METROLINK

Integrated Transport. Integrated Life.

A2.1

EIA Scoping Report

Contents

Executive Summary

On 22 March 2018, the National Transport Authority (NTA) and Transport Infrastructure Ireland (TII) launched the MetroLink project (hereafter referred to as the proposed Project), which included the release of an Emerging Preferred Route (EPR) and initiated the statutory planning stage of the proposed Project.

The objective of the proposed Project is:

To provide a high-capacity, high-frequency rail line running from Swords to Charlemont, linking Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services, creating fully integrated public transport in the Greater Dublin area.

The proposed Project will be approximately 19km in length, running from Estuary Park and Ride, north of Swords, southwards towards Dublin City via Dublin Airport. The proposed Project starts above ground from Estuary through Swords, and goes underground through the airport, before emerging again to cross over the M50. From Northwood, through the city to Charlemont in the south of the city, the proposed Project will run through a single bore tunnel.

The proposed Project will include up to16 stations, a Park and Ride facility, a depot, and ancillary infrastructure. It is envisaged that at peak times MetroLink will be capable of operating a train every 90 seconds carrying at least 20,000 passengers per hour per direction.

Environmental Impact Assessment (EIA) Scoping is a key stage of the EIA process and the main objectives of this EIA Scoping Report are to provide a description of the proposed Project, identify the potential significant impacts which may arise during construction and operation of the proposed Project and outline the relevant assessment methodologies to be incorporated within the Environmental Impact Assessment Report (EIAR). This EIA Scoping Report will form a basis of common reference for consultation about the scope and methodology to be utilised when undertaking the EIA process and preparing the EIAR.

EIA Scoping ensures that potential environmental impacts are identified during the initial stages of the EIA process and environmental protection is taken into consideration in the development of the proposed Project design. Scoping is an ongoing process which continues throughout the EIA process and is informed by feedback received during consultation as well as the detailed assessment of baseline studies.

This EIA Scoping Report outlines the scope of the environmental assessments to be carried out in preparation of an EIAR which will accompany the Railway Order Application to An Bord Pleanála. The Railway Order will be subject to a period of statutory consultation which will provide the public with an opportunity to have their say, following which the Board will determine whether consent should be granted.

The EIAR will comprise the following:

- A background to the proposed Project and the EIA process;
- A description of the proposed Project;
- The planning context for the proposed Project, including national, regional and local policy;
- A description of the baseline conditions for each environmental topic;
- A description of the potential environmental impacts during construction and operation, including any demolition and/or land-use requirements, of the proposed Project. The likelihood, extent, magnitude, duration and significance of the potential effects will be described;

- A description of features of the proposed Project and/or measures to mitigate and compensate the likely significant adverse effects and the residual effects that will persist after mitigation. Monitoring measures, where appropriate will also be described;
- A description of reasonable alternatives which were studied and an indication of the main reasons for the chosen option, taking into account the effects of the proposed Project on the environment;
- An assessment of potential cumulative impacts;
- A description of the interactions between the various environmental topics; and
- A non-technical summary condensing the EIAR into an easily comprehensible version.

It is envisaged that the EIAR will be presented in five volumes as follows:

- **Volume 1: Non-Technical Summary** – summary of the EIAR in non-technical language;
- **Volume 2: Introduction and Project Description** – introduction to the proposed Project and EIA process, including a project background, legislative and planning context, description of alternatives, and a description of consultation;
- **Volume 3: Environmental Baseline and Assessment** – a separate chapter for each environmental topic, describing the baseline, potential effects, mitigation and monitoring requirements for each environmental topic;
- **Volume 4: Figures** - graphics and plans supporting the EIAR chapters, illustrating the proposed Project and environmental information; and
- **Volume 5: Appendices** - technical reference information supporting the EIAR chapters, such as calculations and detailed background data.

The environmental topics identified in Directive 2011/92/EU as amended by Directive 2014/52/EU will be addressed within Volume 3 of the EIAR under the following headings:

- Human Health
- Population
- Electromagnetic Compatibility and Stray Current
- Airborne Noise and Vibration
- Ground-borne Noise and Vibration
- Air Quality
- Climate
- Water: Hydrology
- Water: Hydrogeology
- Soils and Geology
- Land Take
- Material Assets: Traffic and Transport
- Material Assets: Infrastructure & Utilities
- Material Assets: Resource and Waste Management
- The Landscape
- Risk of Major Accidents and Disasters
- Interactions
- Cumulative Impacts

This EIA Scoping Report describes the approach to be taken in assessing each of the listed environmental topics, including a description of the study area for each topic; a description of the methodology to be used in assessing each topic including the desk-based, survey work and consultation to be undertaken to inform the assessment; as well as outlining the current baseline conditions and the likely impacts which will occur as a result of construction and operation of the proposed Project.

TII are now inviting submissions on the EIA Scoping Report and would like your views having regard to the following:

- Is the scope of the proposed assessment for the EIAR adequate?
- Is there any additional information that should be considered in the development of the proposed Project?
- Are there any additional environmental issues that should be taken into consideration in preparing the EIAR?

All relevant submissions on the proposed Project are welcome. Relevant submissions will be taken into consideration in the preparation of the EIAR.

To make a submission please use the following contact details:

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1. Introduction

1.1 Introduction

This document is an EIA Scoping Report for the proposed Project.

The EIA Scoping Report is a key deliverable in the EIA process and provides an opportunity for developers to ask competent authorities about the extent of the information required to make an informed decision about the proposed Project and its potential effects. The principal objectives of this report are to:

- Provide a description of the proposed Project;
- Identify likely significant impacts which may arise during the construction and operation of the proposed Project;
- Outline proposed assessment methodologies for completing the EIAR;
- Outline the likely content of the EIAR; and
- Form a basis of common reference for consultation about the scope and methodology for the EIAR.

On the basis of the information provided in this EIA Scoping Report views are being sought on additional information that should be considered in the development of the proposed Project, and additional environmental issues or alternative methodologies that should be taken into consideration when preparing the EIAR.

1.2 Project Overview

The proposed Project comprises the provision of a high capacity, high frequency, modern and efficient metro rail line between Estuary Park & Ride, north of Swords via Dublin Airport to Charlemont south of Dublin City Centre. The proposed Project, as shown in Figure 1.1 will be approximately 19 kilometres in length and it is intended that it will commence construction in 2021 and will begin operation by 2027.

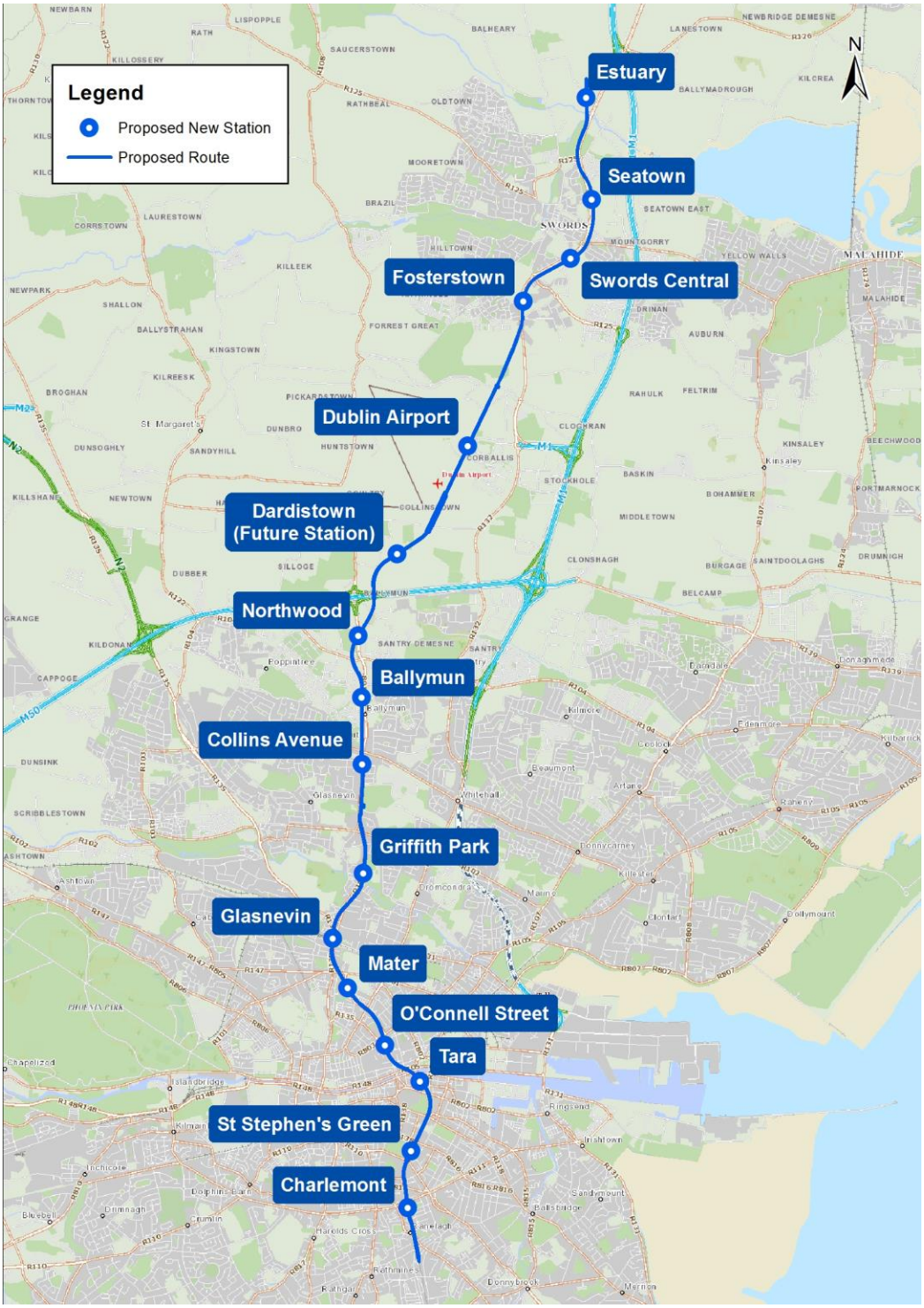

Figure 1.1: Proposed MetroLink Route

1.3 Current Status

The Emerging Preferred Route (EPR) for the proposed Project was published in March 2018, launching a period of public consultation which ran until May 2018. A preliminary design is currently being completed based on the outcomes of the public consultation and findings of studies completed during the route selection.

1.4 Project Team

Transport Infrastructure Ireland (TII) are managing the proposed Project on behalf of the National Transport Authority (NTA). In January 2018 a Jacobs Idom Consortium were appointed by TII to develop a preliminary design for the proposed Project, to prepare an EIAR, to prepare an Appropriate Assessment Screening, to prepare a Natura Impact Statement (NIS) and prepare all required materials for the submission of a Railway Order Application under Section 37 of the Transport (Railway Infrastructure) Act 2001 amended.

The EIAR is being prepared by Jacobs Idom with inputs from competent experts under a number of environmental disciplines as outlined in Table 1.1.

Table 1.1: EIA Study Team

National Transport Authority (NTA) / Transport Infrastructure Ireland (TII)	
↕	
Jacobs Idom Consortium	
↕	
EIA Team	
Discipline	**Company**
Human Health	Corporate Health Ireland Ltd.
Population	Future Analytics Consulting Ltd.
Electromagnetic Compatibility and Stray Current	Compliance Engineering Ireland Ltd.
Airborne Noise & Vibration	AWN Consulting Ltd.
Ground-borne Noise and Vibration	Rupert Taylor Ltd.
Air Quality	AWN Consulting Ltd.
Climate	AWN Consulting Ltd.
Biodiversity	Scott Cawley Ltd.
Water: Hydrology	AWN Consulting Ltd.
Water: Hydrogeology	AWN Consulting Ltd.
Soils and Geology	Jacobs Idom
Land Take	Jacobs Idom
Material Assets: Traffic & Transport	Jacobs Idom
Material Assets: Infrastructure and Utilities	Jacobs Idom
Material Assets: Resource and Waste Management	Jacobs Idom
Agronomy	Phillip Farrelly
Cultural Heritage: Archaeology	IAC Archaeology Ltd.
Cultural Heritage: Architectural Heritage	Historic Building Consultants Ltd.
The Landscape	Mitchell & Associates
Risk of Major Accidents and Disasters	Jacobs Idom
Interactions	Jacobs Idom
Cumulative Impacts	Jacobs Idom

1.5 EIA Scoping Report Structure

This EIA Scoping Report is structured as follows:

Chapter 1: Introduces the EIA Scoping Report and the proposed Project, as well as giving an overview of the roles and responsibilities for the EIA process.

Chapter 2: Provides a description of the proposed Project.

Chapter 3: Provides an outline of the EIA process and the proposed methodology to be used.

Chapter 4: Provides an overview of the consultation process.

Chapter 5 - 24: Provides a description of the possible effects of the proposed Project on the environment in order to inform the scoping opinion for each of the relevant disciplines. These chapters identify these potential effects in the context of the environmental baseline. The chapters also outline the proposed assessment methodology that is proposed to ensure a robust assessment of these effects.

Chapter 25: Outlines the methodology to be used when assessing the interactions between the potential effects identified.

Chapter 26: Outlines the methodology to be used in assessing possible cumulative impacts between the proposed Project and other projects which may be taking place concurrently or consecutively.

Chapter 27: Provides a concluding statement for the EIA Scoping Report.

2. Project Description

2.1 Introduction

This chapter provides a description of the proposed Project, describing the project objectives, planning context, history of the project, and description of the preferred route with available design details of the proposed Project. The proposed Project is now called MetroLink, a name which has superseded Metro North, as explained in Section 2.2.4.

2.2 History of the Project

A metro rail line has been proposed to link Swords to the City Centre, via Dublin Airport for almost 20 years. The following provides a brief overview of the history of the project. Figure 2.1 Old Metro North Alignment 2011 for Railway Order Application shows the "Old" Metro North scheme which was granted a Railway Order in October 2011 (An Bord Pleanála Reference PL06F.NA0003).

2.2.1 2001: Dublin Transportation Office - A Platform for Change

Proposals for a metro system in Dublin were first included in A Platform for Change – Outline of an integrated transportation strategy for the Greater Dublin Area – 2000 to 2016 published by the Dublin Transportation Office (DTO) (now part of the National Transport Authority (NTA)) (DTO 2001). This publication set out a vision of an integrated multi-modal transportation strategy for the Dublin Area to be delivered over the lifetime of the strategy. The strategy included a number of proposed metro routes including a route from Swords to Shanganagh via Dublin City Centre, and an orbital line via Blanchardstown, Clondalkin and Tallaght, to the city centre via Kimmage.

2.2.2 2005: Transport 21

In November 2005 the infrastructure investment programme 'Transport 21' was announced with the aim of greatly expanding Ireland's transport network. This plan included the "old" Metro North and Metro West projects. The plan envisaged a north – south metro line running from St Stephen's Green and potentially serving Dublin City University (DCU), Ballymun and Dublin Airport before terminating at Bellinstown, north of Swords.

2.2.3 2006-2011: Metro North Route Options and Planning

The Railway Procurement Agency (RPA) (now part of TII) published three potential route options in 2006. A route options assessment was undertaken, and this assessment identified a preferred route which was published by the RPA in 2008. This route option, shown in Figure 2.1 was brought through the Railway Order application process, and in October 2011 Metro North was granted a Railway Order by An Bord Pleanála (An Bord Pleanála Reference PL06F.NA0003). Subsequently, approval was granted for the Dardistown Depot (PL06F.NA0007 under a separate application). However, in November 2011 the project was deferred indefinitely, along with many other Transport 21 projects due to the economic downturn.

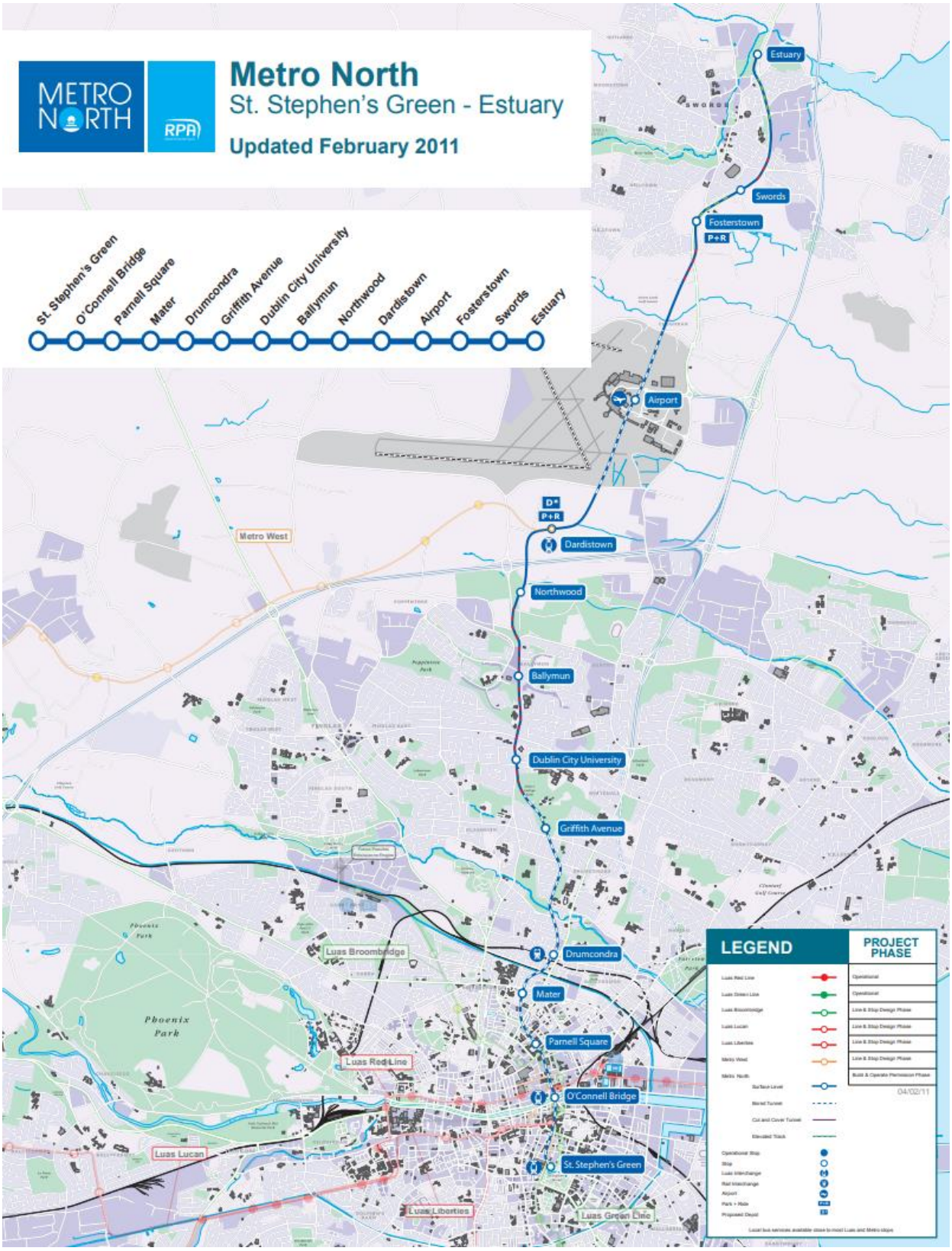

Figure 2.1: Old Metro North Alignment 2011 for Railway Order Application (Reference PL06F.NA0003)

2.2.4 2015: Project Relaunch

In September 2015, following publication of the Fingal/North Dublin Transport Study, it was announced that a new Metro North was to proceed with a number of changes to the original proposal which was granted a Railway Order in 2011 (An Bord Pleanála Reference PL06F.NA0003). A new Alignment Options Report was commissioned.

The EPR was determined through assessment of all possible options against a set of criteria, taking account of all opportunities and constraints. Opportunities within the study areas were key trip attractors (i.e. educational facilities, commercial centres, healthcare facilities, leisure locations and employment centres), and integration with other transport modes; while constraints included Luas Green Line tie-in locations and environmental constraints. Two stages of multi-criteria assessment were carried out on all options identified. Each option was assessed using criteria under the following headings:

- Economy;
- Integration;
- Accessibility and Social Inclusion; and
- Environment.

At the same time as the alignment options were being considered for the new Metro North, TII undertook studies to determine options for tying the metro into the Luas Green Line and for upgrading the Luas Green Line to metro standard.

2.2.5 2018: MetroLink

In March 2018, the new Metro North EPR was launched under the new name of MetroLink. Three central options studies which were used to inform the development of the EPR were as follows:

- **Luas Green Line Tie-In Study** (TII 2018c): The objective of this study was to identify the preferred location for tie-in of the proposed metro to the existing Luas Green Line to enable through running of the metro from Swords to Sandyford.
- **Alignment Options Study** (ARUP 2018a): This study was undertaken in a series of steps to determine an EPR for the new Metro North, i.e. the portion of the proposed Project located from Estuary, north of Swords, to the proposed tie-in with the Luas Green Line at Charlemont in South Dublin City Centre.
- **Luas Green Line Metro Upgrade Study** (TII 2018b): The objective of this study was to assess the feasibility and costing of upgrading the existing Luas Green Line to a metro standard to allow through running of metro services from Swords to Sandyford.

The EPR as presented to the public is shown in Figure 2.2. A period of public consultation on the EPR was completed between 22 March and 11 May 2018. A significant number of submissions were received during the public consultation and the preliminary design is now being developed to take cognisance of the content of submissions received.

As a result of consultation feedback and prolonged environmental and construction constraints, a decision was made to postpone the proposal to upgrade the Luas Green Line to occur at an appropriate point in the future. This decision with reference using a report titled; Constructability Report - Green Line Closure (London Bridge Associates 2019).

Under this arrangement the overall metro system from Swords to Sandyford would be delivered on a phased basis.

A decision to proceed with the northern section of MetroLink from Estuary to Charlemont was made in order to prevent delays to this phase of the proposed Project. In the interim, the proposed Project will provide connectivity to the Luas Green Line at Charlemont and allow for future connection.

During the period between the completion of the proposed Project from Estuary to Charlemont and the ultimate tie-in to the Green Line at a point in the future, there will be a need to increase the carrying capacity of the Luas Green Line. This will be dealt with as a separate project and will deliver capacity enhancements on an incremental basis over this period.

Accordingly, the MetroLink project will now comprise the delivery of a metro system between Estuary and Charlemont. While the last station would be Charlemont, the bored tunnel would continue to, and terminate south of Ranelagh, aligned to facilitate a future connection onto the Luas Green line.

Figure 2.2: MetroLink Emerging Preferred Route 2018 as Released for Public Consultation

2.3 Project Objectives

The overall project objective, as established by the NTA and TII, and as informed by planning policy context is:

To provide a high-capacity, high-frequency rail line running from Swords to Charlemont, linking Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services, creating fully integrated public transport in the Greater Dublin Area (GDA).

In delivering this overall objective the proposed Project will:

- Cater for existing and future public transport travel demand along the defined corridor;
- Be modern, attractive and accessible to all users;
- Be designed to integrate appropriately into the existing public realm;
- Be segregated from other transport modes;
- Contribute to a reduction in urban congestion and the enhancement of sustainable transport provision in the Region;
- Support the continued economic development of the Dublin area and Ireland as a whole;
- Deliver a high-quality service with journey-time reliability along the corridor;
- Be planned, constructed and operated in an environmentally sustainable manner;
- Support public transport network integration by providing high quality passenger interchange points, which facilitate convenient transfer between public transport modes at key locations in the study area;
- Facilitate connection to key trip attractors; and
- Facilitate the provision of a 'strategic Park and Ride' for the M1 Motorway corridor.

2.4 Project Outline

The proposed Project will provide a high capacity, high frequency, modern and efficient public transport service for people travelling in the Swords / Airport to City Centre corridor in Dublin, giving an overall metro length of approximately 19 kilometres. The proposed metro line running from Swords to Charlemont will link Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services, creating fully integrated public transport in the Greater Dublin area. As well as linking all public transport, MetroLink will connect major destinations including Ballymun, the Mater Hospital, the Rotunda, Dublin City University and Trinity College. It is intended that the proposed Project will commence construction in 2021 and will open to passenger services by 2027. It will include the following key elements:

- Up to 16 new stations;
- Mixture of underground and above ground sections;
- Depot at Dardistown; and
- Strategic Park & Ride with 3,000 parking spaces at Estuary Station north of Swords.

2.5 National, Regional and Local Planning Policies and Transport Programmes

This section provides a high level assessment of supporting national, regional and local planning policies, as well as transport programmes and policies. The National Development Plan and other policy documents highlighted below demonstrate Government's commitment to support investment in the strategic rail network.

2.5.1 National Policy Context

The following are national level planning policy documents which are of relevance to the proposed Project:

- **Project Ireland 2040: National Planning Framework (NPF) –** In 2018 the Department of Housing, Planning and Local Government, on behalf of the Government, published an overarching policy and planning framework for national development up to 2040. The NPF consists of a set of national objectives and key principles resulting in a shared set of goals for every community across the country. These goals are expressed in this framework as National Strategic Outcomes (NSOs). The proposed Project is listed as one of the key future growth enablers for Dublin and is mentioned as a National Strategic Outcome 4: Sustainable Mobility, and National Strategic Outcome 6: High Quality International Connectivity.

- **Project Ireland 2040: National Development Plan (NDP) 2018 – 2027 –** The Department of Housing, Planning and Local Government, on behalf of the Government, published the NDP which demonstrates the Government's commitment to meeting Ireland's infrastructure and investment needs through a total investment estimated at €116 billion over a ten-year period. The proposed Project supports a National Strategic Objective of the NDF for an integrated and sustainable national public transport infrastructure system. This is identified in the NDP as "*Complete construction of Metro Link.*" estimated to be built by 2027.

- **Project Ireland 2040: Investing in our Culture, Language and Heritage 2018-2027 -** The Department of Housing, Planning and Local Government, on behalf of the Government, published the cultural investment component on Project Ireland 2040 which demonstrates the Government's commitment to support investment in culture, language and heritage.

- **National Mitigation Plan** – Published in 2017 by the Department of Communications, Climate Action and Environment, the National Mitigation Plan aims to set out a pathway to achieve decarbonisation of the economy to the level required by the Climate Action and Low Carbon Development Act (No. 46 of 2015). The National Mitigation Plan contains measures to cover short-term goals to 2020, as well as beginning the process of developing medium and longer-term options for addressing the climate change challenge. Chapter 5 of the National Mitigation Plan includes decarbonisation of transport, with Mitigation Measure T1; '*Public Transport Investment*' stating that investment in high quality public transport allows modal shift and a reduction in emissions. The "old" Metro North is specifically referenced as one of the public transport infrastructure projects to be progressed to achieve this.

- **Climate Action Plan 2019 – To Tackle Climate Breakdown** – Published in 2019 by the Department of Communications, Climate Action and Environment, on behalf of the Government, the Climate Action Plan identifies the nature and scale of the challenge and charts a course towards ambitious decarbonisation targets. The plan outlines the current state of play across the key sectors including transport and sets out governance arrangements including carbon-proofing our policies. Chapter 10 of the plan addresses transport and includes measures under Section 10.3(1) to ensure *we provide good public transport, cycling and walking infrastructure* and implement major sustainable-mobility projects such as MetroLink.

- **Creative Ireland Programme 2017-2022 –** Published in 2016 by the Department of Culture, Heritage and the Gaeltacht, the programme aims to demonstrate the Government's commitment to support investment in culture and heritage.

- **People, Place and Policy: Growing Tourism to 2025 –** The Department of Transport, Tourism and Sport, on behalf of the Government, published a policy on growing tourism in Ireland which sets out the Government's long-term vision for the sector. At the core of that vision are three aspects of People, Place and Policy. The policy aims to increase overseas tourism revenue and employment in the sector. In order to facilitate increased tourism and increased amounts of tourist arrivals, public transport infrastructure projects are required to accommodate the demand for tourists arriving in Ireland.

- **Smarter Travel: A Sustainable Transport Future: A New Transport Strategy for Ireland 2009 - 2020** – This Strategy document sets out 49 actions to be taken with the aim to achieving sustainable transport in Ireland. These 49 actions are split into four overarching actions, one being '…*ensuring that alternatives to the car are more widely available, mainly through a radically improved public transport service*…' (DTTAS 2009, p.13). Whilst the proposed Project is not specifically referenced in the Strategy; it would contribute towards achieving an improved public transport service in GDA.

2.5.2 Regional Policy Context

The following are regional level planning policy documents which are of relevance to the proposed Project:

- **Regional Planning Guidelines for the Greater Dublin Area 2010 - 2022** – The Regional Planning Guidelines set out the planned direction for growth in the GDA up to 2022. The Guidelines are an integrated model of economic, infrastructure, planning, environmental and social policies to promote sustainable growth and build sustainable communities within the Greater Dublin Area. This document includes specific reference to the "old" Metro North project, including the need to deliver the project as part of a high-class transport system for the "Gateway Core Economic Area" to support the attractiveness and competitiveness of the region. The areas listed in this area are the City Region as well as primary economic growth town of Swords.

- **Regional Spatial and Economic Strategy (RSES) for the Eastern and Midland Region 2019 - 2031** – The RSES is a strategic regional level plan that will form the regional tier connecting the National Planning Framework with local planning policy, replacing the Regional Planning Guidelines. The RSES will identify regional assets, opportunities and pressures and provide appropriate policy responses in the form of Regional Policy Objectives. The strategy provides a strategic framework for investment to better manage spatial planning and economic development throughout the Region.

  One of the key elements of the growth strategy identified at the regional level includes the development of a Metropolitan Area Strategic Plan (MASP) for Dublin which is an integrated land use and transportation strategy for the metropolitan area. The MASP is aligned with other Regional Strategic Outcomes to deliver sustainable, compact regeneration and growth in the Dublin metropolitan area to promote Dublin as a global city region. MetroLink is identified as a key project to deliver the vision for the Dublin Metropolitan Area through achieving the Guiding Principle of Integrating Transport and Land Use and targeting growth along high quality public transport corridors and nodes. Specifically, MetroLink provides the spine that delivers the 'Metrolink Corridor', *"The development of the proposed Metrolink project, which is subject to appraisal and delivery post 2027, will unlock significant long-term residential development capacity in Swords and Swords-Lissenhall and can support economic growth in future Metro Economic Zones in South Fingal and at Dublin Airport, subject to the protection of airport capacity and accessibility.".*

  Furthermore, MetroLink meets the Regional Policy Objective 8.6 Rail Infrastructure. When the RSES is adopted by the Eastern and Midland Regional Assembly, it will supersede and replace the Regional Planning Guidelines for the Greater Dublin Area 2010 – 2022. From that point onwards, each planning authority and public body within the region will be obliged to review their plans and programmes and consider any variations to those plans and programmes as is necessary in order to achieve the objectives of the RSES.

- **Transport Strategy for the Greater Dublin Area 2016 – 2035** – This strategic document was published by the NTA in 2016 and provides a framework for the planning and delivery of transport infrastructure and services

in the GDA. The strategy is an essential component, along with investment programmes in other sectors, for the orderly development of the GDA over the next 20 years. This strategy splits the GDA into a number of corridors, six radial and two central. The study area of the proposed Project lies mainly within Corridor A – Drogheda – Balbriggan – Swords – Airport – North Inner City – to Dublin City Centre. This corridor has been identified as having among the highest forecast growth in transport demand up to 2025. However, the area has limited scope for increases in road capacity, and the strategy concludes that due to this limited capacity, growth in trips across the M50 and Royal Canal will need to be catered for by public transport.

The Luas Green Line section south of Charlemont lies within Corridor F – Arklow – Wicklow – Greystones – Bray – Cherrywood – Dundrum – Dun Laoghaire – Dublin City Centre. The western parts of this corridor were identified as requiring high capacity public transport and proposes an upgrade of the Luas Green Line to Metro standard to Bride's Glen, linking it into the "Old" Metro North Scheme. In order to inform the strategy, the NTA commissioned a number of transport studies, with a study on the Fingal / North Dublin area and the south-east area being relevant to the proposed Project.

The Strategy recommends the development of New Metro North "*light rail link from the south city centre to Swords and serving Dublin Airport, operating in tunnel under Dublin City centre, and providing a high frequency, high capacity service*.

- **Fingal / North Dublin Transport Study 2015** – The Fingal / North Dublin Transport Study was published by the NTA in 2015 in order to identify the optimum long-term public transport solution to connect Dublin City Centre, Dublin Airport and Swords. The study forecasted increases in trip demand up to 2033 across the Fingal / North Dublin area. Compared to 2011, the study calculated that trip demand from Swords to the City Centre would increase 72%, from the Airport to the City Centre by 80%, and Ballymun to the City Centre by 28%. The anticipated population and employment growth to 2033 will have negative impacts on the transport network as it currently stands. The study looked at a number of transport options including Bus Rapid Transit (BRT), light rail and heavy rail options for the study area with respect to environment, safety, economy, accessibility and social inclusion, and integration. It concluded that light rail presented the best opportunity to meet the forecasted increases in travel demand in the corridor from Swords to the City Centre via Dublin Airport and Ballymun. An optimised "old" Metro North scheme was identified as the preferred light rail option for this corridor.

2.5.3 Local Policy Context

The following are local planning policy documents which are of relevance to the proposed Project:

- **Fingal Development Plan 2017 - 2023** – Fingal County Council has recognised that the proposed Project would facilitate future development into Swords and as a result, a land use zoning category, Metro Economic Corridor (ME), was created whose objective is; *"Facilitate opportunities for high density mixed use employment generating activity and commercial development, and support the provision of an appropriate quantum of residential development within the Metro Economic Corridor"*. This zone will apply to approximately 390 hectares of land. "Old" Metro North has been incorporated throughout the Plan and into strategies for the areas to be served by it. An indicative route is included in mapping for the overall plan as well as applicable Local Area Plans (LAPs); Dublin Airport, Dardistown, Fosterstown and Barrysparks. The "Old" Metro North scheme is also central to a number of masterplans included within the County Development Plan; Swords and Dublin Airport Central. There is also a local objective to carry out a comprehensive feasibility study of the South Fingal area to produce a strategic 'vision' and overall strategy for the proper planning and sustainable development of the study area, based on a sustainable transport and smarter travel approach, planning for all transport modes and needs, whilst also being reflective of road network capacity and modal split assumptions.

- **Dublin City Development Plan 2016 - 2022** – The wider encompassing policies, such as economic policies, support the continued development of a quality, affordable and accessible movement system within the city that prioritises walking, cycling and public transport making the city more compact and sustainable. Movement

and transport policies set out an integrated long-term strategy including "old" Metro North; objective MT1 encourages intensification and mixed-use development along planned public transport corridors and at transport nodes, whilst objective MT4 aims to '*promote and facilitate the provision of Metro… in order to achieve strategic transport objectives*'. A number of Local Area Plans also feature the proposed Project; Ballymun, George's Quay and Phibsborough / Mountjoy.

- **Dún Laoghaire-Rathdown County Development Plan 2016-2022 –** The Plan's overarching vision statement is *"To continue to facilitate appropriate levels of sustainable development predicated on the delivery of high quality community, employment and recreational environments - allied to the promotion of sustainable transportation and travel patterns - but all the while protecting Dún Laoghaire-Rathdown's unique landscape, natural heritage and physical fabric, to ensure the needs of those living and working in the County can thrive in a socially, economically, environmentally sustainable and equitable manner".* There is a sustainable travel and transport policy, ST15: Luas Extension. This policy stated that *'It is Council policy to promote, facilitate and cooperate with other agencies in securing the extension of the Luas network in the County as set out in the NTA's 'Greater Dublin Area Draft Transport Strategy 2016-2035' and including any future upgrade to Metro'.*

2.6 Project Description

The proposed Project consists of the provision of a high capacity, high frequency, modern and efficient metro rail line between Estuary Park and Ride, north of Swords to Charlemont in south Dublin City Centre, linking Dublin Airport, Irish Rail, DART, Dublin Bus and Luas services. The proposed Project will be approximately 19 kilometres in length and it is intended that it will commence construction in 2021 and operation by 2027.

2.6.1 Overview of Proposed Project

Northern Section: Estuary to Airport Tunnel North Portal

As shown in Figure 2.3 the proposed Project will commence at its most northern extent with a station location at Estuary north of Swords. It is proposed to locate a park and ride facility with a capacity of up to 3000 spaces at Estuary Station just off the R132 Swords Road near Junction 4 on the M1.

The proposed Project will then progress on the western side of the R132, before crossing the Broadmeadow and Ward Rivers. It will then continue south where it will generally follow the eastern side of the R132 in cutting as far south as Fosterstown North, just south of Airside Retail Park. The proposed Project will be served by three stations along this section at Seatown, Swords Central and Fosterstown.

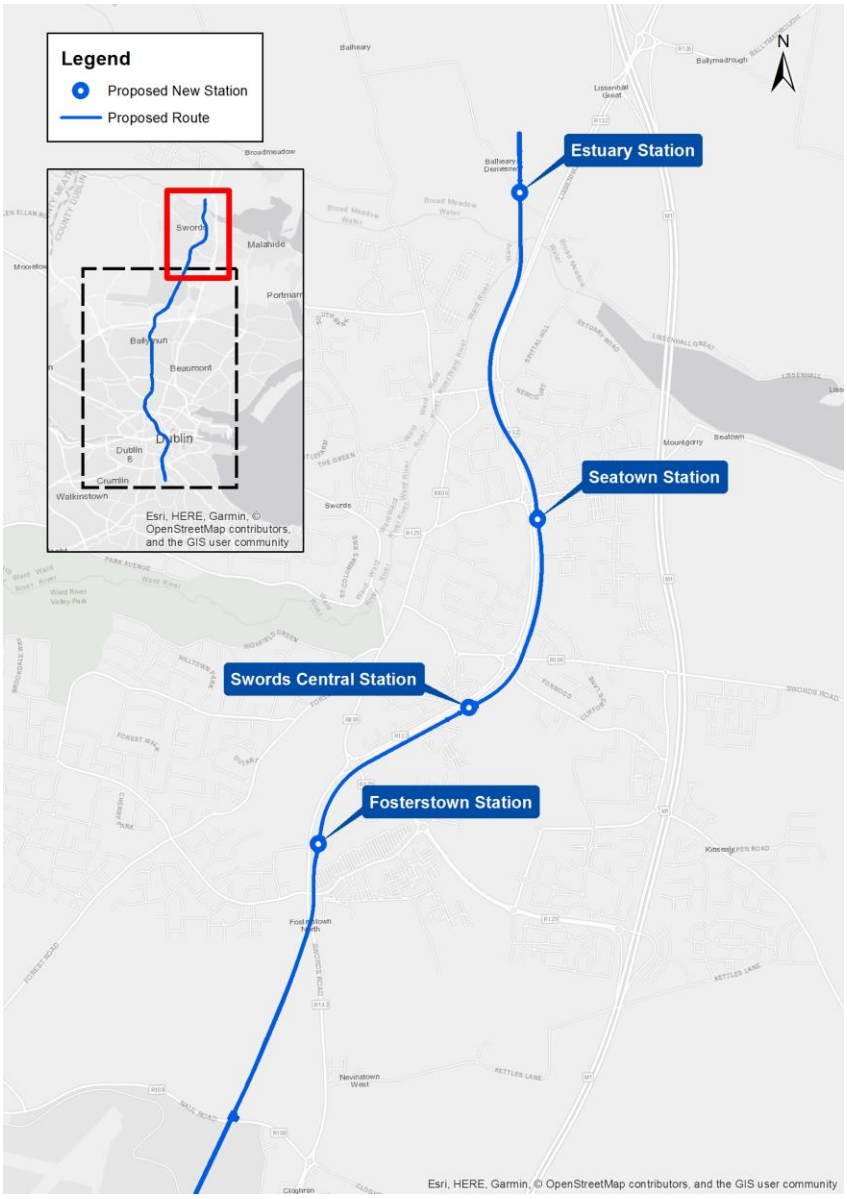

Figure 2.3: Northern Section of proposed Project

Southern Section: Airport Tunnel North Portal to Charlemont

North of Naul Road, and taking advantage of the natural terrain level difference, the proposed Project will enter a tunnel via a portal (tunnel entrance structure) before proceeding south underneath Dublin Airport as shown in Figure 2.5. The 2.5km tunnel will pass under the northern part of the airport apron and hangar areas, and internal roads before arriving at the Dublin Airport Station. This underground station will be located under an area currently occupied by a surface car park, within the area designated as a Ground Transportation Centre in the Dublin Airport Central Masterplan (FCC & daa 2016) and shown in Figure 2.4 Dublin Airport Authority Ground Transport Centre. This car park will be removed to make way for the construction of the new station. From the Airport Station the tunnel will continue south under Terminal 2 and the apron before emerging through a portal in an undeveloped area south of the airport in Dardistown.

Figure 2.4: Dublin Airport Authority Ground Transport Centre (FCC and daa 2016)

A station is proposed for Dardistown (in the future) in addition to a maintenance depot which will house all the facilities required for the maintenance and operation of the proposed Project and its rolling stock or vehicles. Until 3rd party development occurs at Dardistown it is not proposed to construct a station.

South of Dardistown Station the proposed alignment turns south, rising on an elevated structure to cross over the M50 on a viaduct before descending to ground level and then continuing underground to Northwood Station via a cut and cover section which will pass under the R108. Immediately to the west of the R108 the proposed alignment will enter a single bored tunnel, continuing southwards towards Ballymun underground Station.

From Ballymun Station, the proposed alignment will continue in tunnel, passing back under Ballymun Road before deviating east to the Collins Avenue Station.

The proposed Project will continue under Ballymun Road before turning east under St Mobhi Road. It will deviate slightly east to the proposed Griffith Park Station. The alignment will then continue south under St Mobhi Road, descending deeper to cross under the Tolka River. Continuing south, it closely follows Botanic Road, before rising slightly to Glasnevin Station. There is a major interchange station for the Maynooth and Kildare mainline rail services proposed for the Glasnevin Station location, which will provide MetroLink users a connection to other rail services

From here the proposed Project will pass under the Royal Canal and will deviate away from the R108 in a south-easterly direction towards Mater Station located in the Four Masters Memorial park by St Joseph's Church (also known as The Mater Plot), on the corner of Eccles Street and Berkley Road across the street from the Mater Hospital.

From this station location the proposed Project will continue underground in a south-easterly direction descending towards O'Connell Street progressing under rows of Georgian Houses lining Blessington Street, Frederick Street North and Parnell Square East, passing near the Garden of Remembrance, the Rotunda Hospital and the Gate and Ambassador Theatres. O'Connell Street Station is proposed to be located within the planned development area immediately west of O'Connell Street and south of Parnell Street.

The proposed Project will then continue southwards, passing under O'Connell Street, passing east and under the City Centre area, where it will cross under the Red Line Luas track and the Abbey Theatre, moving deeper to

cross under the River Liffey towards Tara Street Station. The proposed location for the Tara Street metro station is underneath an area bordered by the rail line to the east and Poolbeg Street to the north, Tara Street to the west and Townsend Street to the south.

Tara Street Station is proposed to be a major interchange station to provide connections to the train & DART services using the adjacent rail line. From Tara Street the proposed rail line continues south passing under the eastern end of the Trinity College campus.

The proposed Project then proceeds south of Leinster Street South under a number of very significant buildings including Leinster House, Government Buildings, the National Gallery, National Library, and the National Museum of Ireland. The proposed Project then passes under St Stephen's Green North before the alignment rises to the St Stephen's Green Station on St Stephen's Green East.

The proposed St Stephen's Green Station is to be located under the R138 St Stephen's Green East road, outside the north-eastern corner of St Stephen's Green.

Continuing south-west, the proposed Project follows St Stephen's Green East and continues along Earlsfort Terrace, passing close to the National Concert Hall, at which point it turns south passing under Harcourt Terrace and the Grand Canal before Charlemont Station. The proposed Charlemont Station will be located on a site south of the "Carroll's Building" on Grand Parade.

Charlemont Station is proposed to allow for an interchange to the Luas Green Line services. The bored tunnel will continue to, and terminate south of Ranelagh, aligned to facilitate a future tie-in connection.

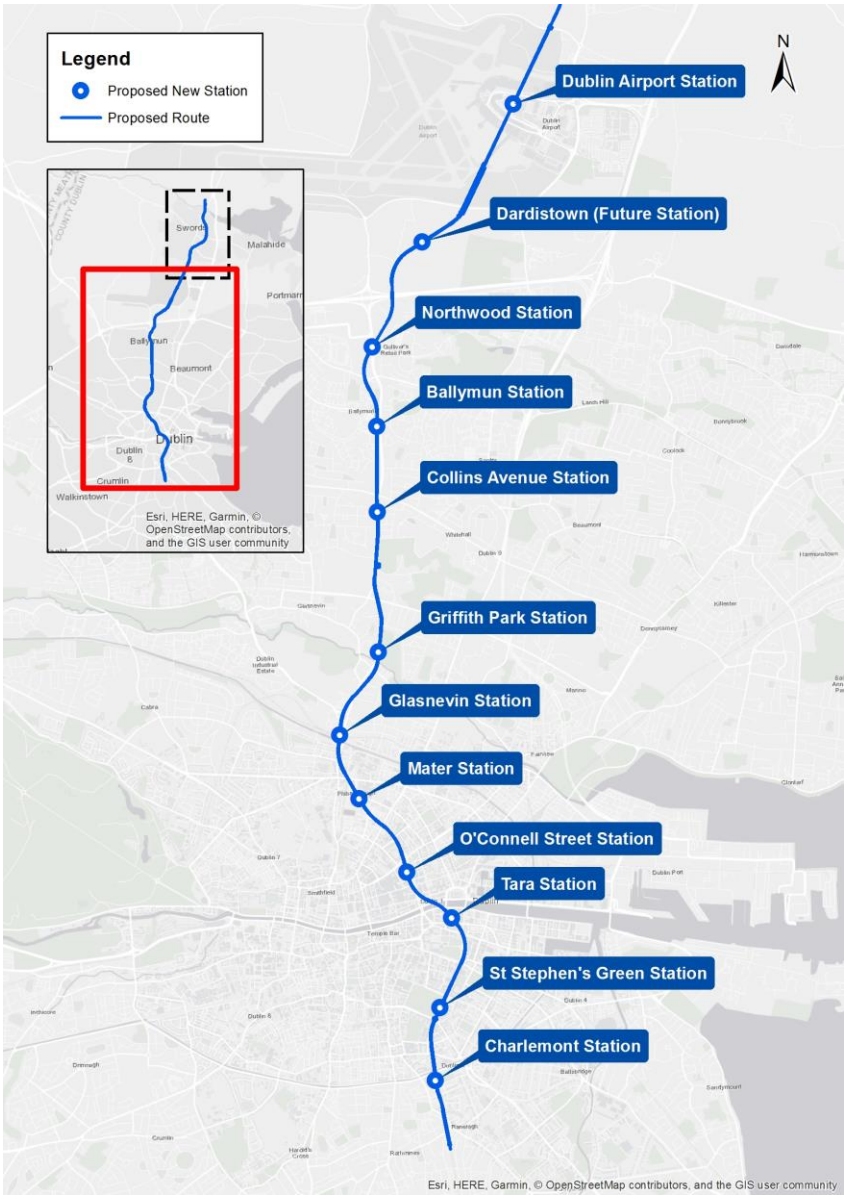

Figure 2.5: Southern Section, Airport Tunnel North Portal to Charlemont

2.6.2 Infrastructural Elements

Stations

Sixteen newly constructed stations are proposed for the proposed Project. Refer to Table 2.1 for details of the proposed stations.

It is proposed that the underground stations will be configured with the track through the middle of the station and, the platforms at the sides. The stations will be approximately 23m wide and contain escalators and lifts to provide access.

Table 2.1: Proposed Stations, Orientation and Description

Station Name	Orientation	Description
Estuary	Above ground	Located in farmland off the R132 adjacent to M1 Junction 4, north of the Broadmeadow River.
Seatown	Open-cut	At the side of the R132 south of Seatown Road Roundabout,
Swords Central	Open-cut	At the side of the R132, south-west of the Malahide Road Roundabout.
Fosterstown	Open-cut	At Airside Retail Park, adjacent to the R132.
Dublin Airport	Underground	Under existing surface carpark in an area proposed for a ground transportation hub.
Dardistown (Future Station)	Above ground	Located on an undeveloped site between Dublin Airport and M50 Motorway. To be constructed in future as land is currently undeveloped.
Northwood West	Underground	Under the R108 near Northwood Avenue junction.
Ballymun	Underground	At the side of the R108 Ballymun Road, under the Ballymun Shopping Centre.
Collins Avenue	Underground	To the east of the R108 Ballymun Road, south of the junction with Collins Avenue.
Griffith Park	Underground	Under the playing pitch of Homefarm Football Club, adjacent to the R108 St Mobhi Road.
Glasnevin	Underground	Just north of the Royal Canal along the R135. A railway station will also be constructed here on the existing rail lines to provide for interchange between the two networks.
Mater Hospital	Underground	Under the Four Masters Memorial park to the south west of the Mater Hospital.
O'Connell Street	Underground	At the northern end of O'Connell Street, west of street and south of Parnell Street under the planned development area.
Tara	Underground	Adjacent to the existing Tara Street Station to provide for interchange to DART services.
St Stephen's Green	Underground	Under St Stephen's Green East.
Charlemont	Underground	Underground station under a vacant lot to the rear of the Carroll's Building on Grand Parade, in close proximity to the Charlemont Luas Stop.

Tunnels

It is proposed to construct the tunnels as single bores containing both north and south-bound tracks within the same tunnel.

The tunnelling is in two sections: the longest section runs from south of Northwood Station to Charlemont Station, crossing under Dublin City Centre; and the shorter section runs below Dublin Airport's land boundaries. It is expected that the airport tunnel will be bored from south to north and, after this is completed, the city centre tunnel will be bored from north to south.

Ventilation and Intervention Shafts

Ventilation shafts will be required at all underground stations, and along the proposed tunnel alignment as needed. These are required to maintain comfortable temperatures on rolling stock and in stations and allow for the circulation of fresh air and removal of stale air from the underground sections of the proposed Project. Ventilation shafts are also important safety features, protecting against unacceptable air velocities within the underground areas caused by the movement of rolling stock, and controlling smoke in the event of fires. Ventilation shafts are proposed at both sides of the stations (Figure 2.6).

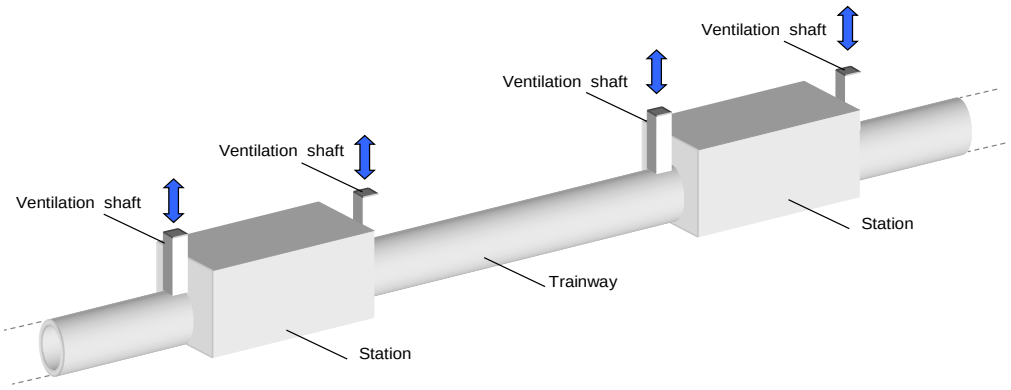

Figure 2.6: Typical Ventilation Shaft Configuration

As per the National Fire Protection Association (NFPA) 130 2017 Standard for Fixed Guideway Transit and Passenger Rail Systems, an intervention shaft will be required along the tunnel alignment to provide adequate emergency egress from the tunnel. This shaft will be visible as surface feature and will be located at Albert College Park as shown in Figure 2.7.

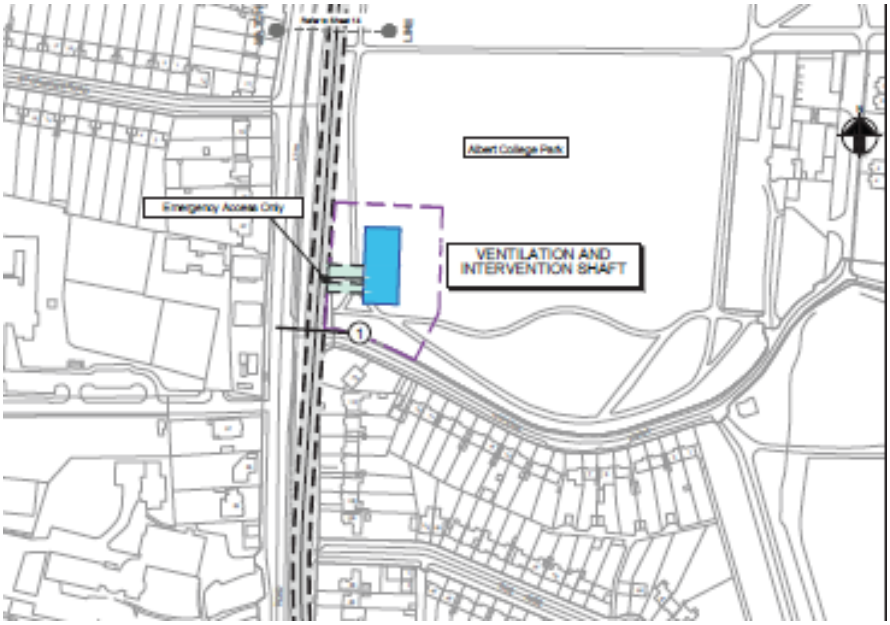

Figure 2.7: Intervention shaft at Albert College Park

Portals

The entrances to the tunnelled sections are referred to as portals. There are three portals proposed, as shown in Figure 2.8. These are:

- Northern portal at the Naul Road, north of the airport;
- South of the airport at Dardistown; and
- South of the M50 in the Northwood area.

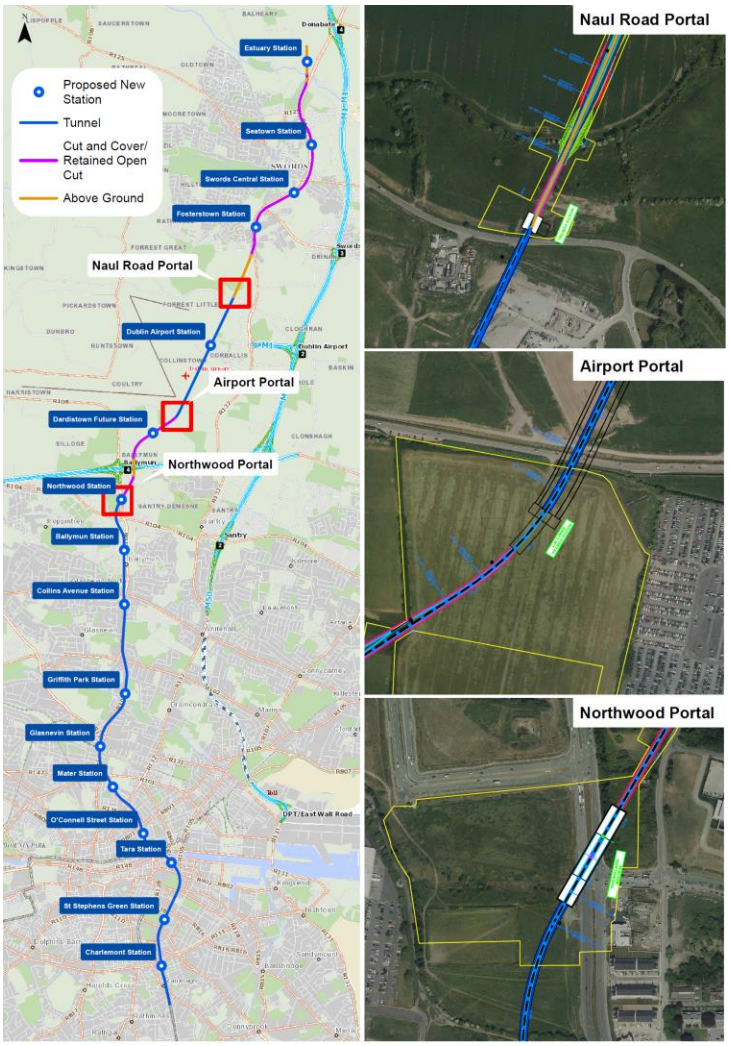

Figure 2.8: Tunnel Portals

Above Ground Track

The majority of the proposed Project north of the M50 will be above ground or in a cut, with the exception of the section under Dublin Airport. The above ground track sections will be a mix of at-grade sections, with some sections in a cut and some elevated track sections required where it is necessary to cross obstacles such as the M50 Motorway or roundabouts.

Strategic Park and Ride at Estuary Station

Figure 2.9 shows the site to the north of Swords and to the south of the M1 was chosen as a Park and Ride facility due to its potential to offer a competitive journey time into the city centre and allow users to bypass congestion on the M1/N1, M50 and R132. The proposed Park and Ride will include provision for up to 3,000 parking spaces adjacent to the northern-most proposed station at Estuary.

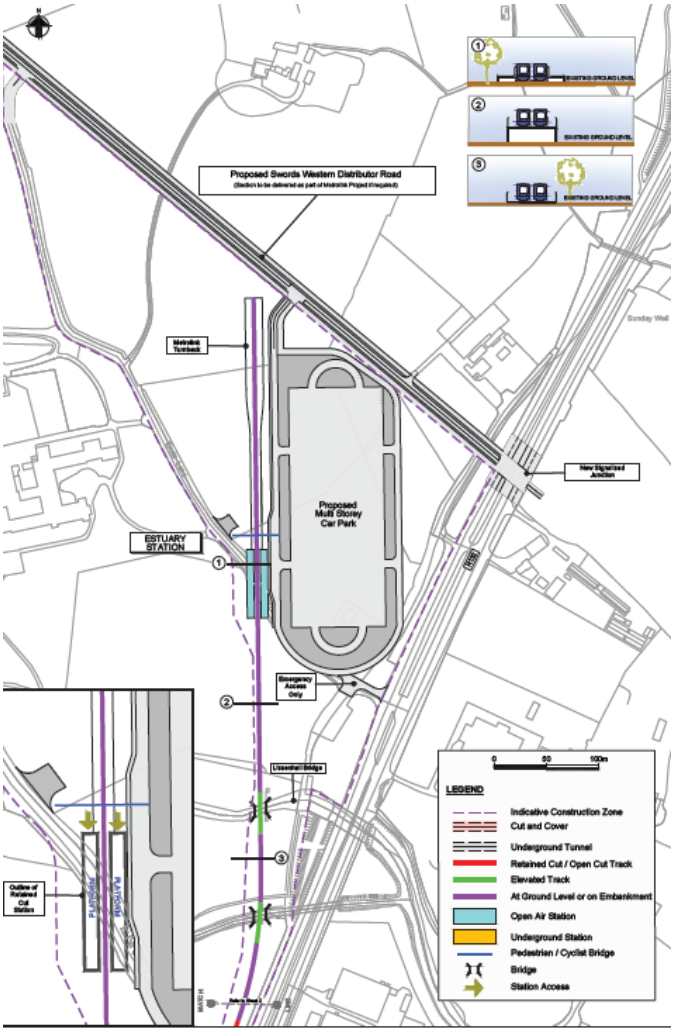

Figure 2.9: Indicative Park and Ride Layout

Dardistown Depot

A maintenance depot is proposed to be located at Dardistown as shown in Figure 2.10. It will be located near proposed (future) Dardistown Station and will house the facilities required to both stable the rolling stock and to carry out light and heavy maintenance activities required for the metro system.

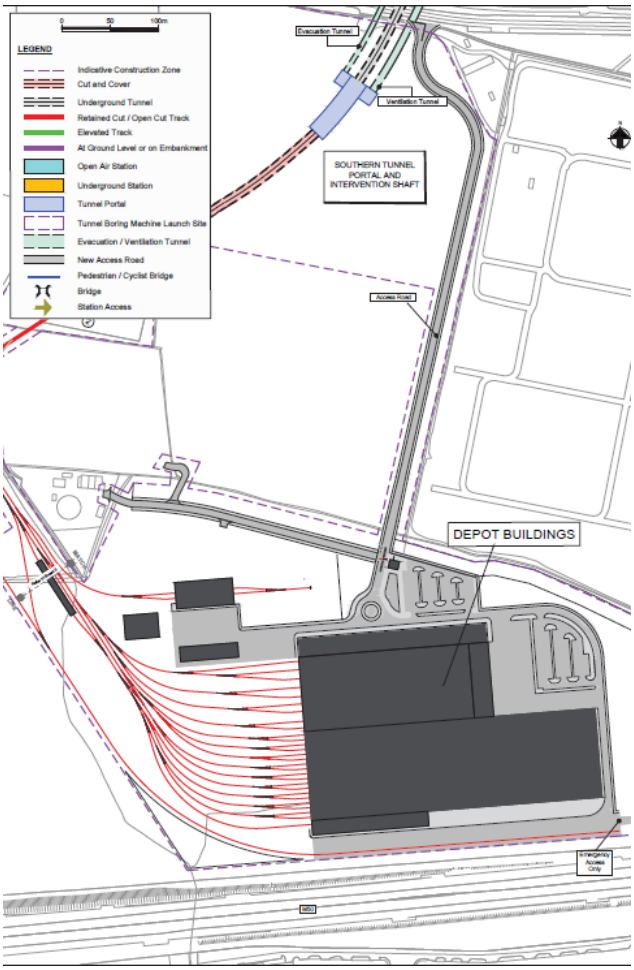

Figure 2.10: Indicative Dardistown Depot Layout

2.6.3 Ancillary Elements

The proposed Project will require a number of ancillary elements in order to facilitate the operation of the metro service. New substations with grid connections will be required to provide power to the vehicles, tunnels and stations. New connections to the water and wastewater systems will be required at each new station. Drainage will also be required for the stations and tunnels. Drainage will bring water from the stations and tunnels to a series of outfalls at appropriate discharge locations.

The proposed Project also requires a number of systems to ensure the metro is operated safely and reliably. The main elements of these systems are listed below.

- **Traction Power:** The power and electrification system required for the proposed Project not only supplies traction power to the rolling stock but will also power all of the infrastructure associated with the metro system. The design requires a high voltage supply from the Distribution Network Operator (ESB) at a number of strategic locations, which will be identified as part of the modelling and in agreement with ESB.

- **Control and Communications Systems:** The proposed Project will include (but not be limited to) supervisory control and data acquisition (SCADA) systems, passenger information system, public address system, radio communication (including voice and data), fibre optic transmission network, telephone system including SOS

help points, CCTV (stations and depot), fire detection; and intruder detection (to include unauthorised access to tunnels and ventilation shafts).

- **Signalling System:** The proposed Project will be equipped with a Communications Based Train Control signalling system to deliver required headways.

- **Fare Collection System:** Collection and Ticketing will be operated on an open system concept without entrance/exit barriers. Where stations are required by efficient design to incorporate a concourse area, ticket machines will be located in the concourses. Where concourses are not required, machines will be placed adjacent to station access or on the platforms.

- **Third Party Communications Systems:** Additional services to provide a positive passenger experience on a modern metro system are proposed which include facilities for third party communications systems to allow for Mobile Network Operators to provide mobile voice and data network access throughout their journey. The design will take into account the spatial requirements for equipment within stations and tunnels.

2.6.4 Construction Arrangements

Construction of the proposed Project is proposed to take place over six years, commencing in 2021/2022. A detailed construction plan and schedule will be developed for the proposed Project to ensure that the construction phasing allows for maximum efficiency while minimising potential for environmental impact.

The general sequence of activities to be followed when constructing this type of project will be broadly as follows:

- Establishing the works area/site and the establishment of site offices, compounds and security;
- Site preparation including demolitions where required;
- Utilities diversion;
- Excavation and construction of stations;
- Construction of tunnels and structures;
- Installation of railway tracks;
- Installation of operating equipment;
- Fitting out of stations; and
- Finishing and landscaping.

Following construction, a period of testing and commissioning of the system will be required.

The following sections outline the principle construction elements.

Construction Compounds and Working Areas

There will be a number of construction compounds and working areas of various scales along the whole proposed Project. The main locations of these will be immediately surrounding the Tunnel Boring Machine (TBM) launch sites and new station locations. There will also be works areas along all above ground track areas, construction areas for other surface features such as ventilation and intervention shafts and materials and waste management sites.

Tunnel Construction

The tunnel will be primarily constructed by the use of a Tunnel Boring Machine (TBM). The TBM will advance from a launch site for each of the two tunnel sections. The launch sites are proposed to be located:

- On the southern edge Old Airport Road and Dublin Airport Between Na Fianna GAA Collinstown Pitches and Quickpark. This launch site allows tunnelling north towards Dublin Airport Station.
- Adjacent to the proposed Northwood Station to the west of the R108 and south of St Margaret's Road. This launch site allows tunnelling south towards Ballymun Station.

Tunnelling will occur at a rate of approximately 80m per week until each tunnel excavation is completed. However, the rate of advancement may vary considerably depending on geotechnical conditions encountered and other requirements that may be needed to reduce the potential impacts of the TBM advancement.

Underground Station Construction

The underground stations will comprise an underground box into which the tunnel connects, with an entrance located at the surface above the station. It is proposed that the underground stations will be constructed using the "top-down" cut and cover method. However other methods such as "mining" may also be required at specific locations. Cut and cover involves excavating the area required for the station from the surface down to the desired level before constructing the station and covering to reinstate the surface to the desired finish. Mining potentially involves a more complex excavation methodology depending on location.

Land Acquisition and Demolition

Construction of the proposed Project will require the acquisition of lands both on a temporary basis to facilitate certain construction activities, and on a permanent basis where proposed Project infrastructure is to be located and where permanent access is required.

In addition to the acquisition of lands for the proposed Project, a number of residential and commercial properties will require demolition.

The full extent of the land acquisitions and demolitions required will be known once the final alignment has been defined. Consultation will be carried out with all affected landowners. The EIAR will include detail of lands and properties to be impacted.

Materials Management

Significant volumes of spoil, mainly comprising soil, stone and rock, will be generated from the construction of the:

- tunnels;
- open cut sections;
- underground stations; and
- portals.

The proposed Project will produce significant volumes of excess spoil, of which approximately half will arise from the excavation of tunnels and portals, with remainder generated from underground station and shaft excavation. This waste material will be managed to maximise the opportunities for reuse and recycling where practicable, while minimising the potential effects of material management on the receiving environment.

Measures to prevent or reduce waste will be identified within the EIAR in addition with detail on recycling and/or recovery of the material off-site.

2.6.5 Operation of the Proposed Project

Once operational it is expected that the proposed Project will operate up to a maximum of 40 TPH (Trains per hour) in each direction. This equates to one vehicle every 90 seconds at peak times. The total journey time between Swords and Charlemont is expected to be approximately 30 minutes.

To ensure the proposed Project will continue to run effectively, there will be a requirement for regular routine maintenance on the line.

2.7 Alternatives

A description of the reasonable alternatives considered is required in accordance with Directive 2014/52/EU amending Directive 2011/92/EU on the *Assessment of the Effects of Certain Public and Private Projects on the Environment* (EIA Directive) in accordance with Article 5.1 (d), Annex IV paragraph 2 and Annex IV.3. The EIA Directive states that the EIAR should include:

'A description of the reasonable alternatives (for example in terms of project design, technology, location, size and scale) studied by the developer, which are relevant to the proposed Project and its specific characteristics, and an indication of the main reasons for selecting the chosen option, including a comparison of the environmental effects'.

The Alternatives Assessment in the EIAR will consider the main alternatives for the proposed Project. This can include alternatives such as: "the do nothing" scenario, alternative locations, alternative alignments, alternative processes or equipment, alternative site layouts, alternative operating conditions, construction methodologies, and alternative ways of addressing potential environmental impacts.

3. EIA Process

This chapter describes the EIA process of identifying, predicting, evaluating and mitigating the effects (positive and negative) on the receiving environment caused by a proposed development or project. Where negative effects are considered unacceptable, design changes and/or other mitigation measures will be proposed to minimise these effects to acceptable levels.

3.1 EIA Directive 2014/52/EU

The EIA Directive (2014/52/EU) on the assessment of the effects of certain public and private projects on the environment became applicable in Ireland from May 16th, 2017. Directive 2014/52/EU is given effect in Irish Law by the European Union (Planning and Development) (Environmental Impact Assessment) Regulations 2018 (S.I. 296 of 2018) which came into effect on 1 September 2018 and the EIAR will be prepared in accordance with these Regulations.

The EIA Directive requires that certain projects and developments that have potential for environmental effects be assessed by way of Environmental Impact Assessment for likely environmental effects before planning approval can be granted. When submitting a planning application for such a development, the applicant must also submit an EIAR.

The various amendments introduced in the 2014 EIA Directive aim to strengthen the quality of the EIA procedure. It is in line with the drive for smarter regulation and reducing the administrative burden. It also improves the level of environmental protection, with a view to making business decisions on public and private investments more sound, more predictable and sustainable in the longer term.

The new approach as set out in the 2014 EIA Directive pays greater attention to challenges that have emerged since the original Directive came into force, which has resulted in increased focus in the assessment process being placed on areas such as resource efficiency, climate change and disaster prevention.

3.2 Environmental Impact Assessment Process

An overview of the stages of the EIA process for the proposed Project is presented Figure 3.1.

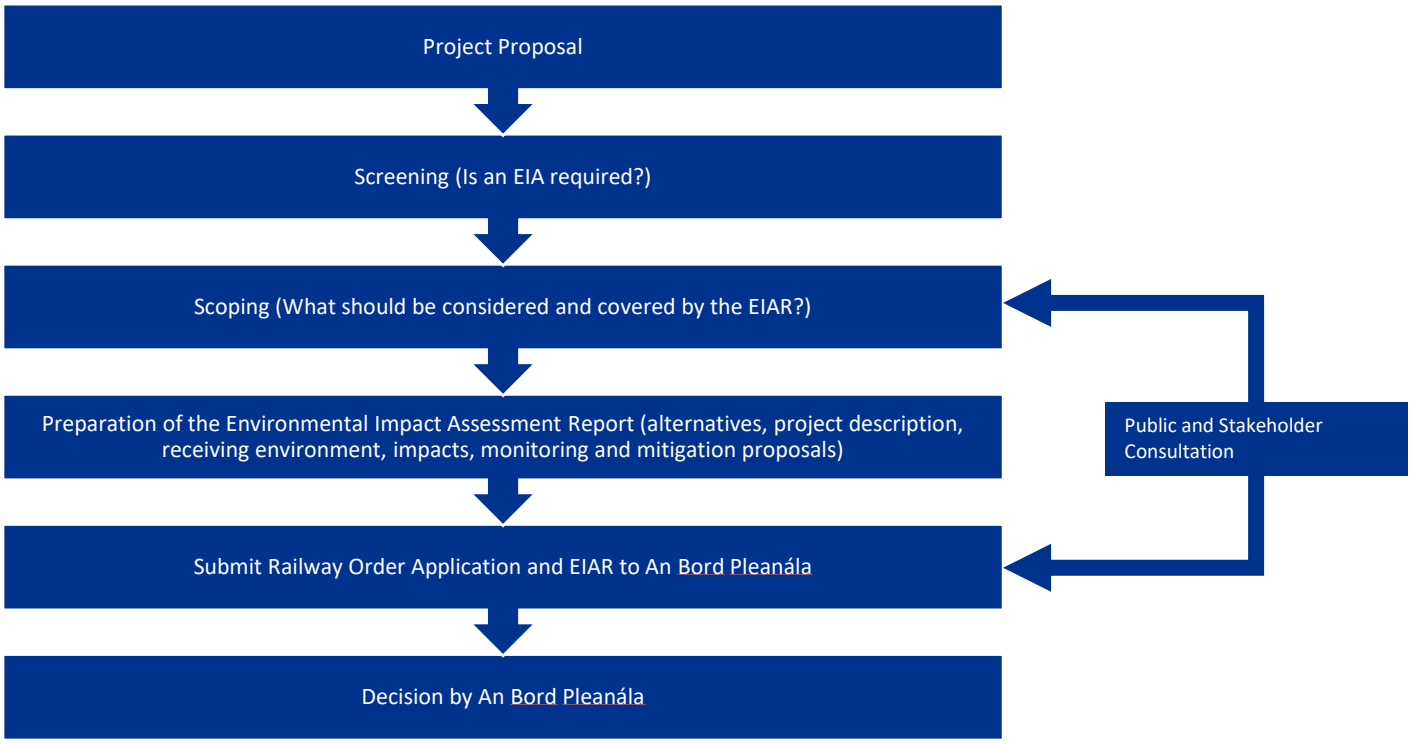

Figure 3.1: EIA Process

The assessment of environmental impacts will be conducted for this proposed Project in accordance with best practice as detailed in the following Chapters for each environmental subject. The EIA process can generally be summarised as follows:

- Screening – Is an EIAR required?;
- Scoping – What issues should be considered within the EIAR?;
- Baseline Data Collection – Establishing a robust baseline of the existing environment on and around the site. This stage includes a review of existing available information and undertaking any surveys identified during the scoping phase;
- Impact Assessment – Assessment of the environmental impacts and establishing their significance;
- Mitigation – Formulation of mitigation measures to ameliorate the potential impacts of the proposed development which cannot be avoided practically through site design;
- Consultation – With Statutory Authorities, Stakeholders, the public and other bodies;
- Decision – The competent authority, in this case An Bord Pleanála, will decide if the proposed development can be authorised and if so will specify conditions that must be adhered to;
- Announcement – The public is informed of the decision; and
- Monitoring – Monitoring of the effectiveness of implemented mitigation measures.

3.3 Screening

Screening is the first stage of the EIA process, whereby a decision is made on whether or not an EIA is required.

The relevant classes of development that require EIA are set out in Schedule 5 of the Planning and Development Regulations 2001 to 2018. In accordance with Part 2, Paragraph 12(h) an EIA is required for the following:

'All tramways, elevated and underground railways, suspended lines or similar lines of a particular type, used exclusively or mainly for passenger transport.'

3.3.1 Transport (Railway Infrastructure) Act 2001

The Transport (Railway Infrastructure) Act 2001 (No. 55 of 2001) as amended, sets out the process required for making an application for a Railway Order. Section 37(2) lists the required documentation when making an application. This includes a requirement for:

'(e) a statement of the likely effects on the environment (referred to subsequently in this Part as an "environmental impact statement") of the proposed railway works.'

It is therefore a mandatory requirement to submit an EIAR with the Railway Order application for this proposed Project.

3.4 Scoping

Scoping is the process of determining the content and extent of matters that should be covered within the EIAR to be submitted to the competent authority, in this case An Bord Pleanála. Scoping requires consideration of the nature and probable scale of potential environmental impacts which are likely to arise as a result of the proposed Project.

This EIA Scoping Report sets out the proposed scope of work and methodologies to be applied in the development of the EIAR for the proposed Project and outlines the proposed structure of the EIAR document.

The key objectives of this EIA Scoping Report are:

- Provide a description of the proposed Project;
- Identify likely significant effects which may arise during construction and operation of the proposed Project and which will be addressed in detail in the EIAR;
- Identify potential environmental effects which may be partially or wholly omitted from the EIAR (scoped out);
- Outline proposed assessment methodologies for completing the EIAR;
- Outline the likely contents of the EIAR; and
- Form a basis of common reference for consultation about the scope and methodology for the EIAR.

3.5 EIA Methodology

The assessment of environmental impacts will be conducted in accordance with the following EPA Guidance:

- Environmental Protection Agency Guidelines on the Information to be Contained in Environmental Impact Statements (EPA 2002);
- Environmental Protection Agency Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA 2003a);
- Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports (EPA 2017c); and
- Draft Advice Notes for Preparing Environmental Impact Statements (EPA 2015).

In addition to the applicable EIA legislation and guidance, all EU Directives and national legislation relating to the specialist areas will also be considered as part of the process.

The EIAR will provide the following:

1. A description of the proposed Project comprising information on the location, design, size and other relevant features including the physical characteristics of the whole project, required demolitions and the land-use requirements during both the construction and operational phases;
2. A description of the main characteristics of the operational phase of the proposed Project having particular regard to energy demand and energy used and the nature and quantity of materials and natural resources used;
3. A description of the relevant aspects of the current environmental baseline and an outline of the likely evolution of the environment without the implementation of the proposed Project;
4. A description of the likely significant effects of the proposed Project on the receiving environment;
5. An estimate by type and quantity of expected residues and emissions and quantities and type of wastes generated during both the construction and operational phases;
6. A description of the features of the proposed Project and/or measures envisaged in order to avoid, prevent or reduce and, if possible, offset likely significant adverse effects on the environment. In addition, opportunities will be identified to incorporate health gain into the proposed Project;
7. A description of the reasonable alternatives studied, which are relevant to the proposed Project and its specific characteristics, and an indication of the main reasons for the option chosen, taking into account the effects of the proposed Project on the environment;
8. A description of the expected significant adverse effects of the proposed Project on the receiving environment deriving from the vulnerability of the proposed Project to risks of major risks and disasters and a description of mitigation measures proposed to mitigate these;
9. A description of monitoring measures, where appropriate;
10. A non-technical summary of the information referred to in points 1-9 above; and
11. Any additional information specified in Annex IV of the EIA Directive 2014/52/EU (as transposed into Irish law) relevant to the specified characteristics of the proposed Project and to the environmental features likely to be affected.

3.6 Potential Impacts

The assessment will be structured to ensure that assessment criteria (i.e. which receptors are considered sensitive) and standards of significance, sensitivity and magnitude used as part of the assessment are identified and documented and that the level of certainty of data is recorded. An explanation will be provided for each environmental aspect on the criteria that have been applied, including reference to the appropriate published guidance for each of the environmental aspects.

The assessment criteria used will be as per the EPA Guidelines (EPA 2017c), as reproduced in Table 3.1 unless otherwise stated and described within the relevant EIAR chapter.

Table 3.1: Reproduction of Table 3.3 Description of Effects from the Draft EPA Guidelines (EPA 2017c)

Assessment Criteria	
Quality of Effects	
It is important to inform the non-specialist reader whether the effect is positive, negative or neutral.	**Positive Effects** A change which improves the quality of the environment (for example, by increasing species diversity or improving the reproductive capacity of an ecosystem; or removing nuisances; or improving amenities)
	Neutral Effects A change which does not affect the quality of the environment
	Negative / Adverse Effects A change which reduces the quality of the environment (for example, lessening species diversity or diminishing the reproductive capacity of an ecosystem; or damaging health or property or by causing a nuisance)
Significance of Effects	
'Significance' is a concept that can have different meanings for different topics – in the absence of specific definitions for the different topics the following definitions may be useful.	**Imperceptible** An effect capable of measurement but without noticeable consequences
	Not significant An effect which causes noticeable changes in the character of the environment but without noticeable consequences
	Slight Effects An effect which causes noticeable changes in the character of the environment without affecting its sensitivities
	Moderate Effects An effect that alters the character of the environment in a manner that is consistent with existing and emerging trends
	Significant Effects An effect which, by its character, magnitude, duration or intensity alters a sensitive aspect of the environment
	Very Significant Effects An effect which, by its character, magnitude, duration or intensity significantly alters the majority of a sensitive aspect of the environment
	Profound Effects An effect which obliterates sensitive characteristics
Extent and Context of Effects	
Context can affect the perception of significance. It is important to establish if the effect is unique or, perhaps, commonly or increasingly experienced.	**Extent** Describe the size of the area, the number of sites, and the proportion of a population affected by an effect.
	Context Describe whether the extent, duration, or frequency will conform or contrast with established (baseline) conditions (is it the biggest, longest effect ever?)
Probability of Effects	
Descriptions of effects should establish how likely it is that the predicted effects will occur – so that the CA can take a view of the balance of risk over advantage when making a decision.	**Likely Effects** The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.
	Unlikely Effects The effects that can reasonably be expected not to occur because of the planned project if all mitigation measures are properly implemented.

Assessment Criteria	
Duration and Frequency of Effects	
'Duration' is a concept that can have different meanings for different topics – in the absence of specific definitions for different topics the following definitions may be useful.	**Momentary Effects** Effects lasting from seconds to minutes
	Brief Effects Effects lasting less than a day
	Temporary Effects Effects lasting less than a year
	Short-term Effects Effects lasting one to seven years
	Medium-term Effects Effects lasting seven to fifteen years
	Long-term Effects Effects lasting fifteen to sixty years
	Permanent Effects Effects lasting over sixty years
	Reversible Effects Effects that can be undone, for example through remediation or restoration
	Frequency of Effects Describe how often the effect will occur (once, rarely, occasionally, frequently, constantly – or hourly, daily, weekly, monthly, annually)

The assessment will evaluate the construction and operational phases of the proposed Project and the likelihood, extent, magnitude, duration and significance of potential impacts will be described. The potential for cumulative impacts to arise will also be considered.

For all environmental aspects, the significance of residual impacts, i.e. those impacts predicted once mitigation is taken into consideration, will be assessed and presented.

3.7 Mitigation Measures

The EIAR will address potential environmental effects associated with the proposed Project and propose mitigation where significant effects are identified. All measures proposed as mitigation for the proposed Project will be reported within the relevant chapter of the EIAR.

The EIAR will also include a final chapter that contains a Schedule of Environmental Commitments which will bring together all of the mitigation measures recommended in the various EIAR chapters for ease of reference.

3.8 Monitoring

In addition to the proposed mitigation measures, monitoring programmes will be developed to assess the actual impacts on the receiving environment and the effectiveness of the proposed mitigation measures. Monitoring also allows for the comparison of pre and post project conditions and will enable any unforeseen impacts to be identified and mitigated where required.

Monitoring measures will be provided by each specialist within each environmental chapter, in addition to the Schedule of Environmental Commitments. A suitably qualified specialist will then be appointed by TII or its agents to oversee and implement monitoring.

3.9 Appropriate Assessment (AA)

European Sites (collectively known as the Natura 2000 network), i.e. Special Protection Areas (SPAs) and Special Areas of Conservation (SACs) are classified under the European Union Directive (2009/147/EC) on the conservation of wild birds (Birds Directive) and Directive (92/43/EEC) on the conservation of natural habitats and of wild fauna and flora (Habitats Directive). The procedures that must be followed when considering developments affecting a Natura 2000 site are specified in Articles 6(3) and 6(4) of Habitats Directive.

The Appropriate Assessment (AA) process will be undertaken concurrently with the EIAR, but both processes will be clearly distinguished. The AA will be documented in a Screening Statement and Natura Impact Statement (NIS) for the proposed Project and these documents will be submitted as part of the Railway Order Application with the EIAR.

3.10 Water Framework Directive (WFD)

A Water Framework Directive (WFD) (2000/60/EC) Compliance Assessment will be prepared as deemed required by the assessment and in consultation with relevant Stakeholders. Impacts on water quality, ecology and hydromorphology will be assessed in accordance with the requirements of the WFD.

3.11 Relevant Policy, Plans and Guidelines

The assessment of environmental impacts has been completed in accordance with, but not limited to, the following legislation and guidance:

- Planning and Development Act 2000 - 2018;
- Planning and Development Regulations 2001 - 2018;
- Transport (Railway Infrastructure) Act 2001, as amended;
- Directive 2014/52/EC amending Directive 2011/92/EU on the Assessment of the Effects of Certain Public and Private Projects on the Environment;
- Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions (European Commission (EC) 1999);
- Guidance on Scoping (EC 2017);
- Guidance on the EIA Report (EC 2017);
- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (EC 2013);
- The Planning Inspectorate, Advice Note Seventeen: Cumulative Effects Assessment Relevant to Nationally Significant Infrastructure Projects (December 2015);
- Guidelines on the information to be contained in Environmental Impact Statements (EPA 2002);
- Advice Notes on Current Practice in the Preparation of Environmental Impact Statement (EIS) (EPA 2003) and draft revised notes (September 2015) (EPA 2015); and
- Draft Guidelines on the information to be contained in Environmental Impact Assessment Reports (EPA 2017).

Key policy documents that informs the examination of all environmental areas include:

- National Planning Framework: Ireland 2040;
- National Development Plan 2018 - 2027;

- Draft Regional Spatial and Economic Strategy for the Eastern and Midland Region;
- Regional Planning Guidelines for the Greater Dublin Area 2010 - 2022;
- Fingal County Development Plan 2017 - 2023;
- South Fingal Transport Study 2019;
- Dublin City Development Plan 2016 - 2022;
- Relevant Local Area Plans;
- Smarter Travel: A Sustainable Transport Future: A New Transport Strategy for Ireland 2009 - 2020
- National Cycle Policy Framework 2009-2020;
- Transport Strategy for the Greater Dublin Area 2016-2035; and
- National Mitigation Plan (2017).

4. EIA Consultation

This chapter provides a description of the consultation process and describes the statutory and non-statutory consultation and engagement process. To assist in developing the EIAR, consultation will serve the following key objectives:

- To establish a sufficiently robust environmental baseline of the proposed Project and its surroundings;
- To identify, early in the process, specific concerns and issues relating to the proposed Project so that they can be discussed and appropriately accounted for in the design and assessment;
- To ensure the appropriate involvement of the public and stakeholders in the assessment and design process; and
- To comply in full with the Aarhus Convention on Access to Information, Public Participation in Decision-Making and Access to Justice in Environmental Matters.

4.1 Consultation to Date

4.1.1 Emerging Preferred Route Consultation (March to May 2018)

Following the launch of the EPR in March 2018, a period of public consultation was completed. This included the launch of a project website (www.metrolink.ie), a Freephone number, an email address and a postal address. There were also a number of public consultation events held, namely:

- Fingal County Council Offices, Swords on Tuesday 27/03/2018;
- Crowne Plaza Hotel, Northwood, Santry on Thursday the 29/03/2018;
- Wood Quay Venue at Dublin City Council Offices on Wednesday 04/04/2018;
- Glasnevin Museum Trust on Thursday 05/04/2018;
- The Helix, Collins Avenue, Dublin 9 on Monday 09/04/2018;
- Hilton Hotel, Charlemont, Dublin 6 on Monday 16/04/2018; and
- Clayton Hotel, Leopardstown, Dublin 18 on Wednesday 18/04/2018.

The attendance across all seven public consultation events totalled approximately 2,600.

The consultation period for the EPR extended from 22 March 2018 to 11 May 2018. In total, 7,929 submissions were received from members of the public and interested parties. These comprised of a mix of emails, phone calls, letters and comment sheets at the public displays. The station location which solicited the most submissions was Griffith Park Station, all of which were associated with impacts to adjacent schools and Na Fianna GAA Club grounds. This was followed by Collins Avenue Station where concerns were raised about impact to Our Lady of Victories Church and the adjacent school.

The issues raised across the proposed Project as a whole included impacts to properties due to vibration and ground movement, disruption as a result of construction traffic, health and safety concerns as a result of dust and noise, visual impact, disruption to Luas Green Line services, community severance due to segregation of the Luas Green Line, and increased noise on the Luas Green Line due to increased frequency and heavier vehicles.

Public consultation is a useful tool in helping to identify local constraints which may be only locally known, and therefore not accounted for during previous parts of the route selection process. This local knowledge gained through the public consultation process has been taken into consideration with regards to revision of the EPR.

4.1.2 Preferred Route Consultation

Following the consultation period on the EPR, changes have been introduced to the proposed Project to address concerns raised during that consultation period.

Further public consultation commenced for the updated route on March 26 2019. This included an update of the project website and a number of public consultation events held, namely:

- Hilton Hotel, Charlemont Place, D02 A893, Monday 8/04/2019;
- The Gresham Dublin Hotel, O'Connell Street, D01 C3W7, Wednesday 10/04/2019;
- Glasnevin Cemetery Museum, Finglas Road, Glasnevin, D11 H2TH, Thursday 11/04/2019;
- Ballymun Civic Centre, Main Street, Ballymun, D09 C8P5, Monday 15/04/2019; and
- Fingal County Council, County Hall, Main Street, Swords, K67 X8Y2, Tuesday 16/04/2019

Submissions are being sought at the time of writing between Tuesday 26th March 2.00pm and Tuesday 21 April 2019 5.30pm.

4.1.3 Key Stakeholder Consultation

As well as consultation on the EPR, consultation is ongoing with a number of key stakeholders which includes, but is not limited to, the following:

- An Bord Pleanála;
- The two Local Authorities within which the proposed Project is located;
- Department of Culture, Heritage and the Gaeltacht and the Department of Housing, Planning and Local Government;
- Vulnerable stakeholder groups including the National Disability Authority and the National Council for the Blind;
- Dublin Airport Authority, Trinity College, the Rotunda Hospital, The Mater Hospital and others to identify sensitive receptors to electromagnetic interference (EMI) and vibration;
- Relevant sections of the Office of Public Works (OPW), the National Gallery, the Houses of the Oireachtas and the Department of the Taoiseach to collect information on potential "sensitive locations" on key sites potentially impacts by the proposed Project; and
- Design team meetings with CIÉ Group, Eirgrid and Irish Water. In addition to the above, consultation letters and questionnaires have been sent to over 400 stakeholders and consultees along the extent of the proposed Project.

4.2 Consultation with Prescribed Bodies and other Consultees

In accordance with statutory requirements a number of statutory consultees and others, listed in Table 4.1, will be issued with this Scoping Report for consultation.

Table 4.1: Prescribed Bodies and other Consultees

Dublin City Council	daa (formerly Dublin Airport Authority)
Dún Laoghaire - Rathdown County Council	Eastern and Midlands Regional Assembly
Fingal County Council	Environmental Protection Agency
South Dublin County Council	Fáilte Ireland
Minister for Agriculture, Food and Marine	Health and Safety Authority
Minister for Business, Enterprise and Innovation	Health Services Executive
Minister for Communications, Climate Action and Environment	Heritage Council
Minister for Culture, Heritage and the Gaeltacht (including the National Parks & Wildlife Service (NPWS))	Inland Fisheries Ireland
Minister for Housing, Planning and Local Government	Irish Aviation Authority
Minister for Justice and Equality	Irish Water
Minister for Transport, Tourism and Sport	National Transport Authority
An Comhairle Ealaion (The Arts Council)	Waterways Ireland
CIÉ Group	An Taisce
Commission for Railway Regulation	Dublin Chamber of Commerce
Commission for Regulation of Utilities	Climate Change Advisory Council
Local Authority Waters and Communities Office (LAWCO);	Office of Public Works (OPW)
Iarnód Éireann	

4.3 EIA Scoping Consultation

The NTA and TII recognise the importance of consultation and engagement with stakeholders. The ongoing consultations and those held to date are outlined in Section 4.1. A further consultation period will commence with

the publication of this EIA Scoping Report. Statutory Consultees, specific stakeholders and organisations will be invited to provide feedback on the content of the report.

To make a submission please use the following contact details:

Email: consultations@metrolink.ie

Postal Address: MetroLink,
Transport Infrastructure Ireland,
Parkgate Business Centre,
Parkgate Street,
Dublin 8, D08 DK10

Freephone: 1800 333 777

Website: www.metrolink.ie

TII are now inviting submissions on the EIA Scoping Report and would like your views having regard to the following:

- Is the scope of the proposed assessment for the EIAR adequate?
- Is there any additional information that should be considered in the development of the proposed Project?
- Are there any additional environmental issues that should be taken into consideration in preparing the EIAR?

All relevant submissions on the proposed Project are welcome.

5. Human Health

5.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts on human health as a result of the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on health and wellbeing as part of the EIA.

5.1.1 Policy, Plan and Guideline Context

The human health assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and:

- Night Noise Guidelines for Europe (World Health Organisation (WHO) 2009);
- Health Impact Assessment Resource and Tool Compilation (US EPA 2016);
- Guidelines for Community Noise (WHO 1999);
- The National Physical Activity Plan for Ireland – Get Ireland Active (Department of Health and the Department of Transport, Tourism and Sport 2016);
- Health in Environmental Impact Assessment - A Primer for a Proportionate Approach (Cave et al. 2017); and
- Health Impact Assessment Guidance (Institute of Public Health Ireland 2009).

5.1.2 Description of the Study Area

From a human health perspective, the primary focus of the assessment will be those who live or work within 500 meters of the proposed Project, as they are considered the most likely to be affected. However, impacts beyond this area will also be reviewed to ensure more distant effects are also captured.

Health in Ireland: Key Trends 2017 is the most recent health statistics report published by the Department of Health. It provides a summary of health and healthcare statistics for the country over the past ten years. A group made up of the Health Services Executive, and, Lenus the Irish Health Research Repository have published health profiles for all the Local Authorities (LAs) in Ireland. The most recent of these profiles published relate to 2015 (Health Service Executive (HSE) 2016a; 2016b; 2016c). These publications have been used to establish a community health profile for the proposed Project.

Nationally, there has been a decrease in mortality rates and a rise in life expectancy over the past decade, with Irish mortality rates lower than the EU by 6.4% (Department of Health 2018). Generally, Ireland has high rates of self-perceived good or very-good health. The population of County Dublin is approximately 1.34 million (Department of Health 2018). The proposed Project will physically traverse areas of Dublin City and Fingal County Council Local Authority areas.

The Fingal County Council area has a population of just over 296,000 according to the 2016 census. According to the 2015 Health Profile it is the second most affluent Local Authority in Ireland, with 85% of the population either above average or affluent. It has the lowest percentage nationally of those who report their health being bad or very bad at 1.1%, or persons with disability at 10.2% (national 1.5% and 13.0% respectively). It has the highest birth rate, and second highest breast-feeding rate in the country. Cancer incidence rates are higher than average for female malignant melanoma, male colorectal cancer and male and female lung cancers (HSE 20016a).

The Dublin City Council area has a population of just over 553,000 according to the 2016 census. According to the 2015 Health Profile Dublin City has a higher than average percentage of persons who report their health as being bad or very bad 2% (national 1.5%) or who have a disability 14.9% (national 13.0%). Cancer incidence rates are higher than average for female malignant melanoma, male colorectal cancer and male and female lung cancers. Mortality rates are above national average for heart disease and stroke in those aged under 65 years (HSE 2016b).

5.2 Baseline Information

5.2.1 Desktop Study

A literature review will be undertaken to develop an in depth understanding of the baseline conditions within the study area. A further literature review of potential health impacts arising from similar projects will be undertaken to identify potential health impacts on the population arising from the proposed Project.

5.2.2 Survey Requirements

In addition to the desktop study the impact assessment will be informed using comprehensive surveys undertaken in the preparation of other EIAR chapters including those for Noise and Vibration, Air Quality, Traffic and Water.

5.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Section 4 of this report.

5.3 Potential Impacts

Potential health effects that may arise during the construction and operational phases of the proposed Project will include but will not be limited to noise, vibration, air quality, water, traffic, vermin, radon, and psychological impacts. Some of the key issues are as follows:

Noise

During the construction phase an assessment will be undertaken to determine the impacts of construction phase noise on sensitive receptors. These sensitive receptors will include schools, hospitals, nursing homes and other facilities where sensitive individuals may be present. Consideration will also be given to residential locations having regard to potential impacts of noise with particular attention paid to potential night-time noise effects on sleep.

For the operational phase the impact assessment will be undertaken to determine the impacts of operational phase noise on sensitive receptors.

Infrasound

Infrasound is sound below the audible frequency range. It is usually associated with transmitted vibration and, while not normally associated with adverse health effects, will be independently assessed to determine the potential effects during both the construction and operational phases.

Vibration

Ground transmitted vibration will be assessed in both the construction and operational phase. In particular, from a human health perspective, consideration will be given to sensitive receptors. These will include hospitals and residences. Consideration will be given to potential impacts on sleep and other health effects.

Water

Potential effects on water, both surface water and groundwater, will be considered in both the construction and operational phases. Potential effects on drinking water will be assessed as well as potential effects on public health arising from changes in surface water quality.

Electromagnetic Force (EMF)

The potential effects of EMF on human health will be assessed having particular regard to the operational phase. Potential effects on human beings will be assessed as well as other effects which would have potential effects on human health such as interference with equipment and machines in sensitive locations such as hospitals.

Additional Potential Health Effects

Additional impacts arising during both the construction and operational phases will include the following:

- Potential air quality effects, both positive and negative, particularly positive effects of reduced car journeys;
- Potential "psychological" effects, both positive and negative;
- Potential effects on health arising from nuisance i.e. vermin;
- Potential effects on health arising due to radon;
- Potential effects on health due to impaired or improved access to public facilities and services;
- Potential effects on vulnerable priority groups;
- Potential effects on health due to severance; and
- Potential effects on health arising from economic development.

5.4 Proposed Methodology and Assessment

The references to the 1985 and 2011 EIA Directives refer to "human health" and include "Human Beings" as the corresponding environmental factor. The 2014 EIA Directive (2014/52/EU) changes this factor to "Population and Human Health". However, no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU.

The 2017 draft EPA guidelines on the information to be contained in EIARs notes that *'while no specific guidance on the meaning of the term Human Health has been issued in the context of Directive 2014/52/EU, the same term was used in the SEA Directive (2001/42/EC)*'. The Commission's SEA Implementation Guidance (section 5.26) states *'The notion of human health should be considered in the context of the other issues mentioned in paragraph (f) and thus environmentally related health issues such as exposure to traffic noise or air pollutants are obvious aspects to study". (Paragraph (f) (of Annex I of the SEA Directive) lists the environmental factors including soils, water, landscape, air etc.)*' (EPA 2017c, p.29).

The 2017 draft EPA guidelines note that the above health assessment approach is consistent with the approach set out in the 2002 EPA Guidelines where health was considered through assessment of the environmental pathways through which it could be affected, such as air, water or soil:

'The evaluation of effects on these pathways is carried out by reference to accepted standards (usually international) of safety in dose, exposure or risk. These standards are in turn based upon medical and scientific investigation of the direct effects on health of the individual substance, effect or risk. This practice of reliance upon limits, doses and thresholds for environmental pathways, such as air, water or soil, provides robust and reliable health protectors [protection criteria] for analysis relating to the environment' (EPA 2017c, p. 29).

These guidelines therefore are supportive of the use of accepted standards such as those issued by authoritative bodies such as the World Health Organisation, European Commission, TII and other bodies. As a result, relevant standards will be used to classify the potential impacts on human health. The standards used will have regard to the assessment criteria used in other chapters in the EIAR and will include:

- Environmental Noise Guidelines for the European Region (WHO 2018);
- Night Noise Guidelines for Europe (WHO 2009);
- Guidelines for Community Noise (WHO 1999);
- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011);
- Air Quality Guidelines (WHO 2005);
- British Standard (BS) 5228-1:2009+A1:2014 – Code of Practice for Noise and Vibration Control on Construction and Open Sites Part 1: Noise (BSI 2008a); and
- Guidance Note for Noise: Licence Applications, Surveys and Assessments in Relation to Scheduled Activities (NG4) (EPA 2016).

The 2017 draft EPA guidelines also note that in an EIA Report, '*the assessment of impacts on population & human health should refer to the assessments of those factors under which human health effects might occur, as addressed elsewhere in the EIAR e.g. under the environmental factors of air, water, soil, etc.*' and that "*assessment of other health & safety issues are carried out under other EU Directives, as relevant. These may include reports prepared under the Integrated Pollution Prevention and Control, Industrial Emissions, Waste Framework, Landfill, Strategic Environmental Assessment, Seveso III, Floods or Nuclear Safety Directives. In keeping with the requirement of the amended Directive, an EIAR should take account of the results of such assessments without duplicating them*' (EPA 2017c, p.29).

The Institute for Environmental Management and Assessment (IEMA) in the UK issued a discussion document in 2017 *Health in Environmental Impact Assessment - A Primer for a Proportionate Approach*. This document provides a discussion on what a proportionate assessment of the impacts on health should be in EIA.

The WHO defined health in its broader sense in its 1948 constitution as '*a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity'*. Therefore, whilst the EPA guidance mentioned above is useful in terms of identifying an approach to health protection, for a more holistic assessment as per the IEMA document, it is also worthwhile to look at broader health effects in terms of opportunities for improvement of health and for improvement of access to services. Therefore, health protection, health improvement and improving services will all be considered in the EIAR.

In relation to health protection the health-based standards referred to above will be the primary assessment tool.

6. Population

6.1 Introduction

This chapter provides an outline of relevant legislation and policy, together with a description of baseline information to be utilised in the EIA. It also considers potential population impacts of the proposed Project during construction and operation and draws conclusions on the requirement for the impact assessment, its methodology, scope, and the implementation of mitigation and monitoring.

Population aspects to be assessed include access to employment, employment effects during the construction phase, economic investment in the region and the impacts on recreation and tourism. As an important access route to Dublin Airport, as well as being a major construction project, the proposed Project is important in terms of employment and investment potential in the region. It will play a key role in how people move throughout the region, both during the construction and operational phases.

The interaction between the various land uses will be assessed, including agricultural, commercial, residential, community and future development lands.

6.1.1 Policy, Plan and Guideline Context

The Population assessment will require a comprehensive review of relevant policy frameworks, statutory and strategic plans including (but not limited to) the documents listed in Section 3.11, and:

- Local economic community plans;
- Fáilte Ireland - Guidelines for the treatment of tourism in an Environmental Impact Statement; and
- The forthcoming Regional Spatial Economic Strategy (RSES) for the Eastern & Midland Regional Assembly (EMRA).

6.1.2 Description of the Study Area

A study area of 500m radius extending from the proposed Project and up to 1km around stations is proposed for assessment of “local effects”, particularly with regard to land use (as shown in Appendix C Figure 6.1). A radius of 500m is frequently used in low level site catchment analysis to simulate the average resident’s walking speed, time and distance threshold that they will undertake to access services deemed to be in their ‘locality’. Extending from 500m to 1km around the station locations will reflect people's higher propensity to travel further to a transport hub than to a local shop. Assuming walking speeds of 3-5 km/h, the catchment will cover landowners living between 12 and 20 minutes walking time from each station location and 6 and 10 minutes walking time elsewhere. The study area itself may be sub-divided so as to allow for lower-level assessment and may be refined as further project details become available.

A wider study area will also be considered as part of the population assessment and will include the regional context of Dublin and specific commuter towns, as well as the communities present within proximity of the development itself.

Included in this Scoping Report is a preliminary assessment of various baseline factors to describe the study area. The information will be used to guide a more comprehensive and low-level assessment in later stages, particularly as the assessment areas are definitively set out.

Population

Census 2016 results show that Ireland's population increased by 173,613 persons over the five years since April 2011, to reach 4,761,865 persons in April 2016. While the population of all provinces grew, only Leinster grew faster than the State overall, increasing by 5.2 per cent in the five years ending April 2016. Leinster accounted for 55.3 per cent of the population in 2016 compared with 54.6 per cent in 2011.

Population change by county varied widely. Fingal grew by 8 per cent over the five years (+22,223 people), more than twice that of the state overall. Dublin City (4.8% or 25,553), Dún Laoghaire - Rathdown (5.7% or +11,013) and South Dublin (5.1% or +13,544) all grew by more than five per cent, as did the commuter belt counties of Laois (5.1%) and Meath (5.9%). The young populations of Fingal and South Dublin along with high birth rates also drove population increases in those areas. Inter-regional and international net inward migration also played a significant role in population movement over the period and future trends noted in the National Planning Framework (DPER 2018) indicate that this is set to continue in the near to mid-term to 2040.

In relation to the local level effects, the proposed Project lies within a number of highly populated Electoral Divisions (ED) across Dublin City and Fingal areas. A preliminary assessment indicates that the resident population of areas within the 500m to 1km catchment of the proposed Project are approximately 225,500 persons in Dublin City and 79,200 persons in Fingal' The desktop study will focus on creating a profile of population at small area (SA) level which will help define population densities per square meter, as well as feed into other demographic related indicators for assessment.

Education

There is a very large number of primary, post-primary and third level educational institutions across Dublin City and County. A large quantum of these are in close proximity to the proposed Project. A preliminary assessment indicates that as many as 48 primary schools and 18 post-primary schools may need to be assessed. A detailed assessment of third level institutions will also be undertaken.

Health

There are 17 hospitals located near to the proposed Project. Preliminary assessments also identify approximately 16 nursing homes and 7 healthcare centres. A detailed facility assessment will be carried out during the desktop study.

Security

A preliminary assessment has identified 10 Garda Síochána stations near to the proposed Project. A detailed facility assessment will be carried out during the desktop study.

Land use & Amenity

There is a broad range of different land uses in proximity to the proposed Project. These mostly comprise of residential and commercial lands, but some have specific transport, service, amenity, employment or sectoral functions A complete land use assessment will be made in addition to an account of local amenities.

Economic Status

There were approximately 614,000 resident workers across the four Dublin Local Authorities in April 2016 (CSO 2016). However, Dublin's catchment area extends far beyond these administrative areas. A detailed assessment of this inflow and outflow will be conducted as part of the desktop assessment on the economic status of people living and working within the region, and specifically the study area, but also at a larger strategic level for the various neighbouring counties in the Greater Dublin Area.

Unemployment

There were approximately 80,000 people unemployed across the four Dublin Local Authorities in April 2016 (CSO 2016). A complete assessment of principal economic status covering unemployed, labour force and participation rates will be undertaken as part of the desktop study. The development of critical infrastructure such as this proposed Project, will have a marked impact on the opportunity potential for employment within Dublin and beyond.

Economic Activity

There is a broad range of different land uses in proximity to the proposed Project. These mostly comprise of residential and commercial lands, but some have specific transport, service, amenity, employment or sectoral functions. A complete land use assessment will be made in addition to an account of local amenities.

6.2 Baseline Information

6.2.1 Desktop Study

The baseline data obtained to date will be supplemented with further desktop study, using the most up to date publicly available data wherever possible. These include, but are not limited to:

- Census - Demographics (including population, age cohorts, gender);
- Census - Residential statistics (including, tenure, owner-occupied/rental, household composition);
- Census - Employment statistics; (including industry of employment, principal economic group);
- Census - Educational statistics (qualifications held);
- POWSCAR 2016 - place of work/school travel data;
- Dublin Economic Monitor (Dublineconomy.ie) and other Dublin region economic indicators;
- International research and data on the socio-economic impact of comparable projects; and
- Projection of population within the area of assessment and at a regional level.

This will also include a full review of local educational and health facilities, as well as local amenities. In addition to the data sources already noted above, further sources will be consulted in order to develop an appreciation for deprivation in each area and access to public transport.

6.2.2 Survey Requirements

Instances may arise where on-site validation of desktop research mentioned above will be of value. These surveys will be assessed on a case-by-case basis.

6.2.3 Consultation

The submissions of business and trade groups, retailers, sectional stakeholders (i.e. tourism organisations and transport operators), and socio-economic groups located along the alignment will be fully reviewed during the preparation of the EIAR.

Consultation may be undertaken with local authorities and stakeholders as part of the EIAR to gain site specific land use details. This will be determined as cases arise.

6.3 Potential Impacts

6.3.1 Potential Construction Phase Impacts

The potential socio-economic effects during the construction phase arising from the proposed Project that will include, but are not limited to:

- Temporary positive indirect economic impacts resulting from increases in local area spend (e.g. as a result of accommodation, subsistence and travel for construction personnel);
- The temporary and permanent loss of residential, commercial and amenity lands (a negative impact);
- The creation of temporary direct and indirect employment opportunities in local areas;
- Temporary disturbance to businesses and non-commercial institutions;
- Temporary adverse impacts on local residential amenity (combined impacts from increased traffic, noise, visual detriment, construction dust);
- Temporary adverse impacts on transport connectivity (e.g. bus routes, cycleways such as the Royal Canal Way, pedestrian walkways and private cars);
- Community severance along the northern above ground section;
- Temporary disturbance to access to Employment for local landowners; and
- Temporary disturbance of access to rights of way and to local green spaces.

As construction will be undertaken in a phased manner, effects will vary over time, with some being relatively short and others relatively longer in duration. Therefore, the magnitude of each effect has the potential to be mitigated differently.

6.3.2 Potential Operational Phase Impacts

The potential socio-economic effects from the proposed Project during the operational phase may include:

- Improved accessibility to a wider offering of key services including medical, educational, commercial and public amenity;
- Improved retail opportunities in and around the proposed station locations;
- Opportunities for the creation of higher density residential supply in and around the proposed station locations;
- Positive impacts on employment opportunities (locally to the proposed Project and also as a consequence of the improved accessibility offered by it);
- Positive impacts from potential development (or redevelopment) of community facilities, shopping and amenity areas in and around station locations / previously used construction yards;

- Potential negative impacts due to the increase in associated demands on surrounding community educational and health facilities as well as local jobs;

- Negative impacts on residential amenity from combined transport and visual impacts and community severance.

Given the scale and nature of the proposed Project, there is considered to be potential for significant socio-economic effects in the longer-term and therefore a complete socio-economic assessment is proposed as part of the overall EIA.

6.4 Proposed Methodology and Assessment

The socio-economic assessment will be carried out in accordance with the EPA guidance as listed in Section 3.11. The baseline will examine the existing demographic characteristics of the areas around the proposed stations along the proposed Project including the density of employment and people, skill levels, economic activity, levels of deprivation, sectoral breakdown of the economy and the labour catchment area as shown by travel to work patterns. It will conclude potential effects which are directly attributable or attributable in part to the proposed Project.

The baseline will also consider the existing and projected transport and land use characteristics such as accessibility of the catchment area, the existing nature of the area in terms of land use and density, the health of the local economy and property market. Planning policies will also be taken into account, through reviews of policies and discussions with local planning authorities, as well as competing sites in the area and the underlying demand for development.

The impact assessment will address a number of effects likely to arise from the proposed Project, namely:

- **Enhanced accessibility to employment, education, health and commercial facilities**

  Commuting times for communities considered within reach of the proposed Project will be assessed quantitatively and qualitatively for the following areas: employment, education, health and commercial accessibility. A composite index of multiple variables will be developed to assess the existing spatial situation and the post development situation. Negative impacts relating to community severance and accessibility to key services, particularly in relation to the northern section, will also be assessed.

- **Construction effects on employment**

  Effects on employment in the local region will be assessed along with the degree of leakage, displacement, substitution and employment multipliers to determine the additional jobs likely to result from construction of the proposed Project.

- **Economic investment in the region from construction expenditure**

  The assessment of the economic investment in the region will be based on economic spend multipliers and a capacity assessment of the local region to supply the requirements of the proposed Project. Available information on local employment levels, labour mix, and educational qualification will be taken into account. Gross Value Added from the required industries will be used to determine the overall economic benefit of increased regional spend in these industries due to the development of the proposed Project.

- **Strategic level benefits**

  The consideration of regional competitiveness, international profile, rankings and reputation.

- **Access to tourism and recreation**

  The assessment of the effect on tourism and recreation will identify key attractions and attempt to derive usage figures where information is available. How the proposed Project may affect access to these facilities will be considered.

Impacts will be determined in accordance with the guidance set out by the EPA in EPA Guidelines on the Information to be Contained in Environmental Impact Statements Draft (EPA, 2017) and EPA Advice Notes on Current Practice in the Preparation of Environmental Impact Statements (EPA, 2003a, and draft revised advice notes 2015).

An overall magnitude will be assigned for each identified impact. The magnitude of an impact represents its severity or scale and is influenced by various considerations such as spatial extent, duration, likelihood of occurrence.

The significance of effects will be determined by assessing the sensitivity of each particular receptor and consideration of the associated magnitude of impact.

7. Electromagnetic Compatibility & Stray Current

7.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts arising from Electromagnetic Fields (EMF) and Electromagnetic Interference (EMI) as a result of the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project to inform the EIAR.

Electromagnetic Fields (EMF) comprise an electric field and a magnetic field and are emitted from both natural and manmade sources in the environment. All sources of EMF below 300GHz in the electromagnetic spectrum are considered Non-Ionising Radiation, which means the EMF does not carry enough energy to remove an electron from its atomic structure.

Sources of EMF in the existing environment includes items such as electrical equipment, power lines, telephone lines, signals from existing telecommunications masts (mobile phone and radio), underground communication cables, electrified rolling stock, broadcast transmitters etc. The emissions from these sources combine to make up the current baseline environment.

The proposed Project will include for an electrified DC rail system. The construction and operation of the new system poses the potential for EMI on receptors. The following potentially sensitive receptors will be considered:

- Local landowners and the community;
- Domestic and industrial electrical equipment;
- Telecommunications infrastructure (including wireless radio services);
- Sensitive medical and research equipment;
- Utilities;
- Mainline rail, suburban rail and light rail systems; and
- Sensitive receptors including conservation labs in the National Gallery, the National Concert Hall, Leinster House and Government Buildings Complex.

7.1.1 Policy, Plan and Guideline Context

The electromagnetic and stray current assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11. In addition, the proposed Project will be required to comply with the requirements of Directive 2014/30/EU on the harmonisation of the laws of the Member States relating to electromagnetic compatibility (EMC Directive), and European Standards EN 50121 (Parts 1-5), which address railway Electromagnetic Compatibility (EMC) (European Committee for Electrotechnical Standardisation (CENELEC) 2006).

In addition, all electrical and electronic products placed on the market or taken into service in the European Union must comply with all applicable Directives which include the above mentioned EMC Directive, Directive 2014/35/EU on the harmonisation of the laws of the Member States relating to the making available on the market of electrical equipment designed for use within certain voltage limits (Low Voltage Directive) and Directive 2014/53/EU on the on the harmonisation of the laws of the Member States relating to the making available on the

market of radio equipment (Radio Equipment Directive). These Directives have been transposed into Irish law under the following statutory instruments:

- European Communities (Electromagnetic Compatibility) Regulations 2016 (S.I. No. 145 of 2016)
- European Union (Radio Equipment) Regulations 2017 (Radio Equipment) Regulations 2017 (S.I. No 248 of 2017)
- European Union (Low Voltage Electrical Equipment) Regulations 2016 (S.I. No. 345 of 2016)

It is proposed to assess the proposed Project's required compliance in accordance with the above Directives and standards in addition to guidelines on limiting exposures to electromagnetic fields as published by the International Commission on Non-Ionising Radiation Protection (ICNIRP) and the EU EMF Recommendation (1999/519/EC).

The EMC Directive and the Radio Equipment Directive do not cover emissions from DC and near DC fields which are also an interference risk to particularly sensitive equipment such as Scanning Electron Microscopes (SEMs) and Magnetic Resonance Imaging (MRI) equipment. Nonetheless an assessment of this type of EMI will be included in the scope of the investigation.

Potential impacts from stray currents arising from the operation of the system will also be covered as per European Standard EN 50122-2 (CENELEC 2010).

The EMI assessment will also require a comprehensive policy, plan and strategy review, against the documents listed in Section 3.11 of this report.

7.1.2 Description of the Study Area

The EMI field strength dissipates over distance. The precise distance at which EMI could be considered an influence will very much depend on the sensitivity of individual receptors. The protection distance provided in the European Directive on Electromagnetic Compatibility (2014/30/EU) is 10m and therefore all systems located 10m or greater from the rail system should not encounter radio frequency interference. However, due to the potential for extremely sensitive equipment used in medical, research or manufacturing facilities the study area is extended to 100m. Table 7.1 below lists the study area either side of the alignment:

Table 7.1: Study Area

Criteria	Width of Study Area (on both sides of the alignment)
Potential impacts from Direct Current (DC) fields	100m*
Potential impacts from Alternating Current (AC) fields	10m
Potential impacts from Radiofrequency (RF) and microwave fields	100m
Potential impacts from stray currents	100m

* Consultation will be conducted with certain stakeholders identified outside this corridor due to the known presence of particularly sensitive equipment at these premises.

7.2 Baseline Information

7.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use in the current assessment. This pre-existing information will be

supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

In order to facilitate a detailed investigation of EMI, sensitive locations along the proposed Project will be selected and predicted levels for these areas estimated based on modelling and the maximum allowable limits imposed on the proposed Project by industry standards (such as EN 50121). The locations will be selected based on a review of GeoDirectory information (an address database), a site survey and previous knowledge from working in the area.

Particularly sensitive sites such as hospitals and research facilities will be provided with a questionnaire to list any equipment that they perceive to be most at risk from EMI (such as SEMs, MRIs etc.) and will be requested to include the physical location within each campus of these pieces of equipment.

To ensure other potentially sensitive sites / equipment are not overlooked, other locations within 100m of the proposed alignment will also be provided questionnaires to identify potentially sensitive equipment.

Predicted levels of emissions will be estimated based on preliminary design stage details for the new system with respect to the electrification scheme, signalling and communications systems to be used. This includes the voltage and currents loads that will drive the rolling stock as well as the physical supply provided by the ESB and the associated substations.

7.2.2 Survey Requirements

Current knowledge of potentially sensitive receptors along the proposed Project coupled with feedback from consultation with stakeholders and the results of the desktop study will be used to identify those locations where baseline surveys of the electromagnetic spectrum will be carried out. Locations of the main traction substations will also be chosen as survey sites with respect to covering the guidelines for exposure to EMF. Depending on the layout of a particular survey, site stakeholder engagement may be necessary on the day of each survey in relation to site access. The survey results will also be used to identify any electromagnetic signals present in the environment that may not be accounted for already and which signify other equipment the needs to be considered from an EMI perspective.

Predicted levels of emissions will be estimated based on design stage details for the new system with respect to the electrification scheme, signalling and communications systems to be used. This includes the voltage and currents loads that will drive the rolling stock as well as the physical supply provided by the ESB and the associated substations.

7.2.3 Consultation

Consultation will be undertaken with some of the larger stakeholders such as hospitals, universities, utility providers and ComReg to establish what particularly sensitive equipment they have, and where it is located on their campuses, to determine proximity to the proposed alignment. Based on these consultations, additional baseline surveys or modelling may also be required.

7.3 Potential Impacts

7.3.1 Potential Construction Phase Impacts

No impacts on the public from an EMI, EMF or stray current perspective are envisaged during the construction phase of the proposed Project.

The power supply requirements for the TBM may be between 1.5MW and 8MW of power. Onsite power convertors and cable runs will be utilised to operate the TBM therefore EMF exposure levels for construction personnel may have to be considered. If necessary, mitigation measures will be implemented.

7.3.2 Potential Operational Phase Impacts

Electromagnetic emissions may be generated by either the power supply system such as electrical sub stations, the current supply system along the proposed Project, or the propulsion system onboard the rolling stock. The proposed Project itself could be susceptible to external electromagnetic fields that are generated by sources such as electricity cables and local radiofrequency (RF) transmitters.

Stray currents may occur on several potential receptors including buried tanks, water pipes and utilities running parallel to the system. The entry/exit points of these potential receptors for the stray current may experience corrosion over time without adequate mitigation measures.

Rail systems can generate transient emissions that are not controlled by EMC regulations. Such emissions can pose a threat to the operation of neighbouring electrical and electronic equipment.

Large electrical installations can also cause voltage fluctuations on the public supply that can cause the phenomenon of flicker. Flicker is evident when lighting dims and can cause a nuisance to local landowners and other sensitive receptors. This will be mitigated by the power profile of the current draw from the proposed system. The current will be gradual rather than a step change.

7.4 Proposed Methodology and Assessment

The Electromagnetic Interference and Radiation Assessment will be carried out in accordance with the EPA guidance as listed in Section 3.11, as well as all relevant existing or emerging national and European legislation.

In line with the guidance, the assessment will describe the baseline conditions, determine the likely potential effects associated with the construction and operation of the proposed Project, determine appropriate mitigation and monitoring and define residual effects. The impact assessment process will involve:

- Assigning the receptor sensitivity;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

All details of the proposed Project will be assessed including the proposed electrification scheme, overhead lines, signalling, public interfaces, ESB and telecoms operators.

Compliance with relevant standards and guidelines shall be achieved through design studies, mitigation measures and verification testing/modelling.

Where potential impacts are identified the EIAR will identify mitigation measures to reduce these impacts as low as reasonably practicable during construction and operation. Where required monitoring requirements will be laid out to monitor the effectiveness of the proposed design and mitigation measures in terms of ensuring that EMI remains as low as reasonably practicable.

The significance of the impact for each identified receptor, or group of receptors, will be evaluated according to limits defined in consideration of the European Directives (refer to Section 7.1.1) for the receptor equipment and the known susceptibility of sensitive apparatus. Significance evaluation criteria will be laid out based on these limits.

8. Airborne Noise and Vibration

8.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of above ground noise and vibration effects associated with the proposed Project. This chapter includes the proposed methodology and a scope of work required to undertake a detailed assessment of the impact of the proposed Project on noise and vibration as part of the EIA.

It should be noted that Chapter 9 (Groundborne Noise & Vibration) will outline the approach to the assessment of groundborne noise and vibration in the EIA.

The assessment of the above ground noise and vibration aspects of the proposed Project shall include consideration of all significant noise & vibration sources including the following:

- Background noise and vibration;
- Above ground sections of rail line;
- Conventional station construction;
- Traffic;
- Noise from tunnel and station ventilation systems; and
- Break-out noise from station public address systems.

8.1.1 Policy, Plan and Guideline Context

The airborne noise and vibration assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11. There are no statutory standards in Ireland relating to noise and vibration limit values for railway sources or construction works. In the absence of specific statutory Irish guidelines, the assessment will make reference to other national guidelines and standards, where available, in addition to international standards relating to noise and or vibration impact for environmental sources. The following standards and guidelines will form the main basis for the impact assessment methodologies to be adopted and for setting appropriate criteria:

- BS 5228-1:2009+A1:2014 – Code of Practice for noise and vibration control of construction and open sites - Part 1: Noise;
- BS 5228-2:2009+A1:2014 – Code of Practice for noise and vibration control of construction and open sites - Part 2: Vibration;
- BS 6472-1:2008 – Guide to Evaluation of human exposure to vibration in buildings, Part 1 Vibration sources other than blasting;
- BS 6472-2:2008 – Guide to evaluation of human exposure in buildings - Part 2: Blast-induced vibration;
- BS 7385-2:1993 – Evaluation and measurement for vibration in buildings Part 2: Guide to damage levels from ground borne vibration;
- BS8233:2014 – Guidance on Sound Insulation and Noise Reduction for Buildings – Code of Practice;
- BS4142:2014 – Method for Rating and Assessing Industrial and Commercial Sound;
- Design Manual for Roads and Bridges (DMRB). Volume 11 Environmental assessment Section 3 environmental assessment techniques. Part 7 213/11 – revision 1 – Noise and Vibration (UK Department of Transport 1993);

- Dublin Agglomeration Environmental Noise Action Plan (2013 – 2018) (DLRCC 2013) and draft NAP 2018-2023 (due in Q4, 2019);
- Draft Noise Action Plan for Fingal County 2019-2023 (FCC 2018b);
- Draft Noise Action Plan for Dublin Airport 2019-2023 (FCC 2018c);
- European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001 (S.I. No. 632 of 2001);
- Good Practice Guide on Noise Exposure and Potential Health Effects – EEA Technical Report (EEA 2010);
- Environmental Management Guidelines - Environmental Management in the Extractive Industry (Non-Scheduled Minerals) (EPA 2006);
- ISO 9613:1996 – Acoustics – Attenuation of sound during propagation outdoors, Part 2: General method of calculation;
- ISO 1996-1:2016 - Description, Measurement and Assessment of Environmental Noise. Part 1 2016: Basic Quantities and Assessment Procedures;
- ISO 1996-2:2017 - Description, Measurement and Assessment of Environmental Noise. Part 2 2017: Determination of Sound Pressure Levels;
- Reken- and Meetvoorschriften Railverkeerslawaai '2006' (RMR-2006);
- Guidelines for the Treatment of Noise and Vibration in National Road Schemes, Revision 1, 25 October 2004 (NRA 2004);
- Good Practice Guide for the Treatment of Noise during the Planning of National Road Schemes (NRA 2014);
- Calculation of Railway Noise (CRN) (UK Department of Transport 1995);
- Calculation of Road Traffic Noise (CRTN) (UK Department of Transport 1988);
- Guidelines on Community Noise (WHO 1999);
- Night Noise Guidelines for Europe (WHO 2009); and
- Environmental Noise Guidelines for the European Region (WHO 2018).

In addition to the above, reviews of relevant railway projects in Ireland and the UK will be undertaken to review the most up to date assessment procedures, assessment methodologies and calculations standards. The assessment will also require a comprehensive policy, plan and strategy review against the documents listed in Section 3.11 of this report.

8.1.2 Description of the Study Area

From an airborne noise and vibration point of view, the key study areas during the construction phase include all the surrounding sensitive environments to surface construction work areas. This includes works areas around park and ride sites, tunnel launch and receiving sites, station boxes, intervention and ventilation shafts, construction compounds, above ground rail lines, stations and platforms, construction of ancillary structures (bridges, maintenance depots etc.) and waste management sites. Construction traffic haul routes will also be assessed as part of the study area for this phase of the works.

For the construction phase, this study area covers a considerable geographical area in close proximity to high density sensitive residential, educational, amenity, religious and commercial receptors.

The study areas for the operational phase impact assessment is reduced compared to the construction phase impact assessment due to the extensive portion of the proposed Project being underground. The key study areas include the following:

- The proposed Park and Ride site at Estuary;
- Above ground rail section between Lissenhall and Naul Road to North of Dublin Airport;
- Above ground rail section between the portal south of Dublin Airport at Dardistown and Northwood West Station;
- Proposed Dardistown Depot;
- Operational noise sources from tunnel and station ventilation systems along length of the proposed Project;
- Operational noise sources from above ground sub stations;
- Operational phase maintenance operations;
- Break-out noise from above ground station public address systems; and
- Sensitive receptors including conservation laboratories in the National Gallery, National Concert Hall, Leinster House and Government Buildings Complex, National Museums and St Stephen's Green.

For the operational phase, the main study area relating to the operation of the above ground section of rail line is located predominately within suburban residential and amenity areas between Lissenhall and Naul Road and between Dardistown and Northwood West. Other study areas in the vicinity of fixed sources (ventilation systems, maintenance areas, etc.) will be dispersed along the length of proposed Project passing through high density urban locations which include a mixture of residential, commercial and retail land uses. Depending on the sources in question and the local area under consideration, the assessment is likely to extend between 50m and 300m from operational sources.

The existing noise environment along the proposed Project alignment will vary depending on the proximity of sensitive receptors to existing sources of noise. Between Lissenhall and Fosterstown, the existing noise environment is dominated by road traffic along the R132 and the key noise sensitive locations adjacent to the proposed Project are predominately residential located in close proximity to this road.

Between Fosterstown and Dardistown, aircraft movements to and from Dublin Airport are a significant contributor to existing noise levels in addition to road traffic along the surrounding road network. Between Dardistown and Northwood, road traffic along the M50 Motorway is a significant contributor to the existing noise environment in addition to aircraft movements from Dublin Airport. This section of the alignment has a lower distribution of noise sensitive areas.

Between Ballymun and Glasnevin, the surrounding environment to the proposed Project is predominately suburban residential with a mixture of educational and amenity areas located in the vicinity also. The existing noise environment is dominated by local road traffic along the R108 and smaller local adjacent roads in addition to existing location activities.

Between Glasnevin and the Mater Hospital, the existing Maynooth rail line in addition to road traffic are the key noise sources in this area. This area remains predominately residential with a larger mixture of commercial and leisure facilities in addition to the large hospital campus of the Mater hospital. Existing baseline vibration is limited to areas in close proximity to the rail line.

Between the Mater Hospital and Charlemont, the proposed Project traverse's high-density urban areas i.e. Dublin City Centre which include residential, commercial, hotels, offices, retail and amenity areas. The existing environment includes existing above ground Luas and DART rail systems, road traffic, commercial and retail operational sources. This section of the proposed Project is expected to experience the highest existing noise

levels along the alignment due to the proximity of a range of existing sources in close proximity to sensitive receptors. Existing baseline vibration is limited to areas in close proximity to the operational intercity, DART and Luas lines.

8.2 Baseline Information

8.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

The key sources of desktop available baseline data include published noise mapping studies undertaken by Córas Iompar Éireann (CIÉ), Transport Infrastructure Ireland (TII), Dublin Airport Authority and Local Authorities which feed into the Dublin Local Authorities Agglomeration Noise Action Plan 2013 – 2018 (DLRCC 2013) and draft Dublin Agglomeration Environmental Noise Action Plan 2018 – 2023 (SDCC 2018). The available noise mapping includes existing sources of major rail, road and aircraft noise sources within the Dublin Agglomeration area. This information provides a useful high-level overview of noise levels in the wider study area but does not provide accurate noise levels for specific locations, taking account of localised features (e.g. boundary walls). The parameters presented in terms of the noise mapping are the L_{den} and L_{night} noise parameters which are both long term noise indicators based on annual traffic and transport modes.

8.2.2 Survey Requirements

A detailed baseline study is being undertaken to characterise the baseline noise environment at sensitive locations along the length of the proposed Project in proximity to above ground construction works and above ground operational sources as noted in Section 8.1.2. Baseline vibration studies will be limited to areas in proximity to existing vibration sources, namely those in proximity to intercity, DART and Luas lines. Vibration monitoring is not undertaken in areas where there are no vibration sources in line with standard practice.

An extensive baseline noise study programme is being undertaken at locations which will be potentially affected by both the construction and operational phases of the proposed Project. The surveys will be undertaken through the use of monitoring installations to capture noise levels at identified sensitive areas. This will be undertaken using both attended and unattended noise monitoring programmes as follows.

- Unattended measurements will be conducted at the identified sensitive locations to determine existing noise levels at these locations over a period of approximately three to seven days.
- Attended measurements will be conducted at the specified locations for short-term periods in order to obtain a snap shot of the existing environment during day and night-time periods.

All surveys will be conducted in accordance with ISO 1996: Description, Measurement and Assessment of Environmental Noise Part 1: Basic quantities and assessment procedures (ISO 2016) and Part 2: Determination of Sound Pressure Levels (ISO 2017).

A series of vibration monitoring surveys will be conducted in the vicinity of residential, commercial and amenity areas along the proposed Project in order to assess current levels of vibration associated with the operation of the Luas Green Line, and at properties in close proximity to the existing Maynooth line and DART line where the proposed Project alignment passes in close proximity to affected properties.

Similar to the baseline noise survey detailed above, two sets of vibration monitoring surveys will be undertaken using attended and unattended monitoring periods.

8.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

8.3 Potential Impacts

8.3.1 Potential Construction Phase Impacts

Noise and vibration impacts relating to above ground activities during the construction phase will be assessed as part of the EIAR. Noise and vibration may arise at the following locations:

- Underground station & ventilation shaft construction;
- Tunnel portal locations;
- Site works areas and compounds;
- Waste Management Sites;
- Areas of cut and cover;
- Above ground rail and station construction; and
- Construction transport.

8.3.2 Potential Operational Phase Impacts

Potential noise and vibration impacts relating to above ground activities during the operational phase will be assessed within the airborne noise chapter of the EIAR. This will consider the following noise sources:

- The operation of above ground sections of new rail line;
- Rail maintenance activities (e.g. grinding, cleaning, tamping etc);
- Ventilation shafts;
- Sub-stations;
- Maintenance / operational depots;
- Station access / PA break out;
- Park and Ride areas; and
- Traffic noise.

8.4 Proposed Methodology and Assessment

It is proposed that the assessment of noise and vibration will be carried out in accordance with the EPA guidance as listed in Section 3.11, as well as all relevant existing or emerging national and European legislation.

In line with the above guidance, the assessment will describe the baseline conditions, determine the likely potential effects associated with the construction and operation of the proposed Project, determine appropriate mitigation and monitoring and define residual effects. The impact assessment process will involve:

- Assigning the receptor sensitivity;
- Identifying and characterising the magnitude and significance of any potential impacts;

- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

8.4.1 Noise Modelling

Predicted noise levels during the construction phase will be calculated in accordance with the guidelines and standards outlined in Section 8.1.1. Proprietary noise modelling software will be used for the purposes of construction noise calculations which enables detailed analysis of source and receiver interfaces and the various factors affecting the propagation of sound.

Construction noise models will be developed for the construction phase work areas in order to assess noise levels at boundary locations and nearest noise sensitive locations. The models will be based on information provided by the design team in terms of construction methodologies, activities, location, duration, etc. The development of the construction noise models will allow identification of the likely significant effects.

Construction traffic noise impacts along the proposed haul routes and in proximity to the site works areas and compounds will also be assessed as part of the airborne noise impact assessment.

Operational rail noise models will be developed using proprietary noise modelling software for the new above ground rail line. Operational noise levels will be calculated for the nearest sensitive receptors taking account of the operational frequency, speed, track type, rolling stock, screening, etc. to be provided by the design team. Vibration will also be considered from this source.

Source noise levels for other activities and sources will be derived making reference to published data and data sets from other projects. The likely level of noise emissions from the proposed Project will be predicted in accordance with standard guidance.

8.4.2 Impact Assessment

The noise and vibration assessment carried out on the proposed Project will include the following elements:

- Review of relevant standards and legislation and setting appropriate criteria for noise and vibration;
- Identification of key sources of above ground noise and vibration issues relevant to the components of the proposed Project;
- Review of baseline noise and vibration (where relevant) in the vicinity of the proposed Project obtained from detailed baseline study work;
- Assessment of potential impacts associated with the construction phase using the guidelines and standards outlined in Section 8.1.1;
- Assessment of potential impacts associated with the operational phase associated with operational rail, fixed plant items and traffic, using the guidelines and standards outlined in Section 8.1.1;
- Identification of required mitigation measures required to reduce identified significant impacts to within the adopted criteria; and
- Assessment of residual impacts following implementation of mitigation.

The assessment will take account of sensitive receptors relevant to the proposed Project. Sensitive receptors include locations where people spend significant periods of time and where concentration, sleep and amenity are important considerations. Examples of these sensitive receptors include:

- Residential dwellings;
- Recreational and amenity areas;

- Schools and other educational establishments;
- Museums, Galleries and Theatres;
- Government Buildings;
- Buildings of religious sensitivity;
- Hospitals and nursing homes; and
- Offices.

9. Groundborne Noise and Vibration

9.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of groundborne noise and vibration effects associated with the proposed Project. Groundborne noise and vibration are essentially the same physical phenomenon which has effects in different ways. The phenomenon is the oscillatory movement of soil or structures which is generated by construction or operational activity and propagated from the source to potential receptors through solid (or liquid) media. The term vibration is mainly used when there is a direct effect on a receptor, either a human being perceiving it through the sense of touch or motion on a sensitive item such as a laboratory instrument or a fragile artefact or structure.

Vibration can cause structures to radiate airborne sound, in the manner of a loudspeaker, so that it can be perceived by human beings through the sense of hearing as an audible noise, although unlike general environmental noise it reaches the receptor mainly by transmission through the ground and/or a structure and is radiated as sound at the end of the transmission path in the room where the receptor is located. In exceptional cases groundborne noise can be heard in the open above a vibrating ground surface, but nearly always it is the effect within a building that is potentially significant. Vibration as defined above is of interest generally in the low frequency range up to 80Hz, and groundborne noise is of interest in a higher frequency range of about 20Hz-500Hz.

9.1.1 Policy, Plan and Guideline Context

The groundborne noise and vibration assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11. There are no statutory standards in Ireland relating to noise and vibration limit values for railway sources or construction works. In the absence of specific statutory Irish guidelines, the assessment will make reference to other national guidelines and standards, where available, in addition to international standards relating to noise and or vibration impact for environmental sources. The Environmental Protection Agency (EPA) has published a Guidance Note for Noise in Relation to Scheduled Activities 2nd Edition (EPA 2016). This includes guidance on vibration from blasting.

9.1.2 Description of the Study Area

Construction Phase

The highest potential impact from construction would be blasting if required. The vibration impact of blasting is dependent on the method used, and in particular the maximum instantaneous charge weight. Perceptible impacts may occur up to a distance of 250m. Excavation by means other than blasting is also a source of vibration including road headers, but the range is less.

The use of a TBM in the lithology of Dublin is also a potential source of vibration and groundborne noise impacts which may extend to a plan distance of 100m either side of the tunnel alignment.

A temporary construction phase railway may be installed behind the TBM for the transport of materials from the TBM excavation. In this scenario, it will be necessary to mitigate potential groundborne noise and vibration by the use of modern locomotives and wagons with suspensions, together with the installation of vibration isolating supports for the temporary track.

A significant source of vibration and groundborne noise is the breaking out of temporary concrete used in the construction of underground tunnels and chambers using sprayed concrete lining. While perceptible vibration may occur, the largest impact is groundborne noise if percussive breaking out of temporary concrete, which can be significant up to 100m from the source.

Beside these sources, vibration impacts are generated on construction sites by percussive piling, and to a lesser extent vibratory pile insertion, by compaction using vibratory rollers or other compacting devices and by demolition work. The range of potential impacts is approximately 50m from the source.

Operational Phase

During the operational phase, vibration is unlikely to have impacts on human beings beyond a distance of 25m from the MetroLink line, whether above ground or in tunnel. However, the operation of the proposed Project could affect highly sensitive equipment up to a distance of 100m. Groundborne noise is unlikely to have an impact beyond 50m from MetroLink line above ground or in tunnel. Recording studios and other performance spaces may require consideration in the vibration and groundborne noise assessment for a distance of up to 100m from the proposed Project.

9.2 Baseline Information

Vibration in the environment is normally unmeasurable, except in the vicinity of operating rail lines (including tramways) or industrial sources. While vibration may exist near to construction sites, this is of transient nature and not normally considered as relevant in the context of an environmental assessment. Vibration can be caused by road vehicles, this also normally only measurable either at very close distances to a highway or in cases where there is a defect in the paving or the formation which would not be considered a permanent feature of the environment.

Vibration assessment criteria are normally based on absolute values and the baseline would only be taken into account where there is likely to be vibration from more than one source in combination.

9.2.1 Desktop Study

Given the limited existence and extent of vibration in the baseline environment, vibration and groundborne noise can be disregarded in all areas more than 50m from an existing line on the intercity, DART or Luas networks. Within that distance it is relevant to consider locations where there is an existing impact due to vibration or groundborne noise from the operation of a rail system. For example, there are theatres where there is a groundborne noise effect from the operation of Luas rolling stock, and this will need to be taken into account in assessing the potential effect of the proposed Project.

Of particular importance is the case of highly sensitive equipment, for example in hospital laboratories or treatment facilities such as linear accelerators. Apart from the potential for cumulative effects, the existence of vibration in the baseline may mean that mitigation has already been incorporated in the installations so that there is significant attenuation of vibration reaching the equipment thus reducing the potential effect of added vibration sources in the future.

Extensive investigation and assessment was undertaken to inform the EIS for the “Old” Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end of the proposed Project, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

9.2.2 Survey Requirements

Baseline surveys may be necessary in the case of sensitive receptors, not only to establish their baseline environment, but also to study the existence of existing mitigation measures in their installations.

In facilities requiring very low background noise levels such as recording or broadcast studios, performance spaces and research and testing facilities, background noise measurements will be required to assist in the setting of acceptability criteria and to aid the consultation process.

9.2.3 Consultation

Consultation plays a key role in the management of groundborne noise and vibration effects, both with regard to community response and appropriate mitigation of effects on sensitive receptors. Groundborne noise and vibration effects during the operational phase of the proposed Project will be capable of mitigation to remove all significant effects. By contrast, the construction phase will cause some temporary and short-term effects, the most important of which is the effect of the passage of the TBM. The effect of the temporary and short-term vibration and groundborne noise from tunnel boring can be reduced and managed by high quality consultation and information dissemination. Additional consultation will be undertaken at locations identified as sensitive to groundborne noise and vibration.

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

9.3 Potential Impacts

9.3.1 Potential Construction Phase Impacts

There is a potential for vibration impacts at residential receptors around construction works areas, and along the alignment of the rail line. Additionally, there is potential for impacts at non-residential sensitive receptors.

Specific cases of potentially sensitive receptors are Trinity College, where the tunnel alignment passes under a number of sensitive facilities, the National Gallery, historic Leinster House and Government Buildings Complex, National Museums, St Stephen's Green, Iarnód Éireann operational rail lines, theatres such as the Abbey and Peacock Theatres, the National Concert Hall and hospitals such as the Rotunda and Mater, and Dublin Airport.

It is proposed that the station boxes will be constructed top down and as a result there are potentially significant construction noise effects where there are sensitive buildings close to the station sites, which can impose severe constraints on construction methods and programme.

The interchange at Charlemont with the Luas Green Line is located in a residential area adjacent to the rear facades of dwellings with potential significant construction phase noise issues.

9.3.2 Potential Operational Phase Impacts

Vibration and groundborne noise effects from operation in underground sections are generally capable of full mitigation by track support design, although where sensitive equipment is affected conventional measures may not provide a reduction in vibration in the specific frequency ranges where the equipment is most sensitive, and case-by-case specific design measures may be needed.

9.4 Proposed Methodology and Assessment

A survey of the existing environment in the area of the proposed Project will be carried out to identify sensitive human populations, sensitive features of archaeological, architectural or cultural importance, and facilities that have vibration-sensitive equipment. Baseline vibration monitoring will be carried out to assess existing vibration levels in areas that have existing sources of vibration. Vibration criteria will be developed for different receptors i.e. human beings, structure types, equipment, etc. These criteria will be based on conservative international standards for annoyance and disturbance and will take into account the operational characteristics of the proposed Project. Levels of operational vibration to be produced by the proposed Project will be predicted using a computer

model called FINDWAVE®. FINDWAVE is a finite difference time-domain numerical model for computing the propagation of waves in elastic media and was used for the assessment of the “Old” Metro North scheme as well as many international projects. The groundborne noise and vibration assessment at the representative sensitive receptors will be used to outline the linear extent of recommended vibration attenuating trackforms.

The EIAR will identify mitigation measures to reduce vibration as low as reasonably practicable during construction and operation.

Criteria for assessing vibration will be based on the following guidance:

- Environmental Protection Agency Guidance;
- BS 6472:2008 Evaluation of Human Exposure to Vibration in Buildings; and
- BS 7385:1993 Evaluation and Measurement for Vibration in Buildings.

There are no standards for the assessment of groundborne noise, and specific criteria will be developed having regard to the sensitive receptors along the proposed Project, and international best practice.

The EIAR will identify monitoring requirements to monitor the effectiveness of the proposed design and mitigation measures in terms of ensuring that vibration and groundborne noise to levels as low as reasonably practicable.

10. Air Quality

10.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of air quality impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on air quality as part of the development of the EIAR.

10.1.1 Policy, Plan and Guideline Context

The air quality assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and:

- Directive (2008/50/EC) on ambient air quality and cleaner air for Europe (CAFE Directive);
- Directive (96/62/EC) on ambient air quality assessment and management and the other associated 'daughter Directives', which set the Limit Values;
- Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), which incorporates European Commission Directive 2008/50/EC which has set limit values for the pollutants SO_2, NO_2, PM_{10}, benzene and CO;
- Air Pollution Act 1987 (No. 6 of 1987);
- 2030 Climate and Energy Policy Framework (European Commission (EC) 2014);
- Guidance on the Assessment of Dust from Demolition and Construction (Institute of Air Quality Management (IAQM) 2014);
- Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA 2011); and
- Local Authority air quality and planning guidance.

10.1.2 Description of the Study Area

The most significant air quality impacts will occur within 200m of the proposed Project and the haul routes for construction vehicles. The UK DMRB guidance (UK Highways Agency 2007) on which Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes (NRA 2011) is based, states that road links at a distance of greater than 200m from a sensitive receptor will not influence pollutant concentrations at the receptor.

The land uses in the immediate vicinity of the proposed Project is predominantly urban and suburban in nature but also comprises of some greenfield and brownfield sites to the north.

This study area covers a considerable geographical area and is in close proximity to both a sizeable urban area containing sensitive residential receptors as well as ecological sensitive areas.

The construction phase study area is focused on potential impacts arising due to the generation of dust. These impacts usually occur within 500 metres of the dust generating activity as dust particles fall out of suspension in the air beyond this distance (Guidance on the assessment of dust from demolition and construction (IAQM (2014)).

The study area with respect to impacts from air quality emissions from vehicle and HGV movements is limited to sensitive receptors less than 200m from road links which are affected by significant changes in volume (i.e. above 5%). This study area is the same for designated conservation areas (either Irish or European designation) with respect to ecology as the potential to impact is highest within 200m of the proposed Project and when significant changes in Annual Average Daily Traffic (AADT) (>5%) occur.

As part of the implementation of the Air Quality Standards Regulations 2002 (S.I. No. 271 of 2002), four air quality zones have been defined in Ireland for air quality management and assessment purposes (EPA 2017a). Dublin is defined as Zone A and Cork as Zone B. Zone C is composed of 23 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 region of the proposed development is categorised as being in both Zones A and D. In order to complete a conservative assessment, it will be assumed that the whole assessment area is categorised as Zone A as there is only a short section to the north of the proposed Project which is in Zone D.

The EPA manage a number of air quality monitoring stations within Dublin, namely Coleraine Street, Wood Quay / Winetavern Street, Rathmines, St Anne's Park, Dún Laoghaire, Swords, Ballyfermot, Phoenix Park and Marino. These show air quality in Dublin to be good. Long-term NO_2 trends have generally been below both the annual and 1-hour limit values, with a few exceedances recorded at the Rathmines and Ballyfermot stations. With respect to PM_{10}, continuous monitoring has been carried out at a number of the monitoring stations, with long-term data showing a general downward trend with an occasional exceedance of the 24-hour limit recorded at Wood Quay / Winetavern Street. Annual averages for both benzene and CO have been recorded well below their respective values.

10.2 Baseline Information

10.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

A review of traffic impacts due to the proposed Project will be carried out and if significant changes in AADT (>5%) occur, an air quality assessment will be carried out following procedures described in the publications by the EPA (EPA 2002, 2003, 2017a) and using the methodology outlined in the policy and technical guidance notes, LAQM.PG(16) and LAQM.TG(16), issued by UK Department for Environment, Food and Rural Affairs (UK DEFRA 2001, 2016a, 2016b; UK Department of the Environment, Transport and Roads 1998, and UK Highways Agency 2007). Transport Infrastructure Ireland's document entitled 'Guidelines for the Treatment of Air Quality During the Planning and Construction of National Road Schemes' (NRA 2011) provides guidance on assessment procedures, the primary aspect of which relates to existing ambient air quality and sensitive receptors. This document, although designed for road schemes, is applicable in this instance due to the linear nature of much of the proposed Project.

Assessment criteria for the impact of dust during the construction phase are set out in TII guidelines referenced above (NRA 2011) and the IAQM guidelines (IAQM 2014). These are used to assess the impact of dust emissions from construction and demolition activities based on the scale & nature of the works and the sensitivity of the area to dust impacts. It is important to note that the predicted impacts associated with the earthworks and construction phases of the proposed development are short-term and temporary in nature.

The following data sources will be referred to during the air quality assessment:

- EPA – National Ambient Air Quality Monitoring Data Archive;
- EPA – Air Quality in Ireland 2016 Report and previous reports (1997 – 2015);
- Dublin Regional Air Quality Management Plan 2009-2012 (DCC 2009);
- National Parks and Wildlife Service Maps; and
- EPA – Integrated Pollution Control Licences.

10.2.2 Survey Requirements

In order to characterise the existing air quality environments, representative air quality monitoring data from public data sources will be analysed to enable a full and proper description of the baseline conditions.

It is proposed that the following monitoring data for a period of up to 1 year will supplement this publicly available data:

- Dust deposition (10 locations),
- NO_2 (1 continuous and 18 diffusion tube locations) and
- Particulates (PM_{10} and $PM_{2.5}$ at 2 locations).

10.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

10.3 Potential Impacts

10.3.1 Potential Construction Phase Impacts

During the construction phase there is potential for an impact on air quality from the following:

- Potential for construction phase dust emissions. Dust generation will potentially be caused by activities such as excavation, soil movement, soil storage and backfilling, and would be exacerbated by winds and dry weather. Dust tends to be deposited within 500 metres of the generation site, and therefore sensitive receptors which fall within this distance of construction activities would be most at risk; and
- Emissions from HGVs and on-site construction plant and equipment which may give rise to emissions including; particulates (PM_{10} and $PM_{2.5}$), benzene, nitrogen oxides (NO_x) and carbon monoxide (CO).

In order to minimise dust emissions during construction, a series of mitigation measures will be proposed in the EIAR and will be implemented during the construction phase of the proposed Project. Typical mitigation measures include the implementation of speed restrictions on site, wheel washing and water misting. The mitigation measures will ensure that significant impacts on sensitive receptors are minimised.

10.3.2 Potential Operational Phase Impacts

The main negative air quality impact during the operational phase is likely to come from operational traffic using the proposed Park and Ride facility. These vehicle-related air emissions may generate quantities of air pollution common to vehicle emissions such as NO_2, CO, benzene and particulate matter (PM_{10} and $PM_{2.5}$). Of these the most pertinent are NO_2 and PM_{10}, as these have the greatest potential to exceed the air quality standards. Aside from the park and ride facility, there should be a significant reduction in traffic as a result of the operation of the proposed Project due to reduced car journeys. This is expected to have a positive effect on air quality in all areas served by the proposed Project.

10.4 Proposed Methodology and Assessment

It is proposed that the assessment of air quality will be carried out in accordance with the EPA guidance as listed in Section 3.11, as well as the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- Transport Infrastructure Ireland (formerly National Roads Authority (NRA)) document entitled Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA 2011).

In line with the above guidance, the assessment will cover potential impacts to air quality and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Assigning the receptor sensitivity;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The air quality assessment carried out on the proposed Project will include the following elements:

- Review of standards and legislation;
- Identification of air quality issues relevant to the components of the proposed Project;
- Review of background ambient air quality monitoring data in the vicinity of the proposed Project (relevant air quality baseline data will be obtained from the EPA);
- Assessment of potential impacts during the construction phase on air quality; and
- Assessment of potential impacts on air quality during the operational phase.

The assessment will take account of sensitive receptors relevant to the proposed Project. Sensitive receptors include locations where people spend significant periods of time. Ecological receptors are habitats that might be sensitive to dust. Examples of these sensitive receptors include:

- Residential dwellings;
- Industrial or commercial uses sensitive to dust;

- Recreational areas and sports grounds;
- Schools and other educational establishments;
- Buildings of religious sensitivity;
- Designated ecological areas of conservation (either Irish or European designation); and
- Hospitals and nursing homes.

A series of mitigation measures to minimise impacts for both the construction phase and operational phase of the proposed Project will be proposed as required as part of the EIAR and monitoring measures will also be proposed.

11. Climate

11.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of climate impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on climate as part of the development of the EIAR.

11.1.1 Policy, Plan and Guideline Context

In order to reduce the risk due to climate change, National and European statutory bodies have set targets for future greenhouse gas (GHG) emissions. Ireland has signed up to several Climate agreements including the '2030 Climate and Energy Policy Framework' (EC 2014) which aims to reduce GHG emissions by 40% compared with 1990 levels by 2030. The assessment of climate will be conducted with consideration of the documents in Section 3.11 of this report and relevant legislation and guidance including:

- 2030 Climate and Energy Policy Framework (EC 2014);
- Guidance on the Assessment of Dust from Demolition and Construction (IAQM 2014);
- Climate Action and Low Carbon Development Act (No. 46 of 2015);
- Climate Action and Low Carbon Development – National Policy Position Ireland (DCCAE 2013);
- National Mitigation Plan: July 2017 (DCCAE 2017); and
- Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA 2011).

11.1.2 Description of the Study Area

Due to the nature of climatic effects, if significant emissions occur they will have the potential to impact Ireland's commitments and targets under various EU Climate Agreements and other international agreements. Therefore, the study area can be classed as Ireland.

11.2 Baseline Information

11.2.1 Desktop Study

Ireland has signed up to several Climate agreements including the '2030 Climate and Energy Policy Framework' (EC 2014) which aims to reduce GHG emissions by 40% compared with 1990 levels by 2030. 2013 and 2014 saw a decreasing trend in Ireland's GHG emissions, this can be attributed to a decrease in economic activity. The agriculture and transport sectors make up the majority of non-ETS emissions making up 72.4% of emissions in 2014. Energy production using fossil fuels is continually decreasing in recent years with renewable energy production increasing. Renewable energy production increased by 6.6% on 2012 levels in 2013 and by 12.6% based on 2013 levels in 2014. This increasing trend continued into 2015 with a 4% increase in renewable energy production based on 2014 levels. However, overall, 2015 data shows a 3% increase in other non-ETS emissions. This change in trend is a result of increasing economic growth and employment. While Ireland had been in compliance with its EU 2020 target for a number of years, the Climate Change Advisory Council has now advised in their Annual Review 2018 that Ireland is not on track to meet its 2020 targets (20% reduction by 2020 compared

to 2005 levels) or its 2030 targets, due to greenhouse gas emissions rising, rather than falling (Climate Change Advisory Council 2018).

11.2.2 Survey Requirements

The assessment to be undertaken for this chapter in the EIAR will be desk-based and it is not envisaged that any surveys will be required.

11.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

11.3 Potential Impacts

11.3.1 Potential Construction Phase Impacts

Construction traffic and embodied energy are expected to be the dominant source of GHG emissions as a result of the proposed Project. GHG emissions from construction traffic and embodied energy from construction materials will increase Ireland's GHG emissions potentially having a climate change effect. The potential effects, if any of this will be assessed in the EIAR.

11.3.2 Potential Operational Phase Impacts

GHG emissions are likely to be reduced during the operational phase due to the displacement of cars and other vehicles as passengers utilise the MetroLink for transportation purposes and use.

11.4 Proposed Methodology and Assessment

It is proposed that an assessment of climate will be carried out in accordance with the EPA guidance as listed in Section 3.11 as well as the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- Transport Infrastructure Ireland document entitled Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA 2011).

In line with the above guidance, the assessment will cover potential impacts to climate and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The climate assessment carried out on the proposed Project will include the following elements:

- Review of legislation;
- Identification of climate issues relevant to the components of the proposed Project;

- Review of baseline GHG emissions;
- Assessment of potential impacts of the construction phase on climate; and
- Assessment of potential impacts during the operational phase on climate.

12. Biodiversity

12.1 Introduction

This chapter describes the scope of works and methods to be applied in the identification and assessment of biodiversity impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project as part of the EIA.

12.1.1 Policy, Plan and Guideline Context

The biodiversity assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and the following:[1]

Legislation

- Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive);
- Directive 2009/147/EC of the European Parliament and of the Council on the conservation of wild birds (Birds Directive);
- Directive 2011/92/EU of the European Parliament and of the Council on the assessment of the effects of certain public and private projects on the environment, as amended by Directive 2014/52/EU of the European Parliament and of the Council of 16 April 2014;
- European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011), as amended;
- Wildlife Acts 1976 to 2017;
- Flora (Protection) Order, 2015 (S.I. No. 356 of 2015); and
- Fisheries Acts 1959 to 2017.

Planning documentation

- National Biodiversity Plan 2017-2021 (Department of Culture, Heritage and the Gaeltacht (DCHG 2017);
- Draft Fingal Biodiversity Action Plan 2018-2023 (FCC 2018);
- Dublin City Biodiversity Action Plan 2015-2020 (DCC 2015); and
- Dún Laoghaire-Rathdown Biodiversity Plan 2009-2013 (DLRCC 2009) (currently under review).

12.1.2 Description of the Study Area

The provisional study area for the likely key biodiversity receptors will vary according to the Zone of Influence (ZoI) of the proposed Project and will be informed by best practice guidelines (described in Section 12.4). The ZoI of the proposed Project '*is the area over which ecological features may be affected by biophysical changes as a result of the proposed Project and associated activities*' (CIEEM 2018). The potential impacts of the proposed Project are discussed in more detail in Section 12.3. Details on the likely study areas are described below. These

[1] This is not an exhaustive list of all legislation and planning documentation but instead a list of those most relevant for the purposes of preparing the Environmental Impact Assessment Report.

study areas may be revised as part of an iterative process informed by the proposed Project design as it progresses. Figures 11.1 and 11.2 in Appendix C show the watercourses and designated sites in the area surrounding the proposed Project.

The ecological conditions located within the study area are comprised of:

- Improved agricultural/arable fields of varying sizes, which are bordered by hedgerows, mature treelines and/or scrub;
- Areas of amenity grassland, scattered trees and parkland and ornamental trees and shrubs located within residential, commercial and industrial estates;
- Private residential dwellings and associated gardens;
- Areas of hardstanding, including various roads such as the R132 and R108, and buildings/structures, including those associated with Dublin Airport;
- Watercourses, and drainage ditches. These watercourses include, but are not limited to: Staffordstown/Turvey River, Broadmeadow River, Ward River, Sluice River, Cuckoo River, Mayne River, Santry River, River Tolka, Royal Canal, River Liffey, Grand Canal; and
- A number of European designated sites located in proximity to and/or downstream of the proposed Project, including, but not limited to: Malahide Estuary Special Area of Conservation (SAC) [000205], Malahide Estuary Special Protection Area (SPA) [004025], Rogerstown SAC [000208], Rogerstown SPA [004015], Baldoyle Bay SAC [000199], Baldoyle Bay SPA [004016], North Dublin Bay SAC [000206], North Bull Island SPA [004006], South Dublin Bay and River Tolka Estuary SPA [004024], South Dublin Bay SAC [000210], Howth Head SAC [000202], Howth Head Coast SPA [004113], Ireland's Eye SAC [002193], Ireland's Eye SPA [004117], Dalkey Islands SPA [004172], Rockabill to Dalkey Island SAC [003000], Lambay Island SAC [000204] and Lambay Island SPA [004069].

12.2 Baseline Information

12.2.1 Desktop Study

The desktop study will involve the collection and review of relevant published and unpublished sources of biodiversity data, collation of existing information on the ecological environment and consultation with relevant statutory bodies (e.g. National Parks & Wildlife Service (NPWS) and Inland Fisheries Ireland (IFI)).

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

The following information sources will be accessed as part of the desktop study[2]:

- Online data available on Natura 2000 network of sites (hereafter referred to as European sites) and on Natural Heritage Areas (NHAs) or proposed Natural Heritage Areas (pNHAs) as held by the National Parks and Wildlife Service (NPWS);

[2] This is not an exhaustive list of all desktop sources but instead a list of those likely to be most relevant for the purposes of preparing the Environmental Impact Assessment Report.

- National Biodiversity Data Centre (NBDC) Online Database;
- Recent Ordnance Survey Ireland (OSI) orthophotography for the proposed Project study area;
- Records of rare and protected species for the 10km grid squares O12, O13, O14 and O22, held by the NPWS;
- Habitat and species GIS datasets provided by the NPWS;
- Bat records from Bat Conservation Ireland's (BCI) database;
- Environmental Impact Statements for previous metro proposals and other developments located along the alignment of the proposed Project;
- Environmental information/data for the area available from the EPA website;
- Information on the status of EU protected habitats and species in Ireland (NPWS 2013);
- Records from the Botanical Society of Britain & Ireland (BSBI); and
- Information contained within the Flora of County Dublin (Doogue et al. 1998).

12.2.2 Survey Requirements

Ecological surveys will be undertaken to inform the EIA for the proposed Project including for some or all of the following groups of biodiversity receptors: amphibians, mammals (including badger, otter and bats), breeding birds, fish, habitats (and flora), and wintering birds.

Table 12.1: Description of Biodiversity Survey Study Areas

Key Ecological Receptor	Study Area Description
Habitats	A corridor along the proposed Project where works are proposed and habitats that could be directly or indirectly affected during construction/operation
Fauna species (other than those listed below)	A corridor along the proposed Project where above are proposed and fauna species could be directly or indirectly affected during construction/operation
Breeding birds	A corridor along the proposed Project where works are proposed, and breeding birds could be directly or indirectly affected during construction/operation
Aquatic Ecology	Watercourses crossed by the proposed Project
Bats	Areas of suitable bat habitats along the proposed Project where works are proposed
Wintering birds	A corridor along the proposed Project where works are proposed, and wintering birds could be directly or indirectly affected during construction/operation

12.2.3 Consultation

The following organisations, amongst others as necessary, with relevance to biodiversity will be consulted:

- National Parks and Wildlife Service (NPWS);
- Inland Fisheries Ireland (IFI);

- Bat Conservation Ireland (BCI);
- BirdWatch Ireland (BWI);
- Botanical Society of Britain & Ireland (BSBI);
- Local Authority Biodiversity Officers; and
- Other members of the public with local knowledge/records (e.g. relating to bat roosts).

12.3 Potential Impacts

12.3.1 Potential Construction Phase Impacts

In the absence of mitigation, the proposed Project could result in the following potential construction phase impacts:

- Changes in surface water quality in the receiving environment as a result of contaminated surface water runoff and/or an accidental spillage or pollution event into any surface water features. This in turn could result in the degradation of aquatic/wetland habitats and indirect impacts on the aquatic species that these habitats may support, such as otters, amphibians and fish (if present). The associated effects of a reduction of surface water quality could potentially extend for a considerable distance downstream of the discharge point or location of the accidental pollution event, potentially as far as coastline.
- Changes in groundwater quality/quantity in the receiving environment as a result of tunnelling and/or deep excavation works. This in turn could result in effects on groundwater dependent terrestrial ecosystems e.g. as a consequence of dewatering activity, which may cause a reduction in groundwater levels in the locality.
- Temporary alteration to the existing hydrological regime of watercourses (i.e. flow and/or local flooding regime) crossed by the proposed Project, which in turn could result in the degradation of aquatic/wetland habitats and indirect impacts on aquatic species that these habitats may support.
- Reduction in air quality as a consequence of dust deposition associated with construction activities, which in turn could result in habitat degradation in the immediate vicinity of the construction works.
- Introduction and/or spread of non-native invasive plant species, which in turn could result in habitat degradation.
- Habitat loss, (either direct and/or indirect, which may arise as a consequence of severe habitat degradation), fragmentation and/or temporary severance (e.g. barrier effect), which in turn may result in impacts on species dependent on these habitats for survival, such as:
  - Amphibians (e.g. the loss of breeding habitat);
  - Badgers (e.g. the loss of suitable breeding and foraging habitats);
  - Bats (e.g. the loss of roosting, foraging and commuting habitats);
  - Breeding birds (e.g. the loss of breeding and foraging habitats);
  - Common lizard (e.g. breeding and resting habitats);
  - Otters (e.g. the loss of breeding, foraging, resting and commuting habitats); and

  - Wintering birds (e.g. the loss of foraging and resting habitats).

- Mortality risk to fauna species (e.g. birds and bats) directly due to construction works associated with the proposed Project (e.g. collision with machinery and/or vegetation clearance) or indirectly due to the occurrence of an accidental pollution event during the construction stage of the proposed Project.

- Temporary increase in noise, vibration and human activity levels, which in turn could result in the disturbance to and/or displacement of fauna species present within the immediate vicinity of the proposed Project.

12.3.2 Potential Operational Phase Impacts

In the absence of mitigation, the proposed Project could result in the following potential operational phase impacts:

- Changes in surface water quality in the receiving environment as a result of the long-term discharge of surface water runoff from drainage outfalls associated with the proposed development to surface water features, which in turn could result in the degradation of aquatic/wetland habitats. The associated effects of a reduction of surface water quality could potentially extend for a considerable distance downstream of the discharge point, potentially as far as coastline.

- Changes in groundwater quality/quantity in the receiving environment as a result of the long-term discharge of road runoff to ground. This in turn could result in the degradation of groundwater fed terrestrial ecosystems.

- Introduction and/or spread of non-native invasive plant species during maintenance/management works, which in turn could result in habitat degradation.

- Permanent habitat severance/barrier effect on fauna species associated with the proposed Project.

- Permanent introduction/increase in light levels, which in turn could result in the disturbance to and/or displacement of fauna species (particularly bats) present within the vicinity of the proposed Project.

- Permanent increase in noise, vibration and human activity levels, which in turn could result in the disturbance to and/or displacement of fauna species present within the immediate vicinity of the proposed Project.

12.4 Proposed Methodology and Assessment

The surveys, impact assessment and the preparation of this chapter will have regard to the EPA guidance as listed in Section 3.11, as well as the following guidance documents:

- Guidance on Integrating Climate Change and Biodiversity into Environmental Impact Assessment (EU 2013);

- Guidelines for Ecological Impact Assessment in the UK and Ireland: Terrestrial, Freshwater, Coastal and Marine, 2nd edition (CIEEM 2016);

- Environmental Guidelines Series for Planning and Construction of National Roads (NRA 2005-2009);

- Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA 2009);

- Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA 2008a);

- Bat Surveys for Professional Ecologists: Good Practice Guidelines (3rd Edition) (Collins (ed.) (Bat Conservation Trust 2016);

- Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA 2008b);
- The Bat Workers' Manual, 2nd Edition (Mitchell-Jones and McLeish 1999);
- Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. (Kelleher and Marnell 2006);
- Design Manual for Roads and Bridges (UK Highways Agency 2001); and
- Various Irish Wildlife Manuals produced by NPWS that may be applicable to the habitats and/or species encountered during the ecological surveys.

The impact assessment criteria will follow the CIEEM (2016) guidelines referred to above. The magnitude or scale of the potential impacts of the proposed Project will be characterised and described based on the type of impact, its extent, duration, frequency, timing and reversibility (i.e. whether or not it is permanent or temporary). The likelihood of an impact occurring, and the predicted effects, will also be assessed and may be identified as being certain, likely or unlikely. Professional judgement will be used in considering the contribution of all relevant criteria in determining the overall magnitude of an impact.

13. Water: Hydrology

13.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of hydrological impacts associated with the proposed Project. A high-level overview of the known baseline conditions is provided, together with the proposed methodology and an overview of the scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on surface water quality, quantity and flood risk during both the construction and operation phase.

13.1.1 Policy, Plan and Guideline Context

Directive 2000/60/EC of the European Parliament and of the Council establishes a framework for community action in the field of water policy (commonly known as the Water Framework Directive (WFD)) requires *'Good Water Status'* for all European waters by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' means both *'Good Ecological Status'* and *'Good Chemical Status'.* In 2009, the Eastern River Basin District (ERBD) River Basin Management Plan (RBMP) 2009-2015 was published. In the ERBD RBMP, the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015. The 2nd cycle River Basin Management Plan for Ireland (2018-2021) was published in April 2018 (EPA 2018a). For the 2nd Cycle, the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts have been merged to form one national River Basin District.

The strategies and objectives of the WFD have influenced a range of national legislation relevant to management and protection of surface water resources. In order to minimise any impact on water body status, the assessment of surface water will consider the potential impacts during construction and operational phases with regard to policy, plan and strategy documents, including (but not limited to) the documents listed in Section 3.11, as well as relevant water quality legislation and guidance such as:

- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010);
- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);
- European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. No. 278 of 2007);
- European Communities (Quality of Salmonid Waters) Regulations, 1988 (S.I. No. 293 of 1988);
- European Communities (Quality of Shellfish Waters) Regulations, 2006 (S.I. No. 268 of 2006);
- Bathing Water Quality Regulations, 2008 (S.I. No. 79 of 2008);
- European Communities (Natural Habitats) Regulations, 1997 (S.I. No. 94 of 1997) and European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011);
- The EU Floods Directive 2007/60/EC; and

- European Communities (Assessment and Management of Flood Risks) Regulations, 2010 (S.I. No. 122 of 2010).

13.1.2 Description of the Study Area

Appendix C Figure 11.1 presents the proposed Project in relation to the surface water environment. The land use in the immediate vicinity of the proposed Project is predominantly urban and suburban but also comprises some greenfield and brownfield sites to the north of the proposed Project.

This study area covers a considerable geographical area and crosses the following water courses: Turvey, Liffey, Tolka, Santry, Mayne, Sluice, Gaybrook, Seapoint, Ward, Broadmeadow, Dodder, Slang and Staffordstown. Underground or culverted rivers which will be crossed by the proposed will also be included in the study.

The construction phase study area is focused on assessing potential effects from temporary discharge of potentially contaminated water from construction areas (above ground and underground). The assessment will consider the suitability of proposed mitigation measures to (i) manage sediment in run-off, (ii) manage any alkaline run-off due to concrete pouring, (iii) manage any accidental releases of hydrocarbons and chemicals, (iv) manage impacts of pumping contaminated water from tunnel and station box excavation and (iv) assess impact of discharge on receiving water flow regime.

For the operational phase, the assessment will consider any on-going point discharges or drainage to receiving waters.

The assessment will consider existing and required water status for all surface waters and any additional measures required for designated areas of conservation (either Irish or European designation) with respect to ecology.

13.2 Baseline Information

13.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the “Old” Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment.

The desktop study will comprise collation of available data in relation to the following key aspects:

Water Quality and Status

WFD classification for surface water bodies consists of ecological status and chemical status classification. The quality element relevant to ecological status includes biological elements, water chemistry and the physical conditions of the water body. Natural surface water bodies are assigned to one of five ecological status classes (High, Good, Moderate, Poor or Bad). Heavily modified water bodies are assigned to one of five ecological status classes (Maximum, Good, Moderate, Poor or Bad). Chemical status follows analysis for the EU list of priority hazardous substances and the status is determined as Good or Fail. This information is compiled by the EPA from sampling of representative points in the national monitoring network and the data is presented on the EPA website and reported in Water Quality in Ireland 2010-2015 (EPA 2017e).

Appendix C Figure 14.2 presents known water quality status at this time.

Water Dependent Protected Areas

These are water bodies or stretches of water bodies which require special protection because of their usage as bathing water, sources of drinking water, sensitive habitats and species, shellfish habitats or areas sensitive to eutrophication due to excessive inputs of phosphorus and/or nitrogen. Relevant data is available in 'Bathing water quality in Ireland 2016' (EPA 2017d), 'EPA Drinking water report for public supplies' (EPA 2018c), and 'Status of EU protected habitats and species in Ireland' (NPWS 2013).

Catchment Characteristics, Environmental Pressures and Programme of Measures

The EPA has undertaken an assessment of the significant pressures on each waterbody and identified waterbodies that are "at risk" of not meeting WFD objectives.

The WFD sets out environmental objectives which are required to be met through the process of river basin planning. The 2nd cycle River Basin Management Plan for Ireland (2018-2021) was published in April 2018 (EPA 2018a) and sets out the planned programme of measures for the next five years.

Flood Risk Assessment

A Stage 1 Flood Risk Assessment in line with the Office of Public Works (OPW) 'Guidelines for Planning Authorities (GPA): The Planning System and Flood Risk Management' (OPW and DoEHLG 2009) will be carried to identify whether there may be any flooding or surface water management issues relating to the proposed Project site that may warrant further investigation. The following information sources will be used to inform the Stage 1 flood risk assessment:

- OPW Preliminary Flood Risk Assessment (PFRA) indicative integrated flood maps;
- National Coastal Protection Strategy Study flood and coastal erosion risk maps;
- Predictive and historic flood maps, and Benefiting Lands Map;
- Predictive flood maps produced under the Catchment Flood Risk Assessment and Management (CFRAM) studies;
- River Basin Management Plans and reports;
- Indicative assessment of existing flood risk under PFRA;
- Previous Strategic Flood Risk Assessments (FRA)s;
- Expert advice from OPW who may be able to provide reports containing the results of detailed modelling and flood-mapping studies including critical damage areas, and information on historic flood events and local studies etc.;
- Topographical maps, in particular digital elevation models produced by aerial survey or ground survey techniques;
- Information on flood defence condition and performance;
- Alluvial deposit maps;
- 'Liable to Flood' markings on the old 6 Inch Maps;

- Local Libraries and newspaper reports;
- Interviews with local people, local history/ natural history societies etc.; and
- Walkover survey to assess potential sources of flooding, likely routes for flood water and the site's key features, including flood defences, and their condition.

National, regional and local spatial plans, such as the National Spatial Strategy, regional planning guidelines, development plans and local area plans provide key information on existing and potential future receptors.

Following completion of Stage 1, a Stage 2 Initial Flood Risk Assessment will be completed to confirm:

- Sources of flooding that may affect the proposed Project site;
- The adequacy of the available flood risk information; and
- The nature of any surveys or modelling approach required to match the resolution and complexity of flood issues affecting the proposed Project site.

The Stage 2 assessment will consider the potential risk of flooding to the proposed Project site, including preparing flood zone mapping where appropriate. The potential impacts of the proposed Project on flood risk will also be assessed with the scope of possible mitigation measures identified.

Based on the outcomes of the Stage 2 assessment, a Stage 3 Detailed Flood Risk Assessment will be undertaken where required to provide a quantitative assessment of the flood risk and arising from the proposed Project and the effectiveness of planned mitigation. Stage 3 assessments are only anticipated where the proposed Project is shown to be in an area of high flood risk or where it is likely to affect existing flooding mechanisms.

13.2.2 Survey Requirements

In order to characterise the existing surface water quality environment at likely points of discharge, representative water quality monitoring data will be collected and analysed for contaminants of concern.

Water quality data will be collected from a pumping test programme undertaken as part of the geotechnical assessment. This data will be used to inform the water quality of any potential groundwater discharges. This will also facilitate assessment of likely discharge flow rates during and post construction.

13.2.3 Consultation

Consultation will be undertaken with relevant stakeholders to ensure that a sufficiently robust environmental baseline assessment is undertaken. The consultation process will include direct consultation with public bodies as well as consideration of feedback received during public consultation. Specifically related to potential impacts on the water environment, the following organisations will be consulted:

- Environmental Protection Agency;
- Local Authority Waters and Communities Office (LAWCO);
- National Parks and Wildlife Service;
- Irish Water;
- Office of Public Works (OPW);

- Dublin City Council; and
- Fingal County Council.

Consultation with relevant authorities, organisations and stakeholders will continue throughout the assessment and design process.

13.3 Potential Impacts

13.3.1 Potential Construction Phase Impacts

During the construction phase there is potential for an impact on the hydrological regime from the following:

- Potential for run-off containing high loadings of suspended solids from earthworks;
- Potential for run-off being contaminated by a spillage or leakage of oils and fuels stored on site or direct from construction machinery;
- Potential for discharges of contaminated water from tunnelling and or station excavations;
- Potential for high alkalinity run-off as a result of concrete works;
- Potential for change in the natural hydrological regime due to an increase in discharge as a result of dewatering; and
- Potential for disrupting local drainage systems due to diversions required to accommodate the construction works.

In order to minimise these potential effects during construction, a series of mitigation measures will be included in the EIAR and be implemented during the construction phase of the proposed Project, such as settlement on site, avoidance of construction where feasible immediately adjacent to open water, bunding of oil storage tanks, etc.

13.3.2 Potential Operational Phase Impacts

During the operational phase there is potential for an impact on the hydrological regime from the following:

- Potential for on-going discharge from dewatering at some stations;
- Potential for discharge being contaminated by a spillage or leakage of oils and fuels; and
- There is a potential that the proposed Project could exacerbated any existing local flood risk due to the increased hardstanding areas at infrastructure sites such as the Park and Ride site.

13.4 Proposed Methodology and Assessment

It is proposed that the hydrological assessment will be carried out in accordance with the EPA guidance as listed in Section 3.11 as well as the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- National Roads Authority Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009). These guidelines are referenced where the methodology for assessment of impact is appropriate;

- Road Drainage and the Water Environment (including Amendment No. 1 dated June 2015) (TII 2015); and
- Office of Public Works (OPW) Guidelines for Planning Authorities (GPA): The Planning System and Flood Risk Management (OPW and DoEHLG 2009).

In line with the above guidance, the assessment will cover potential impacts to water quality and flow and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Assigning the importance of each hydrological attribute;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts;
- Specifying appropriate monitoring; and
- Assessing the significance of any residual effects after mitigation.

The hydrological assessment carried out on the proposed Project will include the following elements:

- Review of guidance and legislation;
- Identification of surface water issues relevant to the components of the proposed Project;
- Review of the receiving hydrological regime in the vicinity of the proposed Project (relevant baseline data will be obtained from the EPA, OPW, NPWS and field collection of representative water quality samples in summer and winter seasons);
- Assessment of potential impacts of construction and operation on receiving water quality and flow. Field assessment of potential discharge locations will be undertaken, and representative seasonal sampling completed. The objective of the monitoring is to determine the baseline quality for potentially receiving waters from discharges. Increase in pH, hydrocarbons and suspended solids represent the more likely significant impacts from the planned construction works. The proposed analytical suite for surface water monitoring includes the following parameters:
  - pH and Conductivity;
  - Extractable Petroleum Hydrocarbons Criteria Working Group (EPH CWG), and benzene, toluene, ethylbenzene and xylene (BTEX);
  - Metals including arsenic, cadmium, chromium, copper, lead, mercury, nickel, selenium, zinc, boron, aluminium, barium, cobalt, iron, molybdenum, manganese, phosphorus, antimony, vanadium, beryllium, thallium; earth metals including calcium, magnesium, potassium, sodium;
  - Major anions and cations (incl. fluoride, chloride, sulphate, Alkalinity);
  - Total Kjeldahl Nitrogen (TKN) ammonia;
  - Orthophosphate (as Molybdate Reactive Phosphorus (MRP));
  - Total Suspended Solids; and
  - Biological Oxygen Demand (BOD) / Chemical Oxygen Demand (COD).

The laboratory test results will be compared with the European Communities Environmental Objectives (Surface Waters) Regulations 2009 (S.I. No. 272 of 2009) [and amendments thereof including Surface Water Amendment Regulations S.I. No. 386 of 2015].

- The assessment will take account of sensitive receptors relevant to the proposed Project. Sensitive receptors include “at risk” and “high” status water bodies, water dependent protected habitats and surface water at risk of flooding.

- A series of mitigation measures to minimise any foreseen impacts for both the construction phase and operational phase of the proposed Project will be proposed as required as part of the EIAR.

As a minimum an FRA Stage 1 and 2 will be carried out and appended to the EIAR. A Stage 3 FRA will be carried out if required following a review of the findings of the Stage 1 and 2 FRAs. The FRAs will be carried out in accordance with the OPW Guidelines for Planning Authorities (GPA) 2009: The Planning System and Flood Risk Management (OPW and DoEHLG 2009).

14. Water: Hydrogeology

14.1 Introduction

This chapter describes the scope of work and proposed methods to be applied in the assessment of hydrogeological impacts associated with the proposed Project. A high level overview of the known baseline conditions is provided, together with the proposed methodology and an overview of the scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on ground water quality and quantity as part of the environmental assessment.

14.1.1 Policy, Plan and Guideline Context

The European Communities Directive 2000/60/EC, establishing a framework for community action in the field of water policy (commonly known as the Water Framework Directive (WFD)) requires *'Good Water Status'* for all European waters by 2015, to be achieved through a system of river basin management planning and extensive monitoring. 'Good status' considers both *quantitative status* and *groundwater chemical status.* In 2009, the Eastern River Basin District (ERBD) River Basin Management Plan (RBMP) 2009-2015 was published. In the ERBD RBMP, the impacts of a range of pressures were assessed including diffuse and point pollution, water abstraction and morphological pressures (e.g. water regulation structures). The purpose of this exercise was to identify water bodies at risk of failing to meet the objectives of the WFD by 2015 and include a programme of measures to address and alleviate these pressures by 2015. The 2nd cycle River Basin Management Plan for Ireland (2018-2021) was published in April 2018 (EPA 2018a). For the 2nd Cycle, the Eastern, South Eastern, South Western, Western and Shannon River Basin Districts have been merged to form one national River Basin District.

The strategies and objectives of the WFD have influenced a range of national legislation relevant to management and protection of water resources. In order to minimise any impact on water body status, the assessment of groundwater will consider the impact of construction and operation with regard to policy, plan and strategy documents, including (but not limited to) the documents listed in Section 3.11, as well as relevant water quality legislation and guidance such as:

- European Communities Environmental Objectives (Surface Waters) Regulations, 2009 (S.I. No. 272 of 2009);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010);
- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities (Drinking Water) Regulations 2014 (S.I. No. 122 of 2014);
- European Communities (Drinking Water) (No. 2) Regulations 2007 (S.I. No. 278 of 2007); and
- European Communities (Natural Habitats) Regulations 1997, (S.I. No. 94 of 1997) and European Communities (Birds and Natural Habitats) Regulations, 2011 (S.I. No. 477 of 2011).

14.1.2 Description of the Study Area

Appendix C Figure 15.1 presents the proposed Project in relation to the groundwater environment (aquifer classification). The land use in the immediate vicinity of the proposed Project is predominantly urban and suburban but also comprises some greenfield and brownfield sites to the north of the proposed Project.

The proposed Project runs across the Dublin Ground Water Body (GWB) (IE_EA_G_008) and Swords GWB (IE_EA_G_011).

The construction phase study area is focused on assessing potential impacts from temporary discharge of run-off water from construction areas and assessment of localised dewatering at stations. The assessment will consider the suitability of proposed mitigation measures to (i) manage any alkaline run-off due to concrete pouring, (ii) manage any accidental releases of hydrocarbons or chemicals (iii) manage any encountered contaminated land (iv) manage any potential for discharges of contaminated water from tunnelling and or station excavations (v) manage impacts of tunnelling on groundwater and (vi) manage impacts of dewatering on the groundwater water flow regime.

During operation, there are no likely direct discharges to groundwater. Indirect discharges may comprise accidental leaks or discharges at the depot, car parking areas, and maintenance compounds. The study will also consider any on-going dewatering requirements for stations and tunnels.

The study will consider existing and required water status for all groundwater bodies and any additional measures required for designated area of conservation (either Irish or European designation) with respect to ecology. Appendix C Figure 15.2 presents the current Groundwater Body Status in the context of the proposed Project.

14.2 Baseline Information

14.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the “Old” Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous scheme.

The principle attributes to be assessed include the following:

- Aquifer vulnerability (Appendix C Figure 15.3);
- High yielding water supply springs/wells in the vicinity of the site to within a 2km radius and the potential for increased risk presented by the proposed application;
- Classification (regionally important, locally important) and the extent of aquifers underlying the proposed Project;
- Natural hydrogeological / karst / gravel features in the area and the potential for increased risk presented by the activities on site; and
- Groundwater-fed ecosystems and the increased risk presented by operations both spatially and temporarily.

The desktop study will comprise collation of available data in relation to the following key aspects:

Water Quality and Status

WFD classification for groundwater bodies consists of quantitative status and groundwater chemical status. Each is assigned as having either good or poor status. This information is compiled by the EPA from sampling of representative points in the national monitoring network and the data is presented on the EPA website and reported in Water Quality in Ireland 2010-2015 (EPA 2017).

Groundwater Dependent Terrestrial Ecosystems (GWDTE)

These are fens, turloughs and bogs, and have been assessed as part of the River Basin Characterisation and Classification assessment process. Of 63 GWDTEs identified as failing to achieve their conservation objectives, groundwater was judged to be a potential contributing factor for 29 of these. Relevant data is available in 'Status of EU protected habitats and species in Ireland' (NPWS 2013)

Catchment Characteristics, Environmental Pressures and Programme of Measures

The EPA has undertaken an assessment of the significant pressures on each waterbody and identified waterbodies that are "at risk" of not meeting WFD objectives. This data set is available on the EPA website.

The WFD sets out environmental objectives which are required to be met through the process of river basin planning. The 2nd cycle River Basin Management Plan for Ireland (2018-2021) was published in April 2018 (EPA 2018a) and sets out the planned programme of measures for the next five years.

14.2.2 Survey Requirements

In order to characterise the existing ground water quality representative water quality monitoring data will be collected and analysed for contaminants of concern. This will add to the desktop assessment and enable suitable mitigation to be designed as needed.

Water quality and discharge estimates will be collated from a pumping test programme undertaken as part of the geotechnical assessment. This will facilitate assessment of likely discharge flow rates during and post construction.

14.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

14.3 Potential Impacts

14.3.1 Potential Construction Phase Impacts

During the construction phase there is potential for an impact on the hydrogeological regime from the following:

- Potential for recharge to ground being contaminated by a spillage or leakage of oils and fuels stored on site or direct from construction machinery;
- Potential for high alkalinity run-off recharging to ground as a result of concrete works;
- Potential for encountering contaminated land; and
- Potential for change in the natural hydrogeological regime due to dewatering during construction and operation.
- Potential for discharges of contaminated water from tunnelling and or station excavations.

In order to minimise these potential effects during construction, a series of mitigation measures will be included in the EIAR and be implemented during the construction phase of the proposed Project. The contractor appointed

to design and build the proposed Project will be required to comply with these measures. The mitigation measures will have to be robust to ensure there are no significant impacts on sensitive receptors.

14.3.2 Potential Operational Phase Impacts

During the operational phase, the potential for impact of the ground water regime is expected to be minimal.

During the operational phases there are no likely direct discharges to groundwater. Indirect discharges may comprise accidental leaks or discharges at the depot, car parking areas and maintenance compounds.

14.4 Proposed Methodology and Assessment

It is proposed that the hydrogeological assessment will be carried out in accordance with the EPA guidance as listed in Section 3.11 as well as the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- National Roads Authority Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009b); and
- Geology in Environmental Impact Statements, a guide (IGI 2002).

In line with the above guidance, the assessment will cover potential impacts to water quality and water level and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Assigning the importance of each hydrogeological attribute;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts;
- Specifying appropriate monitoring; and
- Assessing the significance of any residual effects after mitigation.

The hydrogeological assessment carried out on the proposed Project will include the following elements:

- Review of guidance and legislation;
- Identification of groundwater issues relevant to the components of the proposed Project. These will consider the impact of dewatering on bedrock and overburden, water quality status, location of any drinking water supplies or groundwater dependent terrestrial ecosystems.
- Review of the receiving hydrogeological regime in the vicinity of the proposed Project. Prior to carrying out groundwater monitoring a desk-based review of existing boreholes will be undertaken to identify viable monitoring points for on-going monitoring. The review shall include a gap analysis to identify additional monitoring well installation requirements having regard to the sensitivity of the environment along the proposed Project and the proposed station locations and other works sites.
- Assessment of potential impacts of construction and operation on receiving water quality and water level. Field assessment of potential dewatering locations will be undertaken followed by representative dewatering assessment to identify the likely impact on the natural groundwater regime and provide an assessment for

determining likely discharge rates during construction and operation. Representative groundwater sampling at c. 15 locations will also be undertaken to support existing baseline water quality information and to provide information for preparation of licenses for discharge. The proposed analytical suite for groundwater monitoring includes the following parameters:

- Major anions and cations (including chloride, sulphate, sodium, calcium, potassium, magnesium, fluoride, nitrite, nitrate, ammonia, alkalinity, non-carbonate hardness);
- Metals and other compounds (including aluminium, arsenic, barium, boron, fluoride, cadmium, cobalt, iron, manganese, nickel, chromium, copper, mercury, lead, selenium, phosphorous and zinc);
- Physico-chemical parameters including Total Suspended Solids (TSS), Total Dissolved Solids (TDS), Turbidity, Redox;
- Volatile Organic Compounds (VOCs); and
- Hydrocarbon compounds including benzene, toluene, ethylbenzene and xylene (BTEX) (aliphatics/aromatics), Mineral Oil Fraction (aliphatics).

Laboratory test results will be compared with S.I. No. 9 of 2010 Environmental Objectives Groundwater Regulations 2010, SI. No. 366 of 2016 Environmental Objectives Groundwater Amendment Regulations 2016, and EPA document 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland Interim Report' (EPA 2003b).

- A series of mitigation measures to minimise any foreseen impacts for both the construction phase and operational phase of the proposed Project will be proposed as required within the EIAR.

15. Soils and Geology

15.1 Introduction

This chapter describes the scope of works and methods to be applied in the identification and assessment of land, soils and geology impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed development on land, soils and geology as part of the EIA.

15.1.1 Policy, Plan and Guideline Context

The land, soils and geology assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and relevant legislation and guidance including:

- European Communities (Water Policy) Regulations, 2003 (S.I. No. 722 of 2003);
- European Communities Environmental Objectives (Groundwater) Regulations, 2010 (S.I. No. 9 of 2010);
- Directive 2000/60/EC of the European Parliament and of the Council establishing a framework for the Community action in the field of water policy (Water Framework Directive (WFD));
- Directive 2006/118/EC of the European Parliament and of the Council of 12 December 2006 on the protection of groundwater against pollution and deterioration (Groundwater Directive);
- Institute of Geologists of Ireland, Guidelines for the Preparation of Soils, Geology and Hydrogeology Chapters of Environmental Impact Statements (IGI 2013);
- National Roads Authority, Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA 2009b);
- Environmental Protection Agency, Guidance on the Management of contaminated Land and Groundwater at EPA Licensed Sites (EPA 2013);
- Environmental Protection Agency, Towards Setting Guideline Values for the Protection of Groundwater in Ireland (EPA 2003b) (a consultation document titled Determining Groundwater Pollution: A proposed approach for the development and application of guideline values for groundwater was issued during January 2017, although a finalised version is yet to be issued); and
- Local Authority planning guidance as applicable.

15.1.2 Description of the Study Area

A significant proportion of the proposed Project will be underground, and these underground elements of the proposed Project will be mainly constructed using a TBM with the “cut and cover” method used in some areas. Figures 16.1 and 16.2 in Appendix C provide the bedrock and subsoils in the vicinity of the proposed Project.

The available information indicates that urban soils are present throughout the majority of the proposed Project associated with Dublin City, Dublin Airport and Swords, with some fine loamy drift with limestone present towards the north of the study area (EPA 2018d). Superficial deposits in the study area include alluvium which is anticipated close to river courses, particularly the River Liffey and River Tolka, with glacial deposits and fluvio-glacial deposits (GSI 2018).

Made Ground is anticipated adjacent to the River Liffey where land has been reclaimed from the river. Made Ground is also anticipated within areas associated with existing infrastructure such as roads, railways, buildings and Dublin Airport. A previous desk study undertaken by Jacobs in 2008 'Dublin Metro North Technical Note 023 Desk Study Review' (Jacobs 2008a) identified several small quarries and gravel pits within the study area, including a large limestone quarry (now backfilled) at the proposed Airport station location. It is likely that Made Ground is present at these locations and at other given the history of urban development over much of the proposed Project.

The solid geology of the majority of the study area includes Carboniferous limestones of the Lucan, Tober Colleen, Waulstortian and Malahide Formations. The Lucan Formation is present from the south of the study area up to near the airport and comprises dark grey to black fine grained, occasionally cherty micritic limestones. The Tober Colleen and Waulstortian Formations are present around the airport and consist of calcareous mudstones with subordinate thin micritic limestones, and massive unsorted lime – mudstone. The Malahide Formation is present to the north of the airport, mainly comprising calcareous shales, siltstones and sandstones with occasional thin limestones. Previous ground investigations in the city centre area (Parsons Brinkerhoff 2007) found depth to bedrock to be between 5 and 15m with local variations. A pre-glacial channel crosses the proposed Project east to west to the north of and sub-parallel to the River Liffey. This channel is infilled with mainly granular and some cohesive deposits of glacial origin varying in thickness to in excess of 30m (Parsons Brinkerhoff 2007).

15.2 Baseline Information

15.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the proposed Project, particularly towards the northern end, is similar to the previous alignment, and previously gathered information is of use for the proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the proposed Project deviates from the previous alignment. These supplementary sources of baseline information will include:

- Geological Survey of Ireland geological maps and databases;
- Teagasc soil mapping;
- An Foras Talúntais soil and peatland maps;
- Directories of current and historic mining activities (including quarries, pits and mines);
- Sensitive land use designations;
- Local authority records relating to development, land use and industrial licensing;
- Aerial photographs;
- Historical maps; and
- EPA licensing records.

15.2.2 Survey Requirements

To confirm and update the information gathered through the review of existing desktop studies and existing ground investigations, detailed site walkovers of the proposed Project and above ground infrastructure locations will be undertaken. Ground investigations and a groundwater monitoring programme will also be required particularly

where previous investigations have not provided detailed information on ground and hydrogeological conditions (refer to Chapter 14 (Hydrogeology)) and where information on current conditions is required.

15.2.3 Consultation

Consultation on the land, soils and geology impact assessment will be undertaken with the Geological Survey of Ireland and other key consultees. Comments related to land, soils and geology arising during the consultation phases of the proposed Project will be reviewed and considered within the EIAR as relevant.

15.3 Potential Impacts

15.3.1 Potential Construction Phase Impacts

There are a number of potential impacts during the construction phase of the proposed Project. These include:

- Loss of soil cover;
- Soil erosion and compaction;
- Settlement and the stability of both superficial deposits and bedrock geology during earthworks and tunnelling;
- Removal, storage, placement, re-use and disposal of soils, superficial geological deposits and bedrock from earthworks and tunnelling operations;
- Loss of geological heritage and scientific value;
- Risk of encountering previously unidentified contaminated ground, specifically potential human health and environmental impacts arising from the excavation, handling, on-site processing, transport and off-site disposal or recovery;
- Risk of contamination of existing soils and geology by the construction activities such as accidental fuel spills and introduction of new migration pathways (similar risks to groundwater are addressed in Chapter 14 (Hydrogeology)); and
- Impacts on any features of geological or geomorphological interest and importance.

15.3.2 Potential Operational Phase Impacts

The proposed Project will potentially impact on the underlying land, soils and geology through settlement and stability of the superficial deposits and bedrock, and changes in surface water run-off into the soils within above ground sections over the operational life of the proposed Project. Within the tunnelled sections there is the potential for long term alternations in the local hydrogeological regime including depletion of water resources and deterioration of groundwater quality (refer to Chapter 14 (Hydrogeology) for hydrogeological impacts). There is also potential for contamination of soils and groundwater via accidental spillages of fuels or chemicals once the proposed Project is operational.

15.4 Proposed Methodology and Assessment

The assessment of land, soils and geology will be carried out in accordance with the EPA's current guidance documents tailored accordingly based on professional judgement and local circumstance.

In line with EPA guidance the assessment will cover potential impacts on land, soils and geology, and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Assigning the receptor sensitivity;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to avoid and mitigate (reduce) these impacts; and
- Assessing the significance of any residual effects after mitigation.

The land, soils and geology assessment will include the following elements:

- Review of current standards and legislation;
- Identification of land, soils and geology issues relevant to the proposed Project;
- Development of a baseline via review of current soil and bedrock conditions and a detailed review of all available and relevant site investigation data for works undertaken within the area of the proposed Project;
- Identification of sensitive receptors relevant to the proposed Project;
- Assessment of potential impacts of construction activities on the land, soils and geology in and around the proposed Project;
- Assessment of potential impacts of operations on the land, soils and geology in and around the proposed Project; and
- Proposal of appropriate mitigation and monitoring measures and residual impacts, as required.

The results of the assessment and significance of impact will be presented for each identified receptor of interest. Where contaminated land is identified the Conceptual Site Model approach will be used to describe the nature of and relationships between the contamination source, migration pathways and potential receptors, as well as potential mitigation measures to minimise impacts in accordance with relevant EPA guidance.

Mitigation measures will be proposed in the EIAR to minimise the potential impacts. Compliance with these mitigation measures will be required by the appointed contractor to ensure that residual effects on sensitive receptors are minimised.

16. Land Take

16.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts to non-agricultural properties associated with the proposed Project. Agricultural properties will be covered in Chapter 20 (Agronomy). A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on non-agricultural properties as part of the EIA.

16.1.1 Policy, Plan and Guideline Context

The assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11 of this report.

16.1.2 Description of the Study Area

With respect to land take and property impacts, all non-agricultural properties to be acquired on a temporary or permanent basis as part of the proposed Project are considered to be the study area.

16.2 Baseline Information

The proposed Project runs largely under and through the urban and suburban environment of Dublin. It will include a number of underground and above ground stations, as well as intervention / ventilation shafts, a depot and a Park & Ride facility. The proposed Project also includes ancillary elements of infrastructure that will be required by the proposed Project such as grid connections and water connections. The types of properties which will be impacted by the proposed Project include residential, community, and public properties, and will include buildings, land holdings and access routes such as roadways and laneways.

16.2.1 Desktop Study

An initial desktop study has been undertaken in order to identify the properties along the proposed Project. This includes residential, commercial, recreational, community, and public properties, and includes buildings, land holdings and access routes such as roadways and laneways. This has involved review of aerial photography of the proposed Project and obtaining of property information from sources including the Property Registration Authority of Ireland (PRAI), the Ordnance Survey of Ireland and GeoDirectory.

16.2.2 Survey Requirements

Walkover surveys will be carried out as required along the proposed Project in order to identify unregistered properties, and to confirm that the information acquired through the desktop study is accurate.

16.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report.

16.3 Potential Impacts

The main impact to property as a result of the proposed Project will be the temporary or permanent land take as a result of the need to acquire them and in some cases demolish properties which are currently located in areas

directly interacting with the proposed Project. There are two criteria under which impact to property may occur for the purposes of this assessment, namely:

- Impact on property where the use of the property cannot continue; and
- Impact on property where the use of the property can continue during and/or after temporary acquisition, in some cases after temporary disruption.

Impacts to properties will also be considered in other chapters of the EIAR. For example, impacts due to vibration will be assessed in Chapter 8 (Airborne Noise and Vibration), and Chapter 9 (Ground-borne Noise and Vibration). Impacts to properties from dust will be assessed in Chapter 10 (Air Quality). Impacts to the architectural heritage of properties will be assessed in Chapter 22 (Architectural Heritage). Impacts to agricultural properties will be assessed in Chapter 20 (Agronomy).

16.3.1 Potential Construction Phase Impacts

In order to facilitate the construction of the proposed Project, a number of properties will need to be acquired on a temporary or permanent basis and a number of properties will require demolition. This potential impact will be most prominent at locations of above ground features, i.e. stations, intervention / ventilation shafts, Park & Ride locations, portal locations, and the depot location.

In so far as is possible, the proposed Project alignment has been chosen in order to minimise the required land take and, however due to its alignment within a largely urban environment, some permanent property losses are inevitable.

16.3.2 Potential Operational Phase Impacts

Once construction is completed, acquisition will be finalised, compensation paid, and temporary acquisitions reinstated.

16.4 Proposed Methodology and Assessment

It is proposed that the assessment of the impact to properties will be carried out in accordance with the EPA's current EIA guidance documents as listed in Section 3.11 and established best practice and will be tailored accordingly based on professional judgement and local circumstance.

The land take assessment will cover potential impacts to non-agricultural properties and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to mitigate these impacts; and
- Assessing the significance of any residual effects after mitigation.

All properties to be impacted will be listed and assessed individually, with each to be assigned a significance rating based on:

- The type of property;
- The proportion of the property to be acquired;

- Whether the property will be acquired on a temporary or permanent basis; and
- Whether there is a need to demolish any buildings or structures on the property.

17. Material Assets: Traffic and Transport

17.1 Introduction

This chapter describe the scope of work and methods to be applied in the identification and assessment of traffic and transportation effects associated with the proposed Project. The proposed Project is a major public transport project which will deliver many benefits to both the commuting public of Dublin and to the overall economic growth and sustainability of the Greater Dublin Area. As with all major projects of this nature, its construction and operation will have significant impacts in terms of traffic and the general movement of people and goods.

The objective of this section of the Scoping Report is to set out the baseline situation identifying the potential impacts of the proposed Project on traffic and transport during construction and operational phases. On this basis the proposed methodology for measuring these impacts, identifying mitigation measures and, finally, identifying residual effects is outlined.

17.1.1 Policy, Plan and Guideline Context

The traffic and transport assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and:

- Project Ireland 2040: National Planning Framework (NPF) (DHPLG 2018);
- Smarter Travel: A Sustainable Transport Future - A New Transport Strategy for Ireland 2009-2020 (DTTAS 2009);
- The Regional Planning Guidelines (RPGs) for the Greater Dublin Area 2010-2022 (Regional Planning Guidelines Office 2010); and
- Transport Strategy for the Greater Dublin Area 2016-2035 (NTA 2016).

17.1.2 Description of the Study Area

The traffic and transport study area will include the areas affected by the construction and operation of the proposed Project over its full operational length from Estuary north of Swords to Charlemont in south Dublin City. See route map in Figure 1.1.

Furthermore, effects beyond the extent of the proposed Project will also be considered such as those resulting from haul routes used during the construction phase, impacts on traffic and transport networks during the construction phase and the impacts on traffic and transport networks resulting from the provision of park and ride facilities.

17.2 Baseline Information

17.2.1 Desktop Study

Existing traffic impacts and baseline information will be identified and sourced via a desktop study. The latest traffic counts on roads and streets within the study area will be collated and gaps identified where further data needs to be collected.

Haul routes and material management locations will be identified. Station locations will be assessed for access/egress capacity, safety, wayfinding, interchange, etc.

A transport assessment will be undertaken in accordance with Traffic and Transport Assessment Guidelines (NRA 2014a), Project Appraisal in accordance with Department of Transport, Tourism and Sport (DTTAS) Common Appraisal Framework 2016 (DTTAS 2016), and transport modelling using a range of model tools such as the Eastern Regional Model, Saturn, CUBE, TUBA Lingsig, Transyt, etc. which will be used to assess overall project demands/impacts and local project demands/impacts. These tools will also be used to assess local and regional construction impacts and tested with proposed mitigation measures.

As part of the design process construction impact assessment will be undertaken using construction sequencing scenarios which will be developed for the proposed Project to assess impacts on local and wider general traffic, and on the pedestrian and public transport environment. The safety of pedestrians, vulnerable people, cyclists and other non-motorized users will be paramount in designing mitigation measures around construction sites. The maintenance of access for business, emergency access and public transport systems will be given highest priority, in particular the maintenance and safety to people with disabilities.

Where residual impacts remain after mitigation these will be identified.

17.2.2 Survey Requirements

Data collection and future survey needs will be identified over the construction and operational life of the proposed Project. Gaps in currently available data will be filled by undertaking new street surveys during appropriate periods. All future survey requirements will be advised to the client for approval before proceeding. Count data required will include traffic counts including all turning movements, (HGV/LGV/Bus/Car) pedestrian counts, parking and occupancy data, loading and servicing data, street activity data etc.

17.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report. Key consultees are Local Authorities, daa, An Garda Síochána, Irish Rail, Dublin Bus and other public transport services.

17.3 Potential Impacts

17.3.1 Potential Construction Phase Impacts

The nature of the proposed Project will result in the potential for significant impacts on traffic and transport during the construction phase. These impacts may arise due to the occupation of streets for long periods during construction and the requirement for construction haul routes, particularly for the disposal of construction materials.

Disruption as a result of the works is inevitable. However, the scale of the disruption will be dependent on the area in which the work is being undertaken, the construction methodologies adopted, the sequencing of construction activities and duration.

There are a number of key areas, in particular, which need to be addressed and objectives agreed in relation to how the work will be undertaken and what mitigation measures will be required to minimise disruption to all road users, retail/commercial premises and existing services potentially affected by the works. Such areas include Dublin Airport and how the construction traffic will be managed in a way that does not interfere with airport operations.

The following measures will be implemented where feasible:

- **Pedestrians/Mobility Impaired:** Existing levels of service on footpaths and streets maintained in so far as possible for most of the busy shopping periods;
- **Cyclists:** Existing cycle facilities will be preserved except through work sites. Further cycle facilities will be provided or replaced where possible;
- **Buses/Luas/ Iarnód Éireann:** Minimise potential impacts to bus and Luas services.
- **Taxis:** Where it is necessary to move taxi ranks these will be replaced as close as possible to the removed ranks and rank capacity will be retained;
- **General Traffic:** General traffic will be diverted away from work sites and alternative traffic routes identified;
- **Heavy Goods Vehicles:** Haul routes will be identified for HGVs associated with the proposed Project. These routes will be utilised by all HGV delivering or returning from work sites. Mitigation measures associated with these routes will be identified;
- **Shops/Retail premises directly fronting work sites:** Pedestrian walkways to remain open in so far as is possible. Facilities for mobility impaired and the disabled provided and maintained at access points to affected premises. Wheelchair/buggy ramps provided across work sites and at access points to premises. Alternative arrangements for service access provided to retail commercial premises during the course of both enabling and main works, and;
- **Community Facilities:** Access to churches, schools, car parks and other community facilities will be maintained during the construction phase in so far as possible.

17.3.2 Potential Operational Phase Impacts

Operational phase impacts of the proposed Project will be assessed using the NTA's Eastern Regional Model (ERM) for year of opening and future year operations.

These impacts will be identified, and mitigation measures outlined where required. Potential residual operational impacts will also be identified.

17.4 Proposed Methodology and Assessment

The traffic and transport assessment will be carried out in accordance with the EPA guidance as listed in Section 3.11 as well as the following guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance:

- Traffic and Transport Assessment Guidelines (NRA 2014c).

In line with the guidance, the assessment will describe the baseline conditions, determine the likely potential effects associated with the construction and operation of the proposed Project, determine appropriate mitigation and monitoring and define residual effects.

The transport assessment presented in the EIAR be informed by the following:

- Scheme Assessment;
- Scheme Appraisal;
- Construction Impact Assessment;

- Transport Modelling Report; and,
- Scheme Traffic Management Report.

17.4.1 Scheme Assessment

The scheme assessment will be undertaken utilising the NTA ERM. The ERM provides a comprehensive representation of multi-modal travel patterns across the Greater Dublin Area and is a suitable tool for the testing and appraisal of the MetroLink scheme. The ERM considers the following modes and can provide detailed analysis and outputs for the same:

- Public Transport, including: metro; inter-urban rail; sub-urban rail; DART; light rail (Luas); and bus;
- Traffic, including: private car; taxis; and goods vehicles;
- Walking; and
- Cycling.

The assessment will consider the proposed Project Preliminary design and undertake the transport modelling to consider the multi-modal benefits and impacts associated with the proposed Project.

The assessment will consider the following scenarios:

- Base Year;
- Opening Year 2027;
- Design Year 2042 (Opening Year +15); and
- Forecast Year 2057 (Opening Year +30).

The availability of the most recent update of the ERM will determine the base year to be considered, either 2012 or 2016.

In line with the Common Appraisal Framework (DTTAS 2009) Low, Central and High growth rates will be utilised in the modelling to inform the scheme appraisal. The recently published National Planning Framework (DHPLG 2017) and the upcoming Regional Spatial Economic Strategy growth forecasts and targets will also be considered. The forecast growth will be incorporated into the ERM through the Planning Data Adjustment Tool which takes forecast population, employment and education figures and derives trip ends from these which inform the ERM model run. We will liaise with TII and NTA in relation to the use of forecast data as typically the NTA and TII forecasts can differ on quantum and distribution, so agreement will be required.

A Do Minimum scenario will be developed and agreed with the client. As the Do Minimum scenario provides the baseline for establishing the economic, integration, safety, environmental and accessibility impacts of the proposed Project it is important that the Do Minimum is robust and sensible. TII Project Appraisal Guidelines (TII 2016) recommends that the Do Minimum should only consider “committed” schemes rather than “planned” schemes, or else an additional scenario with only “committed” schemes should be included.

The Do Something scenario will be based on the preliminary design of the proposed Project.

The assessment will utilise the comprehensive suite of analysis and appraisal tools in-built in the ERM. Typical analysis and outputs would include:

- Mode share values for all modes;
- Trip length distributions by mode and area;
- Generalised cost changes;
- Public transport boarding, alighting, patronage and interchange between public transport modes;
- Journey times;
- Traffic volumes, network capacity and operations;
- Level of Park and Ride usage and interchange;
- Pedestrian numbers (including anticipated increases to MetroLink Stations); and
- Cycling numbers.

If significant local effects are identified at operational stage by the strategic ERM analysis, additional local micro modelling will be undertaken to further assess the effects and determine appropriate mitigation. The local modelling will likely incorporate LinSig modelling of signalised junctions, PICADY modelling of priority junctions and ARCADY modelling of roundabouts. If further detail is required Paramics or Vissim modelling can be utilised to assess the impacts on complex areas of the network, with Vissim offering the opportunity to model the pedestrian impacts.

17.4.2 Scheme Appraisal

The Appraisal Tools in-built in the ERM were developed to align with the Common Appraisal Framework (DTTAS 2016) criteria for:

- Economy (using TUBA Transport User Benefit Appraisal software);
- Safety (using COBALT road traffic collision appraisal software);
- Physical Activity (World Health Organisation HEAT tool);
- Environment (tailpipe emissions assessment and GIS mapping);
- Accessibility and Social Inclusion (GIS mapping linking transport benefits and areas of deprivation); and
- Integration (Interchange levels between public transport networks and network journey time improvements).

The above appraisal tool outputs will be used, as part of, and to inform, the Scheme Appraisal and Business Case development.

17.4.3 Construction Impact Assessment

The construction traffic impact will be determined and assessed at a strategic and local level. The strategic level construction impact will be undertaken using the road element of the ERM (SATURN model) only for a 2027-year scenario and will identify the potential capacity impacts and re-routing anticipated with the construction stage. It will provide a worst-case scenario as it will not consider destination choice or mode choice implications of potential increased journey times on the road network, assuming a fixed demand on the road network. The strategic assessment will identify the zone of influence of the construction work in terms of the traffic re-assignment and

junction capacity impacts. The routing of HGVs to and from the works area and waste management facilities can also be considered in this assessment.

The local level assessment will consider junctions and areas that are seen to be within the zone of influence of the construction impacts and also are seen to have operational and capacity related impacts in the ERM construction impact model runs. The local modelling will likely incorporate LinSig modelling of signalised junctions, PICADY modelling of priority junctions and ARCADY modelling of roundabouts. If further detail is required Paramics or Vissim modelling can be utilised to assess the impacts on complex areas of the network, with Vissim offering the opportunity to model the pedestrian impacts.

The strategic and local construction impact assessment will be used to identify appropriate mitigation measures to minimise the impact on all modes of travel within the immediate zone of influence.

17.4.4 Transport Modelling Report

A transport modelling report will be provided that incorporates the Scheme Assessment modelling, Scheme Appraisal elements from the ERM appraisal tool and Construction Impact Assessment. This transport modelling report will inform the input to the EIAR.

17.4.5 Scheme Traffic Management Plan

A standalone Scheme Traffic Management Plan (STMP) will be developed as part of the design process which will advance on the detail contained in the transport chapter of the EIAR. The STMP is intended as a guiding plan to manage traffic in Dublin during the proposed Project enabling and main works contracts.

The STMP will include a review and update of the proposed Project construction programme and scheduling, robust traffic modelling of construction and operational impacts from the traffic models; a review of resultant impacts and a series of both strategic mitigation measures and local mitigation measures where impacts are identified as severe.

The STMP will develop mode specific plans as well as general traffic circulation plans and construction vehicle management plans for both the enabling and construction phases. These plans will identify both strategic and where necessary local impacts of the proposed Project construction programme on all traffic modes (including vulnerable modes) as well as on business and commercial activities affected by the programme. Where impacts are classified as severe mitigation measures will be proposed. Where impacts cannot be satisfactorily mitigated the residual impacts will be identified.

The STMP will constitute a live document throughout the life of the proposed Project design, planning and initial operational period.

18. Material Assets: Infrastructure and Utilities

18.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts on infrastructure and utilities associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on utilities as part of the EIA.

18.1.1 Policy, Plan and Guideline Context

The utilities assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11 of this report.

18.1.2 Description of the Study Area

With respect to infrastructure and utilities, the study area will comprise all areas of proposed construction work for the proposed Project including areas where utility and infrastructural diversions are proposed. It will include a number of underground and above ground stations, as well as intervention / ventilation shafts, a depot, and a Park and Ride facility. There are a large number and variety of utility providers and transport infrastructure which traverse the proposed Project including potable water, sewer, storm water mains, electricity, rail and light rail, gas, telecommunications and road infrastructure.

The proposed Project will cross a number of infrastructure elements and utility providers multiple times. For much of the proposed Project, the line will be underground, deeper than the typical depth for infrastructure and utilities. The main interfaces with existing infrastructure and utilities will be in areas where excavation will be required from the surface, or ‘top down’ construction, such as at station locations.

18.2 Baseline Information

18.2.1 Desktop Study

Information has been provided by a number of utility providers and relevant local authorities which details the locations of infrastructure and utilities. Service data gathered through consultation with the relevant service providers as highlighted above, will be obtained for the EIAR which will present the approximate locations of known services at a point in time.

18.2.2 Survey Requirements

Additional survey requirements will be identified following a desktop review of available data. This will include ground investigation surveys and utility surveys.

18.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other key consultees, relevant service and utility providers including Irish Water, Gas Networks Ireland and ESB, and the public. Further details of consultation can be found in Chapter 4 of this report.

18.3 Potential Impacts

18.3.1 Potential Construction Phase Impacts

The main potential construction phase impact will result from the requirement for temporary utility diversion and diversions on existing transport infrastructure.

Potential impacts include:

- Impacts to water, electrical and gas lines;
- Impacts to physical assets used for utility services;
- Discharge to Irish Water network;
- Surface water discharges to combined sewer networks;
- Impacts on receiving waters used for public water supply; and
- Connections required to utility services.

18.3.2 Potential Operational Phase Impacts

The main operational phase impacts will be as a result of additional utility connections and utility diversions. Additional electricity connections will be required to run the rolling stock and power the stations and operational infrastructure. The stations and other infrastructure will also require water supplies and sewage connections. Surface water drainage infrastructure will also be required for the proposed Project. While the proposed Project will enhance the transport infrastructure within the study area it will also require permanent diversions and alterations to the existing transport network.

18.4 Proposed Methodology and Assessment

It is proposed that the assessment of the impact on infrastructure and utilities will be carried out in accordance with the EPA's current EIA guidance documents as listed in Section 3.11 and established best practice, and will be tailored accordingly based on professional judgement and local circumstance.

The assessment will cover potential impacts on infrastructure and utilities and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. The impact assessment process will involve:

- Identifying the infrastructure & utility connections and diversions required;
- Identifying and characterising the magnitude and significance of any potential impacts;
- Incorporating measures to mitigate these impacts; and
- Assessing the significance of any residual effects after mitigation.

This section of the EIAR will provide a description of the existing major infrastructure and utilities in the area, and a statement of the likely significant effects associated with both the construction and operational phases of the proposed Project. Measures to mitigate the likely significant impacts of the proposed Project will be proposed, and residual impacts described.

19. Material Assets: Resource and Waste Management

19.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts with respect to resource and waste management associated with the proposed Project. This will be an important aspect of the EIAR due to the volumes of material which will need to be managed throughout the construction of the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project on waste as part of the EIA.

19.1.1 Policy, Plan and Guideline Context

The resource and waste management assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and:

- The EU Waste Framework Directive (2008/98/EC);
- Waste Management Act 1996 (No. 10 of 1996) as amended;
- Eastern – Midlands Region Waste Management Plan 2015-2021 (DCC 2015);
- A Resource Opportunity – Waste Management Policy in Ireland (DECLG 2012);
- Towards a Resource Efficient Ireland (EPA 2014);
- EU Construction and Demolition Waste Management Protocol (European Communities 2016); and
- National Hazardous Waste Management Plan 2014-2020 (EPA 2014b).

19.1.2 Description of the Study Area

The study area for the purposes of resources and waste management is the footprint of the proposed Project including associated soil storage areas and compound sites. The study area also expands to the wider Eastern – Midlands area (and beyond if required) for the purposes of identifying suitable materials and waste management facilities and locations. The assessment will encompass all materials and waste generated as a result of the proposed Project. Appendix C Figure 20.1 shows active quarries, landfills and soil recovery facilities in close proximity to the proposed Project.

The majority of the waste to be produced by the proposed Project will be through the excavation of the tunnels, underground stations and open cut. It is anticipated that the majority of this will be clean, uncontaminated soil and stone material, which will be suitable for reuse, recycling or recovery. However, there may be areas of contaminated land in which excavation will be required, which will not be suitable for reuse, and will require handling and disposal in accordance with current legislative requirements and best practice.

19.2 Baseline Information

19.2.1 Desktop Study

A desktop study will be undertaken to identify materials and wastes that potentially require management as a result of the proposed Project. This includes the identification of suitable re-use opportunities for the materials (as a by-product) as well as waste management facilities licensed by the EPA and facilities holding waste facility

permits or certificates of registration from Local Authorities. Documentation pertaining to the above-mentioned facilities will be studied to estimate capacity and usability of the facility for the proposed Project.

19.2.2 Survey Requirements

Sufficient information will be obtained from desktop studies and surveys completed for other chapters e.g. ground investigations to inform the assessment.

19.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with statutory consultees (prescribed bodies), other stakeholders (including waste management facilities) and the public. Further details of consultation can be found in Chapter 4 of this report.

19.3 Potential Impacts

19.3.1 Potential Construction Phase Impacts

Material will be generated through excavation of the tunnels, underground stations and portals. Preliminary estimates are that the proposed Project will generate approximately two million cubic metres. Potential impacts during construction include:

- Production of large quantities of spoil material arising from excavation of material which are unsuitable for reuse within the proposed Project, or are surplus to demand;
- Excavation of possible contaminated soils and materials, which would require disposal off site at a suitably licensed facility; and
- Spoil material generation from construction may cause a number of direct and indirect impacts on other environmental topics such as air quality (dust, odours), traffic, noise, water, health, etc.

19.3.2 Potential Operational Phase Impacts

It is envisaged that, once the proposed Project is operational, the only waste types expected to be developed are quantities of mixed municipal waste, mixed dry recyclables, and food waste from public and staff areas of the stations and infrastructure, as well as waste associated with maintenance activities at the depots, stations and tunnels. The operational phase waste will be insignificant in comparison to the likely construction phase waste quantities.

19.4 Proposed Methodology and Assessment

It is proposed that an assessment of materials and waste generation will be carried out in accordance with the guidance documents as listed in Section 3.11, as well as the below listed guidance and established best practice, and will be tailored accordingly based on professional judgement and local circumstance. Guidance documents to be used will include:

- The Management of Waste from National Road Construction Projects (TII 2017a);
- Guidance on Soil and Stone By-products in the context of article 27 of the European Communities (Waste Directive) Regulations 2011 (EPA 2019);

- Best Practice Guidelines on the Preparation of Waste Management Plans for Construction and Demolition Waste Projects (DoEHLG 2006); and
- CIRIA publication 133 Waste Minimisation in Construction (CIRIA 1997).

This assessment will cover potential impacts with respect to resource and materials / waste management and will describe the existing conditions and the likely potential effects associated with the construction and operation of the proposed Project. The assessment process will aim to identify and quantify the following:

- The types and quantities of materials required for the proposed Project;
- The quantities of material to be generated during the construction and operational phases of the proposed Project;
- The types and quantities of waste arising from the proposed Project, including the identification of any potential hazardous wastes;
- Opportunities for re-use of materials within the proposed Project;
- Opportunities for waste prevention measures;
- Waste requiring treatment and/or disposal off site;
- The impacts that will arise in relation to the generation, re-use and disposal of materials and waste;
- Measures to mitigate and monitor these impacts; and
- Significance of any residual effects after mitigation.

The assessment will identify whether impacts are positive or negative, permanent or temporary, and direct or indirect. Professional judgement will be used with regard to assessing significance of resource and waste management effects, taking into account the volumes of materials used and the properties of any wastes. The assessment criteria used will be as per the EPA guidance as laid out in Table 3.1.

20. Agronomy

20.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of impacts with respect to agriculture associated with the proposed Project. It includes individual land parcels and farm holdings supporting a variety of enterprises. The Agronomy assessment considers agricultural land which has been identified as likely to be affected within the study area.

An agronomy assessment will be conducted to identify the potential impacts of the proposed Project on the agricultural environment with an aim to:

- Identify the relevant land use receptors which could potentially be impacted by the proposed Project;
- Evaluate potential construction and operational phase impacts and identify those impacts which may lead to significant effects; and
- Propose mitigation and monitoring measures to mitigate any potential effects.

20.1.1 Policy, Plan and Guideline Context

The agronomy assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and;

- Guide to Process and Code of Practice for National Road Project Planning and Acquisition of Property for National Roads (NRA 2003);
- Census of Agriculture (CSO 2010); and
- Irish Soil Information System. Soils and Subsoils digital data from Environmental Protection Agency (Teagasc and EPA 2015).

20.1.2 Description of the Study Area

The Agronomy assessment will consider all agricultural land or zoned land in agricultural use along the alignment of the proposed Project. The study area extends from Estuary north of Swords to south Dublin City. The study area is mainly urban and suburban with agricultural land located to the north of the study area in Dardistown, Fosterstown, and Estuary. County Dublin is the only county that is impacted by the proposed Project. Appendix C Figure 19.1 is a map of CORINE land cover in the vicinity of the proposed Project.

To fully consider the potential effects of this proposed Project on agriculture, the agronomy study area will take the total affected land parcel of the agricultural holdings into consideration.

20.2 Baseline Information

An initial desktop review of publicly available data has been used to provide preliminary information on the baseline conditions focusing on farm size and soil type.

County Dublin has 37,963 hectares of utilisable agricultural area (excluding commonage) (CS0 2010). This represents approximately 0.80% of the national agriculture land area. There are 798 farms in County Dublin with an average farm size of 47.57ha. This is considerably higher than the national average of 32.7ha. The soil type is predominately fine loamy drift with limestone. The topography within the study area is gently flat to undulating lowland. The land quality in the area is considered good with the land elevations mostly below 100m above

ordnance datum. Agriculture in this area is intensive in nature due to the relatively high quality of the soil, enabling all the main farm enterprises to be undertaken.

20.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the currently proposed Project, particularly towards the northern end of the scheme, is similar to the previous alignment, and, as such some of the previously gathered information is of use for the current proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information, particularly in areas where the proposed Project deviates from the previous scheme.

An assessment of the existing agricultural environment will be carried out through a desktop survey of available mapping. This mapping will include a study area outline for the entire alignment of the proposed Project and orthophotography mapping with indicative landownership information. The study area consists of the entire land parcel for each of the effected agricultural land parcels.

20.2.2 Survey Requirements

Field visits and farm assessments will be undertaken for all the agricultural land holdings to be impacted by the proposed Project. The surveys will consist of detailed farm surveys and walkover surveys of the land holdings.

20.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with prescribed bodies, other consultees and the public. Further details of consultation can be found in Chapter 4 of this report. Consultation will also be undertaken with Bord Bia, The Department of Agriculture Food, and the Marine, The Agricultural Consultants Association, The Irish Farmers' Association, Teagasc, and Landowners.

20.3 Potential Impacts

20.3.1 Potential Construction Phase Impacts

Construction impacts are those which might occur at individual farm level during the construction phase of the proposed Project. Each infrastructural project has the potential to give rise to a variety of impacts during the construction phase. Agronomy impacts during construction will be associated with the above ground works of the proposed Project including locations of the intervention and ventilation shafts, above ground rail line sections, the depot location, park & ride location and construction works areas. The construction of the proposed Project adjacent to, at the margins of or through agricultural land, would be likely to have the following construction phase impacts:

- Temporary loss of use of land adjacent to the construction site;
- Temporary loss of services (for example water, power, etc.);
- Nuisance caused by increased traffic volume due to construction;
- Nuisance caused by noise emanating from the construction site;
- Nuisance caused by dust emanating from the construction site;
- Impact on animal shelter;
- Disturbance to farm operations;

- Interruption to drainage systems; and
- Restriction on use of land for specialist crop production or animal husbandry adjacent to construction site.

20.3.2 Potential Operational Phase Impacts

As the majority of the proposed Project will be underground the operational impact on agriculture will be limited. Permanent land take will be required for above ground sections of the proposed Project and associated infrastructure. The following potential impacts are of relevance to this proposed Project:

- Permanent loss of agricultural land;
- Possible severance of land with an interruption of access to possible severed lands; and
- Injurious affection to the retained land e.g. restriction of the use potential of retained lands this can arise where the user of the new infrastructure might suffer risk or damage from activities traditionally carried out on remote farmland, e.g. spraying or some harvesting activities.

20.4 Proposed Methodology and Assessment

It is proposed that an assessment of agronomy will be carried out in accordance with the EPA guidance as listed in Section 3.11, as well as the Environmental Impact Assessment of National Road Schemes - A Practical Guide (NRA 2008b).

In line with the above guidance, the assessment will cover potential impacts on agronomy and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. It will be tailored specifically to this proposed Project based on professional judgement and local circumstance.

The impact of the proposed Project on individual farm holdings will be assessed by undertaking meetings and walkover surveys with the landowners, and discussed in terms of land take, the degree of severance, types of farm enterprise, impact on farm buildings, impact on shelter, and disturbance during works.

The impact assessment process will involve:

1. Assigning the agricultural receptor sensitivity;
2. Identifying and categorising the magnitude and duration of the impacts;
3. Identifying the significance of impacts; and
4. Defining Mitigation and Monitoring Measures

21. Cultural Heritage: Archaeology

21.1 Introduction

This chapter describes the scope of works and methods to be applied in the identification and assessment of archaeological and cultural heritage impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project as part of the EIA.

21.1.1 Policy, Plan and Guideline Context

The assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and the:

- National Monuments Acts 1930 to 2014;
- Heritage Acts 1995 to 2018;
- Frameworks and Principles for the Protection of the Archaeological Heritage (Department of Arts, Heritage, Gaeltacht and Islands (DAHGI) 1999);
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 (No. 19 of 1999) and the Local Government (Planning and Development) Acts 2000 to 2016;
- Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (now the Minister of Culture, Heritage and the Gaeltacht) and Transport Infrastructure Ireland, July 2017 (National Monuments Service (NMS) 2017); Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes (NRA 2005a); and
- Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes (NRA 2005b).

21.1.2 Description of the Study Area

A study area of 250m will be assessed where the proposed Project (including stations) is located above ground within greenfield areas. An area of 100m will be assessed at the location of proposed stations where they are located in urban areas and where the proposed Project is confined to a tunnel. All associated works, including proposed works areas, utility diversions and landscaping, will be assessed (250m study area in greenfield areas, 100m in urban areas). Appendix C Figure 21.1 shows all Recorded Monuments (RMP) in the vicinity of the proposed Project.

The proposed Project will travel within the vicinity of a number of RMP sites with the central section running through Dublin City, which itself is an RMP site (Ref.: DU018-020: historic town). Key archaeological and cultural heritage sites within the vicinity of the proposed Project include St Stephen's Green Park (RMP Ref.: DU018-020334) and the Parnell Monument (RMP Ref.: DU018-425), both of which are National Monuments. Under Saint Stephen's Green (Dublin) Act 1877 St Stephen's Green Park is subject to its own special statutory regime.

The section of the proposed Project through the centre of Dublin City will be tunnelled. However, three stations are required for the proposed Project, which are located within the zone of archaeological potential for the 'historic town' (RMP Ref.: DU018-020). The overall zone of potential for the RMP is large in scale and contains 100s of individually recorded sites, which are also included in the RMP. A number of these RMP sites are located within the vicinity of the proposed stations.

The proposed Tara Street Station incorporates the site of a church and a hospital (RMP Ref.: DU018-020648 and RMP Ref.: DU018-020061). Both of these constraints have been the subject of archaeological investigations (preservation by record), and the sites are now occupied by modern office and apartment blocks.

The proposed St Stephen's Green Station will be located in the vicinity of St Stephen's Green Park is a National Monument (RMP Ref.: DU018-020334).

21.2 Baseline Information

21.2.1 Desktop Study

The archaeological and cultural heritage section of the EIAR will incorporate the results of a detailed desktop study. This will include a review of all available cartographic and historical sources, in addition to a review of the results of archaeological investigations previously undertaken within the study area of the proposed Project.

The archaeological and cultural heritage section of the assessment will identify all known cultural heritage constraints that are afforded statutory protection. In addition, any sites of archaeological and cultural heritage merit within the study area of the proposed Project will also be considered and assessed. It will consider the direct and indirect effects likely to arise from either the construction or operational phases of the proposed Project.

21.2.2 Survey Requirements

An Archaeological Geophysical survey and archaeological testing of a significant portion of the proposed Project was undertaken as a component of works associated with the planning and development of the "Old" Metro North scheme.

Some additional land acquisition is required for this proposed Project and as such a programme of additional archaeological geophysical survey will be carried out in order to inform the baseline environment. Pending the results of the geophysical survey, and in consultation with the TII Project Archaeologist and the National Monuments Service of the Department of Culture, Heritage and the Gaeltacht (DCHG), targeted archaeological test excavations of these additional lands may also be undertaken.

21.2.3 Consultation

In compliance with the Code of Practice for Archaeology agreed between the Minister for Arts, Heritage Regional, Rural and Gaeltacht Affairs (now Minister for DCHG) and TII; TII will consult with the Minister (through the National Monuments Service of the Department) on all aspects of MetroLink.

TII will also consult with the National Museum of Ireland and the Office of Public Works as part of the EIA process.

21.3 Potential Impacts

21.3.1 Potential Construction Phase Impacts

It is possible that ground disturbances associated with the proposed Project may have both a direct and indirect negative impact on archaeological and cultural heritage constraints within the study area. Direct impacts are likely to arise from ground disturbance activities associated with construction of the proposed Project. Indirect impacts may include both landscape & visual impacts on archaeological and cultural heritage sites and potential impacts on sites arising from settlement and vibration.

Throughout the course of the EIA process likely significant effects will be identified and appropriate mitigation measures will be devised in order to ameliorate these impacts. Mitigation measures will, where possible, seek

avoidance by design (i.e. preservation in situ). Preservation by record (in whole or in part) will be undertaken where it is agreed with the National Monuments Service of DCHG.

21.3.2 Potential Operational Phase Impacts

It is possible that during the operational phase of the proposed Project there may direct and indirect negative impacts on archaeological and cultural heritage constraints within the study area. Potential direct and indirect impacts may arise due to landscape and visual impacts on sites of archaeological and cultural heritage merit. Furthermore, such sites could also be subject to impacts due to vibration due to the operation of the proposed Project.

21.4 Proposed Methodology and Assessment

The assessment will adopt the following approach in accordance with the 'Guidelines for the Assessment of Archaeological Impacts of National Road Schemes' (NRA 2005a).

An assessment of the impact of the proposed Project will include a comprehensive assessment of the potential direct, indirect, residual and cumulative impacts of the proposed Project. This will include, where applicable, visual impacts on archaeological and cultural heritage constraints.

A systematic search will be undertaken of all readily available and relevant documentary sources.

These will include, but are not exclusive to the:

- Record of Monuments and Places for County Dublin;
- Sites and Monuments Record for County Dublin;
- National Monuments in State Care Database;
- Monuments subject to Preservation Orders;
- Register of Historic Monuments;
- Topographical files of the National Museum of Ireland;
- Cartographic and written sources relating to the study area;
- Place names analysis;
- Dublin City Industrial Heritage Survey, and
- Database of Irish Excavations (1970-2017).

The desktop assessment will be followed by a field inspection of the proposed Project. The field survey will confirm the accuracy of the information collected during the desktop study and will also assess any additional previously unrecorded sites of archaeological and cultural heritage merit, which could be significantly affected by the proposed Project.

The assessment will also be informed by a programme of archaeological geophysical survey and if deemed appropriate targeted archaeological test excavations. In addition, the results of the archaeological monitoring of Geotechnical Investigations and Utility Slit trenches, will also be utilised as part of the assessment.

Where potential impacts are identified, measures to mitigate and monitor these impacts will be outlined, and the significance of any residual effects after mitigation will be assessed.

22. Cultural Heritage: Architectural Heritage

22.1 Introduction

This chapter describes the scope of works and methods to be applied in the identification and assessment of architectural heritage impacts associated with the proposed Project. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake a detailed assessment of the impact of the proposed Project as part of the EIA.

22.1.1 Policy and Plan Context

The architectural heritage assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and:

- National Monuments Act 1930 to 2014;
- The Planning and Development Acts 2000 to 2017;
- Heritage Acts 1995 to 2018;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act 1999 (S.I. No. 19 of 1999);
- Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs (now the Minister for Culture, Heritage and the Gaeltacht) and Transport Infrastructure Ireland, July 2017 (NMS 2017);
- Guidelines for the Assessment of Archaeological Heritage Impacts of National Road Schemes, 2005 (NRA 2005a);
- Guidelines for the Assessment of Architectural Heritage Impacts of National Road Schemes, 2005 (NRA 2005b);
- Historic Street Surfaces in Dublin: Conservation Study and Guidance Document (2008);
- Paving: The Conservation of Historic Ground Surfaces (2015); and
- Architectural Heritage Protection Guidelines for Planning Authorities (DoEHLG 2004; DAHG 2011).

22.1.2 Description of the Study Area

In accordance with the NRA guidelines (NRA 2005a), a study area of 50 metres on either side of the centre line will be assessed, though professional judgement will be used to decide where this should be extended. An area of 100m will be assessed at the location of proposed stations. Appendix C Figure 22.1 shows all National Inventory of Architectural Heritage (NIAH) sites as well as Architectural Conservation Areas in the vicinity of the proposed Project. A Record of Protected Structures (RPS) is also available in Figure 22.1 with data available only as far as Charlemont Station.

In the northern part of the proposed Project, where it is to run above ground there is a small number of individual buildings and other structures of architectural heritage significance. Within the Dublin City area the proposed Project will pass beneath, or close to, large numbers of buildings dating from the eighteenth and nineteenth centuries, many of which are protected structures, while others, though not protected, may be of some heritage

significance. The proposed Project will also pass beneath Conservation Areas (CAs), including Architectural Conservation Areas (ACAs), and the city's Georgian core. The above ground section will run close to protected structures and conservation areas within the city area. Key architectural sites within the vicinity of the proposed Project include many eighteenth-century buildings in the city centre.

22.2 Baseline Information

22.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the "Old" Metro North scheme in 2008. Much of the currently proposed Project, particularly towards the northern end of the scheme, is similar to the previous alignment, and, as such some of the previously gathered information is of use for the current proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the currently proposed Project deviates from the previous scheme.

The architectural heritage section of the assessment will be undertaken with the aid of a desktop study of available data to identify key built heritage receptors that may be affected by the development of the proposed Project. It will consider the likely direct and indirect effects from construction and operation of the proposed Project.

22.2.2 Survey Requirements

The architectural heritage assessment will draw upon information gathered as part of the surveys and assessments undertaken for other disciplines, such as the landscape and visual assessment, and settlement and vibration assessments having regard to building surveys where required.

22.2.3 Consultation

The Architectural Advisory Unit of the Department of Culture, Heritage and the Gaeltacht, the Office of Public Works, the Dublin City Architectural Conservation Officer and the Conservation Officer in Fingal County Council will be consulted as part of the assessment.

22.3 Potential Impacts

22.3.1 Potential Construction Phase Impacts

It is possible that buildings or other structures of architectural heritage merit may be impacted directly by the proposed works through demolition of all or part of the structure or through incursion into the curtilage of the structure. In other instances, the settings of buildings or other structures of architectural heritage merit may be affected by the works. The boring of tunnels to facilitate the proposed Project may lead to damage through settlement or vibration, particularly where older buildings are not in good condition.

Through the course of the assessment (including additional survey works) potential impacts will be identified and mitigation and monitoring measures will be proposed in order to minimise potential impacts.

22.3.2 Potential Operational Phase Impacts

It is possible that the operation of the proposed Project may result in indirect negative visual impacts upon the architectural heritage resource within the receiving environment and possible impacts through vibration. These elements of the proposed Project will be amongst those included in the impact assessment.

22.4 Proposed Methodology and Assessment

The assessment of the impact of the proposed Project will include a comprehensive assessment of the potential direct, indirect, residual and cumulative impacts of the proposed Project. This will include consideration of impacts on architectural heritage assets arising under other headings such as landscape and visual, vibration and as a result of settlement.

A systematic search will be undertaken of all readily available and relevant documentary sources. These will include, the following, amongst other sources:

- National Inventory of Architectural Heritage: Building and Garden Surveys;
- Irish Architectural Archive;
- The Record of Protected Structures;
- Cartographic and written sources relating to the study area; and
- Relevant ACA documentation.

The desktop assessment will be followed by a field inspection of the proposed Project. The field survey will confirm the accuracy of the information collected during the desktop study and will also assess any additional previously unrecorded features of architectural heritage merit, which could be significantly affected by the proposed Project.

Potential impacts of the proposed Project on architectural heritage will vary according to the nature of the affected site or structure. In a small number of instances there may be a direct impact up to and including. In these cases, the impact is to be assessed on the basis of the significance of the affected site or structure, the extent of the impact, the possibility of alternatives and the balance between the resulting gains and losses. Direct impacts can also include possible damage to a structure through vibration and settlement either during construction or during the operational phase and similar criteria would be used. Indirect impacts on the historic built environment would normally be effects on the setting of the site or structure and assessment would take into account the significance of the site or structure, the extent of the impact on the setting and potential mitigation measures.

23. The Landscape

23.1 Introduction

This chapter describes the scope of works and methods to be applied in the identification and assessment of landscape and visual impacts associated with the proposed Project. The Landscape and Visual Impact Assessment for the proposed Project will consider:

- Landscape character and resources, including the effects on aesthetic values of the landscape / townscape that may be caused by changes in the landscape elements, character and quality as a result of the proposed Project; and

- The visual environment and amenity, including effects on potential viewers and groups of viewers which are caused by change in the appearance of the landscape resulting from the proposed Project.

23.1.1 Policy, Plan and Guideline Context

The landscape and visual assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11. Any specific landscape designations and Protected views and Prospects will be identified as well.

23.1.2 Description of the Study Area

The study area will vary in width, depending on the potential visibility of the proposed Project from adjacent areas. In built-up areas this may be limited to the near edge of buildings on either side of the proposed Project, potentially extending further afield in more open landscape where longer distance views are possible and / or where the scale of particular aspects of the proposed Project warrant it.

For the proposed underground section, impacts on the baseline landscape are expected to be limited to the construction and operation of the proposed Project in respect of surface penetrations, such as the buildings housing access elevators, lifts, etc. (at underground stations), tunnel portals and vent/emergency access shafts. Description of the baseline landscape in this section will concentrate on the more localised areas around these surface penetrations. The at-grade sections are largely located across open land (including farmland) alongside existing roads etc. and the baseline for these sections will be described for a broad landscape corridor centred on the proposed Project alignment. The baseline for elevated sections along the proposed Project will be as for the at-grade sections but potentially extending further afield to allow for an extended zone of visual influence related to the increased height above ground. For both the at-grade and elevated sections, the potential for impact upon more distant views (e.g. at Dardistown and at the Estuary park and ride) will need to be considered within the existing broader and more open green landscape context than would be expected for the urban and suburban landscapes south of the M50 motorway – the baseline for these will be extended to cover a broader range.

23.2 Baseline Information

23.2.1 Desktop Study

Extensive investigation and assessment was undertaken to inform the EIS for the “Old” Metro North scheme in 2008. Much of the currently proposed Project, particularly towards the northern end of the scheme, is similar to the previous alignment, and, as such some of the previously gathered information is of use for the current proposed design. This pre-existing information will be supplemented by a review of all currently available desktop study information particularly in areas where the currently proposed Project deviates from the previous scheme.

The Development Plans for Fingal, Dublin City and Dún Laoghaire - Rathdown will be reviewed regarding their landscape character assessments and scenic routes. An initial desktop study will use existing satellite imagery / photography, existing online facilities such as Google Streetview etc., and a variety of historic and Ordnance Survey mapping to outline the existing landscape character adjacent to the proposed Project alignment and the local landscape character associated with proposed station locations.

The preliminary design drawings will be assessed in outline to determine the scale and potential magnitude of impact of the various elements of the proposed Project and this is set against the degree of potential visibility from adjacent areas in order to identify key potential visual impacts.

23.2.2 Survey Requirements

Multiple baseline photographs will be taken as part of the on-site survey process in order to ensure comprehensive photographic coverage of the potential future proposed Project within the study area and to provide a range of viewpoint options from which the most impactful views can be selected.

In addition to the photographic survey, a tree survey will be undertaken. Existing trees, groups of trees and hedgerows will be surveyed in respect of location, height, crown spread, stem diameter / circumference and estimated root-zone. The overall arboricultural impact is assessed at this point and information on retained or removed trees is provided for consideration within the landscape impact assessment and for inclusion in the photomontages being prepared for the visual impact assessment.

23.2.3 Consultation

Apart from the required statutory consultations, each of the two relevant Local Authorities will be consulted specifically in respect of the selection of viewpoints for photomontage illustration. The Office of Public Works will also be consulted with regarding specific areas such as St Stephen's Green. This will assist in identifying key views and protected views and prospects, over and above those already identified within the current respective development plans for each Local Authority area.

23.3 Potential Impacts

North of Beechwood and south of Ballymun, the proposed Project is largely underground and where this is so, a significant portion of the tracks, rolling stock, station platforms etc., will not be visible at ground level. The system is likely to manifest itself on the surface in a relatively subdued manner, at points along the proposed Project alignment of the underground section. Above ground sections north of Ballymun, namely bridging over the M50 and from north of the airport to Estuary will have more potential for more significant landscape and visual effects.

23.3.1 Potential Construction Phase Impacts

The proposed Project is likely to generate a wide variety of construction impacts which will create short term effects upon the existing landscape and visual environment. These will include impacts arising from:

- Site preparation works and operations;
- Site infrastructure and vehicular access;
- Site construction and diversion signage;
- Erection of tree protection and maintenance measures, including fencing;
- Removal of trees and vegetation;

- Removal of pavings and site furniture;
- Temporary compounds, hoardings etc.;
- Temporary site buildings (including office accommodation);
- Temporary site lighting;
- Site excavations, earthworks and tunnelling;
- Construction traffic, dust and other emissions;
- Materials storage areas (including spoil);
- Piling rigs, cranes and scaffolding; and
- Haulage and delivery vehicles.

23.3.2 Potential Operational Phase Impacts

Potential long term to permanent landscape and visual impacts may arise during the operational phase of the proposed Project due to:

- The Park and Ride facility at Estuary, north of Swords;
- Each of the station buildings and ancillary elements;
- Elevated section(s) of track, the structure(s) supporting it and associated system infrastructure;
- Constructed portals between surface level and underground sections;
- Above ground sections of track and associated system infrastructure;
- The depot at Dardistown;
- Approach ramps, the bridge carrying track and associated system infrastructure over the M50; and
- Ventilation and access shafts.

23.4 Proposed Methodology and Assessment

The landscape and visual impact assessment will be based on the EPA guidance as listed in Section 3.11, as well as the following guidelines:

- Guidelines for Landscape and Visual Assessment (GLVIA-2013) published by the Landscape Institute and Institute of Environmental Management and Assessment.

In line with the above guidance, the assessment will cover potential impacts from a landscape and visual perspective and will describe the existing conditions and the likely potential impacts associated with the construction and operation of the proposed Project. In order to assess potential effects of the proposed Project, the baseline will need to be defined based on data collection, research and photographic surveying as outlined in Section 23.2. A number of photomontages will be created based on the photographic survey and proposed Project design. Appraisal of the effects to the baseline by the proposed Project will involve:

- Description of the geographic location and landscape context of the proposed Project;
- General landscape description concerning essential landscape character and salient features of the study area;
- Discussion of any design guidance as well as the planning context and relevant landscape designations;
- Appraisal of the significance of predicted landscape impacts (physical impacts on landform and land cover as well as impacts on landscape character). This will be done using professional judgement and in accordance with the guidelines (GLVIA-2013). Significance is determined on balance of receptor sensitivity versus the magnitude of landscape impacts;
- Appraisal of predicted visual impacts using mapping and the photomontages. This will be done using professional judgement and in accordance with the GLVIA-2013 guidance. Significance is determined on balance of receptor sensitivity versus the magnitude of visual impact;
- Description and discussion of proposed mitigation measures;
- Appraisal of residual landscape and visual effects following the implementation and establishment of mitigation measures; and
- Appraisal of cumulative effects in relation to any existing or future developments within the study area that might be relevant to the proposed Project.

24. Risk of Major Accidents and Disasters

24.1 Introduction

This chapter describes the scope of work and methods to be applied in the identification and assessment of the effects on the environment arising from the vulnerability of the proposed Project to the risk of major accidents and disasters. A high-level overview of the baseline conditions is included, together with the proposed methodology and a scope of work likely to be required to undertake such an assessment of the proposed Project.

24.1.1 Policy, Plan and Guideline Context

The assessment will require a comprehensive policy, plan and strategy review, including (but not limited to) the documents listed in Section 3.11, and the EIA Directive (2014/52/EU) lists the factors which must be assessed with respect to environmental impact in Paragraph 1. Paragraph 2 of Article 3 states:

'The effects referred to in paragraph 1 on the factors set out therein shall include the expected effects deriving from the vulnerability of the project to risks of major accidents and/or disasters that are relevant to the project concerned.'

Annex III of the directive lists the characteristics of a project to be considered as part of the EIAR, including:

'(f) the risk of major accidents and/or disasters which are relevant to the project concerned, including those caused by climate change, in accordance with scientific knowledge.'

24.1.2 Description of the Study Area

The study area for the purposes of identifying risk of major accidents and disasters is the proposed Project extent, the areas surrounding the proposed Project, as well as any haul routes to and from the proposed Project during the construction phase. The assessment will review the current risk profile with respect to natural disasters, transportation accidents, construction accidents, and security. Regard will also be had to sites that have potential for major accident hazard under the Chemical Act (Control of Major Accident Hazards involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015).

Ireland does not tend to experience many of the most destructive types of natural disasters that are seen in some other countries. Ireland is volcanically inactive, relatively stable seismically, and does not tend to experience frequent destructive weather events such as hurricanes or tornadoes. The most common type of natural disaster which is experienced in Ireland is flooding. Dublin has experienced a number of significant flood events over the last decade, both of a fluvial and coastal nature. Flood risk assessment for the proposed Project will be presented in the EIAR.

With respect to the railway safety baseline for Ireland, the Commission for Railway Regulation (CRR) is responsible for regulating Ireland's railways. According to the latest Railway Safety Performance in Ireland Report (CRR 2017), there were no major accidents or fatalities recorded in 2016 (the last year reported on), except for incidences of apparent self-harm. This was true across all railway types for which the CRR are responsible, namely heavy rail, light rail, public highway interfaces with industrial rail systems, and heritage railways. However, consideration will be taken with regard to rail services such as metro, that will bring a much more intense rail service and associated infrastructure to that currently operating. According to the Railway Safety in the European Union Safety Overview 2017 Report (European Union Agency for Railways 2017), Ireland has reported a zero passenger fatality risk for the whole ten year reporting period from 2006 to 2015. With respect to road safety, Ireland is currently ranked 4th safest EU country and is targeting a further 22% reduction in road deaths by 2020.

With respect to current safety trends in the construction sector, the HSA publishes annual statistics in their Summary of Workplace Injury, Illness and Fatality Statistics report (HSA 2017). The most recent of these was published in 2017 and provides statistics for the period of 2015-2016. In 2016, the construction sector reported the second highest number of fatalities after the agriculture, forestry and fishing sector, with nine fatalities recorded. In 2016 there were also 601 reported injuries related to the construction sector. Since 2009, there have been 69 fatalities recorded in the construction sector.

With respect to Ireland's safety and security, the threat of terrorism is categorised as possible but unlikely. Ireland is ranked 10th place on the Global Peace Index 2018, and 6th in Europe. This is an annual ranking of 163 independent states and territories based on 23 qualitative and quantitative indicators including relations with neighbouring countries, role in conflicts, political instability, level of perceived criminality, level of violent crime, impact of terrorism, and ease of access to small arms.

24.2 Baseline Information

Baseline information for the purposes of this assessment will be largely informed by the other chapters, in particular climate, population and human health, socio-economics, biodiversity, traffic and transport, hydrology, hydrogeology, and land, soils and geology.

24.2.1 Desktop Study

The assessment will be entirely desk-based, with the other assessments being carried out as part of the EIA to inform the assessment of risk to the environment as a result of accidents or disasters. Documentation will be reviewed including:

- National Risk Assessment 2017 Overview of Strategic Risks (Department of the Taoiseach 2017);
- Guidance on Assessing and Costing Environmental Liabilities (EPA 2014a);
- A Guide to Risk Assessment in Major Emergency Management (DoEHLG 2010);
- Safe Evacuation for All: A Planning and Management Guide (National Disability Authority 2011);
- A Guide to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015) (HSA 2015);
- Railway Safety Performance in Ireland (CRR 2017);
- Iarnród Éireann Safety Report 2016 (Iarnród Éireann 2017);
- European Commission Implementing Regulation 402/2013 (as amended);
- Flood Risk Management Plan: Liffey & Dublin Bay (OPW 2018a);
- Flood Risk Management Plan: Nanny – Delvin (OPW 2018b); and
- A National Risk Assessment for Ireland 2017 (Department of Defence 2017).

24.2.2 Survey Requirements

Sufficient information will be obtained from desktop studies and surveys completed for other chapters to inform the assessment.

24.2.3 Consultation

The development of the EIAR will be informed by comprehensive consultation that will be undertaken with statutory consultees (prescribed bodies), other stakeholders and the public. Specific consultation will be undertaken as required with the following bodies:

- Health and Safety Authority (HSA);
- Office of Public Works (OPW);
- Commission for Railway Regulation (CRR); and
- Major Emergency Planning Units for Dublin City and Fingal.

Further details of consultation can be found in Chapter 4 of this report.

24.3 Potential Impacts

For the purposes of the assessment of risk of major accidents and disasters, the assessment will assume a worst-case scenario.

24.3.1 Potential Construction Phase Impacts

Potential risks during construction in the absence of any mitigation measures that would be reviewed and presented in the EIAR include the following:

- Subsidence during tunnelling which could potentially lead to dangerous road or building conditions;
- Damage to high voltage lines which cross the proposed Project;
- Damage to existing rail lines crossed;
- Fire in any works areas or the tunnels during construction;
- Flooding of the underground works; and
- Road traffic collisions involving construction vehicles or as a result of temporary traffic management measures put in place as a result of construction activities, or vehicular collisions within the construction sites.

24.3.2 Potential Operational Phase Impacts

Key risks during operation of the proposed Project could include:

- Fire within the tunnels, rolling stock or stations;
- Loss of power to the rolling stock causing operation to halt;
- Flooding of tunnels or stations;
- Train derailment or collision;
- Airport accidents; and

- Security incidents occurring on vehicles or at a station.

24.4 Proposed Methodology and Assessment

The methodology will be based on the guidance listed in Section 3.11 and Section 24.2.1. It is proposed that the risk assessment will be carried out in three stages:

- Identification and Screening – identify potential unplanned risks that the proposed Project may be vulnerable to, and screen them with respect to whether they are already addressed elsewhere (e.g. other EIAR chapters, within the design or covered by legislation), or where the incident cannot be plausibly linked to the proposed Project (e.g. volcanic activity).

- Risk Classification – evaluation of each identified risk with regard to the likelihood of occurrence (as per Table 2 of DoEHLG 2010). and the potential impact (as per Table 3 of DoEHLG 2010). As per those tables, the likelihood is ranked from 1 (extremely unlikely) to 5 (very likely), and potential impact is ranked from 1 (minor) to 5 (catastrophic).

- Risk Evaluation – risks will be subject to a risk matrix to determine the level of significance of each risk based on the multiplication of their likelihood and impact rankings, grouped into three categories, high risk (score from 15 to 25), medium risk (score of 8 to 12), and low risk (score of 1 to 6).

Following identification, classification and evaluation of each identified risk; mitigation and monitoring measures will be proposed for any occurrences which are categorised as medium or high risk. New scoring for the likelihood and consequence post-mitigation will be assessed in order to give a post-mitigation score.

25. Interactions

Article 3 Section 1 of the EIA Directive states that the EIA shall *identify, describe, and assess in an appropriate manner, in the light of each individual case, the direct and indirect significant effects of a project on the following factors:*

(a) Population and human health;

(b) Biodiversity

(c) Land, soil, water, air and climate;

(d) Material assets, cultural heritage and the landscape;

(e) The interaction between the factors referred to in points (a) to (d).

For each environmental aspect there will be certain interactions or interdependencies with other environmental topics. These interactions will be taken into consideration as part of the assessment for each environmental aspect and will be outlined in the EIAR.

Interactions include, for example, the interaction between human health and the potential impacts from air quality, noise, vibration and electromagnetic radiation. Other interactions include the interactions between the proposed Project and environmental elements such as climate change, risks of major accidents and disasters, biodiversity and the use of natural resources.

26. Cumulative Impacts

Cumulative impacts are caused by the combined results of past, present or future activities. A cumulative impact is the total impact arising from the proposed Project in combination with other activities such as other nearby developments to be constructed concurrently or consecutively to the proposed Project. A minor impact caused by the proposed Project could have a more significant effect when combined with the same impact from another development in the same geographical area. It is therefore not only important to look at the impacts caused specifically by the project being assessed, but also the impact in the wider context of similar impacts from unrelated projects in the area.

The cumulative impact section of the EIAR will be prepared in accordance with the 'Guidelines for the Assessment of Indirect and Cumulative Impacts as well as Impact Interactions', prepared for the European Commission (EC 1999). Cumulative impacts will take consideration of all existing and/or approved projects which will be deemed to be likely to cause cumulative impacts.

27. Conclusion

An Environmental Impact Assessment (EIA) and Appropriate Assessment (AA) will be carried out for the proposed Project. An Environmental Impact Assessment Report (EIAR), Appropriate Assessment Screening and potentially a Natura Impact Statement (NIS) will be prepared for the proposed Project which will present the findings of the described assessments, and will accompany the Railway Order Application to An Bord Pleanála in mid-2020. It will be subject to a period of statutory consultation during which the public is afforded the opportunity to provide comments or feedback. Following this period, the Board will determine whether consent should be granted.

The National Transport Authority (NTA) and Transport Infrastructure Ireland (TII) are now inviting submissions on the issues and methodologies outlined in this EIA Scoping Report, or any other issues which they deem relevant

to the EIA process. The consultation period will run for 8 weeks from 2.00pm 26th March 2019 to 5.00pm 21st May 2019. We welcome all relevant submissions on the proposed Project.

To make a submission please use the following contact details:

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Appendix A. Acronym List

Acronym	Meaning
AADT	Annual Average Daily Traffic
AC	Alternating Current
ATO	Automatic Train Operation
ATP	Automatic Train Protection
ATS	Automatic Train Supervision
BOD	Biological Oxygen Demand
BSI	British Standard Institution
BTEX	Benzene, Toluene, Ethylbenzene, Xylene
C&D	Construction and Demolition
CBTC	Communications-Based Train Control
CCTV	Closed Circuit Television
CFRAM	Catchment Flood Risk Assessment and Management
CIEEM	Chartered Institute of Ecology and Environmental Management
CIRIA	Construction Industry Research and Information Association
COD	Chemical Oxygen Demand
CRR	Commission for Railway Regulation
CSO	Central Statistics Office
DAHG	Department of Arts, Heritage and the Gaeltacht
DAHGI	Department of Arts, Heritage, Gaeltacht & the Islands
DART	Dublin Area Rapid Transit
DC	Direct Current
DCC	Dublin City Council
DCCAE	Department of Communications, Climate Action & Environment
DCHG	Department of Culture, Heritage & the Gaeltacht
DCU	Dublin City University
DECHLG	Department of Environment, Community & Local Government
DEFRA	Department of Environment, Food and Rural Affairs
DEIA	Digital Environmental Impact Assessment
DHPLG	Department of Housing, Planning and Local Government
DLRCC	Dún Laoghaire - Rathdown County Council
DoD	Department of Defence
DoEHLG	Department of Environment, Heritage and Local Government
DPER	Department of Public Expenditure and Reform
DTTS	Department of Transport, Tourism and Sport
EIA	Environmental Impact Assessment
EIAR	Environmental Impact Assessment Report
EMC	Electromagnetic Compatibility
EMF	Electromagnetic Field

Acronym	Meaning
EMI	Electromagnetic Interference
EMRA	Eastern & Midlands Regional Assembly
EMWMR	Eastern-Midlands Waste Management Region
EPA	Environmental Protection Agency
EPR	Emerging Preferred Route
ERBD	Eastern River Basin District
ERM	Eastern Regional Model
ESB	Electricity Supply Board
ETS	Emissions Trading System
FCC	Fingal County Council
FRA	Flood Risk Assessment
GDA	Greater Dublin Area
GHG	Greenhouse Gas
GI	Ground Investigation
GIS	Geographical Information System
GSI	Geological Survey of Ireland
GWB	Groundwater Body
GWDTE	Groundwater Dependent Terrestrial Ecosystems
HGV	Heavy Goods Vehicle
HAS	Health & Safety Authority
HSE	Health Service Executive
IAQM	Institute of Air Quality Management
ICNIRP	International Commission on Non-Ionising Radiation Protection
IEMA	Institute of Environmental Management and Assessment
IFI	Inland Fisheries Ireland
IGI	Institute of Geologists of Ireland
IPH	Institute of Public Health
ISO	International Organisation for Standardisation
LA	Local Authority
LAP	Local Area Plan
LAQM	Local Air Quality Management
LGV	Large Goods Vehicle
MRI	Magnetic Resonance Imaging
NACE	Nomenclature Statistique des Activités Économiques
NHA	Natural Heritage Area
NPWS	National Parks and Wildlife Service
NRA	National Roads Authority
NTA	National Transport Authority
O&M	Operations & Maintenance
OCS	Overhead Contact System

Acronym	Meaning
OPW	Office of Public Works
OSI	Ordnance Survey Ireland
PFRA	Preliminary Flood Risk Assessment
pNHA	proposed Natural Heritage Area
PPHPD	Passengers Per Hour Per Direction
PRAI	Property Registration Authority of Ireland
PSD	Platform Screen Door
RF	Radiofrequency
RMP	River Management Plan
RPA	Railway Procurement Agency
RSES	Regional Spatial Economic Strategy
SCADA	Supervisory Control and Data Acquisition
SCL	Sprayed Concrete Lining
SEA	Strategic Environmental Assessment
SEM	Scanning Electron Microscope
STMP	Scheme Traffic Management Plan
TA	Transport Assessment
TBM	Tunnel Boring Machine
TDS	Total Dissolved Solids
TII	Transport Infrastructure Ireland
TKN	Total Kjedahl Nitrogen
TPH	Trains Per Hour
TSS	Total Suspended Solids
VOC	Volatile Organic Compound
WFD	Water Framework Directive
WHO	World Health Organisation
ZoI	Zone of Influence

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Planning and Development (Amendment) Act 2017 – No. 20 of 2017

Planning and Development Regulations 2001 (as amended) – S.I. No. 600 of 2001 (as amended)

Planning and Development Regulations 2001-2018 (Unofficial Consolidation) Updated to 8 October 2018.

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Transport (Railway Infrastructure) Act 2001 (as amended) – No. 55 of 2001 (as amended)

Waste Management Act 1996 (as amended) – No. 10 of 1996

Wildlife Act 1976 (as amended) – No. 39 of 1976

Appendix C. Figures