcrop near the surface have been mapped.

Section 2 – R106 Dublin Road, Malahide

- *Solid Geology and Bedrock Outcrop:* The underlying bedrock geology of Section 3 consists of the Malahide Formation (as described in Section 1). Exposed rock near the surface has been identified in the eastern area of Section 2 at the railway line.

- *Karst Potential:* The area is underlain by a Locally Important Aquifer that would be moderately productive in local zones (Ll). According to the GSI mapping there are no karst features in the area and the risk of karst development is considered to be low.

- *Soils and Subsoils:* Man-made ground has replaced the majority of the original soils within an area stretching from the western boundary to the central area of this section, the Malahide-Dublin Road. The soil underlying the central area of this section has been mapped as Grey or Brown Podzolic/Brown Earth (Bmin DW). Along the eastern area of the section, pockets of surface/groundwater gleys, which are deep poorly drained mineral soil derived from mainly calcareous (limestone), have been identified. The subsoil underlying Section 2 consists primarily of limestone derived till (TLs). However, the majority of soils underlying this area have been replaced by man-made ground. Small pockets of bedrock at the surface (Rck) have been identified along the railway line in the eastern area of Section 2.

Section 3 – R106 Dublin Road to Bissets Strand

- *Solid Geology and Bedrock Outcrop:* The underlying bedrock of Section 3 consists of the Malahide Formation which is described above. No outcrops identified or

mapped in the vicinity are found. Excavation required for the proposed extension of a car park would not result in the exposure of bedrock.

- *Karst Potential:* The majority of the section is underlain by a Locally Important Aquifer, that would be moderately productive in local zones (Ll). According to GSI mapping there are no karst features in the area and the risk of karst development is considered to be low.

- *Soils and Subsoils:* The eastern part of Section 3 comprises surface/groundwater gleys, which are deep poorly drained mineral soil derived from mainly calcareous (limestone) parent materials (BminPD). Small pockets of Grey or Brown Podzolic/Brown Earth (BminDW) occur near the south western boundary of this section. The subsoil underlying Section 3 consists primarily of limestone derived till (TLs). However, the majority of soils underlying this area have been replaced by man-made ground. Alluvium material is identified west of the Section 3 area near the Yellow Walls area of Malahide.

Section 4 – Bissets Strand to the North Shore of Malahide Estuary

7.3.11 Marine environment with man-made causeway structure.

Section 5 – North Shore of Malahide Estuary to R126 Hearse Road

- *Solid Geology and Bedrock Outcrop:* According to the Bedrock Map Sheet 13, the Malahide Formation underlies the southern parts of the townland. Both the Malahide Formation and the Donabate Formation underlie the middle and eastern parts. The Donabate Formation (DE) consists of red coarse lithic-sandstones and quartz-pebble conglomerate. No bedrock outcrops have been identified at the surface and according to the GSI Vulnerability map, the bedrock is between 3-10m below ground surface. It is not considered that the construction of Section 3 will require extensive excavation to the bedrock.

- *Soil and Subsoil:* The soils of Section 5 are dominated by BminDW with zones of BminPW with Marine or Estuarine Sediments (MarSands). Subsoils along the southern estuary boundary comprise Beach Sands (Mbs). Similar to Section 2, limestone derived tills (TLs) dominate the section, with small zones of Alluvium and Estuarine Sediments (Mesc). There will be removal of a thin layer of topsoil in this section to lay the proposed route. The Alluvium and Marine or Estuarine Sands underlie sections of the proposed greenway.

- *Karst Potential:* The majority of the section is underlain by a Locally Important Aquifer that would be moderately productive in local zones (Ll). According to GSI mapping there are no karst features in the area and the risk of karst development is considered to be low. The northern part of Section 3 is underlain by Locally important Aquifers which are generally moderately productive (Lm). This bedrock comprises sandstone and conglomerate and is therefore not subject to karstification

Section 6 – Newbridge Demesne

- *Solid Geology and Bed Outcrop:* The underlying bedrock geology of Section 4 comprises the Malahide Formation and the Donabate Formation, both of which

have been described above. The bedrock is not exposed in this area. According to the GSI Vulnerability map, the bedrock lies approximately 3-10m below the surface.

- *Soils and Subsoils:* The soils of the section are dominated by BminDW and BminPD with zones of mineral alluvium comprising marine and estuarine sediments. The subsoils of the section are dominated by TLs with elongated zones of Alluvium (A).

- *Karst Potential:* The majority of the section is underlain by Locally Important Aquifers with bedrock that is generally in local zones moderately productive (Ll). According to the GSI Public Viewer, there are no karst features identified and the potential for karstification is considered to be low.

7.4 Potential Impacts

7.4.1 The majority of the soils and geological impacts relate to moving topsoil to allow the construction of the proposed development, requiring excavation of usually soft but possibly hard materials, replacement, deposition and compaction of acceptable fill materials and re-use on–site or disposal where suitable and legally permitted to licensed sites for off-site treatment/recycling/disposal.

7.4.2 It is considered that, based on the fact that existing pavements are to be used for the majority of Sections 1-3 and 6, there are no significant impacts on the geological environment both during the construction and operational phases of the proposed development for these sections. In areas characterised by soft ground in Section 5 (Kilcrea Townland) design of substructures and hardstanding should accommodate any possible future settlement.

7.4.3 In areas where construction is required, this has the potential to cause negative short-term to permanent minor to moderate effects to the soils and geology of the proposed greenway area. These impacts, effects and their associated mitigation measures are discussed below.

Potential Construction Impacts

Section 1 – Malahide Demesne

7.4.4 According to the preliminary construction methodology, the works within Malahide Demesne, excluding the works at Bridgefield car park, are for the installation of signage and bicycle racks at the castle car park. The works will include the installation of signage all along the existing internal road and will be carried out by a small standalone crew from the main contractor. Minor excavation will take place for signpost bases, concrete surround and local reinstatement works for each of the bases. All excavated material will be taken off site and disposed of in a suitably licensed facility.

Section 2 – R106 Dublin Road

7.4.5 According to the preliminary construction methodology, the works at this area will include the installation of the new ramp and path alongside Bridgefield car park, realignment and reinstatement works on the Dublin Road and the re-surfacing and widening works to the south end of O'Hanlon's Lane. Welfare facilities and temporary storage of equipment and materials will be required. All excavated material (maximum depth 0.5m) will be disposed of offsite to a suitably licensed facility or to a recycling facility.

Section 3 – Dublin Road to Bissets Strand

7.4.6 According to the preliminary construction methodology, the works in this area include the reconstruction of the junction of O'Hanlon's Lane and Bissets Strand Road, the installation of two new pedestrian crossings, the realignment of Bissets Strand Road at O'Hanlon's Lane, the installation of the proposed greenway on the grass area parallel to Bissets Strand, the works at Bissets Strand railway bridge and the construction of the landscape area at Bissets Strand. All excavated material (maximum depth 0.5m) will be disposed of offsite to a suitably licensed facility or to a recycling facility. Welfare facilities will be required for the contractor during this phase.

Section 4 – Bissets Strand to North Shore

7.4.7 According to the preliminary construction methodology, the works in this area include the installation of the proposed greenway on top of the existing maintenance access track on the south side of the new pedestrian bridge, the installation of the proposed greenway on the existing stone embankment on the north side of the new bridge and the construction of a 1.4m high stone wall along both sections of the proposed greenway. These works will only commence after the bridge is completed. There will be no excavated material for disposal from this section of the project.

Section 5 – North Shore to Hearse Road

7.4.8 According to the preliminary construction methodology, the installation of the proposed greenway in this area will be built so that the surface will match existing ground level with minimum disruption to the surrounding area. Excluding the construction of the bridge and associated ramps the works can be carried out by a small minor works crew. There will be no excavated material off site. Welfare facilities will be required for the contractor during this phase.

Bedrock

7.4.9 Possible contamination of bedrock, by leakage or spillage from machinery and associated equipment, may occur during the construction phases. Leakages or spillages associated with any temporary wastewater facilities would have a negative short-term moderate impact on groundwater quality. No further impact on the quality or quantity of the bedrock is expected during construction.

7.4.10 Any soil excavations that expose the underlying bedrock to the atmosphere can result in weathering of the bedrock, which is considered to be a negative short-term minor impact.

Soils

7.4.11 Soft ground (Alluvium and Marine and Estuarine Sands) are mapped under sections of the proposed route in Section 5 (Kilcrea Townland).

Soil Removal

7.4.12 The construction of the proposed development will require the permanent removal of c. 4,000m^3 subsoil, according to the preliminary construction methodology, within the footprint area of the proposed route. This is a negative permanent direct minor effect on the soils aspect of the environment.

Vehicular Movement and Soil Compaction

7.4.13 The majority of the traffic movement associated with the proposed greenway will be over the existing roadway. During the construction phase of the permitted development, vehicles will also cross over or excavate into greenfield areas, in order to construct the new greenway in the Kilcrea section. Soil compaction can occur due to movement of construction and maintenance traffic. This could lead to an increase in runoff and subsequently to an increase in flooding and erosion. This is considered to be a potential negative short-medium term direct minor effect on the soil and *in situ* earth materials.

Hydrocarbon Leakage/Spillage

7.4.14 Possible contamination of soil and subsoil, by leakage or spillage from machinery and associated equipment, may occur during the construction phase. An accidental hydrocarbon spillage would have a negative short-medium term moderate effect on the soils and subsoils at, and down-gradient of the proposed greenway.

Material Requirement

7.4.15 The proposed scheme will have a requirement for imported materials, primarily comprising high standard fill and stone, hardcore and concrete for foundations, tarmacadam, macadam and asphalt for road pavement construction and car parking areas (see Chapter 3 above).

7.5 Operational Phase

7.5.1 It is expected there will be no significant adverse direct or indirect impacts on the underlying soils and geology as a result of the construction or operation of the proposed development. In the event of future minor maintenance works the mitigation measures detailed below (see Section 7.6) should be followed.

7.6 Mitigation Measures

Overview

7.6.1 A number of planned mitigation measures detailed below will reduce the impacts and associated effects to the soils and geological environment significantly. Many of the mitigation measures below have been based on CIRIA (Construction Industry Research and Information Association, UK) technical guidance and on current accepted best practice.

Construction Phase

Soils and Bedrock

7.6.2 One of the primary mitigation measures already employed at the design stage has been the minimisation of volumes of subsoil required to be excavated. Whenever possible, existing access roads have been utilised to access the section of the proposed greenway that will require construction.

7.6.3 The removal of mineral/soils and subsoils is a slight unavoidable impact of the development but every effort should be made to ensure that the amount of earth

materials excavated is kept to a minimum in order to limit the impact on the geological and hydrological aspects of the site. Some of the excavated subsoils removed during construction can be re-used on site in the form of landscaping where suitable and legally permitted and licensed sites will be used for off-site treatment/recycling/ disposal.

7.6.4 Design of any substructures and hardstanding in areas characterised by soft ground (such as the areas mapped under Section 5 – Kilcrea Townland) should accommodate settlement.

7.6.5 All excavations would be supervised by a competent professional (contaminated land scientist, geologist, geotechnical engineer) to identify the composition of excavated material particularly any potentially contaminated material (made ground). All potentially contaminated material would be either left *in situ* and characterised by a competent professional through laboratory testing, or segregated and stockpiled in a contained manner and characterised by a competent professional through laboratory testing. The excavation of made ground would require careful and methodical excavation.

7.6.6 Excavated material will be separated and stockpiled according to composition and dealt with accordingly. The contractor's methodology statement will be reviewed and approved by a suitably qualified engineer prior to site operations in this context.

7.6.7 Excavations will be backfilled as soon as is possible to prevent any infiltration of potentially polluting compounds to the subsurface and the aquifer.

7.6.8 Prior to the storage of any potentially polluting material on-site the site manager will be responsible for ensuring that a material safety data sheet for each product is available for inspection. A copy of all relevant material safety data sheets will be available at storage locations as well as the site office.

7.6.9 The majority of new material brought to site will be used immediately. Other materials such as asphalt or concrete will be brought directly to the construction site when required and immediately placed.

7.6.10 Any soil imported to site will be subject to assessment to identify any invasive alien species present. A Management Plan will be required which adheres to available guidance, e.g. *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII (formerly NRA) 2010). Storage of soil on-site will be seeded and periodically topped. Such stores will be subject to ongoing monitoring.

7.6.11 Subject to the identification of invasive alien species present at any of the sites, machinery will be cleaned between infested sites (including footwear and tools).

7.6.12 All potentially polluting materials will be stored in bunded areas, the capacity of which will be 110% of the volume of the largest volume of material or 25% of the total volume of liquid to be stored, whichever is greater.

7.6.13 Machinery refuelling will be carried out by competent personnel at a single designated location within the site boundaries, close to the site entrances.

7.6.14 Spill kits will be stored at the machinery refuelling area. The spill kits will comprise of suitable absorbent material, refuse bags etc to allow for the appropriate clean-up and storage of contaminated material in the event of a spillage or leak occurring.

7.6.15 All machinery will be inspected at the start of each work shift for signs of leaking hydrocarbons. Parking areas will be inspected on a daily basis for evidence of hydrocarbons leaking from machinery.

7.6.16 During the operational phase, all materials required for the maintenance of the proposed greenway will be stored according to good practice and in areas either off site or in bunded areas with impermeable floors.

7.6.17 Specialist machinery (such as tracked machinery) will be used to minimise compaction of the subsoils. The machinery used in the construction of the extensions to the roads and any new roads will be operated from the existing road surfaces (and not from the undisturbed surface surrounding them) as it is gradually constructed.

Operational Phase

7.6.18 During the operational phase, all materials required for the maintenance of the proposed greenway will be stored according to good practice and in areas either off site or in bunded areas with impermeable floors.

7.7 Residual Impacts

7.7.1 With the mitigation measures detailed above implemented it is expected there will be no significant adverse direct or indirect impacts on groundwater and the underlying soils and geology as a result of the construction or operation of the proposed development.

7.8 Cumulative Impacts

7.8.1 As there are no expected operational impacts with the proposed development, only construction phase cumulative impacts have been considered.

7.8.2 A range of projects (e.g. Donabate Distributor Road, Portrane Hospital expansion, Sutton to Swords Greenway and the McGarrell Reilly Homes housing development) has been taken into consideration as part of the cumulative assessment.

7.8.3 These projects will have or will be subject to the planning process which will identify and require mitigation measures for such effects, and therefore no significant cumulative impacts or effects are predicted.

8.0 Water

8.1 Groundwater

Introduction

8.1.1 This chapter of the EIAR considers the potential impact of the proposed development upon groundwater and aquatic environments.

Data and Methodology

8.1.2 This assessment has been undertaken in consultation with the requirements and guidelines of the relevant competent authorities (Geological Survey of Ireland) concerning the groundwater environment.

8.1.3 In order to identify any environmental impacts for the proposed greenway with respect to the hydrogeology of the proposed route a desk study has been completed using the following relevant information:

- Geology of Meath, Geological Survey of Ireland (GSI) (1999), Sheet 13;
- GSI Online Database – generalised bedrock geology, subsoil, vulnerability and aquifer maps;
- GSI well and geotechnical data;
- Geological Survey of Ireland (GSI).

Existing Environment

8.1.4 The bedrock underlying the proposed greenway has been characterised as being part of the Swords and Dublin groundwater bodies (GWB), which comprise bedrock aquifers that are classified as Ll, locally important aquifer moderately productive only in local zones and Lm, bedrock which is generally moderately productive (see Volume 3-Figures 36 and 37). The key characteristics of the Swords groundwater body have been identified by the GSI as follows:

- This GWB is located in the north of County Dublin. Elevations range from 100m OD in the west at Ratoath, Co. Meath to sea level along the coast between Swords and Rush. The area is low-lying with elevations reducing toward the east and also more locally towards the streams in the area.
- In general permeability in these rock units is likely to be moderate to low (1-10m^2/d) (Creighton *et al*., 1979). Secondary dolomitisation along faults in the Dublin area suggests that they have been, and may still be open to allow fluid migration. Pumping test analysis at the public supply boreholes at Dunboyne, Co. Meath provided transmissivity values of between 10 and 150m^2/d (Woods *et al.*, 1998).
- There are a number of subsoil types deposited over the area of this GWB. Their distribution is related to ice flow directions during the last ice age. Along the coast and some distance in shore there are various deposits of Irish Sea Till, which is the least permeable of the various subsoils. The majority of the aquifer is overlain by limestone-derived till which came from the limestone expanses around Dublin. There are smaller gravel deposits in the area, which will be the most permeable of the subsoils, including glacial deposits and alluvial gravels.

- The groundwater vulnerability is generally moderate with areas of higher vulnerability around hill and along river channels.
- Diffuse recharge will occur via rainfall percolating through the subsoil. The proportion of the effective rainfall that recharges the aquifer is largely determined by the thickness and permeability of the soil and subsoil, and by the slope.
- Due to the generally low permeability of the aquifers within this GWB, a high proportion of the recharge will then discharge rapidly to surface watercourses via the upper layers of the aquifer, effectively reducing further the available groundwater resource in the aquifer. There are areas of very high drainage density, which indicates a large proportion of the effective rainfall becomes surface runoff in this area. The area is located from Swords to Donaghmore about 10km west of there, and between the Broadmeadow and Ward Rivers.
- The GWB will discharge directly to the Irish Sea along the coast and there will also be discharge to the overlying rivers, if they are in hydraulic continuity with the aquifer.
- The general groundwater flow direction in this aquifer is towards the coast and also towards the overlying rivers. This aquifer is not expected to maintain regional groundwater flow paths.
- Groundwater circulation from recharge to discharge points will more commonly take place over a distance of less than a kilometre. The majority of groundwater flow will be a rapid flow into upper weathered zone but flow in conduits is commonly recorded at depths of 30 to 50m bgl.
- The aquifer is not considered to have any primary porosity and flow will be through fractures, some of which will have been enlarged by karstification and dolomitisation. The fissured nature and the moderate permeability of the bedrock close to the surface imply that water will move at high velocities.

8.1.5 The key characteristics of the Dublin groundwater body have been identified by the GSI as follows:

- This GWB is located in the Greater Dublin City area and extends southwest towards Kildare. The area is generally low-lying with areas of higher elevation surrounding to the south and to a lesser extent to the north. Elevations decrease towards the various river estuaries around Dublin City. At the boundaries of the GWB the highest elevations are to the south at the foothills of the Dublin Mountains and to the northwest where the Namurian rocks form an area of higher elevation to the southwest of Dunshaughlin.
- In general permeability in these rock units is likely to be low (1-10m^2/d) (Creighton *et al.*, 1979). Secondary dolomitisation along faults in the Dublin area suggests that they have been, and may still be, open to allow fluid migration.
- There is a distinct reduction in the permeability of these rocks with depth. Most groundwater flow will take place close to the surface with additional isolated flow along fractures and fissures located at depths up to 50m bgl.
- The area of the aquifer close to surface may be quite significant. Thin subsoil areas are located towards the centre of the GWB.

- The vulnerability of the groundwater is generally extreme to moderate between Maynooth and Phoenix Park in Dublin, to the east and west of this area the general vulnerability is Moderate.
- Conservatively it is estimated that 10% of the city area is available for recharge. Some recharge occurs from leaking sewers, mains and storm drains.
- The GWB will discharge directly to the Irish Sea along the coast.

Recharge

8.1.6 The key characteristics influencing groundwater recharge on the proposed greenway as indicated by the Geological Survey of Ireland (GSI), are outlined below in Table 8.1 below.

Table 8.1 Recharge Characteristics of Proposed Route.

Characteristics	Description of Characteristics Section 1 – Malahide Demesne	Description of Characteristics (Under Kilcrea Townland)	Description of Characteristics (Under Newbridge)
Hydrogeological Setting	1.iv	2.ii	4.i
Hydrogeological Setting Description	Till overlain by well-drained soil.	Sands and gravels subsoil overlain by well-drained soil.	Low permeability subsoil.
Subsoil Drainage	Dry	Dry	Dry
Subsoil Type	TLs	MBs	TLs
Soil Description	Till derived chiefly from limestone.	Beach sands and gravels.	Till derived chiefly from limestone.
Subsoil Permeability Description	N/A (as depth to bedrock is less than 3m).	High	Low
GW vulnerability Description	Extreme	High	Low
Aquifer Category	LI	LI	LI
Aquifer Category Description	Locally important Aquifer – Bedrock which is moderately productive only in local zones.	Locally important Aquifer – Bedrock which is moderately productive only in local zones.	Locally important Aquifer – Bedrock which is moderately productive only in local zones.
Recharge Coefficient (%)	60	85	7.5
Maximum Recharge Capacity (mm/yr)	200	200	200
Effective Rainfall (mm/yr)	301	301	300
Average Recharge (mm/yr)	181	200	23

Groundwater Vulnerability, Third Party Wells and Karst Features

8.1.7 The groundwater vulnerability, third party well location and karst features associated with each section of the proposed route are outlined below (see also Volume 3-Figures 36 and 37).

SECTION 1 – MALAHIDE DEMESNE

- *Extreme (E) and High (H) Vulnerability Areas*: Groundwater vulnerability within this section is dominated by high (H) to extreme (E) vulnerability.
- *Third Party Wells (0-50m accuracy):* Using the GSI online well database, one third party well has been identified within the Malahide Castle Demesne. This is an ancient well, it is sourced from a spring but it is not used as a drinking water source.
- *Karst Features:* There is one spring identified on the site; this spring has been mapped as a well on the GSI online well database.

SECTION 2 – R106 DUBLIN ROAD, MALAHIDE

- *Extreme (E) and High (H) Vulnerability Areas:* Groundwater vulnerability within this section is dominated by high (H) to extreme (E) vulnerability.
- *Third part Wells (0-50m accuracy):* Using the GSI online well database, no third party wells have been identified within 50m of the route alignments from this section.
- *Karst Features:* Using the GSI online karst features, no karst features have been identified within this section.

SECTION 3 – R106 DUBLIN ROAD TO BISSETS STRAND

- *Extreme (E) and High (H) Vulnerability Areas:* Groundwater vulnerability within this section is dominated by high (H) to extreme (E) vulnerability.
- *Third Party Wells (0-50m accuracy):* Using the GSI online well database, no third party wells have been identified within 50m of the route alignments for this section.
- *Karst Features:* Using the GSI online karst features, no karst features have been identified within this section.

SECTION 4 – BISSETS STRAND TO THE NORTH SHORE OF MALAHIDE ESTUARY

8.1.8 Marine environment with man-made causeway structure.

SECTION 5 – NORTH SHORE OF MALAHIDE ESTUARY TO R126 HEARSE ROAD

- *Extreme (E) and High (H) Vulnerability Areas:* This section largely encompasses a low (L) vulnerability groundwater area.
- *Third Party Wells (0-50m accuracy):* Using the GSI online database – generalised bedrock geology, subsoil, vulnerability and aquifer maps, no third party wells have been identified along this section.
- *Karst Features:* Using the GSI online karst database, no karst features have been identified within this section.

SECTION 6 – NEWBRIDGE DEMESNE

- *Extreme (E) and High (H) Vulnerability Areas:* This section has been defined as low (L) groundwater vulnerability. Groundwater would not be considered at risk in low vulnerability areas.
- *Third Party Wells (0-50m accuracy):* Using the GSI online database – generalised bedrock geology, subsoil, vulnerability and aquifer maps, no third party wells have been identified along within this section.
- *Karst Features:* Using the GSI online karst database, no karst features have been identified within this section.

8.1.9 The majority of the route is characterised as low (L) groundwater vulnerability with local zones of High to Extreme vulnerability.

Groundwater Levels, Gradient and Flow Direction

8.1.10 Site specific groundwater levels were not available. The groundwater flow in the vicinity of the proposed greenway is inferred to be towards Malahide Estuary mirroring the regional topography.

Water Framework Directive Status

8.1.11 Under the Water Framework Directive (WFD), the key water quality objective is that all water bodies achieve or retain 'good' status by 2015. The Swords and Dublin Groundwater Body has been classified as having 'good' status and "not at risk" risk status (2010-2015, www.catchments.ie).

Potential Impacts

8.1.12 It is considered that, based on the fact that existing pavements are to be used for the majority of Sections 1-3 and 6, there are no significant impacts and effects on the hydrogeological environment both during the construction and operational phases of the proposed development for these sections.

8.1.13 Construction relating to the proposed route will not occur in areas of high and extreme vulnerability. The removal of soils and subsoils material during the construction will not give rise to an increase in aquifer vulnerability.

8.1.14 In areas where construction is required, this has the potential to cause negative short-term to permanent minor to moderate effects to the hydrogeological environment of the proposed greenway area. These impacts, associated effects and mitigation measures are discussed below.

Construction

SECTION 1 – MALAHIDE DEMESNE

8.1.15 The works within Malahide Demesne, excluding the works at Bridgefield car park, are for the installation of signage and bicycle racks at the castle car park. The works will include the installation of signage all along the existing internal road and will be carried out by a small standalone crew from the main contractor. Minor excavation will take place for signpost bases, concrete surround and local reinstatement works for each of

the bases. All excavated material will be taken off site and disposed of in a suitably licensed facility.

Section 2 – R106 Dublin Road

8.1.16 The works at this area will include the installation of the new ramp and path alongside Bridgefield car park, realignment and reinstatement works on the Dublin Road and the re-surfacing and widening works to the south end of O'Hanlon's Lane. Welfare facilities and temporary storage of equipment and materials will be required. All excavated material (maximum depth 0.5m) will be disposed of offsite to a suitably licensed facility or to a recycling facility.

Section 3 – Dublin Road to Bissets Strand

8.1.17 The works in this area include the reconstruction of the junction of O'Hanlon's Lane and Bissets Strand Road, the installation of two new pedestrian crossings, the realignment of Bissets Strand Road at O'Hanlon's Lane, the installation of the proposed greenway on the grass area parallel to Bissets Strand, the works at Bissets Strand railway bridge and the construction of the landscape area at Bissets Strand. All excavated material (maximum depth 0.5m) will be disposed of offsite to a suitably licensed facility or to a recycling facility. Welfare facilities will be required for the contractor during this phase.

Section 4 – Bissets Strand to North Shore

8.1.18 The works in this area include the installation of the proposed greenway on top of the existing stoned access track on the south side of the new pedestrian bridge, the installation of the proposed greenway on the existing stone embankment on the north side of the new bridge and the construction of a 1.4m high stone wall along both sections of the proposed greenway. These works will only commence after the bridge is completed. There will be no excavated material for disposal from this section of the project.

Section 5 – North Shore to Hearse Road

8.1.19 The installation of the proposed greenway in this area will be built so that the surface will match existing ground level with minimum disruption to the surrounding area. Excluding the construction of the bridge and associated ramps the works can be carried out by a small minor works crew. There will be no excavated material off site. Welfare facilities will be required for the contractor during this phase.

Entry of Surface Contaminants

8.1.20 Any removal and disturbance of soil would cause a potential risk to groundwater as the protective soil layer is removed and the vulnerability of the groundwater to surface contaminants is increased. This would result in a negative short-medium term moderate effect on groundwater and surface water quality at, and down-gradient of the proposed greenway.

Hydrocarbon Leakage/Spillage

8.1.21 Possible contamination of groundwater, by leakage or spillage from machinery and associated equipment, may occur during the construction phase. An accidental

hydrocarbon spillage would have a negative short-medium term moderate effect on groundwater and surface water quality at, and down-gradient of the proposed greenway.

Operational

8.1.22 It is expected there will be no significant adverse direct or indirect impacts on the underlying aquifer as a result of the construction or operation of the proposed development. In the event of future minor maintenance works the mitigation measures detailed below should be followed.

Mitigation Measures

Overview

8.1.23 A number of planned mitigation measures detailed below will reduce the impacts to the hydrogeology of the proposed sites significantly. Many of the mitigation measures below have been based on CIRIA (Construction Industry Research and Information Association, UK) technical guidance on water pollution control and on current accepted best practice.

Construction Phase

8.1.24 Excavations will be backfilled as soon as is possible to prevent any infiltration of potentially polluting compounds to the subsurface and the aquifer.

8.1.25 Prior to the storage of any potentially polluting material on-site the site manager will be responsible for ensuring that a material safety data sheet for each product is available for inspection. A copy of all relevant material safety data sheets will be available at storage locations as well as the site office.

8.1.26 The majority of new material brought to site will be used immediately. Other materials such as asphalt or concrete will be brought directly to the construction site when required and immediately placed.

8.1.27 All potentially polluting materials will be stored in bunded areas, the capacity of which will be 110% of the volume of the largest volume of material or 25% of the total volume of liquid to be stored, whichever is greater.

8.1.28 Machinery refuelling will be carried out by competent personnel at a single designated location within the site boundaries, close to the site entrances.

8.1.29 Spill kits will be stored at the machinery refuelling area. The spill kits will comprise of suitable absorbent material, refuse bags etc to allow for the appropriate clean-up and storage of contaminated material in the event of a spillage or leak occurring.

8.1.30 There will be no discharge of effluent to groundwater or surface water during the construction phase. All wastewater from the construction facilities will be stored for removal off site for disposal and treatment.

8.1.31 All machinery will be inspected at the start of each work shift for signs of leaking hydrocarbons. Parking areas will be inspected on a daily basis for evidence of hydrocarbons leaking from machinery.

8.1.32 During the operational phase, all materials required for the maintenance of the proposed greenway will be stored according to good practice and in areas either off site or in bunded areas with impermeable floors.

8.1.33 The contractor's design of the site drainage system including the design of the run-off collection system from all roads and interface areas with grazing land shall ensure that run-off is collected in a controlled manner. The design of the site drainage system shall also incorporate the principle of Sustainable Urban Drainage System (SUDS) to ensure that landowner(s) downstream of the works will not be adversely affected by the construction and operation of the works. Surface run-off rates shall comply with the following guidelines:

- Greater Dublin Strategic Drainage Study (GDSDS);
- Dublin City Council's "Code of Practice for Drainage Works";
- Irish SUDS: Guidance on Applying the GDSDS Surface Water Drainage Criteria.

8.1.34 The contractor shall be obliged to ensure no deleterious discharges are released from the site to surrounding watercourses during excavation. Throughout the design-build works the contractor shall also take account of relevant legislation and best practice guidance including but not limited to the following:

- C532 Control of water pollution from construction sites: guidance for consultants and contractors;
- C648 Control of water pollution from linear construction projects;
- SP156 Control of water pollution from construction sites – guide to good practice.

8.1.35 The contractor's construction method statements shall also indicate how management, monitoring, interception, removal and/or treatment of silt run-off shall prevent contamination during construction of ground or surface waters by mobilisation of soil particles. Land shall only be stripped as necessary, to minimise soil erosion.

Operational Phase

8.1.36 During the operational phase, all materials required for the maintenance of the proposed greenway will be stored according to good practice and in areas either off site or in bunded areas with impermeable floors.

Residual Impacts

8.1.37 If the mitigation measures detailed above are implemented it is expected there will be no significant adverse direct or indirect impacts on groundwater as a result of the construction or operation of the proposed development.

Cumulative Impacts

8.1.38 Individual impacts from one-off developments may not in themselves be significant. However, these may become significant when combined with similar, multiple impacts elsewhere. As there are no expected operational impacts with the proposed development, only construction phase cumulative impacts have been considered.

8.1.39 A range of nearby projects (e.g. Donabate Distributor Road, Portrane Hospital Expansion, Sutton to Swords Greenway and the McGarrell Reilly Homes housing

development) have been taken into consideration as part of the cumulative assessment.

8.1.40 When these projects have been considered as part of this assessment, there is potential for accidental spills or leaks of construction related material which could impact the hydrogeological environment of the surrounding area. However, the projects will have or will be subject to the planning process which will identify and require mitigation measures for such effects, and therefore no significant cumulative impacts or effects are predicted.

8.2 Aquatic Environment

Introduction

8.2.1 This chapter presents the details of the aquatic receiving environment for the proposed development as well as the potential impacts on the environment associated with the construction and operation of the proposal. Data on the receiving environment was obtained by a combination on online data acquisition and field surveys (see Volume 3-Figure 38 for location detail).

Data and Methodology

8.2.2 A comprehensive desktop study was conducted in support of this assessment. In addition to the standard guidance, the following data sources were utilised:

- *General Habitats and Site Layout:* Online mapping – Google Earth imagery.
- *Natura 2000 (European) Sites:* National Parks and Wildlife Service (NPWS) maps and online reports.
- *Fisheries:* Inland Fisheries Ireland (IFI) Water Framework Directive (WFD) surveys of transitional waters.
- *Water Quality and WFD Classifications:* EPA Envision Mapping.
- *Previous Studies:* EIS for Road Scheme, Donabate Distributor Road.

8.2.3 In addition to the extensive fieldwork conducted during the period of the rail bridge collapse at Malahide Estuary and its reconstruction in 2009-2012, additional fieldwork was conducted for the purposes of this assessment in the period 2013-2016.

Existing Environment

Malahide Estuary

8.2.4 The proposed greenway travels from Malahide North toward Donabate running parallel to Dublin-Belfast railway line for much of its route. The railway line runs along an embankment which separates the inner Malahide Estuary from the outer Malahide Estuary. The inner estuary communicates with the outer estuary through a ~170m gap in the railway embankment coinciding with the railway viaduct. The tide moves in and out to the inner estuary at this point but the amount of exchange is controlled by a weir. The presence of the weir ensures that the inner estuary is largely covered with water at all times except in its very inner 'bottleneck' close to Seatown West, Swords. The Broad Meadow and Ward Rivers join just north of the village of Swords and discharge into the Broadmeadow Water.

8.2.5 As recently as 2014 the EPA has classified the lower reaches of both rivers as poor (i.e. with a Q-rating of Q2-3 and Q3 for the Broad Meadow and Ward respectively) (see paragraphs 8.2.16 to 8.2.19 below for further details of this classification system). Despite this, however, there is a salmon and sea trout run into the Ward River and a sea trout run into the Broad Meadow River and trout are fished in the estuary. In addition surveys in 2008 and 2010 by Inland Fisheries Ireland in the Broadmeadow Water have shown that high numbers of a small number of fish occur there including: sand gobies (*Pomatoschistus minutus*), thick-lipped grey mullet (*Chelon labrosus*), flounder (*Platichthys flesus*) and spratt (*Sprattus sprattus*). Less abundant species include, among others, eel, brown trout, roach, 3-spined stickleback and bass. There does not appear to be a current transitional water classification for this part of the estuary, although it was previously considered eutrophic. It was provisionally classified as good status by IFI in 2010 based on its fish community.

8.2.6 The outer Malahide Estuary, which is classified as a coastal water body under the WFD was classified as intermediate by the EPA for the 2010-2012 period (latest available), while just beyond this the open coast (denoted as the North West Irish Sea) is classified under the WFD as unpolluted.

8.2.7 The principal marine Annex I habitat is mud flats and sand flats uncovered at low tide. Within this broad category, five distinct habitats were identified. Four of these are located in the outer estuary, while the inner estuary, where the extent of the Annex I habitat is much more restricted, has just one habitat type. These habitats, their indicative areas and their locations are listed in Table 8.2).

Table 8.2 The marine habitats comprising Annex I habitat: mudflats and sand flats not covered at low tide in Malahide Estuary.

Benthic Habitat	Indicative Area (Ha)	Location
Sand to muddy sand with *Peringia ulvae*, *Tubificoides benedii* and *Cerastoderma edule* community complex	169	Outer Estuary
Fine sand with oligochaetes, amphipods, bivalves and polychaetes community complex	126	Outer Estuary
Estuarine sandy mud with Chironomidae and *Hediste diversicolor* community complex	7	Inner Estuary
Zostera-dominated community	5	Outer Estuary
Mytilus-dominated community complex	4	Outer Estuary

8.2.8 In addition to these soft sediment habitats which comprise the vast majority of the estuary's area the rock armour of railway embankment comprises a range of typical sheltered rocky-shore habitats dominated by lichens in the upper shore-supra littoral area with the main intertidal dominated by fucoid (brown) macroalgae, along with associated mollusc and crustacean intertidal fauna (Volume 4C-Appendix 12(C)–Plates 1 and 2).

8.2.9 In particular, the intertidal community present along the hard benthos of the maintenance track consists primarily of grey-green and yellow lichens present along the upper zone of the rock armouring. The upper-mid to low shore is dominated by green algae, primarily *Prasiola* sp., *Ulothrix* sp. and *Ursopora* sp. which forms thin coatings on the rock surface. Immediately at low water, a filamentous brown diatom, *Melosira* sp. dominates. A layer of the fucoid, *Fucus serratus*, is present below low water. Overall, faunal diversity along the rock armouring is low, with only barnacles present at

the site. However, below the low water level at one site there was a large clump of mussels present (location co-ordinates: IO 22530 46627).

8.2.10 The hard benthos present along the existing northern arm of the embankment almost identical to that identified along the southern maintenance track. The tidal zonation and species present are the same.

8.2.11 The biotopes identified across the survey area consisted of Yellow and grey lichens on supralittoral rock (LR.FLR.Lic.YG); *Prasiola stipitata* on nitrate-enriched supralittoral or littoral fringe rock (LR.FLR.Lic.Pra) and *Fucus serratus* and large *Mytilus edulis* on variable salinity lower eulittoral rock (LR.LLR.FVS.FserVS). These biotopes were present along both the maintenance track and northern parts of the Malahide railway embankment. See Volume 4C-Appendix 12(A and B) for details of a submersive soft sediment survey at the location of the weir maintenance track prior to placement in September 2009.

8.2.12 At the refurbished weir beneath the railway viaduct the hard substrates of stone, concrete and rock armour provide anchorage for macroalgae and filter feeding blue mussels (*Mytilus edulis*), which benefit from the presence of strong tidal fluxes several times each day as water moves between the inner and outer parts of the SAC via these narrows.

Pill River – Kilcrea

8.2.13 At its northern end the proposed development traverses the lower reaches of the Pill River. The lower kilometre of the Pill from at least the Donabate road bridge (Hearse Road) (at Irish Grid 322133 249415) to the Malahide Estuary outflow, appears to have a tidal influence. This is clear for the lower 400m of Pill where aerial views show the tidally exposed muddy margins of the channel. Aspects of the macroinvertebrate fauna collected as part of this and previous studies in the area also point to a saline influence in these lower sections.

8.2.14 There are no suitable spawning or nursery habitats for salmonids present in this stretch and while slob trout or sea trout might utilise the lower reaches, the limited extent of the channel would suggest that this is unlikely. Given the nature of the habitat and the proximity of extensive saltmarsh and associated creeks immediately beyond the railway embankment to the east, there is a good possibility that smaller species such as common goby (*Pomatoschistus microps*) and sand goby (*P. minutus*) as well as juvenile flounder (*Platichthys flesus*) or possibly plaice (*Pleuronectes platessa*) would use the lower reaches. Other species such as juvenile thick-lipped grey mullet (*Chelon labrosus*) and to a lesser extent bass (*Dicentrarchus labrax*) might also be present occasionally in small numbers.

Field Survey

8.2.15 As part of the assessment a walk-over survey of the lower Pill River and the Malahide Estuary immediately adjoining the outflow from the Pill under the railway embankment was undertaken. The fieldwork included taking replicate intertidal cores in the Malahide Estuary close to the Pill outflow to confirm the principal marine soft sediment habitat in the area. In addition, a kick sample for macroinvertebrates was carried out at the road bridge upstream (Irish Grid 322133 249415) in order to gauge the water quality of the watercourse. Finally, a survey of the habitats at the upstream crossing point of the Pill at (Irish Grid 322406 29100) was also undertaken.

Methods

Intertidal Cores in Malahide Estuary

8.2.16 Three replicate cores (10cm diameter cores) were taken to a depth of 30cm in the mid intertidal level in the mudflat immediately on the Malahide Estuary side of the Pill River outfall. The samples were taken to laboratory on the same day and the following morning were passed through a 0.5mm sieve mesh, fixed in 4% buffered formalin. Samples were then processed by eye with all visible fauna being extracted and stored in 70% ethanol. These were identified to the lowest taxonomic level possible, using standard keys for the European marine invertebrate fauna.

8.2.17 A surface mud scoop taken at the same site as the cores was processed for grain-size. The samples were first dried, then a portion was treated with hydrogen peroxide to remove organic matter and then soaked in sodium hexametaphosphate before being dried and sieved through a series of sieves in order to determine the following grain sizes: <63µm (silt/clay fraction), 63-2000 µm (sand), >2000µm (gravel). These data are used along with the data from the fauna in the cores in order to classify the benthic soft sediment habitat/community present.

Invertebrate Sampling in the Pill River

8.2.18 A kick-sample for aquatic macroinvertebrates was taken immediately upstream of the Hearse Road bridge using a standard kick sampling method as follows: a two-minute moving kick-sample was undertaken in riffle-type habitat with a long-handled pond net (1mm mesh). The material collected was sieved through a 500µm sieve to remove fines and examined on the bankside in a white tray. Abundance categories were assigned using the EPA method and Q-ratings were calculated.

8.2.19 This biotic index is used by the EPA on all river surface water monitoring programmes and is based on interpreting collections of aquatic macroinvertebrates. The index assigns a score to the macroinvertebrate collection at a given site depending on the relative proportion of pollution sensitive and pollution-tolerant organisms present. The greater the number and diversity of pollution sensitive types present (particularly, certain mayflies, stoneflies and cased caddis flies) the higher the score or quality class assigned to a given site. The highest score category is Q5 which indicates pristine water quality conditions and is recognised by having a high proportion of pollution-sensitive species and very few if any pollution-tolerant forms, whereas Q1 at the other end of the scale indicates gross pollution. Table 8.3 lists the Q-value scores, which can be assigned and the corresponding degree of pollution associated with each. This system, used in Ireland since the early 1970's, has been intercalibrated with comparable European systems and now forms one of the cornerstones of ecological status classification under the Water Framework Directive (WFD) in Ireland. Table 8.3 also includes the corresponding WFD Status for each Q-rating category.

Table 8.3 EPA Q-Ratings and Corresponding Pollution Status and Water Framework Directive Status.

Q-Rating	EPA Pollution Status	WDF Status
Q5	Unpolluted	High
Q4-5	Unpolluted	High
Q4	Unpolluted	Good
Q3-4	Slightly Polluted	Moderate
Q3	Moderately Polluted	Poor
<Q3	Moderately-Seriously Polluted	Bad

Results of Fieldwork

MALAHIDE ESTUARY

8.2.20 Results from the present coring exercise in Malahide Estuary indicates the presence of an upper estuarine biological community. Table 8.4 lists the infaunal species and numbers identified in each of the three replicate cores.

Table 8.4 Species – Abundance Matrix for the Three Replicates at a Single Location in Malahide.

Species	Replicate A	Replicate B	Replicate C
Scrobicularia plana	5	5	4
Hydrobia ulvae	1	0	1
Corophium volutator	1	11	6
Hediste diversicolor	5	7	4
Streblospio sp.	0	3	4
Oligochaetae spp.	201	274	168
Nemertea	Present	Present	Present

8.2.21 Sediment grain sized at the coring site comprised 86% mud, 14% sand and <1% gravel. The fauna present at the site are typical of the *Hediste diversicolor* and oligochaetes in littoral mud biotope classification of Connor *et al.* (2004). This biotope has been described as 'A species-poor community found in mud or slightly sandy mud in low salinity conditions, typically at the head of estuaries. The infauna is dominated by the ragworm *Hediste diversicolor* which is typically superabundant. Oligochaetes, including tubificids and *Heterochaeta costata*, can be abundant, as well as spionids. The peppery furrow shell *Scrobicularia plana* may be present in low abundances. The mud is often very soft and fluid, with a 'wet' surface appearance, or it may be compacted and form steep banks in the upper parts of macro-tidal estuaries and along saltmarsh creeks.'

8.2.22 This habitat is likely to be representative of the general soft sediment area immediately outside the tidal flap (Volume 4C-Appendix 12(C)–Plate 3) which controls the outlet of the Pill River (Volume 4C-Appendix 12(C)–Plate 4). This muddy intertidal area is fringed by saltmarsh in the supralittoral (Volume 4C-Appendix 12(C)–Plate 5). In addition, localised areas of loose angular cobble in the upper shore are covered in brown seaweeds (including *Fucus ceranoides* and *Ascophyllum nodosum*). However, the thick veneer of muddy sediment over all hard substrates coupled with the upper estuarine location probably explains the general absence of encrusting faunas such as sponges and anemones on these substrates as well as absence of a range of molluscs and invertebrates one would expect to observe in sediment-free hard substrate intertidal habitats. This habitat, which is located outside the tidal flap which separated the SAC (on the outer side) from the inner Pill Estuary where the greenway will be constructed, is contiguous with the entire Annex I habitat complex which dominates the outer estuary, i.e. Mudflats and Sandflats not covered by seawater at Low Tide, which is just over 300ha in extent.

PILL RIVER

8.2.23 The macroinvertebrate results from the kick-sample taken at the road bridge on the Pill River are presented in Table 8.5.

Table 8.5 Results of Kick Sample on Pill River by Road Bridge.

	Quality Class	Road Bridge
CADDIS FLIES (Trichoptera)		
Limnephilidae	C	Frequent
F/W SHRIMPS (Crustacea)		
Gammarus sp.	C	Dominant
Asellus	D	Common
SNAILS (Mollusca)		
Planorbidae	C	Few
EPA Q Value		Q3 (Q2-3)

Abundance Categories: F = Few (1-5), C = Common (6-20), N=Numerous (21-50), D = Dominant (51-75), E = Excessive (>75%)

8.2.24 These results reveal a very impoverished invertebrate community with no sensitive mayfly or stone fly species and a very low diversity overall. This may point to a residual saline influence even at this point, a proposition supported by the very turbid nature of the water (Volume 4C-Appendix 12(C)–Plate 6). Samples taken on the same river farther downstream as part of a previous study (Conservation Services, 2010) also suggested a saline influence in this stream. While a Q-rating was assigned during the present survey, which indicates that the water is polluted in this case corresponding to Poor WFD Status, the fact that there may be a saline influence means that strictly speaking, the Q-rating system should not be used. Despite this, however, the data probably also points to impaired quality.

8.2.25 A further site on the Pill was examined at a point about 500m further downstream at where the proposed development will cross the channel, although no kick-samples were taken here. This site was about 4-5m wide and about 40-50cm deep with a silted angular cobble bed with softer margins to the channel. There was no evidence of in-channel or marginal macrophyte growth and the banks were earthen with gravel and overgrown. The in-channel habitat was a glide/run with some suggestion that the channel had been drained in the past (Volume 4C-Appendix 12(C)–Plate 7). The habitat was unsuitable for salmonids due to the absence of spawning or nursery areas, furthermore the water was also very turbid in this stretch.

Table 8.6 Pill River at Bridge on Hearse Road (Irish Grid 322133 249415).

Width (m)	~4-5m
Depth (cm)	25-40
Habitat Type	Glide Run and Run
Substrate	Cobble 5, Gravel/pebble 4
Flow	Moderate/swift and turbulent
Macrophyte	Plant free
Other observation	Water very turbid
Q Rating	Q2-3

Habitat Evaluation

MALAHIDE ESTUARY

8.2.26 The area of the Malahide Estuary into which the Pill River discharges contains mud-flats, tidal creeks and saltmarsh, all of which are within the Malahide Estuary SAC and all of which are therefore protected under the Habitats Directive. The designation of

the site by the EPA as being intermediate in terms of its WFD status is consistent with the presence of extensive areas of filamentous green algae in the intertidal areas during the summer-autumn period, indicating that the site is under a degree of nutrient pressure.

8.2.27 At the railway viaduct, where a 180m footbridge is proposed for the proposed greenway, the habitats principally are hard benthic in nature covered with macroalgae and associated with blue mussels taking advantage of the strong local water movements. These currents drop off rapidly in the inner estuary due to the presence of the weir that controls the level, whereas the outer estuary experiences much greater tidal currents. Of the habitats listed above only the mudflats and their associated marine habitats (Table 8.2 above) and saltmarsh areas fall within the conservation objectives of the site. Overall this site is of international importance.

PILL RIVER

8.2.28 This watercourse is a small tidally influenced stream with a very limited range of habitats and species which have likely been further depressed by impaired water quality. An improvement in water quality in the future might see an increase in invertebrate and aquatic plant diversity at the site. Despite its current shortcomings the site would be classified as of high local importance due to the semi-natural nature of some its habitats especially in its very lower reaches which are allowed to flood naturally. It is important to note that this section of the Pill River has no ecological designation and is entirely outside the Malahide Estuary SAC and separated from it by a large tidal flap.

Potential Impacts

Impact Assessment Methodology

8.2.29 Impacts are identified and described according to guidance and terminology outlined in the *Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EIAR)* (EPA, 2017), *Draft Advice Notes for Preparing Environmental Impact Statements* (EPA, 2015)*;* and with reference to the Institute of Ecology and Environmental Management's *Guidelines for Ecological Impact Assessment* (2006) and the TII (formerly NRA) *Guidelines for Ecological Impact Assessment*. Terminology for impact significance and duration follows that set out by the EPA (2003).

Relevant Characteristics of the Proposal

BRIDGING STRUCTURES

8.2.30 The only aspects of the proposed greenway with potentially significant adverse impacts for the aquatic receiving environment would be associated with the three crossing structures proposed along the proposed greenway, these include (from south to north) (i) the crossing of the Malahide Estuary (multi-span 180m long structure), (ii) the crossing of the Pill River where it flows beneath the railway embankment and (iii) the crossing of the Pill River about 750m upstream from crossing (ii). Impacts may also arise from construction drainage of the proposed road realignment on Corballis Cottages Road.

180m Bridge at Railway Viaduct

8.2.31 To complete the greenway bridge structure, 12 precast concrete deck sections will be put in place between the extant piers. Each section will be installed by multi-axle transporter working from north to south. As each new span is placed, its ends will be shuttered and grouted. The multi-axle transporter will cross the 12 narrow tidal channels that flow between the abutments of the viaduct which are part of the weir structure upon which the viaduct is built. To achieve this, imported clean stone will be used to form a level running track along the length of the weir on the inner side (west) of the viaduct. The level of this track will be such that it will still allow tidal flux between the inner and outer estuary during the estimated 16-week construction period. However, it will result in a small temporary rise in the level of the inner estuary as it will increase the average level of the weir for the eight week construction period (see also Chapter 3 and Volume 4C-Appendix 16). Currently each portion of the weir between neighbouring abutments of the viaduct is in the form of a V with the base of the V at 400mm below the edges closest to the abutments. The insertion of the running track will mean that the V portion of each weir channel will be levelled, thereby on average increasing the height of the weir. Once the bridge decking has been put in place the stone infill used to construct the running track will all be removed and the V shape of each of the 12 weir channels will be restored to their original profile, thereby restoring the pre-works level to the inner estuary.

Crossings (ii) and (iii) over the Pill River

8.2.32 The downstream crossing of the Pill River immediately upstream of the railway embankment culvert will comprise a bridge of timber clad steel beam decking (c. 50m) laid across concrete bridge piers piled into ground. The installation of these piers will require ground preparation in terms of vegetation removal on the approaches to the crossing point from both banks. The upstream crossing will require abutments, one at either side of the channel, to support the single span 12m timber deck. As with the downstream crossing, piers will not be placed into the channel of the Pill River. The construction operation will be organised so that the channel will not be crossed by construction vehicles at either crossing point. There will be no in-stream works at these locations. It is important to note that this part of the Pill Estuary is wholly outside of the Malahide Estuary SAC whose boundary is outside the tidal flap on the existing culvert that carried the Pill discharge under the railway embankment.

Realignment of Corballis Cottages Road

8.2.33 This aspect of the project will see a short (approximately 175m) stretch of the existing Corballis Cottages Road immediately east of the railway underpass being realigned to the north, i.e. away from the edge of the estuary, by about 25m at its centre. This local road currently carries a very light traffic density (~AADT 1000) which will not change in response to the proposed works. The stretch of road in question adjoins an extensive area of saltmarsh and a roadside drain runs along its northern edge. Once the new stretch of road has been constructed, the pavement on the bypassed stretch will be removed and it will be reinstated as amenity grassland.

Sources of Impact

8.2.34 The sources of potential impacts associated with the proposal can be listed as follows:

- Losses of suspended solids.
- Cement spillages.
- Hydrocarbon leaks and spills.
- Increased water levels in the inner estuary.

Losses of Suspended Solids

8.2.35 These would be associated with vehicular traffic at the viaduct weir and the importation of stone to construct the temporary running track to allow for vehicle access.

8.2.36 Ground damage during ground preparation works along the sloped approaches to the more downstream crossing of the Pill River.

8.2.37 Stockpiling of spoil or fill adjoining watercourses may also be a source of solids.

8.2.38 Disturbance of the banks beside the Pill River while inserting the bridge abutments could give rise to some solids loss to the Pill River channel.

8.2.39 Exposed soil during excavation and realignment of Corballis Cottages Road.

8.2.40 In each case the receiving waters for any generated suspended solids are already very turbid, this is especially the case in the Pill River and the Malahide Estuary where the Pill River discharges. In each case the habitats present and their associated fauna and flora have developed in a highly turbid environment such that temporary increases in turbidity are unlikely to have a significant negative impact. Nevertheless, mitigation measures will be provided in order to minimise this potential risk.

Cement/Concrete Spillage

8.2.41 Liquid concrete is a highly alkaline material which can have very serious adverse impacts if discharged accidentally to surface waters causing potentially large scale fish and invertebrate mortalities, depending on the size of the spill. However, basic good construction practice can readily prevent such accidents and the likelihood of a spill is therefore considered very low. Concrete will be used to construct the abutments and piers for the River Pill crossings and to grout the butt joints of the footbridge spans across the weir at the railway viaduct.

Hydrocarbon Leaks and Spills

8.2.42 Hydrocarbon leaks and spills from construction vehicles or fuel storage areas could be very damaging to invertebrate fauna, including filter feeders, fish and macroalgae exposed to oil slicks, depending on the size of the spill involved. Again, good site and plant management can easily avoid these impacts.

Increased Water Levels in the Inner Estuary

8.2.43 It is not thought likely that the minor increase in water levels in the inner Malahide Estuary caused by the temporary modification of the weir surface will give rise to any significant adverse impacts in the inner estuary. This is as the significant part of the

habitat is open water, and will therefore not experience any reduction. However, the reduction in the outflow rate from the inner estuary will result in a temporary and short-term rise in average water depth, which in turn will give rise to a reduction in the area of mudflat uncovered at low tide at the western narrow end at Seatown, where mudflats currently exist at low tide. The extent of the affected area was deduced by assessing the effect of the change of level on the water line during low tide over a range of tidal heights (see Volume 4C-Appendix 16).

8.2.44 The duration of this impact will be just eight weeks in total. However, even during this period actual alteration from the current situation will be much shorter than eight weeks. Currently, the design of the weir crest is such that the tidal levels inside the causeway mimic exactly those which obtained before the weir was reconstructed following the railway viaduct collapse. This final design was developed after an extensive hydraulic modelling exercise which involved extensive consultation with the NPWS who approved the outcome. Once the eight week period required for the insertion of the walkway across the viaduct ope is completed then the weir will revert to its current configuration and the water level fluctuations inside the causeway will revert to their current amplitude and periodicity. At present the mudflats in the inner western extremity of the estuary are exposed during low water of both spring and neap tides, however the degree of exposure is very different. During low neap tides they are exposed to their greatest extent while during low spring tide they are, somewhat counterintuitively, almost entirely covered and that is because during the spring ebb there is insufficient time for the large volume of water that entered during the flood tide to exit via the weir opening. This in effect means that even during the existing tidal conditions the bulk of the mudflats remain inundated for a far greater time than they are exposed. The period of increased inundation resulting from the temporary raising of the water levels will in effect only be a fraction of the eight-week period during which these alterations prevail. This is borne out by the results of an additional modelling exercise which compared the degree of exposure of the inner mudflats at various tidal levels under the existing weir design with those that will obtain during the temporary alterations to it (Fluvio Report, 2015 in Volume 4C-Appendix 16). This shows that during low spring tides there was virtually no difference between the degree of mudflat exposure, with both scenarios resulting in virtually full mudflat inundation, with the existing scenario resulting in just a few hundred square metres greater exposure, overall, than the altered scenario (Fluvio Report, 2015–Appendix 13, third figure). At neap tide the situation differs, with about 4-5ha of mudflat more exposed at low neap tide during the existing weir configuration as opposed to the temporarily altered layout (Fluvio Report, 2015–Appendix 14). In effect for a few weeks other than usual, this part of the Broadmeadow Water is acting more as a lagoon than a tidal flat.

8.2.45 The dominant fauna at the site are *Hediste diversicolor* and Chironomid larvae, both groups known to be typical marine/brackish lagoon dwellers both in Ireland (Healy *et al.*, 1982) and abroad. These very short term changes in the degree of inundation of the mudflats will have no impact on the benthic community in these mudflats and therefore no adverse impact will occur to the conservation objectives of the Malahide Estuary SAC as a result of the temporary change to the weir configuration.

Mitigation Measures

Construction Environmental Management Plan

8.2.46 The appointed contractor(s) to undertake the proposed construction work will be required to draw up a detailed Construction Environmental Management Plan (see Chapter 3) which will detail the methods that will be adopted to prevent pollution of the receiving aquatic environment during the construction phase.

Suspended Solids

8.2.47 Only clean stone low in fines will be used to temporarily modify the weir surface thereby significantly decreasing the potential for increased suspended solids during the construction of the 180m bridge at the viaduct.

8.2.48 At the two Pill River bridging points, vehicles will not be permitted to cross the channel. However, if that is deemed necessary, then temporary bridging structures will be used in order to prevent damage to banks and the channel bed that would give rise to increased suspended solids release.

8.2.49 The access track to the works area at the Pill River bridges will be lined with a geogrid and geotextile and topped with clean crushed stone to prevent ground damage and potential subsequent washout of suspended solids into the Pill River and Malahide Estuary. This will be particularly important when inserting the bridge piers at the lower Pill crossing adjacent to the railway embankment where the ground slopes to the river. At these points the ground will be raised using clean crushed rock to form a working platform on the south side of the channel for the pier piling rigs. The base of these temporary platforms will be ringed with silt fences to minimise any escape of fines and sediment from the works area to the Pill River.

8.2.50 All materials excavated in order to construct the bridge abutments will be removed off site and not stockpiled beside the watercourse.

8.2.51 Where it is necessary to de-water excavations all of the water arising will be treated by settlement or filtration before it is discharged back into the Pill River in order to prevent solids contaminated water entering the watercourse.

8.2.52 Check dams will be introduced into the surface drainage if there is evidence of solids run-off from the site.

8.2.53 Soil will not be stockpiled within 10m of surface waters. Where stockpiling is necessary, these will be covered to prevent erosion of solids during heavy rainfall. All stockpiles of materials will be ringed at the base with silt fencing.

8.2.54 Regular inspections of stockpiled soil will be made especially during heavy rainfall events and, if there are signs of solids washout, silt fences will be interposed between the stockpiles and any surface drains.

8.2.55 Particular care will be taken to ensure the support and integrity of form work for the bridge abutments and piers to prevent any concrete spills during or after pours, which will be carefully monitored.

Cement

8.2.56 All shuttering used for *in situ* deck grouting on the weir bridge and for construction of the bridge piers/abutments for the two bridges over the Pill River will be designed to be fit for purpose and carefully checked for integrity before each concrete pour.

8.2.57 All concrete pours will be attended and monitored for any signs of spillage or leakage.

Hydrocarbons

8.2.58 All fuel storage areas will be securely locked and bunded and sited on level ground at least 10m back from surface waters. No vehicles will be refuelled beside watercourses. All construction vehicles and plant will be well maintained and checked for oil or fuel leaks. Pumps and generators will be placed on drip trays to catch leaks.

8.2.59 Oil booms and spill kits shall be available at all times on site and be readily accessible in the event of a spill.

Residual Impacts

8.2.60 Provided the mitigation measures outlined are implemented in full, or are substituted with alternatives designed to result in the same outcome, then no significant adverse impact is expected to impact the aquatic habitats or species along the route of the proposed greenway. There will be a temporary (eight weeks) small-scale reduction in the area of mudflat in the western portion of the inner part of the Malahide Estuary, however this will be fully reversible and therefore only constitutes a temporary and minor adverse impact.

Cumulative Impacts

8.2.61 It is not anticipated that a cumulative impact of significance will arise from the operation of local and regional development plans or projects immediate to this project.

9.0 Air and Climate

9.1 Introduction

9.1.1 This chapter considers an assessment into the likely impact on air quality and climate associated with the proposed greenway.

Ambient Air Quality Standards

9.1.2 In order to reduce the risk to health from poor air quality, national and European statutory bodies have set limit values in ambient air for a range of air pollutants. These limit values or "Air Quality Standards" are health or environmental-based levels for which additional factors may be considered. For example, natural background levels, environmental conditions and socio-economic factors may all play a part in the limit value which is set (see Table 9.1 below and Volume 4C-Appendix 14).

9.1.3 Air quality significance criteria are assessed on the basis of compliance with the appropriate standards or limit values. The applicable standards in Ireland include the Air Quality Standards Regulations (2011), which incorporate EU Directive 2008/50/EC which combines the previous air quality framework and subsequent daughter directives (see Table 9.1 below). Although the EU air quality limit values are the basis of legislation, other thresholds outlined by the EU Directives are used which are triggers for particular actions (see Volume 4C-Appendix 14).

9.1.4 There are no statutory guidelines regarding the maximum dust deposition levels that may be generated during the construction phase of a development in Ireland. Furthermore, no specific criteria have been set in respect of this development. However, guidelines currently exist for dust emissions from quarrying and ancillary activities (DOEHLG, 2004). These can be implemented with regard to dust emissions from the proposed construction sites.

9.1.5 With regard to dust deposition, the German TA-Luft standard for dust deposition (non-hazardous dust) (German VDI, 2002) sets a maximum permissible immission level for dust deposition of 350 mg/(m^2*day) averaged over a one year period at any receptors outside the site boundary. Recommendations outlined by the DOEHLG (2004) guidelines apply the Bergerhoff limit of 350 mg/(m^2*day) to the site boundary of quarries.

9.1.6 The concern from a health perspective is focused on particles of dust which are less than 10 microns. EU ambient air quality standards (Council Directive 2008/50/EC transposed into Irish law as S.I. 180 of 2011) centres on PM_{10} (particles less than 10 microns) as it is these particles which have the potential to be inhaled into the lungs and cause some adverse health impact. The Directive also sets an ambient standard for $PM_{2.5}$ (particles less than 2.5 microns) which will come into force in 2015 (see Table 9.1 below).

Table 9.1 Air Quality Standards Regulations 2011 (Based on Directive 2008/50/EC and SI 180 of 2011).

Pollutant	Regulation [Note 1]	Limit Type	Margin of Tolerance	Value
Nitrogen Dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 18 times/year.	40% until 2003 reducing linearly to 0% by 2010	200 µg/m^3 NO_2
		Annual limit for protection of human health.	40% until 2003 reducing linearly to 0% by 2010	40 µg/m^3 NO_2
		Annual limit for protection of vegetation.	None	30 µg/m^3 $NO + NO_2$
Lead	2008/50/EC	Annual limit for protection of human health.	100%	0.5 µg/m^3
Sulphur dioxide	2008/50/EC	Hourly limit for protection of human health - not to be exceeded more than 24 times/year.	150 µg/m^3	350 µg/m^3
		Daily limit for protection of human health - not to be exceeded more than 3 times/year.	None	125 µg/m^3
		Annual & winter limit for the protection of ecosystems.	None	20 µg/m^3
Particulate Matter (as PM_{10})	2008/50/EC	24-hour limit for protection of human health - not to be exceeded more than 35 times/year.	50%	50 µg/m^3 PM_{10}
		Annual limit for protection of human health.	20%	40 µg/m^3 PM_{10}
$PM_{2.5}$ (Stage 1)	2008/50/EC	Annual limit for protection of human health.	20% from June 2008. Decreasing linearly to 0% by 2015	25 µg/m^3 $PM_{2.5}$
$PM_{2.5}$ (Stage 2)[Note 2]	-	Annual limit for protection of human health.	None	20 µg/m^3 $PM_{2.5}$
Benzene	2008/50/EC	Annual limit for protection of human health.	100% until 2006 reducing linearly to 0% by 2010	5 µg/m^3
Carbon monoxide	2008/50/EC	8-hour limit (on a rolling basis) for protection of human health.	60%	10 mg/m^3 (8.6 ppm)

Note 1 EU 2008/50/EC – Clean Air For Europe (CAFÉ) Directive replaces the previous Air Framework Directive (1996/30/EC) and daughter directives 1999/30/EC and 2000/69/EC

Note 2 EU 2008/50/EC states - 'Stage 2 — indicative limit value to be reviewed by the Commission in 2013 in the light of further information on health and environmental effects, technical feasibility and experience of the target value in Member States'.

Climate Agreements

9.1.7 Ireland ratified the United Nations Framework Convention on Climate Change (UNFCCC) in April 1994 and the Kyoto Protocol in principle in 1997 and formally in May 2002 (Framework Convention on Climate Change, 1997, 1999). For the purposes of the EU burden sharing agreement under Article 4 of the Kyoto Protocol, in June 1998, Ireland agreed to limit the net growth of the six GHGs under the Kyoto Protocol to 13% above the 1990 level over the period 2007 to 2012 (EPA, 2004) (ERM, 1998). The UNFCCC is continuing detailed negotiations in relation to GHGs reductions and in relation to technical issues such as emission trading and burden sharing. The most recent Conference of the Parties (COP22) to the agreement was convened in Marrakesh, Morocco in December 2016.

9.1.8 The previous conference in Paris, COP21, was an important milestone in terms of international climate change agreements. The "Paris Agreement", agreed by over 200 nations, has a stated aim of limiting global temperature increases to no more than 2°C above pre-industrial levels with efforts to limit this rise to 1.5°C. The aim is to limit global GHG emissions to 40 gigatonnes as soon as possible whilst acknowledging that peaking of GHG emissions will take longer for developing countries. Contributions to greenhouse gas emissions will be based on Intended Nationally Determined Contributions (INDCs) which will form the foundation for climate action post 2020. Significant progress was also made on elevating adaption onto the same level as action to cut and curb emissions.

9.1.9 The EU, on the 23rd/24th of October 2014, agreed the "2030 Climate and Energy Policy Framework" (EU, 2014). The European Council endorsed a binding EU target of at least a 40% domestic reduction in greenhouse gas emissions by 2030 compared to 1990. The target will be delivered collectively by the EU in the most cost-effective manner possible, with the reductions in the ETS and non-ETS sectors amounting to 43% and 30% by 2030 compared to 2005, respectively. Secondly, it was agreed that all Member States will participate in this effort, balancing considerations of fairness and solidarity. The policy also outlines, under "Renewables and Energy Efficiency", an EU binding target of at least 27% for the share of renewable energy consumed in the EU in 2030.

9.1.10 The Climate Action and Low Carbon Development Act 2015 outlines in Section 15 "Duties of Certain Bodies", that a local authority should have regard to the following:

- The most recent approved national mitigation plan;
- The most recent approved national adaptation framework and approved sectoral adaptation plans;
- The furtherance of the national transition objective; and
- The objective of mitigating greenhouse gas emissions and adapting to the effects of climate change in the State.

9.2 Data and Methodology

9.2.1 The assessment of air quality has been carried out using a phased approach as recommended by the UK DEFRA (UK DEFRA, 2009) (UK DETR, 1998). The phased approach recommends that the complexity of an air quality assessment be consistent with the risk of failing to achieve the air quality standards. In the current assessment,

an initial scoping of possible key pollutants was carried out and the likely location of air pollution "hot-spots" identified. An examination of recent EPA data (EPA, 2016a) has indicated that SO_2, smoke, CO and Benzene are unlikely to be exceeded at locations such as the current one and thus these pollutants do not require detailed monitoring or assessment to be carried out.

9.2.2 The current assessment thus focused firstly on identifying the existing baseline levels of NO_2 and PM_{10} in the region of the proposed greenway by an assessment of EPA monitoring data. Thereafter, the impact of the development during the construction phase of the project on air quality at the neighbouring sensitive receptors was determined by an assessment of the dust generating construction activities associated with the proposed greenway. The impact of dust from the construction phase is short-term in nature and is assessed below (paragraphs 9.6.1 to 9.6.3).

9.3 Existing Environment

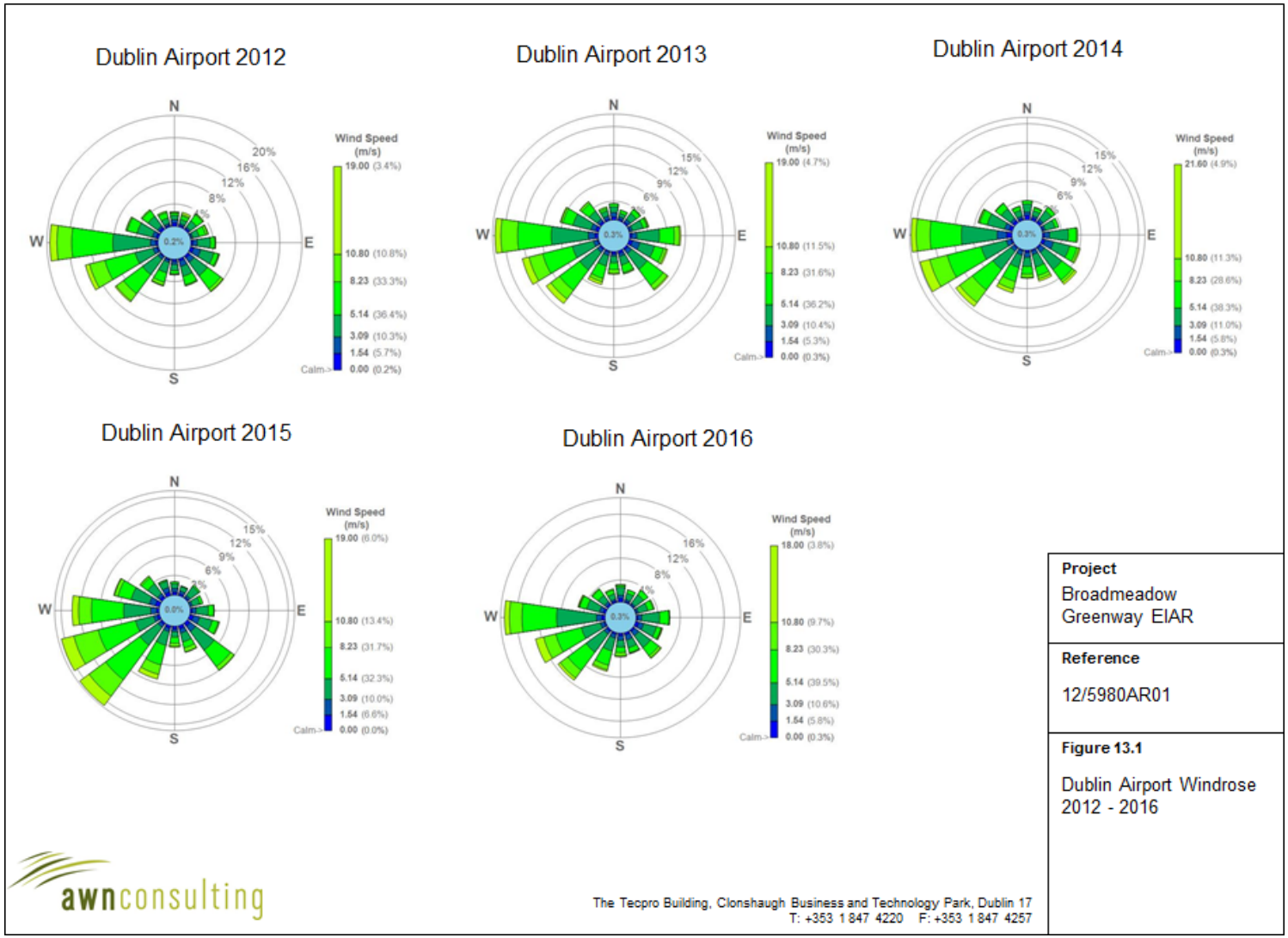
Meteorological Data

9.3.1 A key factor in assessing temporal and spatial variations in air quality is the prevailing meteorological conditions. Depending on wind speed and direction, individual receptors may experience very significant variations in pollutant levels under the same source strength (i.e. traffic levels) (WHO, 2006). Wind is of key importance in dispersing air pollutants and for ground level sources, such as traffic emissions, pollutant concentrations are generally inversely related to wind speed. Thus, concentrations of pollutants derived from traffic sources will generally be greatest under very calm conditions and low wind speeds when the movement of air is restricted. In relation to PM_{10}, the situation is more complex due to the range of sources of this pollutant. Smaller particles (less than $PM_{2.5}$) from traffic sources will be dispersed more rapidly at higher wind speeds. However, fugitive emissions of coarse particles ($PM_{2.5}$–PM_{10}) will actually increase at higher wind speeds. Thus, measured levels of PM_{10} will be a nonlinear function of wind speed.

9.3.2 The nearest representative weather station collating detailed weather records is Dublin Airport, which is located approximately 6.5km southwest of the site. Dublin Airport meteorological data has been examined to identify the prevailing wind direction and average wind speeds over a five-year period (see Text Figure 9.1 below). For data collated during five representative years (2012-2016), the predominant wind direction is westerly and southwesterly. The mean wind speed is approximately 5.3m/s over the period 1981–2010.

Available Background Data

9.3.3 As part of the implementation of the Framework Directive on Air Quality (1996/62/EC), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA, 2014b). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 21 towns with a population of greater than 15,000. The remainder of the country, which represents rural Ireland but also includes all towns with a population of less than 15,000, is defined as Zone D. In terms of air monitoring, the study area south of the Malahide Estuary is categorised as Zone A whilst the study area within the Malahide Estuary and north of the estuary around Donabate is categorised as Zone D (EPA, 2016b).



Text Figure 9.1 Dublin Airport Windrose 2012-2016.

9.3.4 Air quality monitoring programs have been undertaken throughout Ireland in recent years by the EPA and local authorities. The most recent EPA annual report on air quality monitoring undertaken throughout Ireland is entitled *Air Quality in Ireland 2015 - Key Indicators of Ambient Air Quality* (EPA, 2016a). Although no EPA or Local Authority monitoring has been carried out within the study area, data from Zone A and D locations in Ireland can be used to provide an indication of the prevailing air quality conditions.

9.3.5 With regard to NO_2, continuous monitoring data from the EPA at suburban Zone A locations in Rathmines, Dun Laoghaire, Blanchardstown and Swords show that current levels of NO_2 are below the annual limit value with few exceedances of the one-hour limit value. Average levels ranged from 13µg/m^3 in Swords to 25µg/m^3 in Blanchardstown in 2015. Based on these results, a conservative estimate of the background NO_2 concentration in Malahide in 2017 is 20µg/m^3.

9.3.6 The results of NO_2 monitoring carried out at the Zone D locations of Castlebar, Emo Court and Kilkitt in 2015 indicated an average NO_2 concentration of between 2-8µg/m^3 with no exceedances of the one-hour limit value. Long-term NO_2 monitoring was carried out at two Zone C locations, Kilkenny Seville Lodge and Portlaoise. The NO_2 annual average in 2015 for these sites was between 5-10µg/m^3 with no exceedance of the one-hour limit value. Hence, the long-term average concentrations measured at these locations were significantly lower than the annual average limit value of 40µg/m^3. Based on the above information, a conservative estimate of the 2017 background NO_2 concentration in Donabate is 12µg/m^3.

9.3.7 Continuous PM_{10} monitoring carried out at the suburban locations of Rathmines, Blanchardstown, St Anne's Park, Davitt Road, Ballyfermot, Dun Laoghaire and Tallaght showed average levels of 12-17µg/m^3 in 2015 with at most 9 exceedances (in Blanchardstown) of the 24-hour limit value of 50µg/m^3 (35 exceedances are permitted per year). In addition, the average PM_{10} level at the urban background monitoring location in the Phoenix Park in 2015 was 12µg/m^3, with only two exceedances of 50µg/m^3. Based on the EPA data, a conservative estimate of the background PM_{10} concentration in Malahide in 2017 is 18µg/m^3.

9.3.8 Long-term PM_{10} monitoring was carried out at the urban Zone D locations of Castlebar and Claremorris in 2015. The average concentrations measured at each of these sites were 13 and 10µg/m^3, respectively. Long-term PM_{10} measurements carried out at the rural Zone D location in Kilkitt in 2015 gave an average level of 9µg/m^3. Based on the above information a conservative estimate of the 2017 background PM_{10} concentration for Donabate in 2017 is 14µg/m^3.

9.3.9 A study by the UK ODPM (UK ODPM, 2000) gives estimates of likely dust deposition levels in specific types of environments. In open country a level of 39 mg/(m^2*day) is typical, rising to 59mg/(m^2*day) on the outskirts of town and peaking at 127mg/(m^2*day) for a purely industrial area. As a worst case, a level of 127mg/(m^2*day) can be estimated as the existing dust deposition level for the current location.

Characteristics of the Proposal

9.3.10 Construction phases for the proposal will be the key aspect in relation to the air quality assessment.

9.3.11 Main construction aspects of the development include:

- Footpath construction.
- Cycle lane construction.
- Pedestrian crossing construction.

9.3.12 There is the potential for a number of emissions to the atmosphere during the construction of the proposed greenway. In particular, the construction activities may generate quantities of dust. Construction vehicles, generators etc, will also give rise to some exhaust emissions. A dust minimisation plan will be formulated for the construction phase, as construction activities are likely to generate some dust emissions (see paragraphs 9.5.1 to 9.5.6 below).

9.4 Potential Impacts

Construction Phase – Dust Generation Rates

9.4.1 Material handling activities on site may typically emit dust. Dust is characterised as encompassing particulate matter with a particle size of between 1 and 75 microns (1-75µm). Deposition typically occurs in close proximity to each site and potential impacts generally occur within 500m of the dust generating activity as dust particles fall out of suspension in the air. Larger particles deposit closer to the generating source and deposition rates will decrease with distance from the source. Sensitivity to dust depends on the duration of the dust deposition, the dust generating activity, and the nature of the deposit. Therefore, a higher tolerance of dust deposition is likely to be shown if only short periods of dust deposition are expected and the dust generating activity is either expected to stop or move on.

9.4.2 The potential for dust to be emitted will depend on the type of activity being carried out in conjunction with environmental factors including levels of rainfall, wind speed and wind direction.

9.4.3 As indicated, dust generation rates depend on the site activity, particle size (in particular the silt content, defined as particles smaller than 75 microns in size), the moisture content of the material and weather conditions. Dust emissions are dramatically reduced where rainfall has occurred due to the cohesion created between dust particles and water and the removal of suspended dust from the air. It is typical to assume no dust is generated under “wet day” conditions where rainfall greater than 0.2mm has fallen. Information collected from Dublin Airport Meteorological Station (1981-2010) identified that typically 191 days per annum are “wet”. Thus for greater than 52% of the time no significant dust generation will be likely due to meteorological conditions.

9.4.4 Large particle sizes (greater than 75 microns) fall rapidly out of atmospheric suspension and are subsequently deposited in close proximity to the source. Particle sizes of less than 75 microns are of interest as they can remain airborne for greater distances and give rise to the potential dust nuisance at the sensitive receptors. This size range would broadly be described as silt. Emission rates are normally predicted on a site-specific particle size distribution for each dust emission source.

9.4.5 Whilst construction activities are likely to produce some level of dust during earth moving and excavating phases of the project, these activities will mainly be confined to

particles of dust greater than 10 microns. Particles of dust greater than 10 microns are considered a nuisance but do not have the potential to cause significant health impacts. For instance, bulldozing and compacting operations release 84% of particles which are greater than PM_{10} with only 16% of particles being less than 10 microns (USEPA, 1986).

9.4.6 It is envisaged that the construction of the proposed greenway will occur in distinct phases. As such, the potential for dust nuisance and significant levels of PM_{10} & $PM_{2.5}$ concentrations will vary both temporally and spatially as the construction develops.

Climate Change

9.4.7 Construction traffic would be expected to be the dominant source of greenhouse gas emissions as a result of the proposed greenway. Vehicles will give rise to CO_2 and N_2O emissions during construction of the proposed greenway.

Operational Phase

Risk of Accidents/Disasters Including Those Caused by Climate Change

9.4.8 There is no significant risk of accidents/disasters including those caused by climate change due to air emissions or greenhouse gases released to atmosphere as part of the operational phase of the project.

9.4.9 Due to the size, nature and location of the proposed greenway, which will lead to no significant increase in road traffic emissions, the proposed greenway is expected to have an imperceptible impact on air quality and climate.

9.5 Mitigation Measures

Construction Phase

9.5.1 A dust minimisation plan will be formulated for the construction phase of the project, as construction activities are likely to generate some dust emissions. The potential for dust to be emitted depends on the type of construction activity being carried out in conjunction with environmental factors including levels of rainfall, wind speeds and wind direction. The potential for impact from dust depends on the distance to potentially sensitive locations and whether the wind can carry the dust to these locations. The majority of any dust produced will be deposited close to the potential source and any impacts from dust deposition will typically be within several hundred metres of the construction area (UK ODPM, 2000).

9.5.2 In order to ensure that no dust nuisance occurs, a series of measures will be implemented. Site roads shall be regularly cleaned and maintained as appropriate. Hard surface roads shall be swept to remove mud and aggregate materials from their surface. Furthermore, any road that has the potential to give rise to fugitive dust must be regularly watered, as appropriate, during dry and/or windy conditions.

9.5.3 Speeds shall be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential shall be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

9.5.4 Public roads in the vicinity of the site shall be regularly inspected for cleanliness, and cleaned as necessary.

9.5.5 At all times, the dust mitigation measures put in place will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of materials will be immediately terminated and satisfactory procedures implemented to rectify the problem before the resumption of operations.

9.5.6 The dust minimisation plan shall be reviewed at regular intervals during the construction phase to ensure the effectiveness of the procedures in place and to maintain the goal of minimisation of dust through the use of best practice and procedures.

Operational Phase

9.5.7 No mitigation measures are necessary.

9.6 Residual Impact

Construction Phase

9.6.1 With effective implementation of a dust minimisation plan, the proposed greenway is expected to have a negligible impact on air quality. Hence the impact on air quality of the proposed greenway during the construction phase will be insignificant.

Operational Phase

9.6.2 The impact on air quality from the proposal during the operational phase will be insignificant as there will be no significant change in traffic volumes as a result of the scheme.

Climate Change

9.6.3 Current EPA guidance states that a development may have an influence on global climate where it represents "a significant proportion of the national contribution to greenhouse gases" (EPA, 2003). The draft "*Guidelines on the information to be Contained In Environmental Impact Assessment Reports (EIAR)*" (EPA, 2017) state that impacts relevant to adaptation should be assessed and that projects should be assessed in terms of their vulnerability to climate change in addition to determining the nature and magnitude of greenhouse gas emissions. Greenhouse gas emissions as a result of this greenway will be insignificant in terms of national CO_2 emissions and Ireland's agreed limit under the Kyoto Protocol (Framework Convention on Climate Change, 1997, 1999) and the EU Effort Sharing Agreement (20-20-20 Targets). Thus, the impact of the proposed greenway on climate will be insignificant. However, there is the potential that the project may be susceptible to climate change due to rising sea levels and increased risk of flooding. These issues have been addressed in the relevant sections of the EIAR.

9.7 Cumulative Impacts

9.7.1 It is not anticipated that, given current knowledge, any plan or other project would result in full or in part to a potential significant impact for this environmental topic.

10.0 Noise and Vibration

10.1 Introduction

10.1.1 This chapter reviews the potential impacts of the proposed development in terms of noise and vibration. For the purposes of this assessment consideration has been given to guidance contained within a variety of best practice national and international guidance documents. Due to the nature of the project under consideration here the main noise and vibration impacts associated with it relate to the construction works associated with delivering the project.

10.1.2 Volume 4C-Appendix 15 presents a glossary of the acoustic terminology used in this chapter.

Fundamentals of Acoustics

10.1.3 In order to provide a broader understanding of some of the technical discussion in this chapter, a brief overview of the fundamentals of acoustics and the basis for the preparation of this noise assessment is provided here.

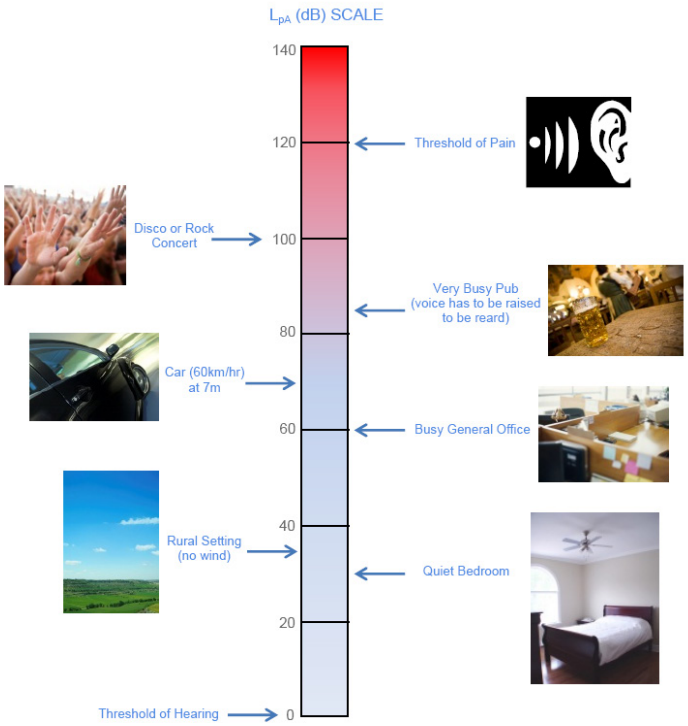
10.1.4 A sound wave travelling through the air is a regular disturbance of the atmospheric pressure. These pressure fluctuations are detected by the human ear, producing the sensation of hearing. In order to take account of the vast range of pressure levels that can be detected by the ear, it is convenient to measure sound in terms of a logarithmic ratio of sound pressures. These values are expressed as Sound Pressure Levels (SPL) in decibels (dB).

10.1.5 The audible range of sounds expressed in terms of Sound Pressure Levels is 0dB (for the threshold of hearing) to 120dB (for the threshold of pain). In general, a subjective impression of doubling of loudness corresponds to a tenfold increase in sound energy which conveniently equates to a 10dB increase in SPL. It should be noted that a doubling in sound energy (such as may be caused by a doubling of traffic flows) increases the SPL by 3dB.

10.1.6 The frequency of sound is the rate at which a sound wave oscillates, and is expressed in Hertz (Hz). The sensitivity of the human ear to different frequencies in the audible range is not uniform. For example, hearing sensitivity decreases markedly as frequency falls below 250Hz. In order to rank the SPL of various noise sources, the measured level has to be adjusted to give comparatively more weight to the frequencies that are readily detected by the human ear. Several weighting mechanisms have been proposed but the 'A-weighting' system has been found to provide one of the best correlations with perceived loudness. SPLs measured using 'A-weighting' are expressed in terms of dB(A). An indication of the level of some common sounds on the dB(A) or LpA (dB) scale is presented in Text Figure 10.1 below.

10.1.7 The 'A' subscript denotes that the sound levels have been A-weighted. The established prediction and measurement techniques for this parameter are well developed and

widely applied. For a more detailed introduction to the basic principles of acoustics, reference should be made to an appropriate standard text[13].



Text Figure 10.1 dB(A) scale & Indicative Noise Levels – (EPA: Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4 – 2012))

10.2 Data and Methodology

10.2.1 For the purposes of this assessment it is appropriate to clearly define what is considered noise and additionally what constitutes a noise sensitive location. The following definitions have been sourced from the Environmental Protection Agency (EPA) document *Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4)*:

- Noise – Any sound, that has the potential to cause disturbance, discomfort or psychological stress to a person exposed to it, or any sound that could cause actual physiological harm to a person exposed to it, or physical damage to any structure exposed to it, is known as noise.
- Noise sensitive location NSL – any dwelling house, hotel or hostel, health building, educational establishment, place of worship or entertainment, or any other facility or other area of high amenity which for its proper enjoyment requires the absence of noise at nuisance levels.

Characteristics of the Proposed Development

10.2.2 The main potential noise and vibration related element of the proposed development is related to the short term impact of the construction phase. The longer term impact of the operational phase is not considered significant in this instance due to the

[13] For example, Woods Practical Guide to Noise Control by Ian Sharland.

activities that will take place on the proposed development are directly comparable to existing recreational activities that are undertaken in the immediate and wider area.

10.2.3 The primary sources of noise during the construction phase will be temporary and include:

- Footpath and cycle path.
- Pedestrian crossing construction.

10.2.4 The primary sources of vibration during the construction phase will be short-term and will typically relate to various ground work processes and installation of a proposed new pedestrian footbridge/cycleway adjacent to the railway viaduct at Malahide Estuary.

10.2.5 The primary sources of noise during the operational phase of the proposed development will be long-term and are typically related to pedestrian activities (i.e. walking, cycling, talking) that will not be of an order of magnitude to have a significant effect on the existing noise environment.

10.2.6 No significant sources of vibration will be present during the operational phase. There are therefore no predicted vibration impacts at neighbouring dwellings during the operational phase.

10.3 Existing Environment

10.3.1 A general description of the noise environment along various sections of the proposed development is detailed in the following paragraphs. Text Figure 10.2 below divides the proposed development into various sections to facilitate this discussion.

Section A

10.3.2 This section considers the area where the proposed development commences in the lands associated with the Malahide Castle demesne and runs to the edge of the Malahide village. It is identified by the red hatched line in Text Figure 10.2 below.

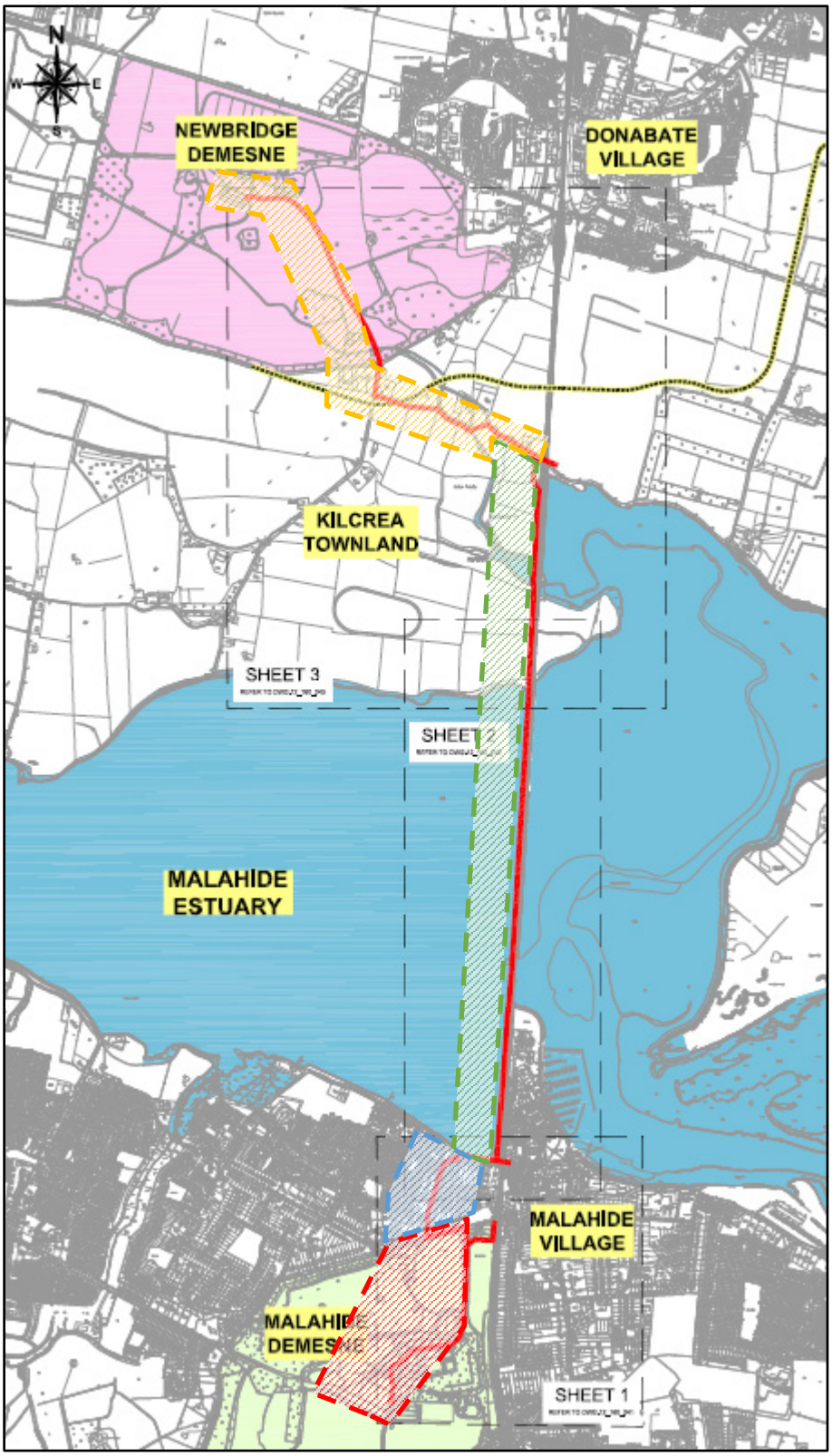
10.3.3 The ambient noise levels (i.e. L_{Aeq} levels) are dictated by patron activity within the demesne and distant road traffic noise associated with the local network. Ambient noise levels are also affected, by varying degrees depending on proximity, by train movements on the Dublin to Belfast rail line. Aircraft noise associated with Dublin Airport would also be expected in the area.

10.3.4 The strategic noise mapping completed by Fingal County Council for the area as part of the requirements of the *Environmental Noise Regulations*[14] (2006) has been reviewed and the expected ambient noise levels in the area are as follows:

L_{day} (dB)	$L_{evening}$ (dB)	L_{night} (dB)	L_{den} (dB)
<40-50	<40-50	<40-50	<40-50

10.3.5 Background noise levels in the area will be typically dictated by distant road traffic noise, wind generated noise and other anthropogenic sources.

[14] Which transpose into Irish law EU Directive 2002/49/EC.



Text Figure 10.2 Proposed Route – Prevailing Noise Levels.

Section B

10.3.6 This section considers the area where the proposed development commences in the town of Malahide and runs to the edge of the estuary. It is identified by the blue hatched line in Text Figure 10.2 above.

10.3.7 The ambient noise levels (i.e. L_{Aeq} levels) are dictated by road traffic noise associated with the local network. Ambient noise levels are also affected, by varying degrees depending on proximity, by train movements on the Dublin to Belfast rail line. Aircraft noise associated with Dublin Airport would also be expected in the area.

10.3.8 The strategic noise mapping completed by Fingal County Council for the area as part of the requirements of the Environmental Noise Regulations (2006) has been reviewed and the expected ambient noise levels in the area are as follows:

L_{day} (dB)	$L_{evening}$ (dB)	L_{night} (dB)	L_{den} (dB)
55–65	55–60	45–55	60–65

10.3.9 Note that review of the relevant strategic noise maps of the Malahide Demesne indicate that existing noise levels are some 10dB below the levels stated in the above table.

10.3.10 Background noise levels in the area will be typically dictated by distant road traffic noise, wind generated noise and other anthropogenic sources.

Section C

10.3.11 Covering the section of the proposed development that crosses the Malahide Estuary and passes through the Malahide Estuary SPA. This section is identified by the green hatched line in Text Figure 10.2 above.

10.3.12 The ambient noise levels (i.e. L_{Aeq} levels) are dictated by noise associated with train movements along the Dublin to Belfast railway line. To a lesser extent aircraft noise associated with Dublin Airport would also be expected in the area.

10.3.13 The strategic noise mapping completed by Fingal County Council for the area has been reviewed and the expected ambient noise levels in the area are as follows:

L_{day} (dB)	$L_{evening}$ (dB)	L_{night} (dB)	L_{den} (dB)
55–65	55–60	45–55	60–65

10.3.14 Background noise levels in the area will be typically dictated by distant road traffic noise, wind generated noise and other anthropogenic sources.

Section D

10.3.15 This section considers the area where the proposed development passes through the townland of Kilcrea and into Newbridge Demesne. It is identified by the orange hatched line in Text Figure 10.2 above.

10.3.16 The ambient noise levels (i.e. L_{Aeq} levels) and background noise levels are dictated by distant road traffic noise associated with the local network depending on the proximity to this infrastructure along with other anthropogenic sources.

10.3.17 The strategic noise mapping completed by Fingal County Council for the area has been reviewed and the expected ambient noise levels in the area are as follows:

L_{day} (dB)	$L_{evening}$ (dB)	L_{night} (dB)	L_{den} (dB)
≤45–50	≤45–50	≤45–50	≤45–55

Noise and Vibration Sensitive Locations

10.3.18 In general the noise sensitive locations consist primarily of residential houses located in the towns of Malahide at the southern end of the proposed development (i.e. Section B of Text Figure 10.1 above) and along local roads (i.e. northern half of Section D of Text Figure 10.1 above).

10.3.19 Other sensitive areas that should be noted relate to the Malahide Estuary SPA for its amenity and ecological value and Newbridge Demesne, again for its amenity value.

Existing Noise and Vibration Sources

10.3.20 As discussed the significant noise sources in the area relate to infrastructural elements including:

- The local road network.
- Dublin to Belfast railway line.
- Aircraft flight paths.

10.3.21 Vibration levels in the vicinity of existing sensitive properties are typically dictated by traffic movements on local roads and rail network. Levels associated with existing roads and rail would not be expected to be of a magnitude sufficient to cause disturbance to people or structural damage to property.

10.4 Appropriate Guidance

Construction Phase

Noise Criteria

10.4.1 There is no published statutory Irish guidance relating to the maximum permissible noise level that may be generated during the construction phase of a project. Local authorities normally control construction activities by imposing limits on the hours of operation and consider noise limits at their discretion.

10.4.2 In the absence of specific noise limits, appropriate criteria relating to permissible construction noise levels for a development of this scale may be found in the British Standard *BS 5228 – 1: 2009+A1: Code of practice for noise and vibration control on construction and open sites – Noise.*

10.4.3 The approach adopted here calls for the designation of a noise sensitive location into a specific category (A, B or C) based on existing ambient noise levels in the absence of construction noise. This then sets a threshold noise value that, if exceeded at this location, indicates a significant noise impact is associated with the construction activities.

10.4.4 This document sets out guidance on permissible noise levels relative to the existing noise environment. Table 10.1 sets out the values which, when exceeded, signify a significant effect at the facades of residential receptors as recommended by *BS 5228 – 1+A1*. These are cumulative levels, i.e. the sum of both ambient and construction noise levels.

Table 10.1 Example Threshold of Significant Effect at Dwellings.

Assessment Category and Threshold Value Period (L_{Aeq})	Threshold Value, in decibels (dB)		
	Category A [A]	Category B [B]	Category C [C]
Night-time (23:00 to 07:00hrs)	45	50	55
Evenings and weekends [D]	55	60	65
Daytime (07:00 – 19:00) and Saturdays (07:00 – 13:00)	65	70	75

A) Category A: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are less than these values.
B) Category B: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are the same as category A values.
C) Category C: threshold values to use when ambient noise levels (when rounded to the nearest 5dB) are higher than category A values.
D) 19:00–23:00 weekdays, 13:00–23:00 Saturdays and 07:00–23:00 Sundays.

10.4.5 It should be noted that this assessment method is only valid for residential properties. For the appropriate periods (i.e. daytime, evening and night time) the ambient noise level is determined and rounded to the nearest 5dB.

10.4.6 This assessment process determines if a significant construction noise impact is likely. Notwithstanding the outcome of this assessment, the overall acceptable levels of construction noise set out in the Transport Infrastructure Ireland (TII) publication *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*, which should not be exceeded at noise sensitive locations during the construction phase of the development. Table 10.2 sets out these levels.

Table 10.2 Maximum permissible noise levels at the facade of dwellings during construction.

Days and Times	Noise Levels (dB re. $2x10^{-5}$ Pa)	
	$L_{Aeq(1hr)}$	L_{Amax}
Monday to Friday 07:00 to 19:00hrs	70	80
Monday to Friday 19:00 to 22:00hrs	60*	65*
Saturdays 08:00 to 16:30hrs	65	75
Sundays & Bank Holidays 08:00 to 16:30hrs	60*	65*

Note * Construction activity at these times, other than that required for emergency works, will normally require the explicit permission of the relevant local authority.

Vibration Criteria

10.4.7 Guidance relevant to acceptable vibration within buildings is contained in the following documents:

- BS7385 – *Evaluation and measurement for vibration in buildings – Part 2: Guide to damage levels from groundborne vibration* (1993); and
- BS5228 – *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration* (2009).

10.4.8 BS7385 states that there should typically be no cosmetic damage if transient vibration does not exceed 15mm/s at low frequencies rising to 20mm/s at 15Hz and 50mm/s at 40Hz and above. These guidelines relate to relatively modern buildings and should be reduced to 50% or less for more critical buildings.

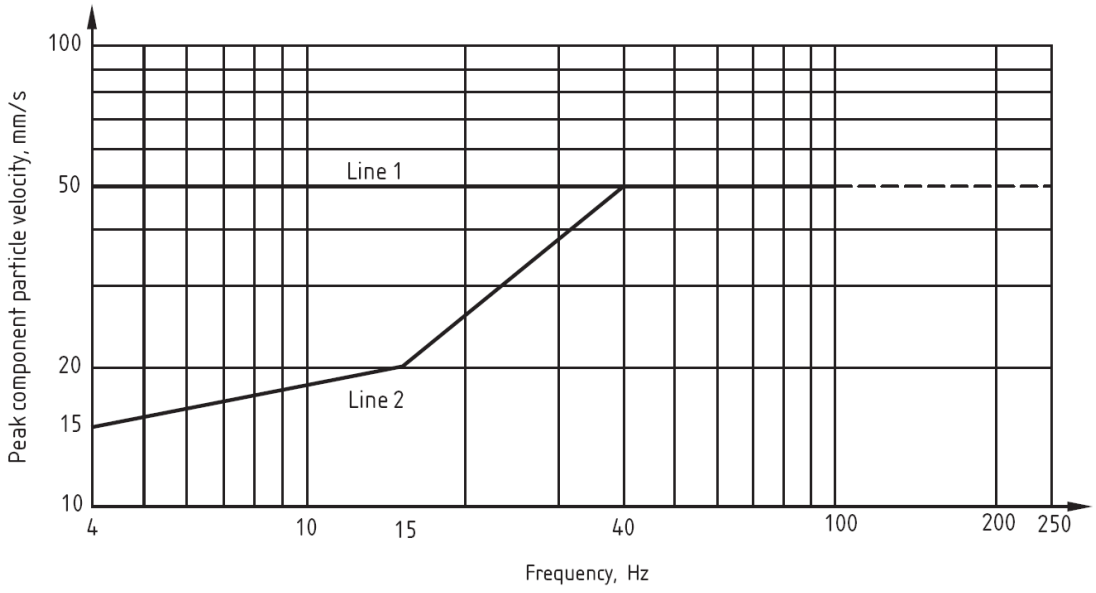
10.4.9 BS5228 recommends that, for soundly constructed residential property and similar structures that are generally in good repair, a threshold for minor or cosmetic (i.e. non-structural) damage should be taken as a peak particle velocity of 15mm/s for transient vibration at frequencies below 15 Hz and 20mm/s at frequencies above than 15Hz. Below these vibration magnitudes minor damage is unlikely, although where there is existing damage these limits may be reduced by up to 50%. In addition, where continuous vibration is such that resonances are excited within structures the limits discussed above may need to be reduced by 50%.

10.4.10 Allowable vibration (in terms of peak particle velocity) at the closest part of sensitive property to the source of vibration, at a frequency of:

Table 10.3 Transient Vibration Guide Values for Cosmetic Building Damage (BS 5228-2:2009).

Line (see Text Figure 10.3)	Type of Building	Peak Component Particle Velocity in Frequency Range of Predominant Pulse	
		4Hz to 15Hz	15Hz and above
1	Reinforced or framed structures Industrial and heavy commercial buildings.	50mm/s at 4Hz and above	
2	Unreinforced or light framed structures. Residential or light commercial building types.	15mm/s at 4Hz increasing to 20 mm/s at 15Hz	20mm/s at 15Hz increasing to 50 mm/s at 40Hz and above.

Note 1 Values referred to are at the base of the building.
Note 2 For Line 2, at frequencies below 4Hz, a maximum displacement of 0.6mm (zero to peak) should not be exceeded.



Text Figure 10.3 Transient Vibration Guide Values for Cosmetic Damage (Source – BS 5228-2: 2009).

Operational Phase

10.4.11 Recommended external daytime noise levels may be taken from the *Guidelines for Community Noise* (WHO, 1995):

> "To protect the majority of people from being moderately annoyed during the daytime, the sound pressure level should not exceed a free-field noise level of 50dB L_{Aeq}".

10.4.12 The WHO criterion is a level desirable to prevent any significant community annoyance.

10.4.13 The National Physical Laboratory (NPL) report (MAM16) entitled *Health Effect – Based Noise Assessment Methods: A Review and Feasibility Study*, dated September 1998 comments on the WHO approach. The WHO levels are those for which the effects are considered negligible.

10.4.14 The NPL report considers it is unwise to use the WHO levels as target for any form of strategic assessment. The guidance contained within this document stipulates that a level of 55dB $L_{Aeq(16hr)}$ or below represents a good outdoor environment, whereas levels above 63dB $L_{Aeq(16hr)}$ are regarded as undesirable.

10.4.15 On the above basis, where practicable external noise levels should be kept below 55dB $L_{Aeq(16hr)}$ to provide a good outdoor environment, however, all noise levels below 63dB $L_{Aeq(16hr)}$ free-field are considered to provide reasonable conditions in external amenity areas to dwellings.

10.4.16 Note that it is not envisioned that the proposed development will be used to any significant extent during night time hours (i.e. 23:00 to 07:00hrs).

10.5 Potential Impacts

Construction Phase

10.5.1 It is predicted that the construction programme will create typical construction activity related noise across the study area for periods as the works progress. During the construction phase of the proposed development, a variety of items of plant will be in use, such as rock breakers, excavators, lifting equipment, dumper trucks, compressors and generators.

10.5.2 The proposed general construction hours are understood to be 07:00 to 19:00hrs, Monday to Friday and 08:00 to 13:00hrs on Saturdays.

10.5.3 Due to the nature of daytime activities undertaken on a construction site of this nature, there is potential for generation of significant levels of noise during particular phases of the works.

10.5.4 The flow of vehicular traffic to and from a construction site is also a potential source of relatively high noise levels. The potential for vibration at neighbouring sensitive locations during construction is typically limited to excavation works and truck movements on uneven road surfaces. Due to the proximity of sensitive locations to site works, however, there is little likelihood of structural or even cosmetic damage to existing neighbouring dwellings as a result of vibration.

10.5.5 It is possible to predict typical construction noise levels using guidance set out in *BS 5228 1: 2009*. Table 10.4 outlines typical plant items and associated noise levels that are anticipated for various phases of the construction programme.

Table 10.4 Typical Noise Levels Associated with Construction Plant Items.

Item of Plant (BS5228-1 Ref.)	Construction Noise Level (dB $L_{Aeq(1hr)}$)					
	10m	20m	40m	60m	80m	100m
Pneumatic Breaker (D2.2)	81	75	69	65	63	61
Rock Breaker (C9.12)	85	79	73	69	67	65
Wheeled Loader (D3 1)	75	69	63	59	57	55
Track Excavator (C2 22)	72	66	60	56	54	52
Dozer (C2.13)	78	72	66	62	60	58
Dump Truck (C4.2)	78	72	66	62	60	58
Concrete Pump (C3.25)	78	72	66	62	60	58
Compressor (D7 6)	77	71	65	61	59	57
Poker Vibrator (C4 33)	78	72	66	62	60	58
Articulated Truck (C11.10)	77	71	65	61	59	57
Hand Tools	81	75	69	65	63	61
Pneumatic Circular Saw (D7.79)	75	69	63	59	57	55
Dump Truck (C4.2)	78	72	66	62	60	58
Surfacing (D8.25)	68	62	56	52	50	48

10.5.6 Guidance in relation to construction noise criteria indicates that the threshold where a significant impact occurs is 65dB $L_{Aeq,1hr}$ at noise sensitive locations. Review of the indicative predictions indicates that this level is typically exceeded at a distance of the order of 40m. Where works are proposed in the vicinity of residential properties within 40m appropriate consideration shall be given to the implementation of an appropriate range of mitigation measures. A range of measures that will be considered on a case by case basis are outlined in the relevant section of this report.

10.5.7 Certain works will be undertaken in the vicinity of the Malahide Estuary SPA. It should be noted that noise and vibration levels generated by the construction works in this area will be comparable to existing levels of noise and vibration generated by train movements on the nearby Dublin to Belfast railway. A solid barrier is to be constructed. The 1.4m high barrier is required to minimise the effect/disturbance to estuary wildlife by blocking the leg movement of the pedestrian users which is understood to disturb birds. It is understood that based on the assessments carried out by others the use of a 'dry stone wall' or a 'precast wall' with a suitable stone finish is proposed. Due consultation should be undertaken with the relevant ecologist and interested bodies in order to schedule construction works in these areas at appropriate times. Where it is considered that noise levels need to be mitigated the construction mitigation measures outlined in the relevant sections of this report should be considered as appropriate.

10.5.8 In terms of noise associated with these construction activities the associated effect is stated to be:

Quality	Significance	Duration
Negative	Slight	Short Term

10.5.9 It terms of vibration due to the distance of activities from the site to the nearest sensitive locations and controlling vibration levels to those detailed in this assessment in terms of the construction phase the associated effect is stated to be:

Quality	Significance	Duration
Neutral	Imperceptible	Short Term

Operational Phase

10.5.10 As previously discussed the day to day activities associated with the proposed development will not have a significant noise or vibration impact on sensitive receptors within the study area. The proposal would not be expected to alter the existing noise environment/soundscape to any significant degree and the existing situation where anthropogenic sources dominate ambient and background noise levels in the area will remain.

Additional Traffic on Local Roads

10.5.11 In terms of the additional traffic on local roads that will be generated as a result of the proposed development the following comment is presented. Considering that in order to increase traffic noise levels by 1dB traffic volumes would need to increase by the order of 25% it is considered that additional traffic introduced onto the local road network due to the proposed development will not result in a significant noise impact.

10.5.12 In terms of noise associated with day to day activities the associated effect is stated to be as follows:

Quality	Significance	Duration
Neutral	Imperceptible	Long Term

10.5.13 There are no source of vibration associated with the day to day operation of the development that will give rise to impacts at nearby noise sensitive locations. In terms of these the operational phase of the development the associated effect is stated to be:

Quality	Significance	Duration
Neutral	Imperceptible	Long Term

10.6 Mitigation Measures

Construction Phase

10.6.1 It is considered that the construction phase would have the greater potential to generate noise and vibration impacts. In general, good practice measures as contained within BS5228:200 – *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* and *Part 2: Vibration* should be considered and implemented where necessary in order to mitigate any issues that may arise.

10.6.2 The works will be managed with a 'best practice' approach to dealing with potential noise and vibration emissions during the construction phase. The following guidance should be adopted by all contractors and sub-contractors involved in construction

activities on the site. The site manager should ensure that adequate instruction is provided to contractors regarding the control measures outlined here.

10.6.3 The assessment presented here for the construction activity has highlighted that construction noise and vibration levels can be controlled to within relevant criteria identified in the relevant sections of this report. The following measures and approaches will be considered as appropriate.

Hours of Work

10.6.4 The proposed general construction hours are 07:00 to 19:00hrs, Monday to Friday and 08:00 to 13:00hrs on Saturdays.

10.6.5 Weekday evening activities should be significantly reduced and generally only involve internal activities and concrete pouring which will be required during certain phases of the proposed development. As a result noise and vibration emissions from evening activities are expected to be significantly lower than for other general daytime activities.

Best Practice Guidelines for the Control of Noise and Vibration

10.6.6 BS5228 includes guidance on several aspects of construction site mitigation measures, including, but not limited to:

- Selection of quiet plant.
- Control of noise sources.
- Screening.
- Hours of work.
- Liaison with the public.
- Monitoring.

10.6.7 Detailed comment is offered on these items in the following paragraphs. Noise and vibration control measures that will be considered include the selection of suitable plant, enclosures and screens around noise sources, limiting the hours of work and monitoring.

Selection of Quiet Plant

10.6.8 This practice is recommended in relation to sites with static plant such as compressors and generators. It is recommended that these units be supplied with manufacturers' proprietary acoustic enclosures where possible. The potential for any item of plant to generate noise will be assessed prior to the item being brought onto the site. The least noisy item should be selected wherever possible. Should a particular item of plant already on the site be found to generate high noise levels, the first action should be to identify whether or not said item can be replaced with a quieter alternative.

General Comments on Noise Control at Source

10.6.9 If replacing a noisy item of plant is not a viable or practical option, consideration should be given to noise control "at source". This refers to the modification of an item of plant or the application of improved sound reduction methods in consultation with the supplier. For example, resonance effects in panel work or cover plates can be reduced through stiffening or application of damping compounds; rattling and grinding

noises can often be controlled by fixing resilient materials in between the surfaces in contact.

10.6.10 BS5228 states that "as far as reasonably practicable sources of significant noise should be enclosed". In applying this guidance, constraints such as mobility, ventilation, access and safety must be taken into account. Items suitable for enclosure include pumps and generators. Demountable enclosures will also be used to screen operatives using hand tools and will be moved around site as necessary.

10.6.11 In practice, a balance may need to be struck between the use of all available techniques and the resulting costs of doing so. As with Ireland's Environmental Protection Agency Act legislation, it is proposed that the concept of "best available techniques not entailing excessive cost" (BATNEEC) be adopted. Furthermore, proposed noise control techniques should be evaluated in light of their potential effect on occupational safety, etc.

10.6.12 BS5228 makes a number of recommendations in relation to "use and siting of equipment". These are all directly relevant and hence are reproduced in full. These recommendations will be adopted on site.

- "Plant should always be used in accordance with manufacturers' instructions. Care should be taken to site equipment away from noise-sensitive areas. Where possible, loading and unloading should also be carried out away from such areas. Special care will be necessary when work has to be carried out at night.
- Circumstances can arise when night-time working is unavoidable. Bearing in mind the special constraints under which such work has to be carried out, steps should be taken to minimise disturbance to occupants of nearby premises.
- Machines that may be in intermittent use should be shut down between work periods or should be throttled down to a minimum. Machines should not be left running unnecessarily, as this can be noisy and waste energy.
- Plant known to emit noise strongly in one direction should, when possible, be orientated so that the noise is directed away from noise-sensitive areas. Attendant operators of the plant can also benefit from this acoustical phenomenon by sheltering, when possible, in the area with reduced noise levels.
- Acoustic covers to engines should be kept closed when the engines are in use and idling. The use of compressors that have effective acoustic enclosures and are designed to operate when their access panels are closed is recommended.
- Materials should be lowered whenever practicable and should not be dropped. The surfaces on to which the materials are being moved could be covered by resilient material."

10.6.13 All items of plant should be subject to regular maintenance. Such maintenance can prevent unnecessary increases in plant noise and vibration and can serve to prolong the effectiveness of control measures.

Screening

10.6.14 Typically screening is an effective method of reducing the noise level at a receiver location and can be used successfully as an additional measure to all other forms of

noise control. The effectiveness of a noise screen will depend on the height and length of the screen and its position relative to both the source and receiver.

10.6.15 The length of the screen should in practice be at least five times the height; however, if shorter sections are necessary then the ends of the screen should be bent around the source. The height of any screen should be such that there is no direct line of sight between the source and the receiver.

10.6.16 BS5228 states that on level sites the screen should be placed as close as possible to either the source or the receiver. The construction of the barrier should be such that there are no gaps or openings at joints in the screen material. In most practical situations the effectiveness of the screen is limited by the sound transmission over the top of the barrier rather than the transmission through the barrier itself. In practice screens constructed of materials with a mass per unit of surface area greater than 7kg/m^2 will give adequate sound insulation performance.

10.6.17 In addition, careful planning of the site layout should also be considered. The placement of site buildings such as offices and stores and in some instances materials such as topsoil or aggregate can provide a degree of noise screening if placed between the source and the receiver.

Liaison with the Public

10.6.18 The contractor will provide proactive community relations and will notify the public and sensitive premises before the commencement of any works forecast to generate appreciable levels of noise or vibration, explaining the nature and duration of the works. The contractor will distribute information circulars informing people of the progress of works and any likely periods of significant noise and vibration.

10.6.19 A designated noise liaison should be appointed to site during construction works. Any complaints should be logged and followed up in a prompt fashion. In addition, prior to any particular construction activity that has potential to generate significant levels of noise or vibration, e.g. heavy groundworks, etc, the site contact should inform the nearest sensitive locations of the time and expected duration of the works.

Noise Monitoring

10.6.20 During the construction phase consideration should be given to noise monitoring at the nearest sensitive locations.

10.6.21 Noise monitoring should be conducted in accordance with the International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise* and be located a distance of greater than 3.5m away from any reflective surfaces, e.g. walls, in order to ensure a free-field measurement without any influence from reflected noise sources.

Operational Phase

10.6.22 The noise impact assessment outlined previously has demonstrated that mitigation measures are not required.

10.7 Residual Impacts

10.7.1 During the construction phase of the project there will be some impact on nearby noise sensitive properties due to noise emissions from site traffic and other activities. The application of noise limits and hours of operation, along with implementation of appropriate noise and vibration control measures, will ensure that noise and vibration impact is kept to a minimum. Also it is reiterated that any construction noise impacts will be temporary and short term in nature. Also, it is considered that, as the project progresses from initial works, construction noise and vibration impacts will be greatly reduced.

10.7.2 Any change in noise levels associated with vehicles at road junctions in the vicinity of the proposed development is expected to be imperceptible. The resultant noise impact is not significant.

10.7.3 There are no significant environmental residual impacts anticipated due to this project.

10.8 Cumulative Impacts

10.8.1 It is not anticipated that, given current knowledge, any plan or other project would result in full or in part to a potential significant impact for this environmental topic.

11.0 Material Assets

11.1 Introduction

11.1.1 This chapter evaluates the potential impacts on agronomy (agriculture) and non-agricultural assets arising due to the construction and operation of the proposed pedestrian and cycle greenway (see Volume 3-Figures 39 to 41).

11.2 Agronomy

Introduction

11.2.1 The potential agronomy impacts have been examined throughout the length of the proposed greenway and impacts will occur only in the Kilcrea area (the remainder of the route being through predominantly urban and non-agricultural areas) (see Volume 3 – Figures 39 to 41). The following key issues have been addressed:

- Impact from landtake;
- Impact from severance;
- Impact on access to land parcels;
- Disturbance due to the construction and operation of the pedestrian and cycle greenway;
- Impact on farm structures (building/yards) etc; and
- Mitigation measures to reduce impacts where appropriate.

Data and Methodology

11.2.2 The assessment has been based on aerial survey information, on-site survey (June 2012, February 2015 and October 2017) and discussions with Fingal County Council landowner liaison officer.

11.2.3 The study area for this assessment is set out in Table 11.1.

Table 11.1 Study Area.

Criteria	Area of Agricultural Land Directly Affected
Five farms, four of which are directly affected by the proposed greenway (Ref Nos 3, 6, 7, 10 & 13) as shown in Volume 3-Figure 40 and listed in Table 11.5.	116.4 ha

11.2.4 The impact of temporarily acquired land along the length of the proposed greenway in Kilcrea and the impact from all permanent built structures associated with the proposed greenway, including earthworks, cuttings, embankments and supporting structures, are assessed.

11.2.5 The main potential types of impacts on farms during the construction and operational phases are:

- Loss of agricultural land due to the landtake requirements: A reduction in land area may reduce agricultural output and the viability of farms. The proposed landtake of agricultural land in the area of Kilcrea is shown in Table 11.5 below.

- Severance of farms: Increasing the segmentation of a farm increases the long-term fixed and variable costs associated with running the farm and reduces the viability of the farm. It increases the difficulty of operating a farm.

- Disturbance: During construction, the day-to-day operation of farms in the study area will be disrupted due to increased levels of construction traffic in the local road network and there will be construction activity adjoining agricultural land which may interrupt and disturb farming activities, cropping and livestock. Water and electricity supplies may be temporarily disrupted. There will be increased levels of noise and dust as result of construction traffic and works. Temporary impacts may occur to soil and land drainage during the construction works. During the operation phase there will be increases in pedestrian and cycle traffic along the proposed greenway with the consequential potential for trespass, littering and disturbance caused by the users of the proposed greenway.

Impact Assessment

11.2.6 Impacts are assessed in terms of sensitivity, magnitude and significance.

SENSITIVITY

11.2.7 Each farm is evaluated to determine the sensitivity and determine any site specific factors. The main criteria in determining the sensitivity of a farm are the enterprise type and the intensity of the farm enterprise. This information is obtained from on-site surveying. Five categories are used to express the sensitivity of farms in the study area: very high, high, medium, low and very low. The criteria for assessment of farm sensitivity are set out in Table 11.2.

Table 11.2 Criteria for Categorisation of Sensitivity.

Farm Enterprise Type	Sensitivity
Stud farm	Range of sensitivity is high to very high. Stud farms have a high to very high sensitivity to linear infrastructural projects.
Dairy farm Intensive equine enterprises.	Usually high sensitivity – but may be medium if it is an out-farm away from milking parlour, or if stocking rate is low. Highly sensitive because the daily movement of cows to and from the milking parlour can be disrupted.
Non-dairy grazing livestock enterprises (including beef, sheep and non-intensive equine) and grass cropping enterprise.	Usually medium sensitivity because movement of livestock is less frequent than on dairy farms. May be low sensitivity if stocking rate is low.
Tillage and field crops	Medium sensitivity. May be high sensitivity if high value field crops are grown (e.g. fruits and vegetables).
Rough grazing, bog, forestry, and woodland	Low or very low sensitivity.
Horticultural enterprises and intensive agriculture (pigs and poultry)	Range is high-very high sensitivity. These enterprises are usually located on relatively small sites but are very intensive and therefore either highly or very highly sensitive to linear infrastructural projects.

MAGNITUDE

11.2.8 The magnitude of the impact takes into account the type and degree of impact that will occur as well as the duration over which the impact will occur. Five categories are used to express the magnitude of the impact in terms of how the impact will affect agriculture and farms in the study area: very high, high, medium, low and very low. The criteria for assessment of impact magnitude are set out in Table 11.3 below.

Table 11.3 Criteria for assessment of impact magnitude.

Criteria	Impact Magnitude
• A very large proportion of the land lost (typically >15%). • A very large proportion of the land severed/separated and/or access is severed. • Permanent loss of farm buildings or water sources. • Impact would cause a change in farming enterprise.	Very high
• A large proportion of the land lost (typically 10-15%). • A medium proportion of land severed/separated and/or access is severed. • Farm buildings or water sources may be affected but can be replaced. • Impact would not cause a change in farming enterprise but would require high degree of operational changes.	High
• A medium proportion of the land lost (typically 5-10%). • A small proportion of land severed/separated or no severance. • Farm buildings or water sources may be affected but can be replaced. • Impact would not cause a change in farming enterprise but would require significant operational changes.	Medium
• A small proportion of the land lost (typically 2-5%). • A small proportion of land severed or no severance. • Farm buildings or water sources may be affected but can be replaced. • Impact would cause a minor change in the day to day operation of farms.	Low
• A very small proportion of the land lost. • A small proportion of land severed or no severance. • No impact on operation of farms.	Very low

SIGNIFICANCE

11.2.9 The significance of the impact is defined by evaluating the magnitude of the impact in light of the sensitivity of the farm. Therefore an impact which affects a farm with a low sensitivity will not be as significant as a similar magnitude of impact which affects a farm with a high sensitivity. The matrix used to define the significance of impacts is shown in Table 11.4. This table has been defined as a guide for the assessment and professional judgement is used in every individual assessment.

Table 11.4 Criteria for Assessment of Impact Significance.

Sensitivity	Magnitude of Impact				
	Very Low	**Low**	**Medium**	**High**	**Very High**
Very low	Imperceptible	Imperceptible	Imperceptible	Slight Adverse	Slight Adverse
Low	Imperceptible	Imperceptible	Imperceptible (possible Slight Adverse)	Slight Adverse (possible Moderate Adverse)	Moderate Adverse
Medium	Imperceptible	Imperceptible (possible Slight Adverse)	Slight Adverse (possible Moderate Adverse)	Moderate Adverse	Major Adverse
High	Imperceptible	Slight Adverse (possible Imperceptible)	Moderate Adverse	Major Adverse	Profound Adverse (possible Major Adverse)
Very high	Imperceptible (possible Slight Adverse)	Slight Adverse (possible Moderate Adverse)	Moderate Adverse (possible Major Adverse)	Major Adverse (possible Profound Adverse)	Profound Adverse

Derived from DMRB Table 2.4 "Arriving at the Significance of Effect Categories", Volume 11, Section 2, part 5 HA 205/08.

Existing Agriculture

11.2.10 The study area is comprised of 116.4ha of agricultural land in five farms. Four of these farms (Farms 6, 7, 10 and 13) are directly affected by the proposed greenway while Farm 3 may experience a low level of disturbance due to the construction of the proposed greenway at its boundary (see Volume 3-Figures 40 and 41 and Table 11.5 below for proposed landtake areas).

11.2.11 Farm 3 is a small 3.2ha holding comprised of a single grass field which is grazed by cattle and may be cut for hay/silage. There is no farmyard. Land quality is reasonably good. It is a medium sensitivity enterprise. No landtake is proposed from the proposed greenway. The Donabate Distributor Road will take approximately 1.4ha of land.

11.2.12 Farm 6 is approximately 18ha (16% of the study area). It has medium sensitivity due to the presence of a drystock beef enterprise. The farmyard is located just north of the proposed greenway on the Corballis Cottages Road. Land quality is good. Proposed greenway landtake is approximately 1.29ha – this land parcel is not directly affected by the Donabate Distributor Road.

11.2.13 Farm 7 is approximately 80ha (69% of the study area). It has high sensitivity due to the presence of a horse training track and growing of field vegetables. Land quality is good. The farmyard is located off the Kilcrea Road over 700m west of the proposed greenway. Proposed greenway landtake is approximately 0.48ha.

11.2.14 Farm 10 is a small 1.9ha holding comprised of a single grass field around a dwelling house which is grazed and may be cut for hay/silage. There is no farmyard. Land quality is reasonably good. It is in the low-medium sensitivity range due to the size of

the holding and low intensity of usage. Proposed landtake due to the proposed greenway is approximately 0.032ha. The combined landtake of the proposed greenway and the Donabate Distributor Road is approximately 0.5ha of land.

11.2.15 Farm 13 is a 13.9 hectare tillage land parcel. This farm was originally split by the Donabate Distributor Road leaving this separated plot on the southern side of this road and north of the Corballis Cottages Road. The land quality is good. There is no farm yard on this plot of land and access is via the public road on the southern boundary. Approximately 0.8 hectares of land will be required for the proposed greenway.

Potential Impacts

Construction Phase

11.2.16 Indirect impacts on other farms who use the local road network to access outlying land or to access services are assessed as Imperceptible.

Land Loss

11.2.17 Permanent land loss will commence when the proposed greenway is fenced off at the start of the construction phase. Additional land will be temporarily required along the length of the proposed greenway to allow access for laying the surface of the proposed greenway, earthworks and fencing. This land will be unavailable for the duration of the construction works and thereafter will be reinstated and returned to the landowner.

Severance

11.2.18 Severance will affect Farm 6 where approximately 1.7ha will be severed/separated. The magnitude of impact on this farm is major adverse unless access can be maintained.

Disturbance

11.2.19 During the construction phase there will be temporary disruption to the day to day operation of the four farms directly affected by the proposed greenway (Farms 6, 7, 10 and 13). Water supplies and electric fencing may be disrupted. Land and farmyard access will be disrupted by construction traffic and fencing off of the proposed greenway. While existing land drains may be temporarily blocked during excavations the drainage design of the scheme will intersect existing land drains and carry the drainage water to a suitable drainage outfall. The equine track in Farm 7 is located more than 400m from the site of construction and therefore the disturbance impact here will be imperceptible. The emissions of dust during construction will not have a significant impact on crop growth or animal performance. Noise from construction traffic and machinery will not adversely affect animal performance. The magnitude of impact on agriculture due to disturbance during the construction phase is low. Although not directly affected by the proposed greenway, Farm 3 may experience a low level of disturbance during the construction phase due to the construction works.

11.2.20 There will be an additional reduction in area farmed during the construction phase because additional land will be required temporarily for the construction of the proposed greenway – to allow construction machinery access. While this land will be reinstated to as close as possible to the pre-construction condition, compaction and topsoil damage will occur and this may reduce grass/crop growth for several years.

11.2.21 Overall, assuming a construction period of seven months and that standard construction methodology is adhered to, the construction activity will not give rise to significant adverse impacts.

Operational Phase

Table 11.5 Summary Details of Individual Farms in the Study Area and Impacts.

	Farm 3	Farm 6	Farm 7	Farm 10	Farm 13
Area (ha) of affected farm	1.8	18.5	80	1.9	13.9
Type of farm enterprise	Grass field used for grazing or silage/hay.	Beef enterprise.	Equine, sheep and tillage, vegetable cropping.	Grass field around dwelling used for grazing or silage/hay.	Tillage
Land type – EPA Code	12, 15	72, 12, 51	12, 31, 51	12	12
Land quality	Good quality	Good quality	Good quality	Good quality	Good quality
% of study area	1.5%	16%	69%	1.5%	12%
Sensitivity	Medium	Medium	High	Low/Medium	Medium
Landtake (ha)	0	1.22	0.4	0.006	0.8
% of farm taken	0%	6.5%	0.5%	0.3%	6%
Severance/ separation	No	Yes (1.7ha)	No	No	No
% land severed	0%	9%	0%	0%	0%
Nature of impact (before mitigation)	Not significant (low level of disturbance from construction activity).	Major adverse impact from separating farmyard from remainder of farm.	Very low impact from loss of land.	Low impact from loss of land.	Moderate impact from loss of land.
Recommended mitigation measures	General mitigation measures specified below.	Provision of agricultural access from farmyard and maintenance of field access from public road.	General mitigation measures specified below.	General mitigation measures specified below.	General mitigation measures specified below.
Significance of impact due to Greenway (after mitigation)	Not significant	Moderate adverse	Not significant	Not significant	Moderate adverse

	Farm 3	Farm 6	Farm 7	Farm 10	Farm 13
Cumulative Impact after considering impact of Donabate Distributor Road (DDR).	DDR landtake = c.1.4ha which is 45% of land parcel; therefore Major Adverse	No landtake or significant impact due to DDR	No landtake or significant impact due to DDR	DDR landtake = c.0.5ha which is 26% of land parcel; therefore Major Adverse	Moderate adverse (There was a major adverse impact on the original holding but this plot is now a separate holding)

LAND LOSS

11.2.22 Following fencing off of the proposed greenway at the beginning of the construction phase land loss cannot be mitigated – other than through statutory compensation.

SEVERANCE

11.2.23 Three permanent agricultural accesses across the proposed greenway will be provided in Farm 6. While these will maintain the access between the farmyard and the lands south of the proposed greenway, the separation will have a residual impact on the operation of the farm; for example to move livestock or machinery will require opening and closing gates – requiring additional time and labour.

DISTURBANCE

11.2.24 Movements and noise from pedestrians and cyclists will become part of the background environment and as such will not disturb livestock. However, there is potential for disturbance if users of the proposed greenway behave in a threatening manner towards livestock, where trespass on to private land occurs, or where dogs are not controlled adequately. There is also an increased risk of disturbance caused by litter which could be accidentally ingested by farm animals. A low level of permanent disturbance will be caused to the farms along the proposed greenway. Damage to soil at construction sites will improve over several years and in the longer term this damage should not be significant.

Mitigation Measures

Introduction

11.2.25 Mitigation of impacts takes place under two headings:

- General mitigation measures – described below.
- Compensation under the Compulsory Purchase System – compensation to farmers due to land acquisition, drainage works, reinstatement of boundaries and loss of facilities is part of the statutory process for compensation for the compulsory acquisition of land and all related matters which is dealt with separately under that procedure.

11.2.26 The landtake and severance impacts will occur during the construction phase once the area required for the proposed greenway is fenced off.

Severance

11.2.27 The severed land parcel will be provided with permanent agricultural crossings on the proposed greenway.

11.2.28 Severed field access from the public road will be reinstated so that there is a permanent access from the public road into the agricultural field.

11.2.29 Where existing water and electricity supplies to fields or farmyard are severed the supply will be reinstated by the developer by provision of ducting or an alternative water source or electricity supply.

11.2.30 Landowner will be compensated to allow for cattle handling facilities in severed land parcel.

Disturbance

11.2.31 The developer will liaise with landowners prior to the finalisation of the design of the scheme. Issues expected to result from disruption during the works will be addressed during consultations between the landowners and the developer.

11.2.32 A key contact will be appointed by the contractor during the construction phase to facilitate communications between affected landowners and the contractor. Good communication with farmers will facilitate the organisation of farm enterprises, so that livestock are kept as far away as possible from the construction work during critical times. Liaison between the contractor and farmers during the works will also minimise difficulties caused by the restriction of access to severed land parcels.

11.2.33 Boundary fencing will be erected to delineate the construction boundary and prevent disturbance to adjacent land and livestock.

11.2.34 The landowner will have access to all severed land during the construction of the scheme. Where this access is temporarily disrupted the landowner must be notified in advance. Temporary gates across the fenced area should be provided.

11.2.35 Disrupted electricity and water supplies shall be restored within a time agreed with landowners. The contractor shall make provision for alternative supplies to be provided (e.g. generators or water tankers) if supplies cannot be restored within the agreed time frame.

11.2.36 The contractor shall minimise impacts on agricultural land due to construction noise through a programme of mitigation measures for noise control as described in Chapter 10 (Noise and Vibration).

11.2.37 The contractor will also employ measures to prevent the spread of dust and mud onto adjoining lands as described in Chapter 9 (Air and Climate).

11.2.38 Where land is taken temporarily for the construction of the proposed greenway the contractor shall store all the topsoil so that it can be spread back over the land to allow for successful crop establishment**.** The restored land shall be level, adequately drained

and shall not contain stones or gravel or other materials imported on to the site during construction.

11.2.39 Where excavations occur or surface drains are crossed the drainage design of the proposed greenway will intersect any existing field drains and carry the drainage water to a suitable outfall.

Residual and Cumulative Impacts

Table 11.6 Summary of Individual Farm Residual Impacts.

Farm ID	Magnitude of Impact	Sensitivity	Overall Significance of Impact
3	Very low due to permanent disturbance.	Medium	Not significant due to greenway but major adverse due to cumulative impact of Donabate Distributor Road.
6	High due to severance. Low – medium due loss and land and permanent disturbance.	Medium	Moderate adverse due to greenway and no cumulative impact due Donabate Distributor Road.
7	Very low – due to loss of land	High	Not significant due to greenway and no cumulative impact due Donabate Distributor Road.
10	Very low due to loss of land and permanent disturbance.	Low/medium	Not significant due to greenway but major adverse due to cumulative impact of Donabate Distributor Road.
13	Medium impact due to loss of 6% of the holding	Medium	Moderate adverse due to greenway and no cumulative impact due Donabate Distributor Road because this is a newly owned land parcel.

Landtake

11.2.40 Temporarily acquired land during the construction phase will be reinstated according to the construction plan which will specify that these lands will be restored to a state which is as close as possible to their original state. The agronomy assessment assumes that it will take several years for this land to reach its pre-construction production potential. The impact of permanent land loss is a residual impact with imperceptible–slight adverse significance after mitigation (see Table 11.6).

11.2.41 Approximately 2.5ha of agricultural land will be acquired for the construction of the proposed greenway which is a not significant impact on the entire affected area (116.4ha). The cumulative impact due to the Donabate Distributor Road increases the overall land take to approx. 3.7ha and the overall cumulative impact is Slight Adverse when the distributor road is considered. This cumulative impact is not significant on a regional basis (County Dublin) (see Table 11.6).

Severance

11.2.42 Severance of direct access between the farmyard and public road gives rise to a moderate adverse impact in Farm 6. While access is provided across the proposed greenway, gates will have to opened and closed and handling facilities may be required to manage livestock at the crossing points (see Table 11.6).

11.2.43 Approximately 1.7ha of agricultural land will be severed/separated due to the proposed greenway which is a not significant impact on the entire affected area (116.4ha). There is no additional cumulative severance/separation impact due to the Donabate Distributor Road. This impact is not significant on a regional basis (County Dublin) (see Table 11.6).

Disturbance

11.2.44 The residual disturbance impacts due to noise and pedestrian and cyclist traffic will not be significant and will not require mitigation. However there is the potential for disturbance from trespass, litter and inadequately controlled dogs. There is a potential impact on land drainage. After mitigation the cumulative disturbance impact from the proposed greenway and Donabate Distributor Road is assessed as being not significant (see Table 11.6).

11.3 Non-Agricultural Assets

Road Network

11.3.1 There will be no significant impact on the local road network arising from the operation of the proposed development at any of the locations where the proposed development and the local road network intersect.

11.3.2 Local upgrade works on the R106 Dublin Road will not affect the normal traffic flow into and out of Malahide village when the construction works are completed. The works will enhance the pedestrian and cycle access for all users and will form part of ongoing upgrade works in the locality for pedestrian and cycle access to all areas.

11.3.3 Works at the junction of O'Hanlon's Lane and Bissets Strand Road will improve the safety of all using this junction and will improve the access and safety for pedestrians and cyclists at this junction. The installation of the new pedestrian crossing at this location will help slow traffic on the road to the benefit of all users. The revised junction will also improve vehicular access to and from O'Hanlon's Lane onto Bissets Strand.

11.3.4 Works at the Bissets Strand Road at the railway bridge will improve the access for all users especially the mobility impaired. The new traffic signals at the bridge will improve safety for cyclists at all times whether they are using the proposed greenway or just travelling along the road. The new dedicated parking area and bin store for the local residents will improve their access and safety.

11.3.5 Proposed works on the Corballis Cottages Road will upgrade this dangerous section of the road and improve sight lines approaching the narrow railway bridge for all users. The installation of the traffic lights at the bridge to allow safe access for pedestrians and cyclists will cause minor delays on this section of road but will help to slow the traffic along a narrow country road and will also improve safety for all users.

11.3.6 Works at the junction of Hearse Road and Kilcrea Road again will help reduce speed on a heavily used section of this road with the installation of a new kerb line and a pedestrian crossing.

11.3.7 It is also proposed to provide advance notice of the proposed new crossing on either side of the junction on the Hearse Road by providing a new kerb, signage and public lighting which will slow traffic as it approaches the junction and give advance warning of the controlled crossing. This section of road currently has a speed limit of 60kph. It is proposed to extend the 50kph speed limit to incorporate this junction.

11.3.8 All works carried out to the local road network as part of the proposed development will enhance safety for both pedestrians and cyclists and will improve their appreciation of the proposed greenway as a safe and useable product.

Potable Water Supply

11.3.9 The construction and operation of the proposed development will have no effect on the potable water supply in the area.

Surface Water Drainage

11.3.10 The construction of the new greenway will increase the impermeable area along some areas of the proposed greenway. This will occur along the Malahide Estuary and along the agricultural lands in Kilcrea. This additional impermeable area will not affect the local drainage network as the drainage for the new paths will be designed to discharge to ground using filter drains.

11.3.11 The new impermeable area along the causeway across the Malahide Estuary will drain into a filter drain parallel to the proposed greenway. This drain will filter the surface water before the water naturally drains through the rock armour into the Malahide Estuary, similar to what occurs at present.

Foul Sewer Drainage

11.3.12 The construction and operation of the proposed development will have no effect on the foul drainage in terms of capacity or the requirements for additional facilities. Both Newbridge Demesne and Malahide Demesne have existing facilities which will be used by users of the proposed greenway. The additional numbers using these facilities will not affect the existing system.

Waste Arising

11.3.13 Wastes arising during the construction process will be recycled and re-used within the project insofar as possible. Residual waste will be disposed of by licensed haulier to a licensed site. Waste arising from operation is not anticipated.

Electricity Supply

11.3.14 The construction and operation of the proposed development will have no effect on the electrical supply services in the area.

Maintenance

11.3.15 The ethos of the proposed greenway will be the "Leave No Trace" principle with signage advising same as part of the overall strategy for the proposed greenway. There will be no provision for rubbish bins along the proposed greenway except at the start and finish of the proposed greenway.

11.3.16 There will be a requirement for occasional small truck access and possible ambulance and/or fire tenders along the proposed greenway for ongoing maintenance and repair along with the possibility of emergency access for ambulance and/or fire tenders. The proposed greenway surface and the bridges will be designed to allow for these occasional loadings.

12.0 Archaeology and Cultural Heritage

12.1 Introduction

12.1.1 Archaeology is the study of past human societies through their material remains and artefactual assemblages. The study of archaeological remains increases our understanding and knowledge of the structure and culture of past and ancient societies that are not recorded by any other means. Archaeology, for the purpose of this chapter, includes all monuments and sites dating to pre-1700 and all levelled/buried features of any date. Post-1700 standing structures are dealt with in the Architectural Heritage chapter.

12.1.2 The term cultural heritage in this chapter encompasses the following topics: archaeology, folklore/tradition/history, architecture/settlements and monuments/ features.

12.1.3 The assessment methodology used is set out in Section 12.2. The existing environment is then set out (Section 12.3) followed by an account of the proposed development (Section 12.4). The field inspection is described (Section 12.5) and impacts and mitigation are given below (Section 12.6 to Section 12.9).

12.2 Data and Methodology

12.2.1 For the purpose of the EIAR, all archaeological and cultural heritage constraints within 150m of each side of the proposed greenway are assessed. Known and recorded archaeological sites within the study area are also assessed. These sites and areas are displayed in Volume 3-Figures 22 to 28.

12.2.2 The methodology used to complete the archaeological and cultural heritage section of this EIAR comprised the following:

- A desktop assessment of the proposed greenway, study area and existing environment.
- A field inspection of the proposed greenway.

12.2.3 The desktop study provided an archaeological and cultural heritage overview of the study area and its hinterland. Information collated during the constraints study and route selection study has been expanded and refined to concentrate and focus on the chosen greenway. The following sources were consulted in the course of the desktop study:

- *Record of Monuments and Places (RMP)* – This record was established under Section 12(1) of the National Monuments (Amendment) Act 1994. It provides a list of all known archaeological monuments and places of archaeological interest, with an accompanying set of constraint maps. Its numbering system consists of two parts: the first part is the county code (DU for Dublin) followed by the Ordnance Survey (OS) map number six-inch to the mile scale, which was further reduced to 1:12,500 to accommodate the RMP; the second part is the number which refers to the specific archaeological site, e.g. DU012-030 refers to circle 30 on OS sheet 12 for Dublin. This number is generally placed beside a circle which surrounds the archaeological site. The area within the circle is referred to as the Zone of Archaeological Notification for that site. The RMP for County Dublin was published

in 1998. It is an offence to interfere with any of the sites or monuments listed in the RMP without first giving two months' notice in writing to the National Monuments Service (NMS) at the Department of Culture, Heritage and the Gaeltacht (DCHG).

- *Sites and Monuments Database of the Archaeological Survey of Ireland* – The purpose of the Archaeological Survey of Ireland (ASI) is to compile a baseline inventory of the known archaeological monuments in the State. The large archive and databases resulting from the survey are continually updated. This database, complete with maps is now available for consultation via the NMS website at www.archaeology.ie. The database also provides lists of National Monuments that are in the ownership or guardianship of the State.

- *National Monuments* – Section 8 of the National Monuments (Amendment) Act 1954 provides for the publication of a list of monuments, the preservation of which is deemed to be of national importance. Ministerial consent must be granted before any works are carried out with respect to a national monument.

- *Files of the National Monuments Service* – Some recorded archaeological sites have been afforded added protection under the following legislation (National Monuments are mentioned above):

  - *Monuments Subject to Preservation Orders and Temporary Preservation Orders* – The National Monuments Act 1930 provides for the making of preservation orders to protect national monuments that are considered to be under threat. The prior written consent of the Minister is required for any works at or in proximity to the monument.
  - *Register of Historic Monuments* – Under Section 5 of the National Monuments (Amendment) Act 1987, two months' notice must be given in writing to the Minister in advance of any proposal to carry out work in relation to a historic monument or archaeological area entered on the register.

- *Database of Irish Excavation Reports (www.excavations.ie)* – This website provides a database of summary reports of all archaeological excavations and investigations in Ireland undertaken since 1970. The database was searched for any excavations that were undertaken in any of the townlands within the study area.

- *Fingal Development Plan 2017-2023* – The development plan outlines the local authority's objectives with regard to the preservation of the archaeological (and architectural) heritage of the county. It provides the following information:

  - *National Monuments in Fingal* in state care or subject to preservation orders.
  - *Locations of RMP sites*. While the Record of Monuments and Places is not included in the Development Plan, icons showing the location of RMP sites are shown on the maps which accompany the plan.

- *Donabate Local Area Plan 2016-22*.

- *Constraints Report* (see Volume 4A) – All relevant information from the report was used. This included the RMP listings and information.

- *Route Options Report* (see Volume 4B) – This report selected the chosen greenway for this EIS.

- *Published Local Historical and Archaeological Information* – All available relevant local historical and archaeological information was consulted where possible.

- *Cartographic Sources* – The various editions of the Ordnance Survey six-inch maps; 1st, 2nd and 3rd editions for Dublin were consulted.

- *Aerial Photographs* – Aerial photographs can be useful in obtaining information on levelled, unknown archaeological monuments or in detecting potential archaeological features that may only be identified from the air. The proposed greenway was examined on aerial photographs from the following sources:

  - National Monuments Database (c. 2013) www.archaeology.ie
  - Ordnance Survey of Ireland website (1995, 2000 and 2005) www.osi.ie
  - Google maps www.googlemaps.ie.
  - Aerial photographs provided by CHE.

- The National Monuments Service and The Underwater Section at the Department of Culture, Heritage and the Gaeltacht (DCHG) were consulted. Further consultation will be undertaken in advance of construction.

Field Walking

12.2.4 The primary purpose of field inspection was to assess the archaeological and cultural heritage environment in which the proposed greenway would be set. The length of the proposed greenway was walked in May 2013 and in October 2017.

12.2.5 Relevant recorded archaeological sites were inspected. This included a visual appraisal of the impact the proposed greenway would have on these sites.

12.2.6 Potential archaeological and cultural heritage features were identified.

12.3 Existing Environment

Geographic Overview

12.3.1 The study area lies in the commuting area of North County Dublin approximately 16km north of Dublin city (Volume 3-Figure 1). It lies in and around the tidal estuary of two rivers – the Ward River and Broad Meadow Water. The estuary, known as the Malahide Estuary, is protected by an extensive sandbar crossing from the north side and leaving only a narrow entrance into the bay. The study area itself is a regular rectangular area spanning the estuary from Malahide on the south to Donabate on the north and extending approximately 2km west from the two villages. Land use within the area varies from a tidal estuary, to reclaimed farmland, to the urban centres of Malahide and Donabate.

Chronological Overview

12.3.2 The pace of landscape change in Ireland accelerated in the second half of the twentieth century and many archaeological sites have been levelled by activities associated with modern development and progress such as agriculture, industry, housing developments and infrastructural improvements. This has ensured that the present day archaeological landscape is not fully representative of the human occupation of this island, which has spanned some nine thousand years. Archaeological sites survive

today as upstanding structures such as earthworks and stone monuments, or subsurface remains. Subsurface remains are usually uncovered during archaeological investigations in advance of development. Archaeological excavation in Ireland and in the Fingal area over the past twenty years or so has yielded new and diverse archaeological sites and information, adding to the store of knowledge on our past history. An assessment of Fingal's archaeological resource was undertaken by Archer Heritage Planning Ltd in 2010. The study, commissioned by Fingal County Council in partnership with The Heritage Council collated information from the existing RMP, and from all archaeological investigations within the county (assessments, testing and excavations) for the period 1999-2009 inclusive. Excavations within the Fingal area between 1999-2000 have yielded an array of archaeological material that spans the archaeological record from the Neolithic to the Post Medieval Period.

Prehistoric Period

MESOLITHIC (C. 7000 TO 4000BC)

12.3.3 The earliest evidence for human colonisation and settlement in Ireland can be dated to 7000BC, the Mesolithic Period. The people of this era were hunter-gatherers, entirely dependent on what food could be obtained through hunting and gathering edible plants and shellfish. They used flint and other hard stone to manufacture their tools and their settlements can often be identified by locating scatters of these discarded stone tools in ploughed fields. The greatest concentration of Irish Mesolithic material in Ireland comes from the northeast of the country, such as the early Mesolithic occupation site at Mount Sandel, Co. Derry. Mesolithic activity, however, is not exclusive to the north. Some of the earliest evidence for human activity in the study area comes from the extensive lithics finds along the Malahide Estuary, dating to the later Mesolithic Period, while two later Mesolithic Bann flint flakes were recorded from the townland of Kilcrea (Courtney & Goucher, 2007). Extensive lithic finds from this period were also recovered to the north of the study area in the Rogerstown estuary (*ibid.*). In addition, Late Mesolithic fish traps were found during archaeological investigations at Spencer Dock on the Liffey Estuary in 2004. These were largely of hazel construction and dated to as early as 6090-5840 BC. In 2007 further investigations were undertaken and additional Mesolithic fish traps were identified along with structures dating to the Middle Neolithic (3630-3370 BC). The structures were, again, mostly built with hazel (McQuade 2004).

12.3.4 Coastal finds of Mesolithic material have been recovered at Lambay Island and at Sutton. A shell midden excavated at Sutton (DU015-024) between 1949 and 1970 revealed a hearth and pits which produced, along with animal bone, flint artifacts of the Larnian type such as parallel-sided blades, leaf-shaped points and scrapers (Mitchell 1956 & 1972). On Lambay Island, analysis and mapping of two collections of surface-collected lithics provided an important perspective on the prehistoric activity of the region and demonstrated the presence of people during the Later Mesolithic with a strong likelihood that the area was occupied since the Early Mesolithic (Dolan and Cooney, 2007).

NEOLITHIC (C. 4000 TO 2400BC)

12.3.5 The transition of the early settlers from hunter/gatherers to a farming way of life in the Neolithic Period brought about revolutionary change. Surplus food could now be produced that would feed people in the leaner months. This led to more permanent

settlements and substantial houses and a more complex and structured social hierarchy. A steady food supply meant that people had more time to increase their toolkit and domestic equipment and develop specialised crafts. Within the study area early prehistoric habitation activity was identified at Beaverstown (DU12-067) during archaeological excavations in advance of development. In 2002 a stone axehead and flint flakes were found as well as several prehistoric features such as pits which produced cremated bone and possible prehistoric pottery (Hagen 2002/03). In 2003 a flint blade was recovered during further works and an area of Neolithic and Bronze Age activity was excavated comprising a number of pits and post-holes; contemporary pottery and flint were recovered in this area (*ibid.*).

12.3.6 On the nearby Lambay Island an axe production factory dating to the Neolithic was identified and investigated by the Irish Stone Axe Project over a number of years from 1993 (Cooney 1993). The local stone, porphyritic andesite, was extracted and used for the production of these high value tools which were traded extensively both within Ireland and beyond. Neolithic pottery and worked flint were also identified at the site (*ibid.*).

12.3.7 Over the years, there have been extensive finds of flint dating to the Neolithic Period from coastal regions in the Fingal Area such as at Robswall and Barnageeragh. The Archaeological Survey of Ireland note a lithic scatter (DU012-037) in Robswall, just to the south of Malahide, where systematic field collecting and an excavation on Paddy's Hill in the 1980s uncovered a significant assemblage, (2,809 pieces) of flint artifacts. The artifacts included cores, blades, arrowheads and scrapers ranging in date from the Neolithic to the Early Bronze Age. In the townland of Barnageeragh along the coastal road to Balbriggan, to the north of the study area, a survey of seven fields in 1990 identified numerous finds of flint debitage. Preliminary analysis of this material indicated human activity in the region from the Mesolithic to the Bronze Age (Guinan 1992, 4-8).

12.3.8 Courtney and Goucher (2007, 9) cite numerous finds of artifacts of Neolithic date from the Fingal Area in the topographical files of the National Museum as follows: two finds from Beaverstown townland, a stone axehead (NMI ref. 1932:5626) and two flint waste flakes (NMI ref. 1978:20-21). In Portraine Demesne two flint flakes (NMI refs. 1978:20-21) and a hollow flint scraper (NMI refs. 1997:8) are recorded. Several flint flakes and artefacts are also recorded from other townlands on the peninsula, such as from Balcarrick (NMI ref. 1946:292), Ballymadrough (NMI refs. 1978:69-72), Kilcrea (NMI refs. 1965:56, 1967:180-184 and 1976:147), Lanestown (NMI refs. 1978:27-42 and 1978:73-74), Lissenhall Great (NMI refs. 1978:77-78), Seapoint (NMI refs. 1978:75-76) and Turvey (NMI ref. 1978:80-116). Two hammer stones from Balcarrick (NMI refs. 1941:409) and Donabate (no NMI ref.) may also belong to this period. Many of the finds are attributed to an intensive survey of field walking carried out in 1978 by Paul Gosling (Archaeological Survey of Ireland).

12.3.9 A characteristic feature of the Neolithic Period is the construction of Megalithic tombs. From the Greek megas litho, meaning big stone, approximately 1,600 of these monuments have been recorded in Ireland to date (Shee Twohig, 2004, 7). The practice of burying the dead in impressive communal tombs is a characteristic of Neolithic farming communities in Ireland and along the western seaboard of Europe (*ibid*.). The burial chamber, which contained cremated remains and often grave goods, was constructed of large unhewn stones and covered by a mound of earth or stones, known as a 'cairn'. The tombs fall into four main classes: court tombs, portal tombs,

passage tombs and wedge tombs. There are no megalithic tombs within the study area; however, there are a number in the broader Dublin Bay area such as the portal tomb, also known as Aideen's grave (DU015-032) in Howth Demesne and a passage grave cemetery containing five tombs (DU002-001 to 005) at Bremore just north of Balbriggan.

BRONZE AGE (C.2400 TO 500BC)

12.3.10 The Irish Bronze Age is characterised by the introduction of metallurgy, distinctive pottery styles, changes in burial traditions and an increase in population. The first metal used as a raw material in Ireland was unalloyed copper with much evidence for primitive copper mining being discovered in the southwest of Ireland. Within the study area, a Bronze Age enclosure partially excavated at Beaverstown (DU012-067) in 2003, comprised a portion of a curvilinear ditch which may have formed part of a larger enclosure. A small number of features appeared to have pre-dated the ditch which revealed pottery dating to the Beaker period (i.e. the Neolithic/Bronze Age transition). Beaker pottery in Ireland is generally associated with communities who were at the forefront of early metal use. As well as the ditch, a number of other probable Bronze Age features were revealed which included a post-hole, pit and possible cremation burial pit (Hagen 2003.). There is one site within the study area which is of uncertain date in the absence of excavation but may fall into this period. The earthwork in Malahide Demesne (DU012-029) comprised, according to Westropp (1915), an earthen platform circa 17m in diameter, enclosed by a fosse, a bank and an outer fosse. It had been quarried in the middle for gravel at the time of Westropp's visit. In addition to this, the Archaeological Survey of Ireland note two ring ditches, in the townlands of Kilcrea (DU012-071) and Newbridge Demesne (DU012-074). Ring ditches generally consist of a circular fosse, less than 10m in diameter. They may represent ploughed out barrows/burial mounds dating to the Bronze/Iron Age. The two examples in the study area consist of circular sites visible as crop marks on aerial photographs. The one in Kilcrea lies within low-lying reclaimed land north of the Malahide Estuary while the second one in Newbridge Demesne lies in flat farmland.

12.3.11 In the wider Fingal area, along the Rogerstown Estuary, the discovery of three cist burials further attest to human activity in the area in the Bronze Age. (Courtney and Goucher, 2007, 9-10). In the townlands of Ballymastone and Corballis (Baker 2006) a possible hut site was found, comparable to examples at Curraghtoor, Co. Tipperary and Lough Gur, Co. Limerick dating to the middle-late Bronze Age. A fulacht fia was found in Corballis and potential archaeology was identified in a geophysical survey in the townlands of Donabate, Corballis, Ballalease North and South and Ballymastone. It will be necessary to carry out archaeological testing on these potential sites to ascertain if they are truly archaeological in nature. Courtney and Goucher (ibid.) suggest that there is a possibility that these untested features may form part of a larger buried Bronze Age landscape.

IRON AGE (C. 500BC TO 400AD)

12.3.12 The Iron Age in Ireland marks the transition from bronze to iron working. It is around this time that we see the adoption of the La Tene style of art practiced by the Celtic peoples of Europe, a people who had been using iron as a far superior metal to bronze from around 1000 to 700BC. Although there is little sign of earlier Hallstatt-like culture in Ireland, the later La Tene culture is represented in metalwork and some stone sculpture, mainly in the north and west of the country. Rotary querns, linear earthworks and the

continued use of hillforts are all aspects of Iron Age Ireland. Burial practices included cremation and inhumation interred in pits or in pre-existing tumuli. Cremation burial appears to have declined in the Iron Age, a trend that has been attributed to a Roman and Christian influence. There are no known archaeological sites dating to the Iron Age within the study area, however, burials dating to this period were found on Lambay Island in the early twentieth century. A number of the grave goods and personal ornaments found at the time are in the National Museum of Ireland. Along the coast to the north of the study area at Drumanagh, a promontory fort (DU008-006001) with three ramparts enclosing 48 acres of the headland, produced evidence of extensive settlement in the form of an enclosure, several structures, burnt material and pits as well as an array of Roman finds such as pottery, coins, brooches, copper ingots and an iron horse bit.

Medieval Period

EARLY CHRISTIAN/EARLY MEDIEVAL PERIOD (C. 500 TO 1100 AD)

12.3.13 Christianity was slowly introduced to Ireland in the late fourth century, becoming widely established during the second half of the sixth century. A distinctive feature of the development of the early medieval period was the important role played by monasticism. From its monasteries, Irish monks set out as pilgrims preaching the gospel and establishing new communities across the continent. Monasteries became a focal point for the lay communities that were spread throughout the countryside in settlements such as ringforts and crannógs.

12.3.14 Irish society in the Early Medieval Period was divided into the free elite and the unfree cottiers, tenants-at-will and serfs/slaves. The elite and their families would have lived in ringforts, while the labourers and others of lower status in society lived outside the ringfort in small huts. Cattle dominated the farm economy of the period, with dairying being the primary pursuit in many areas. Tillage was also practiced, the most important crops being wheat, oats, barley, rye and flax. In the absence of money (coinage did not become widespread until the Medieval Period), cattle were the indicator of one's status and were the currency for payment of fines, rent, tributes and gifts. Land was valued on the basis of the number of cows it could support (Feehan, 2003, 55). Cattle raiding was widespread and the ringfort provided protection for the animals at night when they would have been kept within its defensive palisade (*ibid.*, 62). There are no ringforts within the study area, however, the enclosure in Kilcrea (DU012-017) which was identified on an aerial photograph, may represent the levelled remains of a ringfort approximately 30m diameter with an irregular annex attached. A semi-circular enclosure nearby was also identified. The enclosure at Lanestown (DU012-006), also identified on an aerial photograph, may represent the levelled remains of a large ringfort. The photograph shows a single-ditched circular enclosure approximately 50m in diameter.

12.3.15 Ecclesiastical sites dating to the Early Christian Period vary from large monastic centres to small hermitages, and from cathedrals founded by bishops to parish churches catering for a lay population and small independent foundations attached to family estates (Edwards 2000, 100). Many sites were defined by a curvilinear (less often a rectilinear) bank, which enclosed an area varying in diameter from 40m to 500m. Very often the original bank or fosse is gone but is still represented today in curving field boundaries, roadways or laneways. The larger ecclesiastical enclosures contained the church and graveyard, and depending on their size and status, would have contained dwellings, outhouses and workshops. An array of other archaeological sites, from souterrains and bullaun stones to stone crosses and cross slabs and holy wells, are often

associated with early ecclesiastical sites. The church site at Malahide (DU012-23002-), St Sylvesters Roman Catholic church, is reputedly on the site of an early church site. No above ground remains of this church survive. An earthwork forming a mound (DU012-023003) was apparently present on the site of St Sylvester's Arch. No visible trace of this earthwork remains. Test excavation (McQuade 2010) in advance of an extension to the church identified features relating to the early 19th century church in the form of two post-medieval masonry walls, while further testing (*ibid*., 2011) uncovered medieval structural remains and masonry walls dating to the 18th/19th century. The tradition of visiting holy wells goes back to the very beginnings of Irish Christianity, but most probably has its origin in pre-Christian ritual activities. The majority of the 'wells' are springs or just depressions in rocks where rainwater collects; some have more recently constructed stone or concrete surrounds. Some wells are still maintained for holy use when at certain times of the year they would be visited in the form of a pilgrimage often referred to as a 'round' or 'pattern'. Other wells are known through tradition for their reputed curative properties. There is a holy well in Malahide (DU012-023001), which was known as 'Sunday's Well' or St Sylvester's well, located to the rear of St Sylvester's church. The traditional pattern day for the well was 15th August.

12.3.16 The Viking invasion of Ireland began in 795AD with an attack on Rathlin Island off the Antrim coast. In 798AD, the Vikings attacked Inis Patraic (St. Patricks Island) known locally as Church Island off Skerries to the north of the study area (Johnson, 2004, 10). From about 830AD raids intensified, with the Vikings navigating major rivers and plundering inland. The eastern seaboard suffered attack from, and then settlement by, the Vikings and the Norse invasion left its mark on the area in placenames such as Skerries, Lambay, Howth and Dalkey, all Scandinavian in origin. The name Fingal comes from the Irish fionn gal, meaning fair strangers/Dyflinarskiri. Permanent settlements were established by the middle of the ninth century along the east coast in the Fingal area in the peninsulas of Donabate and Portraine. Dublin became a major stronghold in Ireland and bases were established at Inbher Domhnainn (Malahide) and Ben Eadair (Howth) (Courtney and Goucher, 2007).

MEDIEVAL PERIOD (1100AD TO 1600)

12.3.17 The Anglo-Normans arrived in Ireland in 1169 at the request of Diarmait Mac Murchada, the deposed King of Leinster. With Diarmait reinstated to his lands, the Anglo-Normans set about seizing territory for themselves. By 1350 the Norman influence was evident on the rural landscape in the form of manorial villages with open field systems, occupied by colonists from England and Wales (Aalen, *et al.*, 2000, 55). The well-drained soils of the southeastern quadrant of the country were especially Normanised. A network of towns was established throughout the country, with the exception of the west and north which remained largely under Gaelic control (*ibid.*, 55). Following Anglo-Norman colonisation, the old Gaelic system of farming with its dominance on dairying was replaced. The Anglo-Norman system of agriculture was predominantly arable, based generally on the open field system used in England with crops such as wheat, rye, flax and corn. New crops such as peas, beans, celery and onions were introduced. Sheep were more important on the Anglo-Norman farm and improved breeds meant that wool and sheepskin exports rose. At the same time as the Anglo-Norman invasion of Ireland, the church in Europe experienced a period of reform, which resulted in the foundation of many new religious orders and transformed the unique insular form of monastic life that had developed in this country since the seventh century (Hennessy 1988, 41). Although major reforms of the

church were already underway before the arrival of the Anglo-Normans and socio-economic change had already begun, the Norman invasion accelerated the changes by imposing a feudal system on the areas in which they ruled. The Anglo-Norman lords founded and endowed monastic houses as a means of reinforcing their newly acquired territories, while also imposing their own cultural identity on those territories (Hennessy 1988, 49).

12.3.18 The fifteenth century saw the advent of a second wave of monastic foundations, a period in which many existing monastic complexes were extensively refurbished and extended. It was during this period also that many of the now ruinous churches and graveyards were built. The Catholic faith was celebrated under cover only. It was not until the mid-eighteenth century that Catholic churches began to be built again. In the meantime Church of Ireland churches began to appear but not in large numbers until the early nineteenth century.

12.3.19 Moated sites, Anglo-Norman farmsteads, are among the most numerous earthworks of the medieval period. They usually consist of square, rectangular, trapezoidal or occasionally circular enclosures. The interior is often raised and enclosed by one or more earthen banks with a wide, often water-filled, fosse and causewayed entrance. The levelled earthwork in Corballis (DU012-019) was described as 'site of moat' on the 1837 first edition Ordnance Survey six-inch map. No visible trace of the monument survives.

12.3.20 Motte sites usually comprise a large circular or sub-circular mound on which a wooden castle would have been sited. The mottes are sometimes adjoined by a bailey and may be surrounded by a palisade fence or ditch. There is a motte at Ballymadrough (DU012-014) comprising an oval shaped mound with steeply sloping sides. It is located in a prominent position on the grounds of Seafield House.

12.3.21 Castles, whether of stone, or earth and timber, functioned as a well-defended fortress and a private residence, of someone of importance in medieval society (O'Connor 1998, 25). Castles, although fortresses, were the centre of their owner's estate or manor, usually a functioning farm and centre of rural administration. The many castles dotted throughout the modern landscape were once residences and farm centres in much the same way as contemporary undefended manor houses and later country houses (*ibid.*, 26). The majority of castles in Ireland can be broadly classified into two groups; the early castles of the late twelfth and thirteenth centuries and the tower houses of the fifteenth to seventeenth centuries.

12.3.22 Tower houses consist of fortified residences in the form of a tower that was usually four to five storeys high and often partially enclosed by a bawn. Most tower houses date to the fifteenth/sixteenth centuries.

12.3.23 The core of Malahide Castle (DU012-030) dates to the twelfth century when the lands were granted to the Talbot family in 1174 by Henry II. The family retained its connection with the castle over the following eight centuries during which time the castle was modified and extended, most notably in the 1760s and the nineteenth century. The great hall of the castle which dates to the fifteenth century is described by Bence-Jones as 'the only surviving medieval hall in Ireland to keep its original form' (1996, 198). Also noteworthy in the castle is the Oak Room which is decorated with carved panelling of different dates (*ibid.*, 199) and has an original vaulted undercroft and corbel heads of Edward IV which again, are original. The castle lies at the centre of

a large demesne of approximately 270 acres which was purchased by Dublin County Council in the 1970s.

12.3.24 A short distance east of the castle lie a church (DU012-031001), graveyard (DU012-031006), two sheela-na gigs (DU012-031002 and DU012-031003), a chest tomb (DU012-031005) and an architectural fragment (DU012-031004). The church comprises a nave and chancel with a small sacristy at the southeastern end. There is a 'mitre head' (DU012-031004) on the exterior of the south door of the church. The church is lit by a triple light ogee-headed window and two double-light tracery windows in the east end. Inside there is an altar tomb dedicated to Maud Plunkett (who died in 1494) with a recumbent effigy of a female figure (DU012-031005). There are two sheela-na-gigs on the outside of the building, one (DU012-031003) in the east gable wall and the other (DU012-031002-) on a quoin at the northeast angle of the chancel of the church. The former comprises a carved head and neck in red sandstone, the lower portion of the figure is damaged. The latter comprises a framed seated figure carved in false relief on red-sandstone block. The graveyard (DU012-031006) which is dominated by the church is surrounded by farm buildings and enclosed by a battlemented wall. It contains headstones of nineteenth and twentieth century date.

12.3.25 Lanestown/Lanestown castle at Newbridge Demesne (DU012-004) is a three storey tower house with stepped battlements marked by a cornice and a projecting angle tower in the southwest. There is a barrel vault at ground floor level and a spiral staircase provides overhead access to chambers with corbelled roofs. There is a fireplace at first floor level and a loft building may have stood on the east side.

12.3.26 Similarly the castle at Donabate (DU012-05002) is also a three-storey tower house and in this case it is attached to the eastern end of St Patrick's Church of Ireland church which is on the site of the medieval parish church of Donabate. The tower house has a stepped battlement at parapet level with the cap house, containing the stairs projecting above the battlement level. A carved head projects from the eastern wall at second floor level. A wooden studded door remains in the pointed arched doorway in the north wall and there is a fireplace at first floor level.

12.3.27 The eighteenth century St Patrick`s Church of Ireland church in Donabate (DU012-05001) occupies the site of the medieval parish church of Donabate. The church was mentioned in the mid-seventeenth century Civil Survey and its remains were partially visible in the 1830s. An earlier medieval doorway is incorporated into the south porch of the existing church, which has a pointed arch of chamfered limestone. There are three early eighteenth century graveslabs (DU012-05004) within the porch, one dedicated to John Fitzsimon (died 1709) and a monument to Patrick Barnewall of Staffordstown and his wife Begnot de La Hoyde who died in 1592. There is an inscription and two coats of arms on the latter.

12.3.28 Donabate graveyard (DU012-05003) is a roughly square walled graveyard which contains the aforementioned church and tower house. The graveyard is raised above the adjoining ground and is still in use. It contains eighteenth and nineteenth century memorials. An excavation carried out in advance of road widening at Turvey Avenue in 2008 uncovered a linear ditch (DU012-082001) which contained animal bone of early medieval date and two adjacent structures (DU012-082002 and 003), situated at the edge of the ditch. The structures were associated with N-S drainage ditches from which a lot of 12th to 14th century pottery was recovered (Kavanagh 2008).

12.3.29 A third structure (DU012-082004), defined by an L-shaped dry stone wall (4.7m E-W x 2.7m N-S), overlay the backfilled early medieval ditch and was associated with a rubbish pit which revealed a silver farthing from the reign of Edward III (AD 1335-43) (*ibid.*).

12.3.30 The church at Kilcrea (DU012-016001) is a plain roughly built rectangular structure with the eastern gable and side walls still standing. The graveyard (DU012-016002) has been recently walled and is overgrown and no longer in use.

Post Medieval/Early Modern Period (c. 1600–Present)

12.3.31 In the Post Medieval Period, the Irish farming landscape began to take on its present appearance, with many of the current field systems and boundaries being laid out. The old order of transhumance and open cattle breeding died out and was replaced by a structure of great landed estates, small tenant farmers (lessees) and a mass of landless labourers. The potato, initially introduced as a garden crop in the mid-seventeenth century, became the main food crop of the tenant and labouring classes. This system continued up to the end of the nineteenth century until the formation of the Land League began to bring about land reform. In this process of reform, the former tenants and labourers became landowners, with the great estates being broken up into small and medium sized farms and smallholdings. The process continued well into the twentieth century with the work of the Irish Land Commission.

12.3.32 During this period, with the industrial revolution, there was an increase in production and a change in population shift with more people moving to towns and cities to work. The introduction of railway lines improved communication, shortened travel times and allowed for better trade and commerce. The Dublin Belfast Railway Line (CHS1) runs on the east side of the study area. Construction of the route commenced in 1840, under the stewardship of Sir John Benjamin MacNiell, and the Dublin to Drogheda line was officially opened in 1844 making travelling in both directions simpler and quicker. This was the third railway line to be constructed in Ireland, following the Dublin-Kingstown and Belfast Lisburn lines. It had a 5ft 2in gauge and the Ulster Railway had a 6ft 2in gauge. According to one legend, the engineers of the Ulster Railway and those of the Dublin and Drogheda line deliberately planned the tracks on different gauges, so that if two lines ever met, neither company could use the rolling-stock of the other. The railway line overtook the importance of the sea and the commercial use of the Malahide Estuary for export and import. The subsequent extension and connection of the line northbound later in the nineteenth century further facilitated northbound travel and transport. The railway line has, over the last century and a half, become an integral part of the local landscape and now plays a major part in the commuter value of towns and villages in this area.

12.3.33 The Malahide Estuary (CHS2) has played an important role in the life of generations of Malahide and Donabate people. From the late twelfth century on, the history of the Malahide area is tied to that of the Talbot family of Malahide Castle, who were granted extensive lands in the area and over the following centuries developed their estate, and the village. In the post 1700 period a substantial fishing fleet operated out of the estuary providing an income for those living in and around there. They fished for cod and ling in the Irish Sea but the estuary itself provided seaweed, mussels, cockles, winkles and oysters. The area was famous for its green-finned oysters and there was an oyster bed of c. 2 acres in the area of the present viaduct. By the early nineteenth century, the village had a population of over 1,000, and a number of local industries,

including salt harvesting, while the harbour continued in commercial operation, with landings of coal and construction materials. By 1831, the population had reached 1,223. The area grew in popularity in Georgian times as a seaside resort for wealthy Dublin city dwellers and Malahide continues to be a popular spot for day-trippers, especially in the summer months. In its day the estuary was a rival to Dublin with its safe, sheltered position and sandy beach for unloading ships. Local goods exported included cod-liver oil while coal was imported for the manufacture of town gas in Malahide. With the coming of the railway in 1844 and the construction of the viaduct, a large maritime lake was formed on the south side of the estuary, one mile wide and three miles long. Construction of the viaduct on the north side of the estuary saw its reclamation and the disappearance of the island of Mullan. The estuary was a busy area over the centuries with boats coming and going and invariably there were a number of tragedies with ships going aground and being wrecked. The legacy of the more recent history of the estuary survives in the form of above ground features such as piers and quay walls, while buried features could include shipwrecks, mills and fish traps. Donabate probably began to develop around the medieval church (DU012005001) and tower house (DU012-005002) in Donabate townland. A thriving economy based on fishing and limestone quarrying fuelled a period of significant development in the eighteenth century and, like Malahide, the town underwent further significant change with the construction of the Dublin-Belfast railway line in the mid-nineteenth century.

Country Houses and Demesnes

12.3.34 The eighteenth century was an era of relative peace and political stability in Ireland. This encouraged a growing sense of prosperity and order, which in turn created an environment favourable to industrial and agricultural innovation as well as intellectual and aesthetic pursuits. Perhaps the most notable cultural heritage site type of this period and the ensuing century is the country house and its demesne.

12.3.35 The term ‘demesne’ or ‘demaine’ is Norman French in origin and denotes that portion of the manorial estate not leased out to tenants but retained by the lord for his own use and occupation’ (Reeves-Smyth, 1997, 549). The estate system was finally dismantled in Ireland in the early twentieth century. Although demesnes were widespread in medieval Ireland, the foundation of those still evident on the modern landscape date to the middle of the eighteenth century when ‘natural style’ landscape parks were adopted by Irish landowners. The typical demesne consisting of the big house with associated buildings, ornamental grounds, landscaped gardens and woodlands, often enclosed by high walls and belts of trees still remains the dominant man-made feature of the post medieval landscape in Ireland. At one time demesnes occupied nearly 6% of the country (Aalen *et al.*, 2000, 197).

12.3.36 This was the era of great landed estates, a period when landowners signalled the extent of their authority with the scale of their homes. Abandoned castles and fortified houses were often utilised, either to form the core of the new building or as an attractive focal point on the demesne along with ponds, decoys, bridges and follies. Designed landscapes became an essential part of country estates. Formal design elements dominated the early part of the century but were gradually replaced by more naturalistic compositions characterised by smooth, undulating lawns and casual arrangements of trees.

12.3.37 Two country houses and demesnes lie within the study area; Malahide Castle (DU012-030) and Demesne and Newbridge House (DU012-060) and Demesne. These form important elements of the cultural heritage of the area. Malahide Castle and demesne, associated with the Talbot family for nearly 800 years, are publicly accessible. A botanic garden was developed within the demesne in the twentieth century by Milo Talbot incorporating many southern hemisphere plants. During the First World War (1914-18) airships, used to patrol the sea around Ireland, were stationed at Malahide Demesne. These were nicknamed 'blimps'. The large anchor rings to which they were tethered are apparently still visible in the grounds. Many aspects of the demesne are still extant.

12.3.38 Newbridge Demesne is a largely eighteenth century landscape which is also publicly accessible and incorporates a working farm. It is associated with the Cobbe family who retain an interest in the property still. A survey dated 1705 shows a schematic drawing of a large single storey house which is rectangular in plan with a pitched roof. The single storey house may have been incorporated into the present building on this site.

12.3.39 Both the houses and their demesnes are dealt with in the Chapter 13 (Architectural Heritage).

12.3.40 Kilcrea tidal mill (DU012-018) is an unclassified mill probably located along a millrace east of Kilcrea House where there is some collapsed stone present. This is probably the site of the tidal mill marked on Rocque's map of County Dublin (1756).

Rivers and Streams

12.3.41 Waterways have always been a vital resource and would have encouraged human settlement along their banks and within their drainage areas from prehistoric times to the present. Their channels would have been the focus of much activity such as transport, fishing and trade. Consequently, there is a potential for archaeological finds and features associated with estuaries, rivers and streams, either on their banks or within their beds. The Malahide Estuary (CHS2), which is crossed by the proposed greenway along an existing embankment, is an area which may have been exploited for its abundance of resources by earlier communities. The route will follow the course of the River Pill (CHS3) through the townland of Kilcrea and this river may too have been exploited in the past. The high potential for uncovering archaeological remains in these areas is noteworthy.

Townland Boundaries

12.3.42 The Irish landscape is divided into over 62,000 townlands, a system of landholding that is unique in Western Europe for its scale and antiquity (O'Connor 2001, 7). Many townlands are pre-Anglo/Norman in origin and Irish historical documents consistently use townland names throughout the historic period to describe areas and locate events accurately in their geographical context. The townland names and boundaries were standardised in the nineteenth century when the Ordnance Survey began to produce large-scale maps of the country. The townland boundaries recorded by the Ordnance Survey, therefore, may well be aligned on older land divisions dating to early historic times and may physically overlie archaeological evidence for such early forms of land division. The proposed greenway crosses the townlands of Malahide Demesne, Malahide, Kilcrea and Donabate.

12.3.43 Malahide translates into *Mullach Íde* in Irish, according to the Placename Database of Ireland (logainm.ie). Joyce (1920, 497) translates Malahide to *Baile Atha Thíd* meaning the town of the ford of Teud; Teud being a man's name.

12.3.44 Kilcrea translates into *Cill Chreach* in Irish, according to the Placename Database of Ireland (logainm.ie). Joyce (*ibid.*, 402) translates this as Crea's Church. The townland of Kilcrea in Co. Cork he attributes to the virgin St Crea but he does not specify whether this also applies to the Kilcrea in Co. Dublin.

12.3.45 Donabate translates into Domhnach Bat in Irish according to the Placename Database of Ireland (logainm.ie). This may mean fort of the ferry or church of the boat. Joyce (*ibid.*) does not provide a translation.

Cartographic Information

12.3.46 An examination of cartographic sources from the mid-nineteenth century shows the changes to the landscape over the last century and a half. The first edition OS map compiled in the 1830s shows the landscape as largely rural. Malahide is an established village centred around a T-junction known as 'The Diamond' with the fountain at its centre (Volume 3-Figure 26). Donabate, in contrast comprises two churches and a very small number of dwellings (Volume 3-Figure 26). The settlement at Ballisk a short distance to the north is larger at this time. Both Malahide Demesne and Newbridge Demesne are shown at their most complete, possessing many of the features expected of a demesne landscape. The Dublin Drogheda Railway is shown as being under construction, the line of the embankment running across the estuary is shown but its construction is incomplete.

12.3.47 The growth of Malahide and Donabate is evident by the time of the 25-inch map of 1888-1913 (Volume 3-Figure 27). The railway line is named Great Northern Railway (Ireland) and its completion has facilitated extensive land reclamation on the north side of the estuary in particular in the townland of Kilcrea. Some modifications to field layout is apparent and both demesnes remain largely complete. The two areas are similarly shown on the six-inch maps of the mid-twentieth century (Volume 3-Figure 28).

12.3.48 Modern OS maps and aerial photographs show the development of the towns of Malahide and Donabate as suburban centres to Dublin city with large residential developments in their vicinity. The broad outline of both demesnes has survived this suburbanisation process remarkably well. The railway formed a core element in this process and remains a major infrastructural feature. Further reclamation along the railway embankment is apparent to the north of Malahide town in particular.

12.4 The Proposed Greenway

12.4.1 The proposed greenway will follow, in the main, existing routes and walkways. For clarity, it is divided into six sections:

Section 1 – Malahide Demesne

12.4.2 The proposed greenway starts/finishes at the main car park in Malahide Demesne. It will run roughly northward through Malahide demesne, using existing paths within the demesne (see Volume 3-Figure 23). It will pass within 50m of the church (DU012-031001), graveyard (DU012-031006), sheela-na-gigs (DU012-031002 & 003), chest tomb

(DU012-031005) and architectural fragment (DU012-031004). Malahide Castle (DU012-030) lies c. 100m to the west. For some of the proposed greenway it will run parallel to and within 100m of the railway line (CHS1). It will finish on the Dublin Road, at Hogan's Gate on the east side of the Bridgefield car park. There will be no subsurface disturbance to existing paths. A link between the proposed greenway and Malahide village (including Malahide railway station) is proposed and runs along the southern and eastern side of Bridgefield car park. The existing fence on the southern side will be moved south by 2m to provide space for the new path. This area has been previously disturbed and is now part of a playing pitch. None of these proposals will impact on known or potential subsurface archaeological sites.

Sections 2 and 3 – Malahide

12.4.3 The proposed greenway in these sections will be mainly hardtop commencing at Hogan's Gate and ending at the Irish Rail compound on Bissets Strand Road (see Volume 3-Figure 23). It will follow existing public footpaths. At Bissets Strand the proposed greenway will run on the grass area on the north side of the road. Topsoil will be removed and a path comprising hardcore (0.35m) and bitumen (0.15m) will be laid. At its final point in Bissets Strand Road the church (DU012-023002), holy well (DU012-023001), and levelled earthwork (DU012-023003) are at their closest to the route (100m). They will not be impacted by the proposed greenway. There will be a new landscaped area at the Irish Rail compound. There will also be pedestrian and cyclist links between the proposed greenway and Malahide village. There will be no subsurface disturbance in this section of the proposed greenway and there will be no impact on potential subsurface archaeological remains.

Section 4 – Railway

12.4.4 This section of the proposed greenway will follow the existing weir maintenance track on the western embankment of the railway causeway starting at the new landscaped area and continuing across the Malahide Estuary coming to within 10m of the railway line (CHS1) and the estuary (CHS 2) (see Volume 3-Figure 24). Security fencing will be installed along the entire length of this section (minimum 3m from the existing railway tracks) which will separate the proposed greenway from the railway tracks. A solid 1.4m high barrier in the form of a stone wall will be provided on the western side of the proposed greenway across the estuary. The proposed greenway and wall will be constructed on top of the existing surface (with no excavation of the existing causeway) to the proposed levels. A French drain will be installed on the east side of the proposed greenway between the proposed greenway and the new security fencing. The full width of the existing weir maintenance track will be utilised to provide the maximum width along this section with a minimum width of 4m. This proposal will not impact on known or potential archaeological features.

12.4.5 A new 180m pedestrian/cycle bridge is proposed running separate and parallel to the existing railway viaduct. The new bridge will be a 12-span concrete bridge structure at a minimum height of 2.8m above the weir crest and will provide a 4m wide shared path. It includes ramps at both ends, formed in concrete, to link to the proposed greenway north and south of the proposed bridge.

12.4.6 A viewing area will be provided on the southern side of the pedestrian bridge which will include seating. A section of removable/demountable fencing will also be provided

at this location to allow Irish Rail access to the weirs for inspection and maintenance purposes.

12.4.7 The proposed greenway will then continue north on top of the existing causeway at approximately the same level as the railway tracks with the 1.4m high stone wall barrier and security fencing continuing on both sides. This section is approximately 1,100m long. The proposed greenway and wall will be constructed on top of the existing surface (with no excavation of the existing causeway) to the proposed levels. A French drain will be installed on the east side of the proposed greenway between the proposed greenway and the new security fencing. The full width of the remainder of the causeway will be utilised to provide the maximum width along this section with a minimum width of 3m.

12.4.8 The raised stone area stops short of the north shore of Malahide Estuary by approximately 70m. It is proposed to continue the proposed greenway at the same level as the railway tracks as far as the agricultural lands along the north shore of the estuary by completing the rock armour as far as these raised agricultural lands. This will not impact on potential archaeological material.

12.4.9 There is an existing drainage ditch at this location that will be culverted under the proposed extended rock armour.

Section 5 – North Shore of Malahide Estuary to R126 Hearse

12.4.10 The proposed greenway continues north through agricultural lands. The first section runs parallel to the railway tracks on the western side of an existing hedge and drainage ditch as far as the Pill River (see Volume 3-Figures 24 and 25). The proposed greenway will be 4m wide with a timber post and rail fence on both sides. The proposed greenway crosses the Pill River with a new 50m span pedestrian/cycle bridge. The bridge will be constructed using concrete bridge piers and steel beam structure. It includes ramps at both ends to link to the proposed greenway north and south of the proposed bridge and to take account of the difference in existing ground levels on the north and south side of the bridge. The construction of this bridge will impact on potential subsurface archaeological levels.

12.4.11 The proposed greenway continues north along the existing stoned access track which was installed by Irish Rail to allow access to the railway line when the railway viaduct was being repaired. The proposed greenway will be constructed on top of the existing stoned access track and the proposed greenway will be built up to the required levels. Post and wire fencing will be provided on both sides of the proposed greenway along this section. This work will not impact on potential subsurface archaeological levels.

12.4.12 The proposed greenway continues north as far as Corballis Cottages Road where it diverts around the boundary of a recently refurbished private dwelling. It is proposed to link the proposed greenway to Donabate on the eastern side of the railway tracks at this point and some upgrade works, including some road realignment, will be carried out here with a view to this future link. It is proposed to locate a site compound and temporary access point (to accommodate works on the railway embankment) adjacent to the bridge on the south side of the road. These works may impact on potential subsurface archaeological material.

12.4.13 The proposed greenway will then continue west inside the new hedging and fencing in a level field of pasture on the southern side of the Corballis Cottages Road. It then turns in a southwest direction towards the southern side of a private dwelling and farm buildings through a level field in pasture. Construction of the proposed greenway in this area will require the removal of topsoil to a width of 4.5m. The proposed greenway will comprise hardcore (average diameter 0.2m) overlaid by bitumen (average diameter 0.15m). A timber post and rail fence will require concrete pads around each post in the ground. There will be subsurface disturbance along the length of the proposed greenway in this area to accommodate the proposed greenway itself and the fencing on both sides of the proposed greenway. The proposed greenway crosses the Pill River where a 12m span pedestrian/cycle bridge is proposed. This will require piling and the construction of this bridge may impact on potential subsurface archaeological levels.

12.4.14 The proposed greenway runs along the south bank of the River Pill on the north side of a level field in pasture. It then leaves the river and continues westwards on the northern edge of two more level fields in pasture as far as Kilcrea Road where a pedestrian crossing will be required. There will be some alterations to the road and hedging at this point to accommodate the pedestrian crossing, a new entrance to a field and a pull-in location. Construction work in these areas may impact on potential subsurface archaeological levels.

12.4.15 The proposed greenway continues north on the western side of the Kilcrea Road as far as the junction with the Hearse Road.

Section 6 – Newbridge Demesne

12.4.16 This is the final and most northern element of the proposed greenway (see Volume 3-Figure 25). It crosses Newbridge Demesne to the car park in the demesne along an existing route, coming to within c. 70m of Newbridge House (DU012-060). There will be no archaeological impacts in this section.

12.5 Field Inspection

12.5.1 The site of the proposed greenway was visited on 5th June 2013 on a warm and sunny day and again on the 23rd of October 2017 in dull but dry weather conditions.

Section 1 – Malahide Demesne

12.5.2 The southern section of the proposed greenway begins in Malahide Castle car park where a route through Malahide Castle demesne will connect this car park with the existing car park at Bridgefield (Volume 4C-Appendix 8–Plates 1 and 2). The proposed greenway will follow existing pathways within the demesne firstly running roughly north from the car park behind Malahide Castle (DU012-030) and very close to the church and graveyard (DU012-03101-6). It turns northeast and then north along a tree-lined walkway as far as Hogan's Gate. A proposed link between the proposed greenway and Malahide village (including Malahide railway station) along the southern and eastern sides of Bridgefield car park will require the existing fence on the south side of the car park to be moved south by 2m. This area has been previously disturbed and is now part of a playing pitch. None of these proposals will impact on known or potential subsurface archaeological sites. The proximity of the proposed greenway to recorded sites within Malahide Demesne is an asset to the proposed greenway and will not impact in any way on these sites. The only subsurface disturbance on this section of

the proposed greenway will be in the area of the car park and as this area has been disturbed in the recent past there will be no impact on potential subsurface archaeological remains.

Sections 2 and 3 – Malahide

12.5.3 This section of the proposed greenway commences at the Bridgefield car park within Malahide Demesne (Volume 4C-Appendix 8–Plates 3 and 4). It leaves the car park on the northwest side and continues west along the Dublin Road for a short distance before turning north into O'Hanlon's Lane (Volume 4C-Appendix 8–Plates 5 and 6) where it continues until it meets the road at Bissets Strand. It then continues east along Bissets Strand as far as the railway line and the Irish Rail compound. It follows existing public footpaths all the way. The estuary (CHS2) and railway line (CHS1) are visible from Bissets Strand; there are no archaeological sites on, or visible from this section of the proposed greenway. There will some subsurface disturbance in the Bissets Strand section of the proposed greenway where topsoil will be removed from the grassed area parallel to Bissets Strand and a bitumen path laid. This may impact on potential archaeological remains. There will be no impact on potential subsurface archaeological remains on the other parts of the proposed greenway in this section.

Section 4 – Railway

12.5.4 The proposed greenway turns north from the Irish Rail compound at Bissets Strand and follows the existing western embankment of the railway causeway (CHS1) continuing across the Malahide Estuary (CHS2). This section of the route was not walked. There are no recorded archaeological sites on this section of the proposed greenway although the railway line itself is a cultural heritage site. The Malahide Estuary is also a cultural heritage site. The proposed greenway will be constructed on the existing embankment and its construction, along with the security fencing and stone wall barrier will not impact on any archaeological finds or features. The installation of rock armour on the north shore of the estuary will not impact on potential archaeological material.

Section 5 – Kilcrea

12.5.5 In this section the proposed greenway initially runs parallel to the railway tracks following the weir maintenance access track, as far as Corballis Cottages Road crossing the Pill River about midway along (Volume 4C-Appendix 8–Plates 7 and 8). There are no recorded archaeological features on this section of the proposed greenway. There will be no impact on archaeological remains in this section except at the crossing point of the River Pill where the construction of a pedestrian/cycle bridge may impact on the river and the estuary. This is part of an area which is shown as a tidal estuary (in the process of reclamation) on the 1842 OS map. The construction of the bridge (bridge no. 1) may impact on potential underwater subsurface archaeological levels along with evidence for reclamation of this area in the nineteenth century. This section of the proposed greenway was not inspected as it was inaccessible at the time. The bridge area was inspected from the agricultural land to the west. It comprises reclaimed land with the River Pill running through it. No features of an archaeological nature were noted.

12.5.6 There is a proposed link to Donabate on the eastern side of the railway tracks on the existing Corballis Cottages Road. Upgrade works, including some road realignment, will

be carried out here with a view to this future link. A works compound and temporary access road are proposed in this area although the exact location has not been established. These works may impact on potential subsurface archaeological material.

12.5.7 The proposed greenway continues west along the north side of a level field in pasture on the southern side of the Corballis Cottages Road. It then heads in a southwest direction across a pasture field (Volume 4C-Appendix 8–Plate 9) down to the River Pill and towards the southern side of a private dwelling and farm buildings. This area is shown as estuarine on the 1842 OS map. There are no recorded archaeological features on this section of the proposed greenway and none were noted in the course of the field inspection. Construction work on the proposed greenway in these areas may impact on potential subsurface archaeological material. The proposed greenway will cross the Pill River on the southwest corner of the field where a 12m span pedestrian/cycle bridge (bridge no. 2) is proposed. The bridge will be constructed using piled foundations. The 1842 OS map shows the Pill River splitting in two for a short distance to the northwest of the proposed crossing point and the river becomes one again just at the proposed crossing point. A wooden bridge is shown a short distance to the west of the crossing point even though much of the area is depicted as estuarine on the map. There is now no surface evidence for the more northerly branch of the river or for the wooden bridge. The construction of this bridge may impact on potential subsurface archaeological levels.

12.5.8 The proposed greenway runs along the south bank of the River Pill on the north side of a level field in pasture. It then leaves the river and continues westwards on the northern edge of two more level fields in pasture as far as Kilcrea Road. There are no recorded archaeological features on this section of the proposed greenway and none were noted in the course of the field inspection. Construction work on the proposed greenway in these areas may impact on potential subsurface archaeological material.

12.5.9 The proposed greenway continues across the Kilcrea Road (Volume 4C-Appendix 8–Plate 10) where a pedestrian crossing will be required. There will be some alterations to the road and hedging at this point to accommodate the pedestrian crossing, a new entrance to a field and a pull-in location. It then continues north on the western side of the Kilcrea Road as far as the junction with the Hearse Road. No evidence for archaeological features was noted on this section of the proposed greenway. Minor alterations to the road in this area will not impact on potential subsurface archaeological remains.

Section 6 – Newbridge Demesne

12.5.10 The proposed greenway swings northwest across Newbridge Demesne (Volume 4C-Appendix 8–Plates 11 and 12) from the gate on Hearse Road/Corballis Cottages Road to the car park and Newbridge House (DU012-060) following an existing route (Volume 4C-Appendix 8–Plates 13 and 14). There will be no subsurface disturbance on this section of the proposed greenway and there will, therefore, be no impact on potential subsurface archaeological remains.

12.6 Potential Impacts

12.6.1 This EIAR considered the impact the proposed greenway would have on all archaeological and cultural heritage sites within 150m of each side of the proposed route (Tables 6.1 and 6.2) (see also Volume 4C-Appendix 7).

Table 12.1 Impacts on Recorded Archaeological Sites within 150m of the Proposed Greenway.

RMP/SMR Number	Townland	Site Type	Distance From Route	Impact
DU12-023001	Malahide	Ritual site-holy well	150m	None
DU12-023002	Malahide	Church	150m	None
DU12-023003	Malahide	Earthwork	150m	None
DU12-030	Malahide Demesne	Castle-tower house	80m	None
DU12-031001	Malahide Demesne	Church	25m	None
DU12-031002	Malahide Demesne	Sheela-na-gig	25m	None
DU12-031003	Malahide Demesne	Sheela-na-gig	25m	None
DU12-031004	Malahide Demesne	Architectural fragment	25m	None
DU12-031005	Malahide Demesne	Chest tomb	25m	None
DU12-031006	Malahide Demesne	Graveyard	25m	None
DU12-060	Newbridge Demesne	House-18th/19th century	50m	None

Table 12.2 Impacts on Cultural Heritage Sites within 150m of the Proposed Greenway.

CHS Number	Townland	Site Type	Distance From Route	Impact
CHS1	Various	Railway	5m	None
CHS2	N/A	Estuary	5m	None
CHS3	Various	River	5m	None

12.6.2 The proposed greenway will not impact directly on any recorded archaeological sites. It will come close (25m) to the church, graveyard and associated features in Malahide Demesne (DU012-031001-6) and it will also come close (80m) to Malahide Castle (DU012-030-). The three recorded archaeological sites in Malahide village (DU012-023001, 2, 3) are 150m away from the proposed greenway and will not be affected by the proposal. Newbridge House (DU012-060-) lies at the northern end of the proposed greenway, c. 50m from it and will not be impacted by the proposal. In all cases the impact can be described as indirect, positive and the proximity of the proposed greenway to each archaeological site will not detract from it, rather it will enhance the experience for the user.

12.6.3 The proposed greenway will not impact directly on the railway line (CHS 1). It will, however, impact on the railway embankment by its use of the weir maintenance access track and by the construction of a bridge adjacent to the railway line. This impact will be minimal. Construction of three bridges (*in toto*) will impact directly on the other two cultural heritage sites; the Malahide Estuary (CHS2) and the River Pill (CHS 3). One of the bridges will be constructed parallel to the railway line on the Malahide Estuary. The other two bridges will cross the Pill River that now runs through an area which was reclaimed in the mid-nineteenth century. One of the bridges will be constructed parallel to the railway line in this reclaimed area in the townland of Kilcrea. A second bridge will cross the Pill further west along its course also in reclaimed land. Even though construction methods will use driven piles, there will be some (minimal) impact to potential subsurface underwater archaeological levels in each of the three bridge construction areas.

12.6.4 The proposed greenway will impact on potential archaeological remains which may exist below ground level in parts of Kilcrea townland where there is previously undisturbed ground. There may be subsurface remains of the wooden bridge depicted

on the 1842 OS map, a short distance to the west of the third proposed bridge above. These would be impacted by the proposed greenway.

12.7 Mitigation

12.7.1 No mitigation is required for the majority of this proposal as much of the proposed greenway will follow existing pathways or will cross areas where much disturbance has already taken place.

12.7.2 Three bridges will be constructed along the proposed greenway route; one over the Malahide Estuary (CHS 2) and two over the River Pill (CHS 3). Driven piles will keep construction impacts on the waterways to a minimum. However, there will be some impact to potential subsurface underwater archaeological levels in these areas. Consultation with the Underwater Unit at the DCHE will be carried out in advance of bridge construction, to determine what mitigation may be required.

12.7.3 Monitoring of topsoil stripping is recommended in Kilcrea, where the proposed greenway will cross agricultural lands.

12.7.4 Monitoring of topsoil stripping is recommended adjacent to Bissets Strand where topsoil will be removed from the grassed area and a bitumen path laid.

12.7.5 Where subsurface disturbance is to take place on any part of the proposed greenway consultation will take place in advance of the works with the National Monuments Service at the DCHG.

12.8 Visual Impact Measures

12.8.1 Much of the proposed greenway will follow existing pathways and these sections, therefore, will not visually impact on archaeological or cultural heritage sites. There will be some construction work on bridges along the railway line and across the River Pill. In addition there will be construction work on the proposed greenway in the townland of Kilcrea. The barrier along the railway embankment will be low level and will not impact on the railway line which will be raised above it. Likewise the proposed greenway along the bank of the Pill River will be low level and there will only be a low level impact on the river.

12.9 Construction Impacts

12.9.1 There will be minimal construction impacts with very little machinery and ground disturbance. Much of the proposed greenway will follow existing pathways and ground disturbance will be confined to a section of agricultural land in Kilcrea and pilling for the construction of bridges.

12.10 Residual Impact

12.10.1 It is considered that there will be no residual impact of significance arising from construction or operation of this greenway. If archaeological features are revealed during archaeological investigation and are preserved by record they will be permanently removed from the cultural landscape.

12.11 Cumulative Impacts

12.11.1 There are a number of proposed development projects in the Fingal area which, in combination with the proposed greenway development, may have a cumulative impact on the archaeological and cultural heritage of the area. These projects are outlined below.

- Malahide: Sutton to Swords Greenway (design stage).
- Kilcrea: Donabate Distributor Road (construction stage, opening late 2019).
- Kilcrea: Expansion of Portrane Hospital (construction stage, opening 2020).
- Kilcrea: Housing application (McGarrell Reilly Homes, planning ref. F17A/0113) (opening late 2019).

12.11.2 When the cumulative impacts of these projects are considered no significant cumulative effects are predicted on the recorded and known archaeological and cultural heritage of the area. Construction work for these projects will require large scale ground works and subsurface disturbance and may reveal previously unknown archaeological features and material. If such features are preserved by record they will be permanently removed from the cultural landscape.

13.0 Architectural Heritage

13.1 Introduction

13.1.1 This chapter focuses on all post-1700 standing structures. Pre-1700 structures, all levelled/buried features and structures considered to be of archaeological rather than architectural heritage merit are dealt with in Chapter 12 (Archaeology and Cultural Heritage).

13.1.2 The methodology followed in the assessment is set out initially, the existing architectural heritage environment is then described, predicted impacts are detailed, proposed mitigation measures are set out and residual impacts are detailed.

13.1.3 Guidance and definitions relevant to this assessment are considered in detail in Volume 4C-Appendix 9.

13.1.4 The mitigation proposals outlined below (see Section 13.5) are prepared in liaison with the archaeology and landscape consultants owing to the close relationship between these three disciplines. Consequently, this chapter should be read in conjunction with Chapter 14 (Landscape), and Chapter 12 (Archaeology and Cultural Heritage).

13.2 Data and Methodology

13.2.1 All sites, structures and features of architectural heritage merit identified during the desktop study were assigned an Architectural Heritage Constraint (AHC) number, listed on a database and displayed on an accompanying map to the scale of 1:10,000. The database and map were updated when additional constraints were identified during windshield surveys and fieldwork.

13.2.2 There are 20 sites and structures of architectural heritage merit within the study area. The protected status of these 20 sites and structures is summarised in Table 13.1 below. It should be noted that country houses and their demesnes have been considered as two separate entities in this study. For a discussion on the definition of the term ‘demesne’ and protection afforded to such sites, please see above (see also Volume 4C-Appendix 10).

13.2.3 Fieldwork was carried out along the entire length of the route to assess the nature of potential impacts and to record any architectural sites not identified at the constraints or route options stage. New structures were included only if they represented good examples of local architecture and retained their original fabric; if they represented architectural styles unique to or unusual in the region; if they had important local associations; or if they were subject to demolition.

13.2.4 A total of 17 new sites and structures were identified as listed in Table 13.2 below. Fourteen of them enjoy statutory protection. Of these structures, 15 were deemed to be of regional and two of local importance.

Table 13.1 Protected Status of Sites and Structures within the Study Area.

AHC No.	Site Type	Site Name	Townland	Statutory Protection	NIAH Survey	Importance
AHC001	Country House	Malahide Castle	Malahide Demesne	RMP D012-030---- RPS 383 + ACA	Yes (Buildings)	National
AHC002	Demesne	Malahide Castle	Malahide Demesne, Mabestown	ACA	Yes (Gardens)	Regional
AHC003	Outbuildings	Malahide Castle	Malahide Demesne	RPS 383 + ACA	Yes (Buildings)	Regional
AHC004	Stewart's House	House	Malahide Demesne	RPS 383 + ACA	Yes (Buildings)	Regional
AHC005	Church, Undetermined	Malahide Abbey	Malahide Demesne	RMP D012-031001- RPS 384 + ACA	Yes (Buildings)	National
AHC006	Graveyard	Malahide Abbey	Malahide Demesne	RMP D012-031006- RPS 384 + ACA	Yes(Buildings)	National
AHC007	Gate Lodge	Malahide Castle	Malahide Demesne	RPS 383 + ACA	Yes (Buildings)	Regional
AHC022	Railway Bridge	Malahide Station	Malahide	RPS 423	Yes (Buildings)	Regional
AHC023	Viaduct	Malahide Railway Viaduct	Malahide	RPS 420	No	Regional
AHC024	Vernacular House	Casino	Malahide	RPS 385	Yes (Buildings)	Regional
AHC025	Milestone	Milestone	Malahide	RPS 386	Yes (Buildings)	Regional
AHC026	Church, Presbyterian	Malahide Presbyterian Church	Malahide	RPS 426	No	Regional
AHC027	Town House	Sonas	Malahide	RPS 425	No	Regional
AHC028	Town House	Rosca	Malahide	RPS 424	No	Regional
AHC031	Bridge	Railway Bridge	Kilcrea	RPS 502	Yes (Buildings)	Regional
AHC040	Country House	Newbridge House	Newbridge Demesne	RMP DU012-060---- RPS 494 + ACA	Yes (Buildings)	National
AHC041	Demesne	Newbridge House	Newbridge Demesne	ACA	Yes (Gardens)	Regional
AHC042	Outbuildings	Newbridge House	Newbridge Demesne	RPS 494 + ACA	Yes (Buildings)	Regional
AHC044	Gate Entrance	Newbridge House	Newbridge Demesne	RPS 494 + ACA	Yes (Buildings)	Regional
AHC045	Bridge	Mack's Bridge	Newbridge Demesne	None (but within ACA)	Yes (Buildings)	Regional

Table 13.2 Previously Unrecorded Sites of Architectural Heritage Merit.

AHC No.	Site Type	Townland	Statutory Protection	Importance
AHC042	Outbuildings	Newbridge Demesne	RPS	Regional
AHC044	Gate Entrance	Newbridge Demesne	RPS	Regional
AHC045	Bridge	Newbridge Demesne	Within ACA	Regional
AHC046	The Square	Donabate	ACA	Regional
AHC047	Gate Lodge	Donabate	RPS	Local
AHC049	Church, C of I	Donabate	RMP, RPS	Regional
AHC050	Graveyard	Donabate	RMP	Regional
AHC051	Wall Monument	Donabate	RMP	Local
AHC052	House	Donabate	RPS	Regional
AHC053	Water Pump	Donabate	RPS	Regional
AHC055	Public House	Corballis	RPS	Regional
AHC057	Railway Station	Beaverstown	RPS	Regional
AHC058	Station Master's House	Beaverstown	RPS	Regional
AHC059	Signal Box	Beaverstown	RPS	Regional
AHC060	Railway Bridge	Beaverstown	RPS	Regional
AHC061	Parish Hall	Beaverstown	RPS	Regional
AHC063	Cemetery	Beaverstown	None	Regional

13.2.5 The information gathered in the course of desktop study and fieldwork was amalgamated and used to assess the impact of the proposed greenway on architectural sites as outlined in this chapter. For the purpose of this chapter, all known architectural heritage sites have been assigned an Architectural Heritage Constraint (AHC) number. Architectural Heritage Constraints in the vicinity of the proposed greenway are presented on Volume 3-Figures 29 to 31 to the scale of 1:10,000. Architectural sites are displayed by a red 'X' while demesnes are outlined in yellow with yellow hatching. Demesne and ACA numbers have a box outline.

13.2.6 A full schedule of all sites, features and structures of architectural heritage merit within the study area can be found in Volume 4C-Appendix 10. The inventory includes the identification number and location co-ordinates of each structure; their type and approximate age; and their importance, legal status and distance from the centre line. It also provides a summary of the type, nature, quality, magnitude and significance of impacts; recommended mitigation measures; and the magnitude and significance of impacts with mitigation measures.

13.2.7 A photographic record of each site, feature or structure of architectural heritage merit within the study area is provided in Volume 4C-Appendix 11. General location maps, together with individual location maps of impacted sites, features and structures are provided in Volume 3-Figures 29 to 31.

13.3 Existing Environment

13.3.1 The study area covers the historic core of the suburban coastal town of Malahide, a section of the Malahide Estuary, and the small suburban coastal town of Donabate. The area is characterised by predominantly flat estuarine landscape with low-lying pastures and small fields, framed by mature demesne planting at its extremities.

13.3.2 The settlement of Malahide is dominated by Malahide Castle and Demesne, which lie in its heart. This former country estate was the home of the Talbot family to whom the lands and harbour of Malahide had been granted in 1185. The three-storey tower house, which was built on these grounds c. 1250, was embellished and enlarged by subsequent generations of the family, most notably in the reign of Edward IV (1442-1483), when the Great Hall was added; in the reign of Charles II (1660-1685), when most of the outworks and the defences of the castle were demolished; and between 1765 and 1782, when the west wing was reconstructed following a fire, new drawing rooms and two circular turret rooms were added and the north wing of the castle was developed. As was customary among Anglo-Irish settlers, the Talbots also founded and endowed Malahide Abbey, which replaced Malahide's first church (dedicated to St Fenivus) as the parish church until the dissolution of monasteries in the reign of Henry VIII (1509-1547). The church and graveyard of the abbey date from the thirteenth century. The last burial in the graveyard took place in 1960, and certain families still retain burial rights to this site.

13.3.3 Malahide Castle is adjoined by c. 10ha of ornamental gardens, created largely by Milo, seventh Baron Talbot (1912-1973), who re-landscaped the grounds and introduced over 5,000 different species and varieties of plants. The property was sold to Dublin County Council in 1976, since when the 116-hectare (286-acre) demesne has been developed as a recreational and public sporting facility. It contains playgrounds, picnic sites, a cricket pitch, tennis and basketball courts, a Boules area, a 9-hole golf course and an 18-hole pitch-and-putt course. There is also an extensive system of pedestrian walkways throughout the estate, allowing the visitor to explore the picturesque park and its many structures of architectural interest. Malahide Castle has been opened to the public and displays a fine collection of Irish antique furniture.

13.3.4 The settlement of Malahide originated as a Viking trading post and later enjoyed a brisk trade in herring, whitefish and oysters. A cotton mill was established in the town in 1783 at a location which became known as Yellow Walls from the yellow dye stains left by produce placed on the walls to dry in the sun. The arrival of the railway in 1844 marked the gradual end of maritime trade and the transformation of Malahide into a tourist resort and residential town.

13.3.5 The town developed its present layout in the course of the nineteenth century. At its core is the Diamond, or town centre, from which four streets radiate to north, south, east and west. A sprinkling fountain which originally stood in the junction was removed in c. 1870 to make room for stage and other large coaches. The Mall, extending to the east and west of the junction, was originally constructed as a promenade to the Grand Hotel. To the north of it, diagonally across from the Grand Hotel, were the Pleasure Gardens with serpentine wooded walks where military bands played in the summer and where displays of various kinds were held on special occasions, such as the Malahide Regatta. New Street, extending to the north of the Diamond, forms the commercial heart of the town, while Church Street to the south contains a range of handsome Regency and Victorian terraced buildings. Similar elegant terraces were constructed along The Mall and the seafront, emulating in their design the seaside elegance of Brighton and other English coast towns. The former main street, Old Street, was inhabited by tradesmen and artisans and comprised 26 neat thatched cottages with diamond-paned windows. Public building works in the nineteenth century included the construction of the Roman Catholic Church of St Sylvester in 1837; and Malahide Cricket Club house in 1861. The historic core of the town, comprising Main Street; Old Street; New Street; South side of Strand Road; South side of The

Green; South side of Railway Avenue; Townyard Lane; James' Terrace Upper; West side of James' Terrace; St Margaret's Road approximately half the distance to the intersection with St Margaret's Avenue; Church Road to the intersection with St Margaret's Avenue; and St Margaret's Avenue (only to the extent of which the rear boundaries of properties on Dublin Road front onto it) have been designated an Architectural Conservation Area.

13.3.6 The arrival of the railway in 1844 marked an important turning point in the town's history. The construction of the line took nine years and involved the building of an eleven-span wooden viaduct over the Malahide Estuary. Some 90,000 tons of stone were discharged along the line in an attempt to overcome the problem of scour produced by tidal currents. The first train, carrying 565 passengers in seven coaches, pulled into Malahide Station on 17th March 1844. In 1965, the original timber viaduct on the Malahide Estuary was replaced by a 12-span pre-cast superstructure, the largest of its kind at the time. The line from Dublin to Malahide was electrified in 1999, and a suburban DART service commenced a year later to accommodate the rapidly expanding town.

13.3.7 Since 1961, the population of Malahide has grown from 2,534 to 15,846. The settlement has grown in all directions through the construction of housing estates, allowing the historic town core to retain its nineteenth-century seaside resort character.

13.3.8 On the north side of the Malahide Estuary lies the townland of Kilcrea. The area is largely rural in nature and remains predominantly in agricultural use. Kilcrea and the adjoining townlands are characterised by handsome country estates, most notably Seafield at Ballymadrough. This Palladian villa was constructed soon after 1737 for Benedict Arthur, but later became the seat of the Hely-Hutchinson family. Kilcrea House forms an attractive feature on the east side of Kilcrea Road. Across the road to the northwest of Kilcrea House are the remains of Kilcrea church and graveyard, possibly of medieval origin. Another feature of historical interest on this townland are the fragmental remains of a seventeenth-century tidal mill, the Baltray Corn Mill.

13.3.9 North of Kilcrea is Newbridge Demesne. This estate came into being in 1736, when Dr Charles Cobbe, later Archbishop of Dublin, purchased several townlands in the area. A year later he built Newbridge House, possibly designed by Richard Castle. The estate was extended in 1742 through further land purchases, and the house enlarged to the rear in 1751 by the Archbishop's son, Colonel Thomas Cobbe. It remained the home of the Cobbe family until 1985, when it was acquired by Fingal County Council, with the family retaining the right to reside in the house from time to time. The building is open to the public and its 150-hectare (370-acre) walled demesne, designated an Architectural Conservation Area, is in use for amenity purposes. The grounds, bisected by a number of scenic walks, are characterised by extensive woodbelts and islands of specimen trees, and extensive walled gardens to the north of Newbridge House.

13.3.10 To the east of Newbridge Demesne lies the village of Donabate. Its early history is similar to that of Malahide, with evidence of prehistoric habitation and the subsequent arrival of the Vikings to utilise the trading and raiding opportunities afforded by the sheltered Malahide Estuary. Following the Anglo-Norman invasion, a series of tower houses were constructed to protect the Donabate Peninsula, including the fourteenth century peel tower, Lanistown Castle, which is located on the present Newbridge House demesne. Also of Anglo-Norman origin is St Patrick's Church, built in the first

half of the thirteenth century and incorporating the remains of a Norman keep. The church was rebuilt in 1775, and forms the focal point of The Square, the former heart of the original village of Donabate.

13.3.11 In 1804, St Patrick's Roman Catholic Church was built to the northwest of Donabate, and it was probably at this stage that the settlement began to shift and relocate around the new church. A school was established in the village in 1824. The arrival of the railway in 1844 resulted in further expansion and the town grew northwards to Ballisk, which with its thatched cottages became the residence of the poorer inhabitants of the town. In 1903, a new church was built in Donabate, also dedicated to St Patrick, located on the Main Street of Donabate, and the old one was converted into a parish hall. The village remained a small settlement for more than a century, its population being just 734 persons occupying 150 houses in 1912. In recent years, the DART service and the town's proximity to Dublin have resulted in considerable population growth, increasing from 1,868 in 1996 to 6,778 in 2012. Most of the housing development has taken place around the town core, allowing the heart of the settlement to retain some of its old world charm. The Square, the former town centre, has been designated an Architectural Conservation Area.

13.4 Potential Impacts

Introduction

13.4.1 A detailed assessment of the nature and magnitude of the predicted direct impacts on sites and structures of architectural heritage merit is provided here. The impacts are grouped in order of significance and the findings are summarised in Table 13.3 to Table 13.5 below. A full photographic record of architectural heritage sites and structures within the study area can be found in Volume 4C-Appendix 11.

Predicted Construction Impacts – General

13.4.2 The only impacts on sites and structures of architectural heritage merit will occur during the construction stage within the development boundary. These direct impacts include the widening of existing entrances, encroachment on demesne lands and the removal of small sections of screening boundaries. Three sites or structures of architectural heritage merit are located fully or in part within the development boundary and are subject to direct impacts, as outlined in Table 13.3.

13.4.3 Visual impacts and impacts on settings are referred to in the following assessment but are considered in greater detail in Chapter 14 (Landscape). For noise and vibration impacts in sensitive locations, please refer to Chapter 10 (Noise and Vibration).

Predicted Slight Construction Impacts

13.4.4 Three sites of architectural heritage merit within the study area are predicted to experience slight negative impacts from the proposed greenway, as follows:

AHC002: Malahide Demesne

13.4.5 This 116-hectare demesne is located on the townlands of Malahide Demesne and Mabestown. It is bounded to the north and west by the Dublin/Malahide Road (R106/R107); to the east by a railway line; and to the south by Back Road. The demesne grounds as highlighted on the First Edition Ordnance Survey map remain intact and in

single ownership, the transport network following the original demesne boundaries. The demesne is used as a public amenity and sporting facility and some of the attendant grounds, while retaining virtually the entire original tree plantation, have been converted to cricket grounds, tennis and basketball courts, golf courses and football pitches. These facilities, along with a car park, are located in the northern third of the demesne. A second car park has been added a short distance to the south of Malahide Castle (AHC001). The designed landscape is characterised by a mature tree belt extending horizontally across the middle third of the demesne, providing Malahide Castle with a sheltered wooded setting. Less pronounced tree belts are located along the demesne boundaries. To the immediate east of Malahide Castle are c. 10ha of ornamental gardens, created largely by Milo, seventh Baron Talbot (1912-1973), who re-landscaped the grounds and introduced over 5,000 different species and varieties of plants. The ornamental grounds incorporate a 1.8-hectare walled garden constructed in 1775, an ornamental pond and a number of greenhouses, most notably the ornate Victoria House transported to the estate in the 1990s from the Ursuline Convent in Cabinteely, Co. Dublin. Apart from Malahide Castle (AHC001) and its outbuildings (AHC003), a number of interesting architectural features are located within the demesne, including (but not limited to) the church and graveyard of Malahide Abbey (AHC005 and AHC006), a lime kiln (AHC009), several gate lodges (including AHC007 and AHC08) and a two-storey Victorian stewart's house (AHC004). A low stone wall defines part of the western boundary. See Volume 4C-Appendix 11 – Site 1.

13.4.6 The proposed greenway utilises existing paths within Malahide Demesne. It extends in a north/northeasterly direction from the main car park southeast of Malahide Castle to Hogan's Gate at the northern extremity of the demesne. An information board and directional signage will be provided along the way at agreed locations. The proposed greenway will impact the northeastern extremity of Malahide Demesne where a new footpath will be constructed along the southern and eastern edges of Bridgefield car park to provide safe pedestrian access to and from the park. In addition, new pedestrian steps and cycle ramp will be constructed in the landscaped area to the east of the car park. This will necessitate the removal of existing planting and the widening of the existing pedestrian entrance. As the car park is a relatively modern insertion into the historic demesne and alterations to it are not considered as significant as alterations to historic planting and designed landscape, the overall magnitude of these impacts is considered to be low negative. While some of the individual features of the demesne merit the rating of national importance, its conversion to a public amenity has compromised its original integrity and its overall importance is therefore considered to be regional. Malahide Demesne is an Architectural Conservation Area (ACA).

Predicted Not Significant Construction Impacts

AHC027: Sonas Town House

13.4.7 Sonas on the townland of Malahide is the name of the eastern half of a two-storey four bay semi-detached red brick building comprising on the ground floor two central round-headed entrances flanked by canted bay windows. It has segmental-headed window openings with one up-one down sash windows, brick string course to window heads, coursed brick cornices, slated hip-roof and tall brick chimney stacks. The building is set within its own grounds with a circular gravelled sweep, lawns, ornamental plantation and a gate entrance comprising red brick piers and cast iron gates. See Volume 4C-Appendix 11 – Site 2.

13.4.8 This town house overlooks the Dublin Road (R106) and its shared grounds with Rosca are bounded to the west by O'Hanlon's Lane from which the property is screened by a tall White Cedar hedge. The existing pavement on the R106 will be widened in this location to facilitate a cycle lane; however, the widening will be achieved by reducing the width of the existing carriageway and will not impact on the existing stone boundary wall and gate entrance to Sonas. In addition, the hedgerow bounding the property to the west along O'Hanlon's Lane will be trimmed back to maximise the width of the lane. The overall magnitude of the impact on this structure is considered to be not significant negative. Monitoring of the boundary treatment will be required during construction to prevent physical damage. Sonas is considered to be of regional importance. It is a protected structure (RPS 425).

AHC028: Rosca Town House

13.4.9 Rosca on the townland of Malahide is the name of the western half of a two-storey four bay semi-detached red brick building comprising on the ground floor two central round-headed entrances flanked by canted bay windows. It has segmental-headed window openings with one up-one down sash windows, brick string course to window heads, coursed brick cornices, slated hip-roof and tall brick chimney stacks. The building is set within its own grounds with a circular gravelled sweep, lawns, ornamental plantation and a gate entrance comprising red brick piers and cast iron gates. See Volume 4C-Appendix 11 – Site 2.

13.4.10 This town house overlooks the Dublin Road (R106) and its shared grounds with Sonas are bounded to the west by O'Hanlon's Lane from which the property is screened by a tall White Cedar hedge. The existing pavement on the R106 will be widened in this location to facilitate a cycle lane; however, the widening will be achieved by reducing the width of the existing carriageway and will not impact on the existing stone boundary wall and gate entrance to Rosca. In addition, the hedgerow bounding the property to the west along O'Hanlon's Lane will be trimmed back to maximise the width of the lane. The overall magnitude of the impact on this structure is considered to be not significant negative. Monitoring of the boundary treatment will be required during construction to prevent physical damage. Rosca is considered to be of regional importance. It is a protected structure (RPS 424).

Predicted No Construction Impacts

AHC001: Malahide Castle

13.4.11 Malahide Castle is a detached multi-period country house set within its own grounds (AHC002 – Malahide Demesne). The three-storey tower house, which was built on these grounds c. 1250, was embellished and enlarged by subsequent generations of the family, most notably in the reign of Edward IV (1442-1483), when the Great Hall was added; in the reign of Charles II (1660-1685), when most of the outworks and the defences of the castle were demolished; and between 1765 and 1782, when the west wing was reconstructed following a fire, new drawing rooms and two circular turret rooms were added and the north wing of the castle was developed. The castle is adjoined by outbuildings (AHC003) and extensive ornamental gardens to the east. Malahide Castle and gardens are open to the public. See Volume 4C-Appendix 11 – Site 3.

13.4.12 While a modern car park within the demesne associated with the building will experience a slight negative impact from the proposed development, the house and its curtilage are located outside the study area and will experience no physical impact or visual intrusion. The overall magnitude of the impact on this structure is therefore considered to be neutral. Malahide Castle is considered to be of national importance. It is a protected structure (RMP D012-030---- and RPS 383).

AHC003: Outbuildings, Malahide Demesne

13.4.13 The outbuildings associated with Malahide Castle form a two-storey stable yard complex on a U-shaped plan. Constructed c. 1840, they comprise a gabled central block of coursed rubble stone and red brick dressings with pairs of carriageway arches to the north and south gables attached to flanking perpendicular blocks. The slate roof is double-pitched, with concrete ridge tiles, a red brick chimney stack and cast iron rainwater goods. The complex was remodelled c. 1990 and again in 2012 to accommodate visitor and retail facilities. The square-headed window openings have concrete sills, red brick quoined surrounds and replacement 8/8 timber sash and casement windows. The round-and square-headed door openings have red brick quoined surrounds and replacement glazed timber doors. The outbuildings have recently been converted into an Avoca gift shop and food hall. See (Volume 4C-Appendix 11 – Site 4.

13.4.14 The outbuildings are located close to the proposed greenway; however, as the proposed greenway at this point utilises existing paths the overall magnitude of the impact on this structure is considered to be neutral. The outbuildings are considered to be of regional importance. They are a protected structure (RPS 383).

AHC004: Stewart's House, Malahide Demesne

13.4.15 The house to the immediate south of the outbuildings associated with Malahide Castle is a detached three-bay two-storey structure constructed c. 1860 with a single-bay two-storey return to the rear. It has a hipped slate roof with concrete ridge tiles, red brick chimney stacks with yellow terracotta pots and cast-iron rainwater goods. The walls are of rubble stone with lime rendering and red brick dressings. The segmental-headed window openings have granite sills and 2/2 timber sashes. The window openings on the return are square headed with timber casement windows. The round headed door opening has a timber pilaster doorcase, timber panelled door and an overlight. The door opening on the return is square-headed with a timber door. See Volume 4C-Appendix 11 – Site 5.

13.4.16 The house is located close to the proposed greenway; however, as the proposed greenway at this point utilises existing paths the overall magnitude of the impact on this structure is considered to be neutral. The house is considered to be of regional importance. It is a protected structure (RPS 383).

AHC005: Malahide Abbey, Malahide Demesne

13.4.17 Malahide Abbey is located between Malahide Castle and its outbuildings. It is a ruinous structure comprising a late fifteenth-century nave, sixteenth-century chancel and a sacristy to the south. The walls are of random coursed rubble stone, and there is a cut stone bellcote to the right gable end. The pointed-arch door openings have carved cut stone hood mouldings and there is a trefoil-headed blind opening with a cut stone

surround. The apex on the exterior of the south door contains a "mitred head" and a zoomorphic figure on the moulding stop, while interior features include two sheela-na-gigs and a red sandstone stoup. See Volume 4C-Appendix 11 – Site 6.

13.4.18 The ruins of Malahide Abbey are located close to the proposed greenway; however, as the proposed greenway at this point utilises existing paths the overall magnitude of the impact on this structure is considered to be neutral. The church is considered to be of national importance. It is a protected structure (RMP DU012-031001- and RPS 384).

AHC006: Graveyard, Malahide Abbey, Malahide Demesne

13.4.19 This relatively small sub-circular graveyard is located in the grounds of Malahide Castle opposite the recently renovated courtyard and is enclosed by a battlemented wall. The graveyard contains a number of inscribed eighteenth, nineteenth and early to mid-twentieth century gravestones. There are also undecorated grave markers and possibly reused architectural fragments. See Volume 4C-Appendix 11 – Site 6.

13.4.20 The graveyard is located close to the proposed greenway; however, as the proposed greenway at this point utilises existing paths the overall magnitude of the impact on this site is considered to be neutral. The graveyard is considered to be of national importance. It is a protected structure (RMP DU012-031006- and RPS 384).

AHC007: Hogan's Gate Lodge, Malahide Castle

13.4.21 This detached three-bay single-storey gate lodge is located in the northeastern extremity of Malahide Demesne at the vehicular entrance to Bridgefield car park, and is used as a bike rental station. Constructed c. 1880, it has a projecting gabled central bay flanked to the north by an open recessed entrance bay. The slate roof is pyramidal while that on the projecting central bay is pitched behind a limestone parapet. The square-headed window openings have cut limestone surrounds and tracery and square-leaded timber casement frames. The door opening has a glazed timber panelled door. The gate lodge is adjoined to the west by a gateway of contemporaneous date, comprising a pair of limestone ashlar piers with moulded capping and ball finials, and with cast-iron gates and railings. See Volume 4C-Appendix 11 – Site 7.

13.4.22 While the gate lodge is located close to the proposed development and subject to visual intrusion, its natural function as an entrance marker and as a visual focal point to the demesne negates any such intrusion. The overall magnitude of the impact on this structure is considered to be neutral. The gate lodge is considered to be of regional importance. It is a protected structure (RPS 383).

AHC024: The Casino

13.4.23 This detached eight-bay single- and two-storey thatched house is located on the townland of Malahide to the immediate north of the Dublin Road (R106), where it forms a popular landmark. Constructed c. 1750, its façade is dominated by a central three-bay two-storey curved entrance bow. There is also a pair of three-bay single-storey curved bows on the west elevation. The roof is thatched with hazel rod pinning, red brick chimney stacks, clay pots and overhanging eaves. The walls are of rubble stone construction and whitewashed. The openings are square-headed, with stone sills and 6/6 timber sash windows. The panelled timber door has a spider's web fanlight and sidelights. The building was originally set within its own attendant grounds which,

however, have been virtually obliterated by a modern housing estate. Some remains of the boundary wall survive along the north side of the R106. See Volume 4C-Appendix 11 – Site 8.

13.4.24 The Casino is located close to the proposed greenway. A new controlled pedestrian crossing of the R106 is provided at Hogan's Gate/entrance to the Casino. In addition, the existing pavement will be widened in this location to facilitate a cycle lane; however, the widening will be achieved by reducing the width of the existing carriageway and will not impact on the existing stone boundary wall at the entrance to the Casino. The overall magnitude of the impact on this structure is therefore considered to be neutral; however, monitoring of the boundary treatment will be required during construction to prevent physical damage. The Casino is considered to be of regional importance. It is a protected structure (RPS 381).

AHC025: Milestone

13.4.25 This wall-mounted cast-iron milestone is located on the townland of Malahide in the boundary wall of the Casino (AHC024) and is inscribed "GPO/Dublin/9/Malahide/0". It has a cut granite surround but may originally have been freestanding. The milestone is believed to date from c. 1850. Volume 4C-Appendix 11 – Site 9.

13.4.26 The milestone is located on the opposite side of R106 from Malahide Demesne, east of the proposed controlled pedestrian crossing at Hogan's Gate/entrance to the Casino. The existing pavement will be widened to facilitate a cycle lane; however, as the widening only applies to a section of the R106 to the west of the proposed pedestrian crossing, the overall magnitude of the impact on this structure is therefore considered to be neutral. The milestone is considered to be of regional importance. It is a protected structure (RPS 386).

AHC026: Malahide Presbyterian Church

13.4.27 Malahide Presbyterian Church on the townland of Malahide was designed by William Baird and built in 1956 as the first Presbyterian Church to be constructed in the Republic in the twentieth century. It is also the first building in Ireland constructed of split concrete blocks. It has a steeply pitched roof with flared eaves and a copper-clad spire. The walls are buttressed, the flared eaves of the roof resting on the buttresses. Between each buttress is a triangular-headed triple light with 1/1 sashes. There is a large arched window in the south gable with intersecting tracery. Volume 4C-Appendix 11 – Site 10.

13.4.28 This church is located on the opposite side of R106 from Malahide Demesne, close to the proposed greenway. The existing pavement will be widened in this location to facilitate a cycle lane; however, the widening will be achieved by reducing the width of the existing carriageway and will not impact on the existing stone boundary wall and gate entrance to the Presbyterian Church. The overall magnitude of the impact on this structure is therefore considered to be neutral. The church is considered to be of regional importance. It is a protected structure (RPS 426).

AHC022: Railway Bridge, Malahide

13.4.29 This single-arch railway bridge over road is located on the townland of Malahide adjacent to Bissets Strand. It was opened in 1844 and is constructed of coursed snecked limestone. The bridge has cut-stone piers with concrete coping, cast-iron

panels to one parapet wall, and a red brick soffit. The arch is round-headed, with cut-stone voussoirs. See Volume 4C-Appendix 11 – Site 11.

13.4.30 A link between the proposed development and Malahide village will be provided to traverse underneath the railway bridge. As the existing underbridge width is insufficient to safely facilitate pedestrians and cyclists alongside vehicular traffic, an on-demand signalised shuttle system will be introduced in this location. The system will not interfere with the physical fabric of the bridge and the overall magnitude of the impact on this structure is therefore considered to be neutral; however, monitoring of this structure will be required during construction to prevent physical damage. The railway bridge is considered to be of regional importance. It is a protected structure (RPS 423).

AHC023: Malahide Railway Viaduct

13.4.31 This viaduct spans the Malahide Estuary, connecting the townlands of Malahide and Kilcrea. The original Malahide Viaduct was built in 1844 and was of timber construction supported on timber piles driven into the estuary bed. Within a few years of its opening the viaduct was strengthened against the effects of scour with the placing of rock armour, encapsulating the timber supports and thus forming a weir extending over the length of the bridge from abutment to abutment. In 1860, the viaduct was replaced with masonry piers and wrought iron girders, the piers founded directly on top of the weir. In the late 1960s, the twelve wrought iron spans were replaced with precast post-tensioned beams placed on the masonry piers and supporting ballasted track. The masonry piers are founded directly on top of the weir and therefore were extremely vulnerable to the effects of scour. Following a partial collapse in 2009, the damaged pier was reinstated and supported on piles driven through the weir to bed-rock level. To protect the viaduct against the effects of potential scour, micro-piles were installed at each pier and abutment, with a total of fifteen piles in each. See Volume 4C-Appendix 11 – Site 12.

13.4.32 A new 180m pedestrian and cycle bridge will be constructed parallel to and to the west of the railway viaduct. The new bridge will be a 12-span concrete bridge structure at a minimum height of 2.8m above the weir crest and will provide a 4m wide track with a viewing area on the southern side and with ramps at both ends. The proposed pedestrian bridge is a freestanding structure and will have no impact on the physical fabric of the existing viaduct. The overall magnitude of the impact on this structure is therefore considered to be neutral. The viaduct is considered to be of regional importance. It is a protected structure (RPS 420).

AHC031: Railway Bridge, Kilcrea

13.4.33 This metal railway bridge spanning between stone piers over Corballis Cottages Road is located on the townland of Kilcrea. It is constructed from coursed rock-faced stone with ashlar piers. It was constructed c. 1860 as a single-arch bridge. Alterations c. 1960 have partially obliterated the arch. See Volume 4C-Appendix 11 – Site 13.

13.4.34 A section of the Corballis Cottages Road on both sides of the railway bridge will be widened. As the current underbridge width is insufficient to safely facilitate pedestrians and cyclists alongside two-way vehicular traffic, a 2m wide path will be provided under the railway bridge by reducing the existing carriageway to a single vehicular lane underneath the bridge. In addition, an on-demand signalised shuttle system will be

provided to improve safety. The proposed works will not interfere with the physical fabric of the railway bridge. The overall magnitude of the impact on this structure is considered to be neutral; however, monitoring of this structure will be required during construction to prevent physical damage. The railway bridge is considered to be of regional importance. It is a protected structure (RPS 502).

AHC044: Gate Entrance, Newbridge Demesne

13.4.35 This gate entrance provides access to Newbridge House at the junction of Kilcrea Road and Hearse Road (R126) on Newbridge Demesne. Constructed c. 1770, the entrance comprises granite entrance piers of alternating courses of ashlar and vermiculated stone, capped by crown finials. It is flanked by smaller piers of similar design to form pedestrian entrances. See Volume 4C-Appendix 11 – Site 14.

13.4.36 The junction in this location will be upgraded which necessitates the realignment and re-grading of the existing junction and the provision of a new controlled crossing. A new kerb, signage and public lighting will also be provided on either side of the junction on Hearse Road to provide advance notice of the new crossing. The surface outside the entrance to Newbridge Demesne will be upgraded by means of gravel surfaces to either side of the proposed greenway. The overall magnitude of the impact on this structure is considered to be neutral; however, monitoring of this structure will be required during construction to prevent physical damage. The gate entrance is considered to be of regional importance. It is a protected structure (RPS 494).

AHC045: Mack's Bridge, Newbridge Demesne

13.4.37 This single-arch humpback avenue bridge is located on the main avenue within Newbridge Demesne, spanning the Pill River. Constructed c. 1780, the bridge comprises a carved limestone archivolt and keystones. The parapet walls are random rubble stone with wrought-iron railings and ashlar piers. See (Volume 4C-Appendix 11 – Site 15.

13.4.38 The proposed greenway crosses Mack's Bridge along an existing pathway and no construction impacts are predicted. The overall magnitude of the proposed development on this structure is therefore considered to be neutral. The bridge is considered to be of regional importance. It is not a protected structure but is located within the ACA of Newbridge Demesne and was surveyed by NIAH in 2000.

AHC041: Newbridge Demesne

13.4.39 This 150-hectare demesne is located on the townland of Newbridge Demesne in Co. Dublin. It is bounded to the north by Turvey Avenue, to the east and south by Hearse Road (R126) and to the west by Cobbe's Lane. The demesne grounds as highlighted on the First Edition Ordnance Survey map remain intact and in single ownership, the transport network following the original demesne boundaries. The demesne is used as a public amenity and incorporates a number of playing fields, children's adventure ground and a large traditional farm with animal enclosures. These facilities, along with a car park, are predominantly located to the immediate southwest of Newbridge House. The designed landscape is characterised by well-defined wood belts along the boundaries and a 'Brownian' design concept of open ground alternating with naturalistic tree belts and islands. Large walled gardens adjoin Newbridge House (AHC040) to the north. A low demesne wall, missing or collapsed in parts, bounds the demesne to the south and east. See Volume 4C-Appendix 11 – Site 16.

13.4.40 The proposed greenway will utilise existing pathways within the demesne. The existing path between Newbridge House and main car park will be re-surfaced and a safe crossing point provided together with cycle parking and directional signage. The overall impact of the proposed greenway on this site is considered to be neutral. Newbridge Demesne is considered to be of regional importance. It is an Architectural Conservation Area (ACA).

AHC040: Newbridge House

13.4.41 Newbridge House is a detached country house set within its own grounds (AHC041 – Newbridge Demesne). It was built in 1737 for Dr Charles Cobbe, afterwards Archbishop of Dublin, and extended to the north c. 1765. The design of the building is attributed to Richard Castle. Newbridge House is a detached six-bay two-storey over basement structure with a dormer attic, of ashlar sandstone, with a pedimented tripartite doorcase approached by flight of granite steps. The M-shaped double pitched slate roof with clay ridge tiles is hidden behind a parapet wall with urns and eagles. There are also a number of double-pitched slate subsidiary roofs to the wings and return. The façade has granite quoins, coping and cornice, while the side and rear elevations are roughcast rendered. The window openings are square-headed with shouldered architraves, granite sills and 9/9 or 6/6 timber sashes. The pedimented ionic limestone doorcase incorporates a glazed and timber panelled double leaf door flanked by 6/6 timber sash sidelights. The interior contains plasterwork by Robert West. Newbridge House and gardens are open to the public. See Volume 4C-Appendix 11 – Site 17.

13.4.42 Newbridge House forms the culmination point of the proposed greenway. The principal building will experience no construction impact. As the building forms the focal point of the demesne and is a popular visitor attraction, visual intrusion is not an issue. The overall magnitude of the impact on this structure is therefore considered to be neutral. Newbridge House is considered to be of national importance. It is a protected structure (RMP D012-060---- and RPS 494).

AHC042: Outbuildings, Newbridge Demesne

13.4.43 This courtyard quadrangle is located to the immediate north of Newbridge House (AHC040) in the townland on Newbridge Demesne. Designed by Robert Mack c. 1790, it comprises two-storey stable blocks, single-storey random rubble ranges and an adjoining aviary. The slate roof of the complex is hipped, except for a gabled section to the central three bays of the main block, with terracotta ridge tiles and red brick chimneys. The walls are roughcast render with red brick string courses to an L-shape block, and random rubble limestone and red brick to other ranges. The windows are square-headed with brick dressed openings except for the L-shaped blocks which are rendered; mostly with granite sills and timber casements. The door openings are round headed, with timber panelled doors. See Volume 4C-Appendix 11 – Site 18.

13.4.44 The courtyard is enclosed and forms part of the traditional farm operated on the grounds of Newbridge House and access requires the purchase of a ticket. There is no physical or visual impact on the courtyard and its buildings. The overall magnitude of the impact on this structure is therefore considered to be neutral. The courtyard is considered to be of regional importance. It is a protected structure (RPS 494).

Table 13.3 Summary of Construction Impacts on Sites and Structures of Architectural Heritage Merit.

AHC No.	Site Type	Townland	Proximity to Centre Line	Magnitude of Impact	Importance of Structure	Nature of Impact	Significance of Impact Before Mitigation	Type of Impact	Visual Impact (Refer to Chapter 14)
AHC001	Country House	Malahide Demesne	100m	Neutral	National	None	No predicted impact	No predicted impact	None
AHC002	Demesne	Malahide Demesne	0m	Low negative	Regional	Construction of new footpath; construction of new pedestrian steps and cycle ramp necessitating the removal of existing plantation within car park area; widening of existing pedestrian entrance.	Slight	Direct	None
AHC003	Outbuildings	Malahide Demesne	8.5m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC004	Stewart's House	Malahide Demesne	10m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC005	Church, undetermined	Malahide Demesne	34.4m	Neutral	National	None	No predicted impact	No predicted impact	None
AHC006	Graveyard	Malahide Demesne	34.7m	Neutral	National	None	No predicted impact	No predicted impact	None
AHC007	Gate Lodge	Malahide Demesne	8m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC022	Railway Bridge	Malahide	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC023	Viaduct	Malahide	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC024	Vernacular House	Malahide	76m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC025	Milestone	Malahide	55m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC026	Church, Presbyterian	Malahide	44m	Neutral	Regional	None	No predicted impact	No predicted impact	None

AHC No.	Site Type	Townland	Proximity to Centre Line	Magnitude of Impact	Importance of Structure	Nature of Impact	Significance of Impact Before Mitigation	Type of Impact	Visual Impact (Refer to Chapter 14)
AHC027	Town House	Malahide	17m	Low negative	Regional	Trimming of overgrown hedgerow to facilitate a pull in area.	Not significant	Direct	None
AHC028	Town House	Malahide	25m	Low negative	Regional	Trimming of overgrown hedgerow to facilitate a pull in area.	Not significant	Direct	None
AHC031	Railway Bridge	Kilcreagh	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC040	Country House	Newbridge Demesne	38m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC041	Demesne	Newbridge Demesne	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC042	Outbuildings	Newbridge Demesne	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC044	Gate Entrance	Newbridge Demesne	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None
AHC045	Bridge	Newbridge Demesne	0m	Neutral	Regional	None	No predicted impact	No predicted impact	None

Table 13.4 Summary of the Magnitude of Impacts on Architectural Heritage.

Site Importance	International	National	Regional	Local	Subtotal
Magnitude of Impact	0	0	0	0	0
Very High	0	0	0	0	0
High	0	0	0	0	0
Medium	0	0	0	0	0
Low	0	0	3	0	3
Subtotal	0	0	3	0	3

Table 13.5 Summary of the Significance of Impacts on Architectural Heritage.

Site Importance	International	National	Regional	Local	Subtotal
Significance of Impact	0	0	0	0	0
Profound	0	0	0	0	0
Very Significant	0	0	0	0	0
Significant	0	0	0	0	0
Moderate	0	0	0	0	0
Slight	0	0	1	0	3
Not Significant	0	0	2	0	0
Imperceptible	0	0	0	0	0
Subtotal	0	0	3	0	3

Predicted Operational Impacts

13.4.45 Sites and structures of architectural heritage may be subject to operational visual impacts. These can result either from tree and hedgerow screening loss, in which case they are pronounced in the short term, or from visual obstruction caused by embankments, noise barriers or elevated bridges and interchanges, which will cause a significant and permanent change in the local character. Sites and structures of architectural heritage merit may also be subject to operational noise impacts. In some cases, continued exposure to air pollutants may result in chemical changes such as corrosion of façades.

13.4.46 Owing to the low-impact nature of the proposed greenway, sites and structures of architectural heritage merit in its vicinity are unlikely to experience operational impacts.

13.5 Mitigation Measures

Introduction

13.5.1 Wherever possible, measures have been recommended to mitigate the negative impacts of the proposed greenway on sites of architectural heritage merit. The mitigation measures are listed below. For detailed mitigation measures for individual sites, please refer to Table 13.6 below.

Schedule of Mitigation Measures

(1) All mitigation measures shall comply with relevant legislation concerning architectural heritage.

(2) All mitigation measures are subject to approval from the relevant local authority Conservation Officer and, for sites listed on the Record of Monuments and Places, from the Department of Communications, Climate Action and Environment.

(3) The option of site avoidance has been considered in all cases where sites or structures of architectural merit are impacted by the proposed greenway. Site avoidance was considered during the constraints, route selection and EIA stages and instigated wherever possible. Where avoidance has not been possible, considered attempts have been made to reduce the impacts of the proposed greenway by way of the mitigation measures proposed.

(4) Boundary treatment will be reinstated as detailed in Table 13.6 below.

(5) The following structures and/or their boundary treatments will be monitored and fenced off if necessary during construction to prevent physical damage: Railway Bridge (AHC022), Casino (AHC024), Presbyterian Church (AHC026), Sonas Town House (AHC027), Rosca Town House (AHC028), Railway Bridge (AHC031) and Gate Entrance, and Newbridge House (AHC044).

Table 13.6 Mitigation Measures Proposed for Sites of Architectural Heritage Merit.

AHC No.	Site Name	Mitigation	Schedule of Mitigation Measures Item No. (Section 13.5 above)
AHC002	Malahide Demesne	Construction of simple exit piers. Monitoring demesne boundary and fencing off if necessary during construction to prevent physical damage.	4
AHC022	Railway Bridge	Monitoring structure and fencing off if necessary during construction to prevent physical damage.	6
AHC024	The Casino	Monitoring boundary treatment of structure and fencing off if necessary during construction to prevent physical damage.	6
AHC026	Presbyterian Church	Monitoring boundary treatment of structure and fencing off if necessary during construction to prevent physical damage.	6
AHC027	Sonas Town House	Monitoring boundary treatment of structure and fencing off if necessary during construction to prevent physical damage.	5, 6
AHC028	Rosca Town House	Monitoring boundary treatment of structure and fencing off if necessary during construction to prevent physical damage.	5, 6
AHC031	Railway Bridge	Monitoring structure and fencing off if necessary during construction to prevent physical damage.	6
AHC044	Gate Entrance, Newbridge House	Monitoring structure and fencing off if necessary during construction to prevent physical damage.	6

Table 13.7 Summary of Residual Impacts on Architectural Heritage.

AHC No.	Site Type	Townland	Importance of Structure	Magnitude of Impact before Mitigation	Significance of Impact Before Mitigation	Magnitude of Impact After Mitigation	Significance of Impact After Mitigation
AHC002	Demesne	Malahide Demesne	Regional	Low	Slight Negative	Low	Not significant negative
AHC027	Town House	Malahide	Regional	Low	Not Significant Negative	Neutral	No impact
AHC028	Town House	Malahide	Regional	Low	Not Significant Negative	Neutral	No impact

13.6 Residual Impacts

13.6.1 This chapter considers any residual physical or structural impacts after mitigation on the three sites of architectural heritage merit predicted to experience direct negative impacts from the proposed development. The findings are summarised in Table 13.7 above.

13.6.2 The impacts on Malahide Demesne (AHC002) are considered to be slight negative as a result of the provision of a new footpath and pedestrian exit/entrance. Appropriate mitigation measures are considered to reduce these impacts to not significant. There will be no impact on the principal building associated with this demesne or its curtilage.

13.7 Cumulative Impacts

13.7.1 It is not anticipated that, given current knowledge, any plan or other project would result in full or in part to a potential significant impact for this environmental topic.

14.0 Landscape

14.1 Introduction

14.1.1 This chapter considers the landscape and visual implications of the proposed development. Throughout the assessment the appraisal has sought to distinguish between the direct effects upon the physical landscape and the visual implications of the development of the scheme upon the observer.

14.1.2 The landscape and visual assessments are set against an understanding of the existing landscape character and context. The impact of the proposed development on this existing context is appraised and, where significant impacts occur to either the landscape character or visual amenity, then appropriate forms of mitigation to alleviate these impacts are proposed and described.

14.1.3 The visual assessment aims to identify and assess the significance of the likely visual impacts of the proposed scheme upon both the alignment footprint and the surrounding area. Visual effects relate closely to landscape effects, but concern the potential changes in and impacts on views within the study area. Visual assessment concerns people's perception and response to changes in visual amenity. Effects may result from new elements within the landscape that cause visual intrusion (the interruption of a view without blocking that view) or new features that obstruct views across the landscape.

14.1.4 The appraisal assesses the predicted impacts on the physical landscape of the application area and its immediate vicinity and describes changes to its character and how this is experienced. Recognised elements of cultural or heritage interest as represented by designated and non-designated historic structures also contribute to the landscape character and, in this respect, the text should be read in conjunction with Chapter 12 (Archaeology and Cultural Heritage). Similarly, there are frequent interrelated impacts between landscape and ecological effects and, here, this chapter of the report should be read alongside Chapter 6 (Biodiversity).

14.2 Data and Methodology

14.2.1 Through the identification of impacts and assessment of the potential effects, distinctions may be drawn between temporary, permanent, short-term and long-term impacts and effects. Landscape and visual impacts and effects may be further categorised as being either direct, that is, within the study area as determined by the Zone of approximate Visual Influence (ZVI) (see Volume 3-Figure 6), from where views of the proposed scheme may be available; or indirect, for example, the visual impact of construction traffic moving off-site.

14.2.2 The operation assessment year allows time for any mitigation measures to establish, for example, any associated planting to become mature and effective as a screen or significant visual presence. The significance of effects has been assessed against the pre-construction baseline year of 2017.

14.2.3 A detailed desktop assessment has been effected. Site visits have been made in the period 2012-2017.

Planning Policy

14.2.4 The Fingal Development Plan 2017-2023, Chapter 9-Natural Heritage, contains a Landscape Character Assessment subdividing the county into six different landscape character types (LCTs) (see Volume 3-Figures 7 to 9). The character of the landscape is determined by a combination of the underlying topography, geology and ecology, overlaid by the components of the landscape dictated by the historic land-uses, for example, the woods, hedgerows and settlement patterns. Furthermore and as stated, 'each landscape type is given a value through the consideration of such elements as aesthetics, ecology, historical, cultural, religious or mythological.'

14.2.5 The high quality of the landscape in which the proposed greenway is proposed is reflected in the landscape designations contained within the Fingal Development Plan.

14.2.6 Both Newbridge and Malahide Demesnes lie within low-lying agricultural landscape character. These areas are determined to be of an overall modest value and low sensitivity, but it is acknowledged that there are pockets of important value and sensitivity within this wider categorisation which require particular attention. Historic demesnes and archaeological monuments are given as examples of this occurrence and certainly the demesnes of both Malahide and Newbridge would fit under this description and are of a high value and sensitivity.

14.2.7 Route works in the main are located in the Estuary Landscape Character Type. The value attached to this landscape is very high – 'The Estuary Character Type is categorised as having an exceptional value, recognised by the EU designations (candidate Special Areas of Conservation and Special Protection Areas) that apply to each in addition to national designations such as proposed Natural Heritage Areas and Ramsar. The aesthetic quality of the estuaries is also outstanding.'

14.2.8 The quality of the visual landscape of the estuary is recognised by the protection of views from the southern shores northwards and northern shores southwards, over the estuary. The Development Plan outlines objectives for these areas as follows:

- Objective NH40: Protect views and prospects that contribute to the character of the landscape, particularly those identified in the Development Plan, from inappropriate development.
- Objective NH35: Resist development such as houses, forestry, masts, extractive operations, landfills, caravan parks and large agricultural/horticulture units which would interfere with a view or prospect of special amenity value, which it is necessary to preserve.

14.2.9 To the north of the estuary at Kilcrea the agricultural lands are zoned 'HA' high amenity and designated 'highly sensitive landscape'. The zoning objective seeks to protect and enhance high amenity areas.

14.2.10 These lands at Kilcrea are also a designated ecological buffer zone in the Fingal Development Plan, which seeks to protect the ecological integrity of the nationally and internationally designated sites by providing suitable habitats for key species such as birds. This buffer zone is an important roosting habitat for various birdlife species and, around the estuaries, these buffer zones can provide for low intensity recreational use such as walking and cycling where a proposal will have no significant adverse impact on the habitats and species of interest in the buffer zone.

14.2.11 The River Pill is a recognised valuable habitat and important ecological corridor that shall be protected. The fields surrounding the river are subject to riverine and tidal flooding and are, therefore, highly sensitive.

14.2.12 The two demesnes of Malahide and Newbridge are both designated Architectural Conservation Area (ACA) status. This is a place, area, group of structures or townscape that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or value, or contributes to the appreciation of protected structures.

14.2.13 The demesnes are also offered protection under the Development Plan through that afforded by the designation of the sites as a Designed Landscape – Historic Gardens, Demesnes and Estates. Objectives CH45 and CH46 seek to promote the conservation of historic designed landscapes and ensure that any proposed development is sensitive to, and respects the built heritage elements and green space values of the site. Objective CH25 is particularly pertinent to this proposal as it ensures that infrastructure projects consider and seek to avoid impact on the built heritage and historic designed landscapes.

14.2.14 Objectives CH49, CH50, and CH51 seek to further and enhance access to and understanding of the heritage of Fingal, which, in principle, would be promoted by these proposals.

14.2.15 Green Infrastructure Mapping Objective 2, seeks to protect the natural and built heritage of the demesnes, and recognises the site as a Highly Sensitive Landscape.

14.2.16 Given the above and in keeping with the designation of the Development Plan, the area is determined as being of High Landscape Sensitivity and Value.

14.3 Existing Environment

14.3.1 The study area for the landscape assessment is indicated on Volume 3-Figure 6 and to a large extent has been determined by extent of the ZVI, but is set within the much broader landscape of the Fingal coastline. This coastline extends from Dublin city to the Meath border in the north. It contains a number of important beaches, islands and headlands which together create a sensitive and nationally important landscape of high amenity and landscape value. The land is generally low-lying, except for some prominent headlands and hills to the north of area. Views along the coast are generally contained within these headlands, ridge lines and harbours, which combine to create spectacular viewing points.

14.3.2 Immediately inland from the coastal strip are three heritage houses and demesnes: Ardgillan Demesne, Newbridge Demesne and Malahide Demesne. This study is concerned with the connection of the Malahide to Newbridge demesnes.

14.3.3 From its early beginnings as an agricultural, maritime and industrial centre, Malahide has developed into a modern, progressive town. While retaining its 'village' atmosphere in the centre of the town, Malahide has become a popular and desirable residential area on the outskirts of Dublin.

14.3.4 The coastal location has also helped the development of tourism in the town. Malahide has a popular marina with some 300 berths and the only natural inlet along the east

coast. As a result, Malahide is a popular destination for visiting yachts from both Ireland and overseas.

14.3.5 The estuary is divided east/west by the rail viaduct, with the outer, eastern area remaining tidal and containing the marina and the inner estuary retaining an artificially consistent water level through a weir placed at the midpoint of the viaduct. The creation of the inner estuary basin is attractive to both wildfowl and yacht owners, with a number of boat clubs around the estuary and a highly protected ecology.

14.3.6 Once complete, the proposed development would not only form a valuable new link in the chain of the long distance trail, but would, with imaginative routing and links to public transport, also create an important local recreational focus and educational amenity.

Landscape Baseline

14.3.7 The proposed route runs through a variety of landscape types within the study area. As discussed, for the ease and clarity of reporting and assessing, the study area has been divided into zones of common landscape character. These are:

- Zone 1 – Malahide Demesne (Section 1).
- Zone 2 – Malahide Village (Sections 2 and 3).
- Zone 3 – Railway Causeway (Section 4).
- Zone 4 – Kilcrea Townland (Section 5).
- Zone 5 – Newbridge Demesne (Section 6).

The Character Zones

Zone 1 – Malahide Demesne

14.3.8 The Malahide demesne has a history extending back to the twelfth century, but what is apparent now is a mature landscape, with a readily recognisable eighteenth century designed parkland structure of open lawns, meadows and glades framed by woodland, tree belts and punctuated with groups and stands of trees. The castle, parkland and gardens extend to 270 acres and were acquired by Dublin City Council in 1976 from the Talbot family, who had owned the castle and grounds since 1185. The demesne is now fully open to the public and forms an important amenity resource for the town and region, with numerous formal and informal recreational facilities contained within the park including cricket and football pitches, tennis courts, golf, and pitch & putt.

14.3.9 The last Lord Talbot was a renowned botanist and plantsman, creating what is now the Talbot Botanic Gardens within the heart of the demesne. This represented one of the finest private plant collections in Ireland and has now been fully restored by Fingal County Council as a principal feature of the park.

14.3.10 A complex of stable and demesne workers buildings set around a stable courtyard has been converted and extended into a modern expansive Visitor Centre, with shops, restaurant and interpretation. The complex, adjacent to the historic castle and at the heart of the demesne, also provides access into the walled garden to the east. A large car and coach park has also been created to the south of the Visitor Centre and the east of the main access.

14.3.11 The main areas of woodland and formal gardens extend to the east and west of the castle to connect to the perimeter woodland belts. This basically divides the demesne in two, creating large open expanses to the north and south. The formal recreation areas are predominantly in the north, towards the town, and are serviced by a separate car parking facility at Bridgefield in the northeast corner of the demesne.

14.3.12 The nature of the eighteenth century idealised concept of the romantic English Landscape style evident at Malahide, containing and controlling views and screening the demesne off from the outside world, creates an insular landscape remote from the effects of the surrounding environment.

Zone 2 – Malahide Village

14.3.13 The demesne is immediately adjacent to the town centre and residential areas, representing an immediate amenity for the local community and visitors to the town. The character of this section, once outside the demesne, is urban/suburban.

14.3.14 North of Malahide Demesne, the land falls away towards the estuary. The R106 running into town borders the demesne to the north and the railway runs to the eastern boundary, with the station immediately north of the R106. As the land falls towards the estuary, the railway leaves Malahide Station on embankment and forms the western edge of a promontory of land pointing northwards into the estuary. East of the railway the main town centre extends along this promontory, with three and four storey residential properties overlooking the marina. These residential units also look westward over the railway and the eastern inner estuary. Housing continues around the western shore of the inner estuary along Bissets Strand. However, these properties are predominantly bungalows with long views northwards over the estuary towards Kilcrea.

14.3.15 For the purposes of this assessment, therefore, it is important to note that the railway acts as a strong physical and visual barrier and a divide between the town centre to the east and suburban residential areas to the west.

Zone 3 – Railway Causeway

14.3.16 The viaduct continues northwards and at the end of the promontory a weir has been created to permit the movement of water between the two parts of the estuary. The weir restricts the flow of water at low tide retaining a significant body of water within the inner estuary. At low tide, therefore, there is a considerable change in character and appearance between the inner and outer estuary with the outer estuary displaying a vast expanse of mudflats.

14.3.17 The proposed greenway would leave Malahide at the access point at Bissets Strand. A high palisade fence currently protects the yard and access to the maintenance track. The route would follow the weir maintenance access approximately 3m below the level of the railway and would continue at this level northwards to a pedestrian bridge over the weir constructed upon the existing piers. This part of the route would be designed for a higher level of use, encouraging residents of and visitors to Malahide to walk to the weir and back. The route would be wider than elsewhere, with macadam topping to the hardcore base of the existing maintenance access.

14.3.18 The activity and interest of the weir would be an attraction and it is proposed that the railing detail changes to lighter steel profile across the end of the path at the bridge to

permit views through the rails of the racing waters of the weir. The pathway would also be widened here to form a viewing area with the inclusion of seating. With the proposed open space at Bissets Strand this would form an attractive and satisfying 'out and back' route from the town for the less adventurous. The proposed greenway would need to ramp to the level of the bridge.

14.3.19 North of the weir, the route continues to rise to run at almost the same level as the railway tracks. It is on this section of the viaduct that a true sense of the scale of the estuarine landscape can be perceived, with long ranging views to both the east and the west across the inner and outer estuary. This change in elevation again reinforces the distinction between the two sections of the route across the viaduct.

Zone 4 – Kilcrea Townland

14.3.20 North of the estuary, the study area embraces the agricultural landscape of the Kilcrea peninsula, from the railway in the east to the Kilcrea Road to the west and north to Newbridge Demesne. The Kilcrea peninsula rises gently from the northern shore to a low ridgeline some 400-600m back from the shore, in a patchwork of arable fields with significant hedgerows and stands of trees.

14.3.21 Although relatively close to the open expanse of the estuary, to the north of the ridgeline described above, the landscape is relatively small scale and enclosed. This is primarily due to the small size of the fields and the abundance and height of road and field hedgerows.

14.3.22 The railway continues northwards on a lower embankment with a mature hedgerow at its base, until it crosses the River Pill; a narrow, winding river course that flows through low-lying pasture to the north of the ridgeline and discharges into the estuary immediately to the east of the railway. This flat, low-lying area of pasture to the north of the peninsula is an attractive, damp landscape, defined by the numerous watercourses feeding into the River Pill and subdivided by sparse hawthorn hedgerows and is in stark contrast to both the demesnes to the north and west and the estuary to the south and east.

14.3.23 North of the River Pill and west of the railway a wide hardcore maintenance track parallels the railway to the west of the boundary hedgerow. This track deviates westward to skirt around a recently constructed bungalow and joins the Corballis Cottages Road. The route corridor follows the Corballis Cottages Road to Hearse Road and into the Newbridge Demesne.

14.3.24 The River Pill passes under Corballis Cottages Road at a farm complex. To the north of Corballis Cottages, along the River Pill the land is very low-lying, marshy and subject to flooding. The alignment and nature of the river corridor is easily evident from the mature willows and scrub to the banks and within adjacent hedgerows.

14.3.25 The river emerges from beneath the R126 Hearse Road, having flowed from the wooded boundary to Newbridge Demesne to the immediate north of the road.

14.3.26 To the west of the study area in this section, Kilcrea Road runs southwards from the R126, at the southern gateway to Newbridge Demesne, towards the north shore of the estuary. The significant demesne boundary wall of Seafield House rises to the west of the road towards the estuary. Elsewhere, banks and hedgerows, punctuated with access drives to detached properties, enclose the road. Kilcrea House and cottages are

set in a wooded glade to the western end of the ridge that bounds the estuary. The paddocks and stables of Kilcrea Equestrian Centre to the south of the ridge lend a distinctive pattern to the landscape in this area. At the estuary the fields run down to the water and a narrow shingle strand, with wide views over the estuary to Malahide and the railway viaduct.

Zone 5 – Newbridge Demesne

14.3.27 The 150 hectare park is a fine example of an eighteenth century designed parkland set around a Georgian house, with extensive views across open meadows to heavily planted perimeter woodland belts and stands of historic and more recent tree groupings. In a similar manner to Malahide Demesne, Newbridge provides a valued amenity for the local communities, although the catchment is smaller, with many walkers and runners evident.

14.3.28 Although primarily an open space amenity, the grounds also have a traditional farm and a restaurant within the courtyard to the house. Sports pitches and a children's playground are also provided for public use.

14.3.29 A car park is set within the heart of the parkland close to the house and this forms the northern end of the proposed greenway. Access to the car park is by way of a driveway leading from the R126 Hearse Road, through the parkland. Further to the east along the R126, a second gateway to the demesne would form the area of access for the proposed greenway into the park.

14.3.30 Approximately half way along the drive, some 250m from the gateway, a second footpath, called Newbridge Avenue, cuts eastward through the meadows towards Donabate. Donabate adjoins the eastern boundary of the demesne and the railway station within the village provides the potential means of return or arrival (depending on the direction of travel) to, or from, Malahide. Newbridge Avenue forms part of the route, therefore, and is an attractive walkway with a gentle but pronounced topography and areas of interest along the way. Within the park and alongside the footpath, there is a deer enclosure, where the animals can be easily observed, and close to the woodland perimeter there is an historic lime kiln. Passing through the demesne gates, one immediately enters the village of Donabate and soon crosses the Square, a rectangular green surrounded by properties, with St Patricks Church of Ireland to the north overlooking the square. After another 100m, the railway station is visible along Turvey Avenue.

Visual Baseline

Zone of Visual Influence

14.3.31 The Zone of approximate Visual Influence (ZVI) is the area from which the proposed development or parts of the scheme may be visible. The potential ZVI was noted during the site visits and the resulting Visual Envelope Map (VEM) is shown on Volume 3-Figure 6. The VEM reflects the visibility of the site based upon the topography of the surrounding area and known elements such as buildings and the existing vegetation, where noted in the visual assessment, which provide all year screening. It should be noted that there will be areas within the VEM which do not have views of the proposed greenway (due to the localised screening effects of vegetation, structures,

topographical formations, etc), but it is an approximate guide used to assist in identifying key visual receptors and viewpoints.

14.3.32 To the south within Malahide Demesne, views are generally confined by perimeter woodland to within the demesne boundary and are often screened internally by strong belts of woodland planting.

14.3.33 Through Zone 2, the town of Malahide, the visual envelope is even more contained within the houses and properties along the road corridors. On reaching Bissets Strand and the southern shore of the inner estuary, however, the views open out dramatically to embrace the shoreline, the viaduct and as far as the northern shore. These views are protected within the Development Plan.

14.3.34 Due to the open nature of the rail viaduct and lack of vegetation upon it, views are open across both the inner and outer estuary, with only the bulk of the viaduct providing screening to either side.

14.3.35 Within Zone 4, Kilcrea Townland, the northern shores of the inner estuary are relatively open with large fields sloping down towards the shore. To the north of the ridgeline bordering the northern shore, the visual envelope is restricted and contained by the smaller field parcels and tall hedgerows.

14.3.36 Once within Newbridge Demesne, and beyond the screening woodland belts to the boundary, views open out across the open parkland, but the visual envelope is primarily contained within the demesne.

Selection of Viewpoints

14.3.37 Viewpoints are chosen to study the potential visual effects of the scheme. The principal criterion is that they must be representative of the range of views and viewer types within each character area, which are likely to experience significant impacts. Viewpoints have been selected at locations that are currently accessible to the public and are likely to remain so should the scheme be developed, for example, roads, footpaths and cycleways. Specific points may also be chosen because they are important existing viewpoints in the landscape, even though from these, the visual effects may not be significant. The viewpoint locations are shown on Volume 3-Figures 10 to 20.

14.4 Potential Impacts

14.4.1 The following elements of the proposed greenway development have the potential for landscape and visual impact during the construction stage:

- Tree, hedgerow and scrub removal to the northern section;
- River Pill bridge construction;
- Viaduct bridge construction;
- Construction of walls, fencing and screening structures;
- General construction disturbance, traffic, plant, working lights, etc;
- Storage of materials.

14.4.2 The features of the operational stage of the proposed scheme which have potential for landscape and visual impact include the following main elements:

- Screens and fences;
- Bridges;
- Lighting
- Signage;
- Greenway users – cyclists and walkers.

Construction Impacts

Zone 1 – Malahide Demesne

IMPACT ON LANDSCAPE FEATURES, TREES AND WOODLAND

14.4.3 There will be a need to undertake certain works within Malahide Demesne in the provision of signage and construction of cycle parking and improved access to the Bridgefield car park. The cycle parking works will be a relatively minor extension to the northern boundary of the existing car park and, similarly, the access improvements would involve the reconstruction of the existing cycle ramp. This latter work would require the removal of the length of screen planting and trees to the west of the car park ramp. Inclusion of additional signage and way marking within the demesne would be both localised and minor work. Overall, these works would cause a slight negative landscape effect of medium term duration during the construction phase.

14.4.4 There would be minimal impact on the setting of the castle and historic landscape or the architectural conservation area (ACA) of Malahide Demesne, and these impacts would be short-term during construction.

14.4.5 Any construction activity has the potential to cause disruption, which might be of detriment to policies CH49, CH50 and CH51 promoting access and understanding of the history of the area, but any such impacts would be minor and short-term.

IMPACT ON LANDSCAPE CHARACTER

14.4.6 Due to the limited nature and magnitude of construction effects within the demesne, with the proposed greenway alignment on existing roads and footpaths, there would be negligible impact overall on the low lying agricultural landscape character type and negligible effect on highly valued and sensitive character at a localised level within the demesne.

Zone 2 – Malahide Village

EFFECT ON LANDSCAPE FEATURES, TREES AND WOODLAND

14.4.7 The proposed greenway within this zone would be routed through a predominantly hard, suburban and urban environment, making use of existing footpaths and roads. As works are restricted to within the road, provided excavations do not damage the roots of trees in the adjacent park and gardens, there would be no impact on landscape features. The construction of the cycle facilities and additional layby parking along Bissets Strand would entail the removal and regrading of the grass verges between existing car park pull-ins. There would be little impact, therefore, on significant landscape features and this category of effects within this section of the route proposals can be considered slight negative impact.

EFFECT ON LANDSCAPE PLANNING

14.4.8 None of the options would have an effect on existing planning policy.

EFFECT ON LANDSCAPE CHARACTER

14.4.9 The effects on the visual domain of the estuary are described below (see Section 14.5 and Section 14.6). Due to the limited nature and magnitude of physical construction effects within this section, with the majority of all route options primarily on existing roads and footpaths, there would be negligible impact overall on the estuary landscape character type and minimal impact on character at a localised level. The potential car parking provision along Bissets Strand is a consolidation of an existing condition.

Zone 3 – Railway Causeway

EFFECT ON LANDSCAPE FEATURES, TREES AND WOODLAND

14.4.10 There are no landscape features affected along this section of the route.

EFFECT ON LANDSCAPE PLANNING

14.4.11 There are specific objectives of the Development Plan to preserve the views of Malahide Estuary from the Bissets Strand Road and from the coastline at Kilcrea. Overall the development is considered to have a neutral effect upon these objectives.

EFFECT ON LANDSCAPE CHARACTER

14.4.12 The effects of the construction on the visual domain of the estuary are described below (see Section 14.5 and Section 14.6). The works to the railway causeway will have minimal impact on what is already clearly a man-made structure within the estuary and the proposed greenway would share a transport and movement corridor with the railway. Landscape improvements are proposed at Bissets Strand (see Volume 3-Figure 21). Effects on the estuary landscape character type would be slight neutral.

Zone 4 – Kilcrea Townland

IMPACT ON LANDSCAPE FEATURES, TREES AND WOODLAND

14.4.13 Kilcrea is recognised as a high amenity area in the County Development Plan. Overall the development is considered to have a neutral to slightly positive effect upon the amenity value of the townland.

14.4.14 The development of the proposed greenway through this zone would require the removal of sections of hedgerow to enable the construction of ramps, bridges and new lengths of greenway to pass through the landscape. The water features of the River Pill would be protected during construction.

14.4.15 The relative impact in this respect is determined by the length and value of the hedgerow to be removed. There would be a moderate local negative effect due to the length of hedgerow to be removed along Corballis Cottages Road to allow sufficient visibility. Replacement hedgerows will be introduced at a greater set back from the road, reducing this effect to a short to medium term impact.

IMPACT ON LANDSCAPE PLANNING

14.4.16 Post construction the proposed development will have no significant negative impact on high amenity areas. The proposed greenway will have a positive effect in opening up managed access to, and views of these amenity areas for pedestrians and cyclists.

IMPACT ON LANDSCAPE CHARACTER

14.4.17 The impact of the construction on the visual domain of the estuary is described below (see Section 14.5 and Section 14.6 below). The magnitude and nature of the construction works would not be significant in the broader scale of the estuary landscape. Whilst there are no significant structures or earthworks, there would be minor structures required to either bridge watercourses or ramps to accommodate changes in level. The proposed scheme would require the construction of the proposed greenway alongside the field boundary and parallel to the railway to the south of the zone and then a ramp and bridge structure over the River Pill. A new second bridge crossing of the River Pill would be required further to the north. The fabrication of these structures off site would reduce adverse impacts during construction and erection.

14.4.18 Overall, the route would not result in significant effects on the character of this zone and would result in a slight neutral effect on the landscape character. At the point that the route leaves the road to enter into the agricultural fields to the immediate east of the farm, effects would be moderate but again neutral in character.

Zone 5 – Newbridge Demesne

IMPACT ON LANDSCAPE FEATURES, TREES AND WOODLAND

14.4.19 As the alignment enters the demesne through the existing gates and follows the existing roadway, there would be no impact on the landscape features, trees and woodland of the demesne.

14.4.20 Any construction activity has the potential to cause disruption, which might be of detriment to policies CH49, CH50 and CH51 promoting access and understanding of the history of the area, but any such impacts would be minor and short-term.

IMPACT ON LANDSCAPE PLANNING

14.4.21 There would be minimal impact on the setting of the castle and historic landscape or the architectural conservation area (ACA) of Newbridge Demesne, and these impacts would be short-term during construction.

IMPACT ON LANDSCAPE CHARACTER

14.4.22 Due to the limited nature and magnitude of construction effects within the demesne, with the alignment sharing existing upgraded existing roads and footpaths, there would be negligible effect overall on the low lying agricultural landscape character type and minimal impact on the more highly sensitive and valued character at a localised level.

Operation Impacts

14.4.23 Upon completion of construction of the proposed greenway, there will be a change in the nature of effects, but this would be particularly on the visual realm. The physical

presence of the proposed greenway will remain, but rather than construction works, the activity will become the visitor and user of the proposed greenway. The physicality of the new greenway will be most pronounced in the pre-establishment period, before new planting to soften and screen the proposed greenway has established and the effects of construction traffic on the fields and hedgerows have had a chance to repair and regrow.

14.4.24 As the use of the route as a greenway is entirely within national, regional and local policy, overall landscape effects during operation would be slight beneficial.

Zone 1 – Malahide Demesne

14.4.25 The positive benefits of providing increased and improved cycle and pedestrian access through and to the demesne are balanced by the slight negative aspect of the new intrusion into the historic fabric. Similarly the increased flow of, particularly, cycles through the demesne would create a slight change of character and alter the historic resonance of the aspect, resulting in an overall slight negative landscape impact.

Zone 2 – Malahide Village

14.4.26 The use of the proposed greenway would have an imperceptible to slight positive landscape effect.

Zone 3 – Railway Causeway

14.4.27 The effects of opening the route along the railway causeway would be a significant positive landscape effect, as the proposed greenway would introduce a new permanent character, quality and amenity to the viaduct, greatly enhancing the enjoyment and experience of the resident and visitor.

Zone 4 – Kilcrea Townland

14.4.28 As the scheme matures from pre-establishment to post-establishment, the proposed greenway throughout this area would become settled into the environment and in keeping with the character of the landscape. On balance, the alignment would be considered a slight neutral landscape effect.

Zone 5 – Newbridge Demesne

14.4.29 The proposed greenway in use would have negligible impact on the landscape of the demesne, either in terms of landscape features, landscape planning designations or character. It might be argued that increased visitor numbers or further encouragement of cycling within the demesne could be considered a detrimental change in character, but this would have to be balanced against the amenity and policy enhancements. This demesne attracts a large number of visitors and currently holds large public events such as the Flavours of Fingal and successfully caters for such. It would be a beneficial effect to bring the existing gates back into active use and this would be a moderate positive landscape effect.

14.4.30 In operation and on balance, therefore, the effect would be an imperceptible landscape effect.

14.5 Visual Effects During Construction

14.5.1 Following a desk-based study and series of trips to the site, key areas from which the alignment is visible have been established. The process of then selecting both indicative and particular viewpoints has already been described and, using the ZVI and knowledge of the site and the development, these effects are summarised.

14.5.2 The photographs and tables describing the viewpoints (Volume 3-Figures 10 to 20) illustrate the visual effects of key and representative aspects of the development on receptors. These provide an assessment of sensitivity of the viewpoint, magnitude of the effect and thus the significance overall upon the viewpoint.

14.5.3 Visual impacts tend to be most pronounced during the construction stages of a project when disturbance, particularly close to properties, is at its greatest and mitigation measures have not been introduced or have not matured to affect the intended results.

14.5.4 During the construction stages, impacts will generally arise from visual intrusion and disturbance from construction traffic, and activity and in rural areas the loss of trees, hedgerows and scrub. The noise generated by construction can also draw attention to the visual activity, thereby heightening the perceived impact of any visual disturbance.

14.5.5 The viewpoint tables identify the possible source of construction impacts. All the impacts are assumed to be adverse during the construction phase and for viewpoints closest to the site effects would be increasingly adverse due to the disruption. However, these effects would only be temporary and would become beneficial on completion.

Zone 1 – Malahide Demesne

14.5.6 The demesne at Malahide is a recognised and protected sensitive and valued landscape. However, works within the demesne are likely to be discreet, as the proposed greenway would use existing footpaths and roads. Signage would need to be incorporated and both the signage and the associated construction would have the greatest visual impact in areas of open grassland, where new signage and the works would be seen in stark isolation. The proposed alignment follows less-trod footpaths through wooded areas of the demesne and any construction activity would be screened and of reduced magnitude. Similarly, the construction of cycle facilities and improved access arrangements are within the busy and wooded car parks and would be both screened and mitigated by the existing level of vehicular activity.

14.5.7 Overall within the demesne, visual impacts during construction would be a slight negative visual impact of temporary duration.

Zone 2 – Malahide Village

14.5.8 No physical works would be required to the walls or boundaries to either side of the main Malahide-Dublin Road and all minor construction to kerbs, lights, crossings and lining would be contained within the road corridor.

14.5.9 A controlled signal crossing of the road would be required and the reconstruction of one of the footpaths to create a shared cycleway and pedestrian footpath. During construction, therefore, there would be greater intrusion, but as this is work of a roads

nature contained within a main road corridor the effects would only be slight negative and temporary.

14.5.10 It is intended to construct additional layby car parking along Bissets Strand, through connecting the existing indented car parking spaces within the grass verge along the shore frontage. Views from the estuary shoreline are protected and the associated construction activity would be local and of short duration, but highly visible.

14.5.11 In the streets to the west of the railway, works within the quieter suburban environment would be more evident and intrusive, but still of limited magnitude. Excepting the car park construction as discussed above, by utilising existing road and footpath construction, the limited intervention of the construction works along the southern shore of the estuary would have negligible impact on the protected views. Visual impacts associated with the alignment in this zone during construction would be of slight negative visual effect.

Zone 3 – Railway Causeway

14.5.12 Given the open nature of the estuary and lack of cover on the viaduct, the route would be open to views from the north and south banks of the estuary. Only the section of greenway to the north of the weir would be visible to views from the east and west, as the length of greenway to the south of the weir, being at a lower level, would be screened by the body of the rail embankment.

14.5.13 Views over the estuary from the southern and northern shore are protected and during construction the human and vehicular activity on the railway embankment would be open to view. This would be a short-term effect and, given the use of the causeway by the railway, heavy machinery on the viaduct is not an uncommon site. The railway causeway is also a recognisable man-made structure of ongoing engineering use and construction work would not appear as an incongruous activity.

14.5.14 Any work undertaken after dark and requiring lighting would be highly visible from the roads and properties lining the estuary, particularly from the protected views to the north of Malahide. Again, however, as this is also the case for regular maintenance on the railway causeway the nature of the intrusion would not be new.

14.5.15 During the construction phase visual effects would be of slight negative visual impact, but short-term.

Zone 4 – Kilcrea Townland

14.5.16 On attaining the northern shore of the estuary, the initial section of the route within the Kilcrea townland descends from the causeway to follow the field boundary to the west of the railway. It then ascends the ridge forming the backdrop to the estuary to views from the south. Due to the distance of the views from the southern shores of the estuary and the location of the proposed greenway alongside the field boundary, visual effects would be negligible and neutral in nature. Night-time working under lights would be visible from a considerable distance across the estuary, but as with works on the causeway, these effects are transitory and localised.

14.5.17 From the River Pill, the route in this section deviates from the rail embankment to the north of the ridgeline backing the estuary and would therefore enter an enclosed agricultural field pattern with limited views due to the screening effects of the mature

hedgerows. The lack of access within this section, other than to the users of the proposed greenway, would also limit areas from which the proposed greenway would be visible, restricting visibility to glimpsed views through the dense screening along the three encircling roads or from the few adjacent properties. Where it is necessary for the proposed greenway to break through field boundaries, then obviously the screening effect would be removed. This impact would be most pronounced where the route is required to cross or access the roads. However, these clearances would be of such limited lengths that the effect of opening up views of construction would be imperceptible. This construction impact would be further mitigated if the works could be phased to undertake the construction of the alignment within the fields prior to removal of the roadside hedgerows, which then become the last activity.

14.5.18 Any works after dark requiring lighting would be noticeable even through the hedgerows, and particularly in winter.

14.5.19 During the construction phase visual impacts would be of slight negative visual effect.

Zone 5 – Newbridge Demesne

14.5.20 This is a landscape of high value and sensitivity. However, from the inner gates, north of the wooded perimeter planting, the route through the parkland of the demesne to the car park, makes use of existing footpaths, which would be upgraded in certain areas and the only further works required to create the proposed greenway would be the erection of associated signage. Visual effects would be, therefore, slight negative in nature.

14.6 Visual Effects During Operation

14.6.1 Walkers and cyclists would replace machinery associated with construction and the rawness of new structures would mellow and be screened by maturing new planting as the proposed greenway moves from the pre-establishment to post-establishment phase. Proposed lighting to the railway causeway and Kilcrea townland would introduce a new visual impact in these zones as discussed below.

Zone 1 – Malahide Demesne

14.6.2 New signage could have a permanent detrimental visual impact and should be carefully located.

14.6.3 The envisaged increase in visitor numbers would have a noticeable visual impact, but as this is an intended consequence, promoted by Local Plan policy and in a landscape capable of accommodating such change, any visual effect would be neutral.

Zone 2 – Malahide Village

14.6.4 The works to create the proposed greenway along and across the main road corridor would be entirely complementary to the roads environment and, in extending the influence of the public and recreational utility of the park across the road, would result in a slight positive visual effect.

14.6.5 The additional car parking spaces along Bissets Strand would increase the number of intrusive elements within the view over the estuary from the road and adjacent

properties. As parked cars already fall within this view, the visual effect would only be slightly negative.

14.6.6 The visual impact throughout the remainder of the Malahide section in operation would be imperceptible, as the user of the proposed greenway would be indistinguishable from the ordinary pedestrian or walker along the streets and throughout the town. For the user, the route passing down O'Hanlon's Lane is a more interesting and direct route through the housing area, bringing the visitor onto the strand closer to the viaduct. The transition from the tight streetscape into the estuary landscape would be both dramatic and memorable and the location of a proposed viewing area would be a positive benefit.

14.6.7 Views northwards across the inner estuary from Bissets Strand are protected in the Development Plan. The proposed lighting to the proposed greenway across the causeway and within Kilcrea townlands would be visible from Bissets Strand and would affect the character of the views. The lighting is low level, on 1.8 metre high columns, has been designed to reduce light spillage and would not be permanently on, but activated by motion sensors (see Volume 4C-Appendix 6). To the south of the weir, the lamps would be located below the skyline due to the low level of the causeway. North of the weir the causeway and, therefore, the lighting would be at a higher level, putting the lamps above the horizon line of the top of the embankment, but still lower than the existing overhead line equipment (OHLE). As has been stated, the causeway is a man-made structure and the lamp standards would be in character with the engineered nature of the railway embankment and infrastructure. The illumination from the lamps, activated by the movement of people on the proposed greenway, would also be in character on the embankment, creating a similar effect to a passing train crossing the causeway at night.

14.6.8 From Bissets Strand the larger fields on the south-facing slopes of the northern shoreline of the estuary are also visible in the distance. The lights and illumination of the proposed greenway heading away from the shore would be a new impact within this landscape. Trains running along this section of the embankment are screened by trackside vegetation and therefore the night-time effect of moving trains is not perceived, whereas the alignment of the proposed greenway at the base of the rail embankment would not be screened to view in the initial years and the effects of the lighting would be visible. After ten to fifteen years of growth, new planting to the west of the proposed greenway would screen the lighting from view.

14.6.9 Overall, visual effects within this zone would be slight neutral.

Zone 3 – Railway Causeway

14.6.10 The transition from construction to operation will improve the visual amenity of the highly visible railway causeway. The removal of the palisade enclosure on Bissets Strand, construction of the screening walls, completion of the weir bridge and amenity benefits of the viaduct in active use by the community and visitor, would be a positive change to the appearance and perception of the viaduct and in operation the visual experience of the user will be dramatic.

14.6.11 The effects of the proposed lighting are discussed above and would be entirely in keeping with the engineering infrastructure and nature of the railway embankment and would therefore have a moderate but neutral impact.

14.6.12 Overall the visual impacts would be a permanent change of moderate positive visual effect.

Zone 4 – Kilcrea Townland

14.6.13 During use, as the timber bridges and greenway mellow with age and the effects of mitigation planting and seeding mature, on balance, the effects of the alignment would result in slight neutral visual effect. There is also the experience of the user of the proposed greenway to consider. The route would create an attractive alternative for the user, and in following the line of hedgerows, roads and short lengths of the river in its northern section, the alignment would lie comfortably with the field pattern.

14.6.14 The proposed lighting and illumination would have a slight negative effect in the short term as the lighting, particularly to the south of the townland on the shores of the estuary, would have a slight urbanising effect altering the character of the landscape. The careful design of the lighting would minimise this impact and over time, as the new hedgerow vegetation matures, the effects of the lighting and the lights would be screened from view. The users of the proposed greenway would, obviously, be affected by the lighting, but any intrusion would be balanced by the safety and sense of personal security the lighting would bring.

14.6.15 Overall the visual impact would have a neutral to slight positive visual effect.

Zone 5 – Newbridge Demesne

14.6.16 Within the demesne the minimal nature of the requirements to accommodate the proposed greenway would have negligible impact and throughout the demesne visual impacts would be imperceptible. With respect to the means of access into the demesne, it would be a marked beneficial effect to see the Kilcrea Gates in active use once again.

14.7 Mitigation Measures

14.7.1 The following mitigation measures have been considered in the route selection process and in the design of the scheme:

- Avoidance – seeking to relocate damaging or adverse impacts to less sensitive locations;
- Modification – modifying the design to achieve a reduction in impacts upon the landscape, heritage features and the visual domain through the implementation of sensitive design, lessening physical impacts or impacts upon the setting;
- Substitution – substituting features or areas with improved compensatory areas or features; and
- Enhancement – introduction or reintroduction of features or areas which might have been lost, or rectifying previous poor development.

14.7.2 In particular the following measures have been considered.

- A light touch approach to the design and construction of structures such as the bridges and fences, with components fabricated off-site.

- A detailed design of the screening and choice of materials on the viaduct to create a visually appropriate structure.
- Design of lighting to minimise light spillage; reduce the visual impact of lighting columns through their design, height and colour.
- Signage carefully located and designed to enhance the enjoyment of the proposed greenway without creating additional visual and physical clutter. Co-location of new signage on existing columns, walls and street lights to avoid increasing the number of new structures.

14.7.3 The following physical mitigation measures will be adopted to ensure potentially adverse effects are reduced or removed:

- Avoid or minimise damage to existing hedgerows and trees.
- If during construction it becomes apparent that tree removal becomes necessary for the satisfactory and safe construction of the scheme, then a replacement planting scheme will be implemented within the next available growing season. Within the demesne landscapes, larger sized specimens will be considered.
- A complementary scheme of landscape within the boundary treatment of the alignment to maximise the potential for contiguous wooded hedgerows.
- The development of a considered and planned programme of construction methods to ensure that landscape and visual disruption would be minimised or avoided.

14.7.4 Work will be carried out in line with the Construction Environmental Management Plan (CEMP) (see Chapter 3) specific to the scheme. These plans will provide guidance on appropriate working methods, outlining suitable adverse impact avoidance measures and mitigation strategies.

14.8 Residual Impact

14.8.1 The location, scale and detail of the proposed greenway is entirely appropriate to the site and surrounding estuarine environment, with the introduction of the proposed cycleway and footpath improving human interaction and creating links to the surrounding areas.

14.8.2 The method of construction of both the new sections of greenway and associated structures have been considered to reduce adverse effects on the landscape and visual domain, and in most cases are reversible. Residual landscape and visual effects are, therefore, generally positive and negligible.

14.8.3 The hedgerow lost during construction would be replaced as part of the scheme and in the medium term continue to provide visual continuity and coherence within the landscape.

14.8.4 The impact of the proposed lighting of the proposed greenway on the causeway and within Kilcrea townland would have a slight negative impact initially, but these visual effects would be decreased significantly once the proposed planting became established with Kilcrea.

14.8.5 Overall, the proposed development would create a significant positive contribution to the recreational amenity of the area and region, furthering landscape policy within the Development Plan.

14.9 Cumulative Impacts

14.9.1 The proposed Donabate Distributor Road is currently under construction and due for completion in 2019. The route will bypass the centre of Donabate, picking up traffic in the southwest along the R126 Hearse Road and reconnecting with the R126 Portrane Road to the northeast of the village. In so doing the route cuts across the proposed greenway to the immediate east of Kilcrea Road.

14.9.2 A significant positive effect of the development of the distributor road would be the closure to traffic of the existing section of Kilcrea Road between the new junction with the bypass and Hearse Road. This would enable the proposed greenway to be free of traffic improving the landscape and visual quality of the route in this area and importantly the quality of the approach to Newbridge Demesne and Kilcrea Gates. The reduction in traffic on Hearse Road would further enhance the quality of the landscape at the road crossing and the facility and experience of entering into the demesne.

15.0 Interaction of Effects and Cumulative Effects

15.1 Introduction

15.1.1 This chapter considers environmental inter-relationships of effects and cumulative impacts of the proposed greenway having regard to current knowledge and methods of assessment.

15.2 Inter-Relationships and Interactions

15.2.1 Table 15.2 below shows the typical relationships which one might anticipate between the environmental topics considered in this EIAR. As shown in this table, the dominant relationship is shown "both ways" (i.e. the relationship between noise and ecology is the same as ecology and noise). Table 15.3 below provides explanatory notes for these dominant relationships. Subsidiary, reverse and more remote links are not commented upon.

15.2.2 Further to the design team workshops, the likely significant interactive impacts arising from the proposed greenway development are outlined in Table 15.4 below.

15.2.3 Upon examination, it is considered that no residual significant interactive impact will survive the mitigation strategies identified for the proposed greenway development.

15.3 Cumulative Effects

Directives and Plans

15.3.1 A number of EU Directives and national and development plans apply to the proper planning and environmental control of activities in this area. It is considered here that no significant negative effect arises by virtue of the operation of these directives and plans in cumulation with this project (see Table 15.1 below).

Table 15.1 Potential cumulative impacts.

Plan	Purpose	Cumulative Impact
EU Water framework Directive	Maintain and enhance water quality within the EU	None predicted
EU Freshwater Fish Directive	Protect freshwater bodies within the EU suitable for sustaining fish populations	None predicted
EU Groundwater Directive	Maintain and enhance the quality of groundwater within the EU	None predicted
EU Floods Directive	The Floods Directive applies to river basins and coastal areas at risk of flooding	None predicted
Nitrates Directive	Reducing water pollution within the EU	None predicted
Urban Waste-water treatment Directive	Protecting the environment from adverse impacts of waste-water discharge	None predicted
Sewage Sludge Directive	Regulate the use of sewage sludge	None predicted
The IPPC Directive	To achieve a high level of environmental protection	None predicted
National Development Plan	To promote more balanced spatial and economic development	None predicted

Plan	Purpose	Cumulative Impact
National Spatial Strategy	To achieve a better balance of social, economic and physical development across Ireland	None predicted
Fingal County Development Plan	Sustainable development of Co. Fingal	None predicted
Malahide and Donabate Local Area Development Plans	Sustainable development of Malahide and Donabate	None predicted
Land spreading of organic waste by farmers in the locality	Fertilising land, disposing of organic waste	None predicted

Development Projects

15.3.2 There are a number of known proposed development projects in the Fingal area which, in combination with the proposed greenway development, may have a cumulative environmental effect. These projects include.

- Malahide: Sutton to Swords Greenway (design stage).
- Kilcrea: Donabate Distributor Road (construction stage, opening late 2019).
- Kilcrea: Expansion of Portrane Hospital (construction stage, opening 2020).
- Kilcrea: Housing application (McGarrell Reilly Homes, planning ref. F17A/0113) (opening late 2019).

15.3.3 With the exception of the Donabate Distributor Road, the other projects are remote in terms of location or design stage. As to the Distributor Road, no significant negative cumulative effect has been identified as the project is due to complete in late 2019 and the construction of the proposed development is not contemplated before 2020. Significant positive effects are anticipated, however, in terms of landscape, population and human health.

Within Project

15.3.4 The guidance of the Environmental Protection Agency (EPA, 2015, 2017) considers that a cumulative effect may arise where a number of small impacts (within a project) may create a larger impact, which may potentially be significant.

15.3.5 It is considered that in the context of the proposed greenway the only potential area where smaller impacts may sum to a larger impact is in biodiversity. These may include effects upon hedgerows and trees; and watercourses. Upon examination, however, the small quantum of local hedgerow removal in the townland of Kilcrea would not constitute a cumulative impact of significance.

Table 15.2 Typical Relationships between the Environmental Topics (relationship shown by grey shading).

Typical Inter-Relationship Matrix – Environmental Elements	Biodiversity	Land & Soil	Hydrogeology	Hydrology	Climate	Population & Human Health	Landscape	Noise & Vibration	Air & Climate	Archaeology & Cultural Heritage	Architectural Heritage	Material Assets (Agronomy)	Material Assets (Non-Agricultural)
Biodiversity	■												
Land & Soil		■											
Hydrogeology			■										
Hydrology				■									
Climate					■								
Population & Human Health						■							
Landscape							■						
Noise & Vibration								■					
Air Quality									■				
Archaeology & Cultural Heritage										■			
Architectural Heritage											■		
Material Assets (Agronomy)												■	
Material Assets (Non-Agricultural)													■

Table 15.3 Explanatory Notes on the Relationships between the Environmental Topics.

Typical Inter-Relationship Matrix – Environmental Elements*	Biodiversity	Land & Soil	Hydrogeology	Hydrology	Climate	Population & Human Health	Landscape	Noise & Vibration	Air Quality	Archaeology & Cultural Heritage	Architectural Heritage	Material Assets (Agronomy)	Material Assets (Non-Agricultural)
Biodiversity		Nature of Soils & Geology affects Biodiversity	Groundwater level and quality affects Biodiversity	Surface Water levels and quality affect Biodiversity		Ecological quality affects country sports and eco-tourism	Nature of Landscape affects Biodiversity and vice versa	Noise & Vibration levels affect Biodiversity	Air Quality affects Biodiversity			Nature of Agriculture affects Biodiversity	
Land & Soil			Groundwater nature and level affects Soils & Geology	Surface Water nature and level affects Soils & Geology			Underlying soils/geology affects Landscape	Depth & nature of bedrock will determine excavation methods		Presence of Caves		Nature of Soils & Geology affects Agriculture	Nature of Soils & Geology affects Material Assets
Hydrogeology				Nature and quality of one affects the other		Quality and availability of Groundwater affects Community				Fluctuations in ground water levels affects bogland and wetland environments		Quality and availability of Groundwater affects Agriculture	Quality and availability of Groundwater affects Material Assets
Hydrology						Quality and availability of Surface Water affects Community	Presence or absence of Surface Water affects Landscape			Fluctuations in surface water levels affects bogland and wetland environments		Quality and availability of Surface Water affects Agriculture	Quality and availability of Surface Water affects Material Assets
Climate									Air Quality indices exceeding limit values may affect climate				
Population & Human Health							Visual impacts may affect amenity and tourism	Noise & Vibration levels may affect Community	Air Quality parameter levels may affect Community	Sites can have amenity or tourism value	Sites can have amenity or tourism value	Nature and level of Agriculture activity may affect Community	Nature, quality and location of Material Assets may affect Community
Landscape										Changes in landscapes affect settings of Archaeological sites	Architectural demesnes and land design affects Landscape	Nature of Agriculture affects Landscape	

Typical Inter-Relationship Matrix – Environmental Elements*	Biodiversity	Land & Soil	Hydrogeology	Hydrology	Climate	Population & Human Health	Landscape	Noise & Vibration	Air Quality	Archaeology & Cultural Heritage	Architectural Heritage	Material Assets (Agronomy)	Material Assets (Non-Agricultural)
Noise & Vibration										Vibration may affect built structures	Vibration may affect built structures		
Air Quality										Air Quality may affect built fabric	Air Quality may affect built fabric		
Archaeology & Cultural Heritage											Some archaeological sites are also of architectural interest		
Architectural Heritage													
Material Assets (Agronomy)													
Material Assets (Non-Agricultural)													

*Relationships where a change in one parameter could lead to a significant impact on the other. The dominant relationship is commented on, subsidiary, reverse and more remote links are not expanded.

Table 15.4 Interaction Matrix: Potential Significant Impacts Pre-Mitigation (relationship shown by grey shading).

Interaction Matrix – Environmental Elements Potential Significant Impacts Pre-Mitigation	Biodiversity	Land & Soil	Hydrogeology	Hydrology	Climate	Population & Human Health	Landscape	Noise & Vibration	Air Quality	Archaeology & Cultural Heritage	Architectural Heritage	Material Assets (Agronomy)	Material Assets (Non-Agricultural)
Biodiversity	■		▒	▒			▒						
Land & Soil		■	▒	▒									
Hydrogeology	▒	▒	■	▒		▒				▒		▒	▒
Hydrology	▒	▒	▒	■		▒	▒			▒		▒	▒
Climate					■								
Population & Human Health			▒	▒		■		▒					▒
Landscape	▒			▒			■			▒	▒		
Noise & Vibration						▒		■					
Air Quality									■				
Archaeology & Cultural Heritage			▒	▒			▒			■			
Architectural Heritage							▒				■		
Material Assets (Agronomy)			▒	▒								■	
Material Assets (Non-Agricultural)			▒	▒		▒							■

16.0 Schedule of Commitments

16.1 Traffic and Transportation

16.1.1 During construction, transportation of site machinery and materials will take place only during non-peak traffic hours, and not between the hours of 19:00 to 07:00, to minimise impact on the road network and disturbance to residents.

16.1.2 A preliminary traffic management plan will be prepared by the Council appointed designer; this will be included in the tender pack for the construction stage. This preliminary traffic management plan will be further developed to a construction stage traffic management plan by the contractor in close consultation with Fingal County Council. The contractor will be obliged to apply for appropriate consents to carry out works on the public road. Adequate public notices will be put in place to inform both residents and road users.

16.1.3 During construction, a car park monitoring regime will operate at Malahide Demesne and Newbridge Demesne to ensure optimisation of the overflow areas, particularly during weekends and peak season.

16.1.4 Traffic signals for the proposed signalised shuttle system/toucan crossing at Bissets Strand railway underbridge will be linked with the proposed toucan crossing at O'Hanlon's Lane junction, so that traffic signal sequencing and timings can be optimised.

16.1.5 All crossings will be fitted with push-buttons so that these are activated only when in demand. Green times for vehicles can be set to a minimum, e.g. 7sec, so that vehicles are not stopped continuously or too frequently when demand for crossings is high.

16.2 Population & Human Health

16.2.1 The Construction Environmental Management Plan (CEMP) will provide for interaction between residents and the construction team to minimise potential impacts on residents who could be affected by the timing of works or construction transport.

16.2.2 On operation, measures such as directional and advisory signage, and road marking, will be utilised to minimise disruption from noise or nuisance in the vicinity of existing properties and landholdings and to facilitate ease of movement by cyclists and walkers travelling in two directions. As well as the waymarking signage on the route, signage at other locations will help users find their way to sections of the proposed greenway or to car parking from the road network and public transport nodes. Signage will also complement the experience of users with information of local natural and cultural heritage.

16.3 Biodiversity

16.3.1 Construction operations in the vicinity of the estuary will take place during the hours of daylight to minimise disturbances to roosting birds or any active crepuscular/nocturnal bird species and mammals.

16.3.2 Works on the causeway and bridge across Malahide Estuary will be carried out outside of the overwintering period. Construction activities in this area will only be permitted

from May until September. Minor works (e.g. maintenance) may be carried out at any time of year.

16.3.3 All edible and putrescible wastes will be stored and disposed of in an appropriate manner. Similarly, all construction materials will be stored and stockpiled according to the Construction Environmental Management Plan (CEMP) (see Chapter 3 above). The construction activities will be governed by the CEMP and all environmental control measures will be fully implemented.

16.3.4 A comprehensive pre-construction baseline ecological survey will be carried out in advance of the establishment of site compounds and before the clearance and trimming of any field boundaries.

16.3.5 Bankside vegetation will not be removed during the months of March to August. Planting of native hedgerow species along the route corridor of the proposed greenway track will occur at appropriate locations and will provide mitigation for any small areas of hedgerow lost as a result of works.

16.3.6 The construction compounds, and operational greenway will not be lit at night (with the exception of low-level switchable safety lighting).

16.3.7 Shielded, downward directed lighting will be used wherever possible and all non-essential lighting will be switched off during the hours of darkness.

16.3.8 A 1.4m high wall will screen the pedestrians and cyclists from fauna present in areas close to the causeway and bridge crossing in the inner estuary. This feature has been incorporated into the design to minimise the potential impacts of disturbance associated with the movement of pedestrians and cyclists along the causeway.

16.3.9 Bird numbers and distribution in the estuarine and terrestrial areas in the vicinity of the route will be monitored by Fingal County Council throughout the construction phase and for two years following the opening of the cycle/walkway.

16.3.10 An ecologist will supervise/check areas where vegetation removal may occur prior to and during construction. This will ensure that any site specific issues in relation to wildlife will be highlighted (e.g. unforeseen mammal activity) and appropriate mitigation measures are applied.

16.3.11 A baseline mammal survey will be carried out during the year of construction and for the first two years of the operation of the proposed greenway by Fingal County Council. A report will be submitted to NPWS at the end of each annual survey period.

16.3.12 Bat activity will be monitored at the site in the year of construction and for the first two years of operation by Fingal County Council. A report will be submitted to NPWS at the end of each annual survey period.

16.3.13 Standard environmental control measures for working near sensitive sites, especially watercourses and areas of wetland saltmarsh and wet grasslands, will be applied (e.g. TII (formerly NRA) *Guidelines on Crossings of Watercourses*; www.nra.ie; CIRIA Guidelines, www.ciria.org). The risk of significant adverse impacts on the local European sites through pollution or introduction of alien invasive species, contaminants will be minimised.

16.3.14 Feeding the birds from the causeway will be discouraged. Signs will be displayed prominently to dissuade members of the public feeding birds, particularly waterbirds. Signs will also instruct users of the proposed greenway of the importance of the general area to wintering birds and request responsible behaviour for all those using the amenity.

16.4 Land and Soil

16.4.1 Excavated subsoils removed during construction will be re-used on site in the form of landscaping. Suitable and legally permitted and licensed sites will be used for off-site treatment/recycling/disposal.

16.4.2 Design of any substructures and hardstanding in areas characterised by soft ground (such as the areas mapped under Section 5 – Kilcrea Townland) will accommodate settlement.

16.4.3 Excavated material will be separated and stockpiled according to composition and dealt with accordingly. The contractor's methodology statement will be reviewed and approved by a suitably qualified engineer prior to site operations in this context.

16.4.4 Excavations will be backfilled as soon as is possible to prevent any infiltration of potentially polluting compounds to the subsurface and the aquifer.

16.4.5 Materials such as asphalt or concrete will be brought directly to the construction site when required and immediately placed.

16.4.6 Any soil imported to site will be subject to assessment to identify any invasive alien species present. A Management Plan will be required which adheres to available guidance, e.g. *The Management of Noxious Weeds and Non-native Invasive Plant Species on National Roads* (TII (formerly NRA) 2010). Storage of soil on-site will be seeded and periodically topped. Such stores will be subject to ongoing monitoring.

16.4.7 Subject to the identification of invasive alien species present at any of the sites, machinery will be cleaned between infested sites (including footwear and tools).

16.4.8 All potentially polluting materials will be stored in bunded areas, the capacity of which will be 110% of the volume of the largest volume of material or 25% of the total volume of liquid to be stored, whichever is greater.

16.4.9 Machinery refuelling will be carried out by competent personnel at a single designated location within the construction compounds, close to the site entrances.

16.4.10 Spill kits will be stored at the machinery refuelling area. The spill kits will comprise of suitable absorbent material, refuse bags etc to allow for the appropriate clean-up and storage of contaminated material in the event of a spillage or leak occurring.

16.4.11 All machinery will be inspected at the start of each work shift for signs of leaking hydrocarbons. Parking areas will be inspected on a daily basis for evidence of hydrocarbons leaking from machinery.

16.4.12 During the operational phase, all materials required for the maintenance of the proposed greenway will be stored according to good practice and in areas either off site or in bunded areas with impermeable floors.

16.4.13 There will be no discharge of effluent to groundwater or surface water during the construction phase. All wastewater from the construction facilities will be stored for timely removal off site for disposal and treatment.

16.4.14 The contractor's design of the site drainage system including the design of the run-off collection system from all roads and interface areas with grazing land will ensure that run-off is collected in a controlled manner. The design of the site drainage system will also incorporate the principle of Sustainable Urban Drainage System (SUDS) to ensure that landowner(s) downstream of the works will not be adversely affected by the construction and operation of the works. Surface run-off rates will comply with the following guidelines:

- Greater Dublin Strategic Drainage Study (GDSDS)
- Dublin City Council's "Code of Practice for Drainage Works"
- Irish SUDS: Guidance on Applying the GDSDS Surface Water Drainage Criteria

16.4.15 The contractor will ensure no deleterious discharges are released from the site to surrounding watercourses during excavation. Throughout the works the contractor will take account of relevant legislation and best practice guidance including but not limited to the following:

- C532 Control of water pollution from construction sites: guidance for consultants and contractors;
- C648 Control of water pollution from linear construction projects;
- SP156 Control of water pollution from construction sites – guide to good practice.

16.4.16 The contractor's construction method statements (CEMP – see Chapter 3 above) identifies how management, monitoring, interception, removal and/or treatment of silt run-off will prevent contamination during construction of ground or surface waters by mobilisation of soil particles. Land will only be stripped as necessary, to minimise soil erosion.

16.5 Water

16.5.1 The appointed contractor(s) will utilise a Construction Environmental Management Plan (see Chapter 3 above). This considers the methods that will be adopted to prevent pollution of the receiving aquatic environment during the construction phase.

16.5.2 Only clean stone low in fines will be used to temporarily modify the weir surface thereby significantly decreasing the potential for increased suspended solids during the construction of the 180m bridge at the viaduct.

16.5.3 At the two Pill River bridging points, vehicles will not be permitted to cross the channel. However, if deemed necessary, temporary bridging structures will be used to prevent damage to banks and the channel bed.

16.5.4 The access tracks to the works area at the Pill River bridges will be lined with a geogrid and geotextile and topped with clean crushed stone to prevent ground damage and potential subsequent washout of suspended solids into the Pill River and Malahide Estuary. This will be particularly important when inserting bridge piers at the lower Pill crossing adjacent to the railway embankment where the ground slopes to the river. At these points the ground will be raised using clean crushed rock to form a working

platform at the south side of the channel for the pier piling rigs. The base of these temporary platforms will be ringed with silt fences to minimise any escape of fines and sediment from the works area to the Pill River.

16.5.5 All materials excavated in order to construct bridge abutments will be removed off site and not stockpiled beside the watercourse.

16.5.6 Where it is necessary to de-water excavations all of the water arising will be treated by settlement or filtration before it is discharged to the Pill River to prevent solids contaminated water entering the watercourse.

16.5.7 Soil will not be stockpiled within 10m of surface waters. Where stockpiling is necessary, these will be covered to prevent erosion of solids during heavy rainfall. All stockpiles of materials will be ringed at the base with silt fencing.

16.5.8 Particular care will be taken to ensure the support and integrity of form work for the bridge abutments and piers to prevent concrete spills during or after pours, which will be carefully monitored.

16.5.9 All shuttering used for in situ deck sealing on the weir bridge and for construction of the bridge piers for the two bridges over the Pill River will be designed to be fit for purpose and carefully checked for integrity before each concrete pour.

16.5.10 All concrete pours will be attended and monitored for any signs of spillage or leakage.

16.6 Air and Climate

16.6.1 A dust minimisation plan will be formulated for the construction phase of the project. Site roads will be regularly cleaned and maintained as appropriate. Hard surface roads will be swept to remove mud and aggregate materials from their surface. Any road that has the potential to give rise to fugitive dust will be regularly watered, as appropriate, during dry and/or windy conditions.

16.6.2 Speeds will be restricted on hard surfaced roads as site management dictates. Vehicles delivering material with dust potential will be enclosed or covered with tarpaulin at all times to restrict the escape of dust.

16.6.3 Public roads in the vicinity of the site will be regularly inspected for cleanliness, and cleaned as necessary.

16.6.4 The dust mitigation measures will be strictly monitored and assessed. In the event of dust nuisance occurring outside the site boundary, movement of materials will be terminated and satisfactory procedures implemented to rectify the problem before the resumption of operations.

16.7 Noise and Vibration

16.7.1 Good practice measures as contained within BS5228:200 – *Code of practice for noise and vibration control on construction and open sites – Part 1: Noise* and *Part 2: Vibration* will be implemented to mitigate any issues that may arise.

16.7.2 The construction hours will be 07:00 to 19:00hrs, Monday to Friday and 08:00 to 13:00hrs on Saturdays.

16.7.3 During the construction phase noise monitoring will be carried out at the nearest locations which may be considered to be noise sensitive.

16.7.4 Noise monitoring will be conducted in accordance with the International Standard ISO 1996: 2007: *Acoustics – Description, measurement and assessment of environmental noise*.

16.8 Material Assets

16.8.1 Severed land parcels will be provided with permanent agricultural crossings on the proposed greenway. Severed field access from the public road will be reinstated so that there is a permanent access from the public road into the agricultural field.

16.8.2 Where existing water and electricity supplies to fields or farmyard are severed the supply will be reinstated by the developer by provision of ducting or an alternative water source or electricity supply.

16.8.3 The County Council will liaise with landowners prior to the finalisation of the design of the scheme. Issues expected to result from disruption during the works will be addressed during consultations between the landowners and the developer.

16.8.4 A dedicated contact will be appointed by the contractor during the construction phase to facilitate communications between affected landowners and the contractor.

16.8.5 Boundary fencing will be erected to delineate the construction boundary and prevent disturbance to adjacent land and livestock.

16.8.6 The landowner will have access to all severed land during the construction of the scheme. Where this access is temporarily disrupted the landowner will be notified in advance. Temporary gates across the fenced area will be provided.

16.8.7 Disrupted electricity and water supplies will be restored within a period agreed with landowners. The contractor will make provision for alternative supplies to be provided (e.g. generators or water tankers) if supplies cannot be restored within the agreed time frame.

16.8.8 The contractor will minimise impacts on agricultural land due to construction noise through a programme of mitigation measures for noise control as described Chapter 10 (Noise and Vibration).

16.8.9 The contractor will employ measures to prevent the spread of dust and mud onto adjoining lands as described in Chapter 9 (Air and Climate).

16.8.10 Where land is taken temporarily for the construction of the proposed greenway the contractor will store all the topsoil so that it can be returned to the land to allow for successful crop establishment. The restored land will be level, adequately drained and will not contain stones or gravel or other materials imported on to the site during construction.

16.8.11 Where excavations occur or surface drains are crossed the drainage design of the proposed greenway will intersect any existing field drains and carry the drainage water to a suitable outfall.

16.9 Archaeology and Cultural Heritage

16.9.1 Where subsurface disturbance is to take place on any part of the proposed greenway consultation will take place in advance of the works with the National Monuments Service at the DoAHG.

16.9.2 In particular, monitoring of topsoil stripping will be conducted in Kilcrea, where the proposed greenway will cross agricultural lands.

16.10 Architectural Heritage

16.10.1 All mitigation measures will comply with relevant legislation concerning architectural heritage as outlined in Chapter 13 of this EIAR.

16.10.2 All mitigation measures are subject to approval from the relevant local authority Conservation Officer and, for sites listed on the Record of Monuments and Places, from the Department of Culture, Heritage and the Gaeltacht.

16.10.3 The following structures and/or their boundary treatments will be monitored and fenced off if necessary during construction to prevent physical damage: Railway Bridge (AHC022), Casino (AHC024), Presbyterian Church (AHC026), Sonas Town House (AHC027), Rosca Town House (AHC028), Railway Bridge (AHC031), and Gate Entrance, Newbridge House (AHC044).

16.11 Landscape

16.11.1 Damage to existing hedgerows and trees will be avoided or minimised.

16.11.2 If during construction it becomes apparent that tree removal becomes necessary for the satisfactory and safe construction of the scheme, a replacement planting scheme will be implemented within the next available growing season. Within the demesne landscapes, larger sized specimens will be considered.

16.11.3 A light touch approach to the construction of structures such as the bridges and fences, with components fabricated off-site, will be implemented.

16.11.4 A complementary scheme of landscape treatment of the alignment will be introduced to maximise the potential of contiguous wooded hedgerows. Wherever possible or appropriate, both hard and soft materials will be indigenous to the area.

16.11.5 The design of the screening and choice of materials on the viaduct will contribute to a visually appropriate structure.

16.11.6 Signage will be carefully located and designed to enhance the enjoyment of the proposed greenway without creating additional visual and physical clutter. Co-locate new signage on existing columns, walls and street lights to avoid increasing the number of new structures.

16.11.7 Work will be carried out in line with the Construction Environmental Management Plan (CEMP) specific to the scheme. These plans will provide guidance on appropriate working methods, outlining suitable adverse impact avoidance measures and mitigation strategies.

16.11.8 All tree replacement will be carried out in consultation with Fingal County Council. All replacement or new tree planting will be incorporated in an overall landscape scheme to support the development and approval by the local planning authority.

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