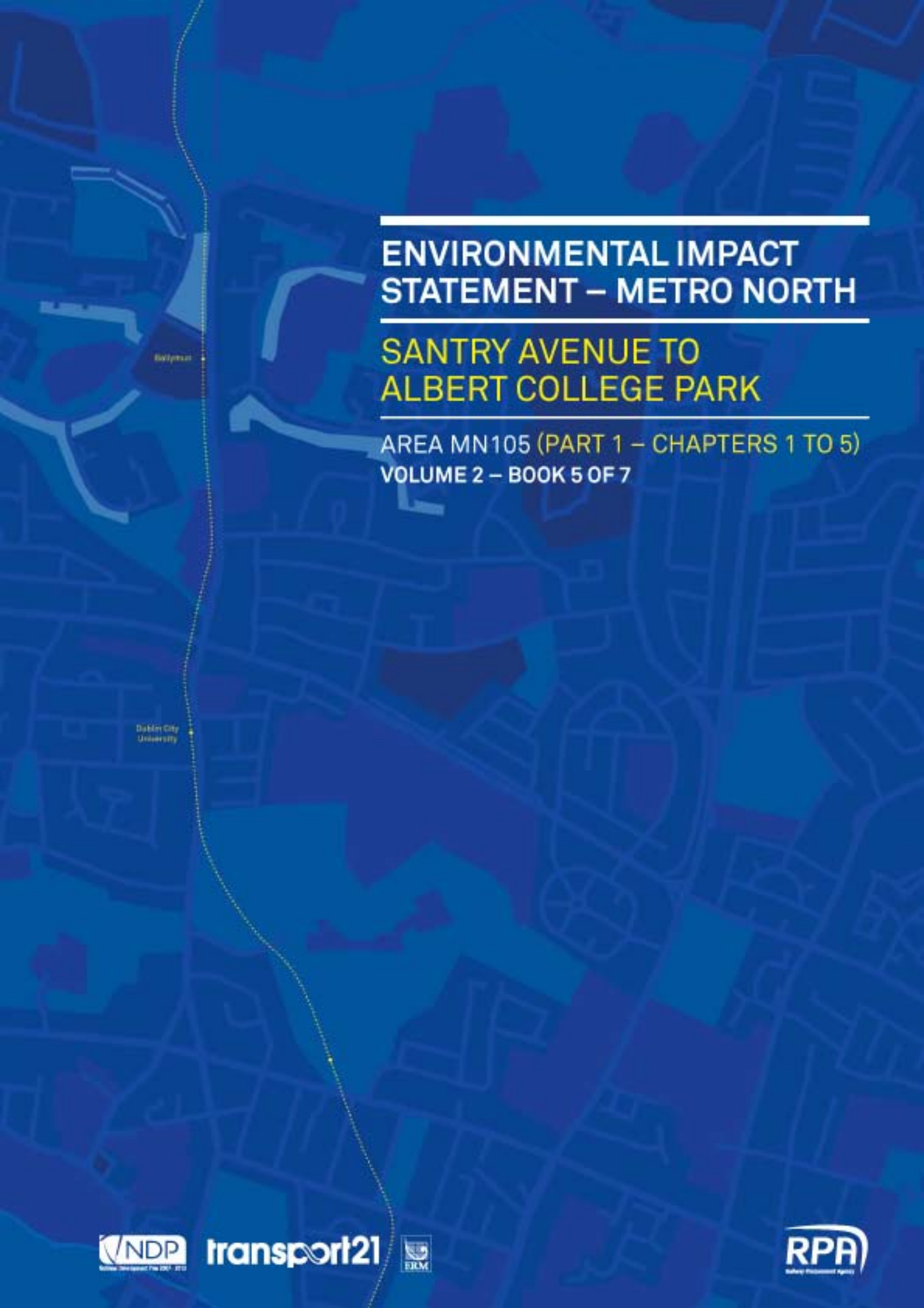


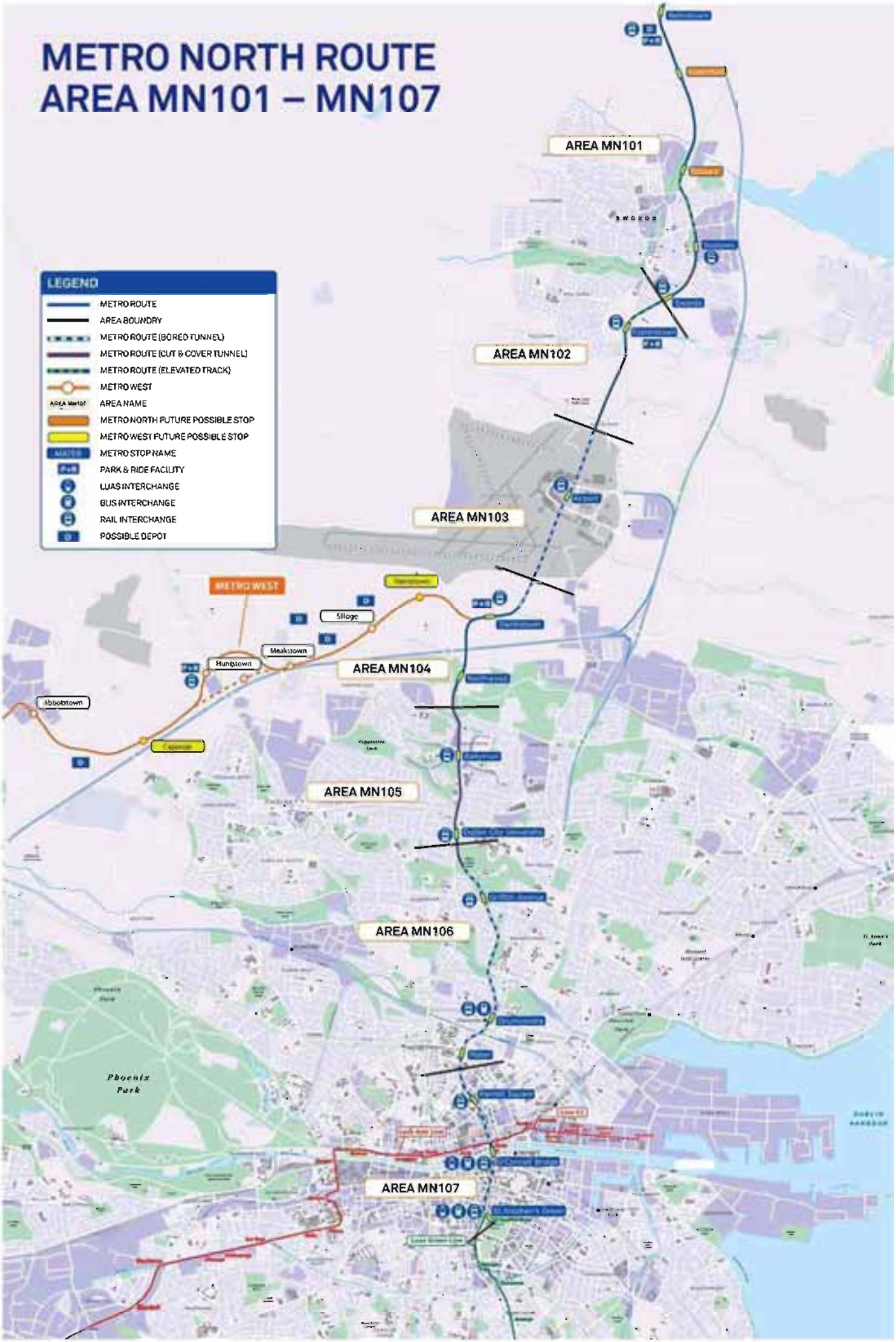
ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

SANTRY AVENUE TO ALBERT COLLEGE PARK

AREA MN105 (PART 1 – CHAPTERS 1 TO 5)

VOLUME 2 – BOOK 5 OF 7

NDP transport21 EIRM RPA


METRO NORTH ROUTE
AREA MN101 – MN107
AREA MN101
AREA MN102
AREA MN103
AREA MN104
AREA MN105
AREA MN106
AREA MN107
LEGEND
METRO ROUTE
AREA BOUNDRY
METRO ROUTE (BORED TUNNEL)
METRO ROUTE (CUT & COVER TUNNEL)
METRO ROUTE (ELEVATED TRACK)
METRO WEST
AREA NAME
METRO NORTH FUTURE POSSIBLE STOP
METRO WEST FUTURE POSSIBLE STOP
METRO STOP NAME
PARK & RIDE FACILITY
LUAS INTERCHANGE
BUS INTERCHANGE
RAIL INTERCHANGE
POSSIBLE DEPOT
METRO WEST
Swords
Sillogue
Ashbourne
Hunstown
Meakstown
Abbotstown
Phoenix Park

ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

SANTRY AVENUE TO ALBERT COLLEGE PARK

AREA MN105

VOLUME 2 – BOOK 5 OF 7

NDP National Development Plan 2007 - 2013
transport21
ERM
RPA Railway Procurement Agency

ENVIRONMENTAL IMPACT STATEMENT

For ease of local identification this Environmental Impact Statement (EIS) has been divided into seven areas. These areas are numbered Area MN101 to Area MN107 inclusive going from Belinstown in north County Dublin to St. Stephen's Green in the city centre.

The environmental impact of the proposed scheme in each of these areas is set out in individual books numbered MN101 to MN107 and which collectively make up Volume 2 of this EIS.

The Environmental Impact Statement (EIS) is being published in three separate Volumes as follows:

VOLUME 1

Introduction to the scheme and a description of the receiving environment

Volume 1 of the EIS is set out in 25 Chapters as follows:

Chapter 1 Introduction

Chapter 2 Need and Objectives

Chapter 3 Legislation

Chapter 4 Planning and Policy Context

Chapter 5 Alternatives

Chapter 6 Description of the Scheme

Chapter 7 Consultation

Chapter 8 Human Health

Chapter 9 Difficulties Encountered

Chapter 10 – 25
Description of the baseline environment

VOLUME 2

Environmental Impact – Area MN101

Environmental Impact – Area MN102

Environmental Impact – Area MN103

Environmental Impact – Area MN104

Environmental Impact – Area MN105

Environmental Impact – Area MN106

Environmental Impact – Area MN107

Volume 2 of the EIS is set out in 18 Chapters as follows:

Chapter 1 Introduction to Areas MN101 -107

Chapter 2 Human Beings: Landuse

Chapter 3 Human Beings: Socio-economics

Chapter 4 Human Beings: Noise

Chapter 5 Human Beings: Vibration

Chapter 6 Human Beings:
Radiation and Stray Current

Chapter 7 Human Beings: Traffic

Chapter 8 Flora and Fauna

Chapter 9 Soil and Geology

Chapter 10 Groundwater

Chapter 11 Surface Water

Chapter 12 Air and Climatic Factors

Chapter 13 Landscape and Visual

Chapter 14 Material Assets: Agronomy

Chapter 15 Material Assets: Archaeology, Architectural Heritage and Cultural Heritage

Chapter 16 Material Assets:
Non Agricultural Property

Chapter 17 Material Assets: Utilities

Chapter 18 Interrelationships, Interactions and Cumulative Impacts

VOLUME 3

Book 1 of 2
Specialist maps – baseline and impact

Book 2 of 2
Annexes to the EIS

Volume 3 of the EIS is set out in 2 books.

Book 1 of 2 contains all baseline and impact assessment maps and Book 2 of 2 contains annexes to the EIS e.g. technical reports.

EIS NON-TECHNICAL SUMMARY (NTS)

EIS METHODOLOGY

The methodology used in this EIS generally involves the following steps:

- Definition of the study area;
- Data collection and description;
- Baseline description and evaluation;
- Identification of potential environmental impacts and the potential areas to be affected;
- Description and evaluation of the impacts;
- Derivation of mitigation measures to minimise the impact;
- Description of the residual impacts of the scheme.

Further detail in relation to the EIS methodology is provided in Volume 1 of the EIS.

ENVIRONMENTAL IMPACT STATEMENT STUDY TEAM

The EIS was prepared on behalf of the Railway Procurement Agency (RPA) by a study team led by Environmental Resources Management (Ireland) Ltd, who were responsible for the overall assessment management and co-ordination as well as for the production of the Landuse, Socio-economics, Noise, Vibration (part), Radiation and Stray current, Flora and Fauna, Soil and Geology (part), Air and Climatic factors, Non Agricultural Property and Utilities chapters of this EIS. The other members of the study team are outlined in the table below.

AVAILABILITY OF THE EIS

This EIS is available to download for free through the RPA website at www.dublinmetronorth.ie

Copies of this EIS including the Non-Technical Summary may be purchased by any member of the public during normal office hours at the following location:

Railway Procurement Agency (RPA)
Parkgate Street
Dublin 8

The EIS may be purchased as a complete document for a sum of €170.00 (Volumes 1, 2 & 3)

The EIS can also be purchased as individual books e.g:

- Copies of Volume 1 may be purchased for €30.00 each;
- Copies of Volume 2 (individual book e.g. MN101) may be purchased for €15.00 each;
- Copies of Volume 3 (individual books e.g. Book 1 of 2) may be purchased for €15.00 each;
- Copies of the NTS of this EIS may be purchased for €5.00 each.

A DVD version of the whole EIS may be purchased for €15.00 which includes Volume 1; Volume 2 (Area MN101 – MN107); Volume 3 (Book 1 of 2 and Book 2 of 2) and the Non-Technical Summary.

Input	Contributor
Human Health	EHA Consulting Group
Human Beings: Vibration	Rupert Taylor F.I.O.A
Human Beings: Traffic	MVA Consulting
Soil and Geology	Jacobs Engineering Ireland Ltd.
Groundwater	AWN Consulting
Surface Water	AWN Consulting
Landscape and Visual (photomontages)	Digitech
Material Assets: Agronomy	Curtin Agricultural Consultants
Material Assets: Archaeology, Architectural Heritage and Cultural Heritage	CRDS Ltd.

CONTENTS

01 INTRODUCTION TO AREA MN105

Metro North is the next phase of Dublin's integrated light rail network. The proposed scheme will serve an 18km corridor from Belinstown in the north of County Dublin to St. Stephen's Green in the city centre via Dublin Airport.

The proposed scheme is the next phase of Dublin's integrated light rail network. The proposed scheme will serve an 18km corridor from Belinstown in the north of County Dublin to St. Stephen's Green in the city centre via Dublin Airport. The proposed scheme is a light rail system running on a line of sight basis, at grade, in underpasses or on elevated sections between Belinstown and Fosterstown and under full signal control on a segregated alignment between Fosterstown Stops and St. Stephen's Green. The proposed scheme will run in a mix of bored and cut and cover tunnels beneath the city and in Dublin Airport.

For ease of local identification, in this EIS the proposed scheme is divided into seven areas. These areas are numbered Area MN101 to Area MN107 inclusive going from Belinstown in north County Dublin to St Stephen's Green in the city centre. The environmental impact of the proposed scheme in each of these areas is set out in individual books numbered MN101 to MN107 which collectively make up Volume 2 of this EIS. This document relates to Area MN105 Santry Avenue to Albert College Park.

The route runs in a cut and cover tunnel beneath Ballymun Road, to a shallow underground stop at Ballymun, adjacent to the new civic plaza. Continuing south in a cut and cover tunnel along the Ballymun Road, crossing under Collins Avenue, the next stop is DCU. This is a shallow underground stop on the east side of Ballymun Road beside Albert College housing estate. Area 105 ends on the DCU access road, just south of the DCU Stop.

02 HUMAN BEINGS: LANDUSE

This chapter of the EIS describes the potential impacts on landuse which may arise due to activities associated with the construction and operation of the proposed scheme in Area MN105.

2.1 INTRODUCTION

This chapter of the EIS describes the potential impacts on landuse which may arise due to activities associated with the construction and operation of the proposed scheme in Area MN105.

2.2 STUDY AREA

The study area for the assessment is set out in Table 2.1.

Table 2.1 Study area

Criteria	Width of study area (on both sides of the alignment)
Temporary and permanent land-take	All areas encompassed by the Compulsory Purchase Order (CPO) line for permanent and temporary land-take and construction compounds
Severance	

2.3 IMPACT ASSESSMENT METHODOLOGY

The source and type of all potential impacts are described in Section 2.4.1. Mitigation measures to be put in place are defined in Section 2.4.2. The extent to which mitigation is needed increases as the significance of the impact increases. Residual impacts are evaluated in Section 2.4.3 in terms of magnitude and significance.

2.3.1 Magnitude

The criteria used to assess the magnitude of impacts are shown in Table 2.2.

Table 2.2 Criteria for assessment of impact magnitude

Criteria	Impact magnitude
Permanent land-take Permanent severance	very high
Temporary land-take for a period of more than 1 year or near/in residential areas Temporary severance for a period of more than 1 year or near/in residential areas	high
Temporary land-take for a period of less than 1 year Temporary severance for a period of less than 1 year	medium
Land-take in existing streetscapes	low
N/A	very low

2.3.2 Significance

The significance of all impacts is assessed in consideration of the magnitude of the impact and the quality of the area (functional value) upon which the impact has an effect. The quantity of the land-take, relative to the affected landuse is a factor of magnitude, and has therefore been taken into account in the assessment of an impact's significance.

2.4 IMPACT ASSESSMENT

2.4.1 Impact identification

The impact of the proposed scheme on the landuse along the alignment is assessed with reference to two categories: temporary and permanent impacts.

Temporary impacts
Temporary impacts typically occur during construction. These impacts are short to medium-term in nature. Sources of temporary impact include construction compounds and construction activities.

Permanent impacts
Permanent impacts are long-term impacts associated with the structure and operation of the proposed scheme. Sources of permanent impacts include all permanent, above-ground, built structures associated with the proposed scheme including stops, tracks, bridges, viaducts, substations, Park & Ride sites, ancillary roads, access ways, tunnel portals and areas affected by permanent changes to traffic routes.

The types and sources of impact considered in this chapter are summarised in Table 2.3. Table 2.3 also provides clarification as to whether the impact assessment of each impact type is carried out on a qualitative or quantitative basis.

Typical light metro vehicle (LMV)

Table 2.3 Impact identification

Potential impact type	Impact source	Assessment type: qualitative/ quantitative*
Construction phase		
Temporary land-take	Temporary construction compounds, construction roads, tunnel launching sites, cut & cover locations, tunnel portals, storage areas, temporary land-take associated with the CPO etc.	Quantitative and qualitative
Temporary severance (only impacts that don't result in permanent land-take)		Qualitative
Permanent land-take	Road widening for construction roads, etc.	Quantitative and qualitative
Operational phase		
Permanent land-take	Scheme infrastructure: track; stop locations; access and egress locations; substations etc.	Quantitative and qualitative
Permanent severance		Qualitative

*Quantities are not calculated for land-takes in the existing streetscapes.

2.4.2 Mitigation measures

The amount of land taken for the proposed scheme has been minimised as much as possible and areas of land-take have been carefully chosen so as to try to minimise the level of impact that occurs.

In cases where land that has to be taken on a temporary basis, existing landuses will be maintained where possible and the land will be reinstated and returned to its original use as quickly as possible. Measures are to be taken where possible to ensure that open spaces remain easily accessible through the provision of, for example, adequate gating, redirected footpaths, pedestrian crossings and agricultural access routes. Road diversions and other traffic management mechanisms are to put in place before roads are closed to minimise severance impacts. Temporary road closures and diversions will be minimised, in number and duration, wherever possible.

In some locations, hoarding and other mechanisms will be used to ensure that the boundary of land-take is clearly demarcated so as to minimise the potential for 'drift' of the sites and impacts on adjacent landuses. The hoarding will be used to provide public information about the proposed scheme and alternative access arrangements to local businesses and facilities. Landscaping of areas will be designed so as to complement the surrounding landuses. A more detailed specific description of the mitigation measures to be put in place at each location is provided in Table 2.4 and Table 2.5.

2.4.3 Assessment of residual impacts

2.4.3.1 Project scenario: construction phase

Temporary land-take

Within Area MN105 there will be several occurrences of temporary land-take. The temporary land-take, due to the process of cut and cover tunnelling along the Ballymun Road, is of Low significance, post mitigation. This is due to the fact that all temporary land-take will be located in the existing streetscape. There will be impacts on traffic within the area as a result of these temporary land-takes and construction works; these are detailed in the Traffic chapters of this EIS (Volume 2, Chapter 7).

Construction Compound 11 will facilitate the construction of the Ballymun Stop. The significance of this impact is Medium due to it being located in the existing streetscape. Within Ballymun Town Centre there is also to be local Construction Compound 11A adjacent to the Ballymun Road, on land that is classified as residential areas/uses. The functional value of the area in which the construction compound is to be located is high. The construction compound is to be used for a period of more than 1 year and will support the construction of cut and cover tunnels beneath the Ballymun Road. The residual significance of the impact of this construction compound is Medium due to it being an open space within the residential area that is highly valued and used. There are numerous alternative open spaces located nearby.

The temporary land-take in the existing streetscape throughout Area MN105 is determined to be of Low residual impact significance. Tunnels will be constructed using the cut and cover techniques and will take more than one year to construct. Associated with the construction works in the existing streetscape there will be temporary land-take for a period of less than one year to accommodate diverted traffic. This temporary land-take will be from the gardens of several residential properties on either side of the Ballymun Road, in the vicinity of the junction with Glasnevin Avenue. Lands will also be temporarily taken from the Victory Credit Union to accommodate the diverted traffic. The significance of their impact post mitigation is determined to be Medium.

There will be temporary land-take of the gardens Our Lady of Victories Church, the access road to Albert College Drive and part of the open space adjacent to Albert College estate. These lands will be temporarily taken during the cut and cover construction phase. They will be returned to their original condition after construction of the tunnel. The significance of the impact is determined to be High due to the fact that the area is of very high functional value and the temporary land-take is for a period of more than 1 year.

There will also be some temporary land-take from land associated with a residential property on Albert College Lawn to facilitate the construction of the tunnel. This impact is determined to be of Medium impact significance post mitigation due to the fact that the temporary land-take is for a period of less than 1 year and will be reinstated to its current use post construction.

The locations of the temporary land-take are illustrated on the maps (Landuse Impact) included in Volume 3, Book 1 of 2.

Temporary severance
Severance in Area MN105 is to be kept to a minimum. The busy junctions at Santry Avenue, Balbutcher Lane, Shangan Road, Collins Avenue and Glasnevin Avenue will be kept operational at all times. There will be disturbances to traffic as a result of the reduced number of lanes available. Lanes will be closed in order to facilitate the construction of the cut and cover tunnel. There will be some severance of Albert College Drive; however, residential properties will be accessible via alternative access. The pedestrian access to DCU, next to Albert College Park will be unusable for a short period. Access to DCU will be by the main entrance on Collins Avenue.

2.4.3.2 Project scenario: operational phase

Permanent land-take
Two locations within Area MN105 where there will be permanent land-take are at Ballymun Stop and DCU Stop. At the Ballymun Stop the permanent land-take will be in the existing streetscape and in lands which a planning application has been lodged to develop as an underground car-park. The new stop entrances, emergency exhaust vents, access stairways and passenger lifts will not impact significantly on the existing landuses; it is rated as an impact of Low residual significance.

The permanent land-take at DCU Stop is in a very high functional area and is located on land currently classified as open space and recreational lands, Brownfield/Vacant/Derelict lands and Residential Areas. The permanent land-take is to accommodate the stop entrances and all associated features. It has been determined that the impact on landuse is of Medium significance due to the fact that it will impact on several landuses and will require the demolition of two existing building, one of which is currently derelict. There will also be the loss of some incidental open space. This open space is incidental and of low amenity value.

Throughout Area MN105 there will be substratum permanent land-take to accommodate the tunnels beneath the Ballymun Road. This land-take will have no impact on the existing surrounding landuses, but will limit the future landuses directly above it. The significance of this impact is determined to be Low due to the fact that the roads will be reinstated after the construction phase and the substratum permanent land-take will have no impact on surface landuses.

The locations of the permanent land-take are illustrated on maps (Landuse Impact) included in Volume 3, Book 1 of 2.

Permanent severance
There will be no permanent severance in Area MN105 as a result of the operation of the proposed scheme.

Table 2.4 Summary of predicted impacts in Area MN105 occurring during the construction phase

Impact ID	Location	Source of impact	Impact description	Functional Value (FV) of affected area	Mitigation measure	Post mitigation	
						Magnitude	Significance
MN105/ CN-01	LA 13 Ballymun Town Centre/ Main Street on land in the existing streetscapes	Cut and Cover Tunnelling	Temporary land-take for a period of more than 1 year from land in the existing streetscapes. The carriage ways on the Ballymun Road will be temporarily narrowed while construction works excavate, construct tunnel and cover. This impact will occur in an area primarily comprising residential landuses.	high	The existing carriageway will be reinstated upon completion. Roadways, cycleways and footpaths will be diverted and/or re-provided wherever possible.	low	Low
MN105/ CN-02	LA 13 Ballymun Town Centre/ Main Street on land classified as Residential Areas	Local Construction Compound 11A to support construction of the cut and cover sections and Ballymun Stop	Temporary land-take for a period of more than 1 year from Residential Areas lands. This construction compound will be approximately 0.45ha in size. This construction compound will be used to support the construction of the Ballymun Stop and the cut and cover sections of the tunnel. The land, while classed as residential is an open space. This construction compound is to be located in an area classified as residential. The compound is to be located on open space within the residential area. It will also be adjacent to the Ballymun Road. This open space is not used for recreational purposes. There is plenty of residential area within MN105, however, this construction compound is located on residential open space, of which there is very little in LA 13, or along the Ballymun Road.	high	As little land as possible will be temporarily taken. The land will be returned to its original use as quickly as possible. It is located as near as possible to the construction works which it supports for efficiency purposes. The construction compound should not threaten the character of residential landuses. It should be maintained and kept clean. While there are other open spaces in the area the benefit of this open space was to separate the busy road traffic from the residential areas.	medium	Medium

Impact ID	Location	Source of impact	Impact description	Functional Value (FV) of affected area	Mitigation measure	Post mitigation	
						Magnitude	Significance
MN105/ CN-03	LA 13 Ballymun Town Centre/ Main Street on lands classified as Residential with Mixed Uses (Commercial/ Retail/Office) and lands in the existing street scapes	Ballymun Stop Box, Construction Compound 11	Temporary land-take for a period of more than 1 year from Residential with Mixed Uses (Commercial/Retail/Office) lands in the existing streetscapes. This construction compound will be approximately 0.3ha in size and will be used to support the construction of the Ballymun Stop. In order to construct Ballymun Stop an area of the eastern carriageways will be blocked off while the underground station is constructed. This impact occurs in an area primarily comprising residential landuses. The majority of this temporary land-take will ultimately form part of the permanent land-take.	high	The existing carriageway will be reinstated upon completion. Roadwa ys, cycleways and footpaths will be diverted and/or re-provided wherever possible.	low	Low
MN105/ CN-04	LA 14 Northwood area and Ballymun Residential Areas on lands in the existing streetscapes	Cut and Cover Tunnelling	Temporary land-take for a period of more than 1 year from lands in the existing streetscapes. The carriageways on the Ballymun Road will be temporarily narrowed during construction works, excavation, construction of tunnel and covering. This impact will occur in an area primarily comprising residential landuses.	very high	The existing carriageway will be reinstated upon completion. Roadways, cycleways and footpaths will be diverted and/or re-provided wherever possible.	low	Low
MN105/ CN-05	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands in the existing streetscapes	Cut and Cover Tunnelling	Temporary land-take for a period of more than 1 year from lands in the existing streetscapes. The carriageways on the Ballymun Road will be temporarily narrowed during construction works, excavation, construction of tunnel and covering. This impact will occur in an area primarily comprising residential landuses.	very high	The existing carriageway will be reinstated upon completion. Roadways, cycleways and footpaths will be diverted and/or re-provided wherever possible.	low	Low

Impact ID	Location	Source of impact	Impact description	Functional Value (FV) of affected area	Mitigation measure	Post mitigation	
						Magnitude	Significance
MN105/ CN-06	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands classified as Residential Areas and Educational/ Institutional/ Community/Civic	Traffic Diversions	Temporary land-take for a period of less than 1 year from Residential Area and Educational/Institutional/ Community/Civic lands. Lands will be temporarily taken from the gardens of houses on both sides of the Ballymun Road, as well as lands part of Our Lady of Victories School and Victory Credit Union. These lands will be temporarily taken to accommodate diverted road traffic during the process of cut and cover tunnelling.	very high	As little land as possible will be temporarily taken. The land will be returned to its original use as quickly as possible.	medium	Medium
MN105/ CN-07	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands classified as Educational/ Institutional/ Community/Civic	Cut and Cover under church grounds and Albert College Drive	Temporary land-take for a period of more than 1 year from Educational/Institutional/ Community/Civic lands. Land in front of the church will be temporarily closed off as the tunnel is constructed by cut and cover techniques. The road into Albert College Drive will be temporarily out of use when it is being cut and covered. The cut and cover construction works will be adjacent to a residential housing estate. The area of the Church and its grounds is approximately 0.9ha. Approximately 0.2ha of this land will temporarily used during the cut and cover, construction phase.	very high	Existing church boundary walls and gardens, as well as Albert College Drive Infrastructure to be reinstated on completion. Alternative access to the church is to be provided during the cut and cover construction phase. Alternative access is to be provided to Albert College Drive during the cut and cover construction phase. The construction work will avoid areas of the church grounds where there are known graves.	high	High
MN105/ CN-08	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands classified as Residential Areas	Cut and Cover Tunnelling	Temporary land-take for a period of less than 1 year from Residential Area lands. Land associated with a residential property on Albert College Lawn will be temporarily taken to facilitate the cut and cover tunnelling.	very high	As little land as possible will be temporarily taken. The land will be returned to its original use as quickly as possible.	medium	Medium

Table 2.5 Summary of predicted impacts in Area MN105 occurring during the operational phase

Impact ID	Location	Source of impact	Impact description	Functional Value (FV) of affected area	Mitigation measure	Post mitigation	
						Magnitude	Significance
MN105/ OP-01	LA 13 Ballymun Town Centre/Main Street on lands in the existing streetscapes	Tunnel constructed by cut and cover	Permanent land-take from the existing streetscapes. There will be substratum permanent land-take beneath the Ballymun Road. This will have no impact on the existing surrounding landuses, but limit's the future landuses above it.	high	As little land as possible will be taken. The tunnel will be constructed at such a depth so that it will not impact on the current surface level landuses.	low	Low
MN105/ OP-02	LA 13 Ballymun Town Centre/ Main Street on lands classified as Residential with mixed uses (Commercial/ Retail/Office) and lands in the existing streetscapes	Ballymun Stop entrances, emergency exhaust vents, access stairways and passenger lifts	Permanent land-take from lands in the existing streetscapes and Residential with Mixed Uses (Commercial/ Retail/Office) lands. There will be a permanent land-take for Ballymun Stop entrances, emergency exhaust vents, access stairways and passenger lifts. Planning permission has been sought to develop the area on the eastern side of the R132 as an underground car-park with kiosks and access from the street level.	high	As little land as possible will be taken. The above ground Stop features will be finished to a high quality and will be designed to fit in with the existing built environment.	low	Low
MN105/ OP-03	LA 14 Northwood area and Ballymun Residential Areas on lands in the existing streetscapes	Tunnel constructed by cut and cover	Permanent land-take from the existing streetscapes. There will be substratum permanent land-take beneath the Ballymun Road. This will have no impact on the existing surrounding landuses, but limit's the future landuses above it.	very high	As little land as possible will be taken. The tunnel will be constructed at such a depth so that it will not impact on the current surface level landuses.	low	Lo
MN105/ OP-04	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands in the existing streetscapes	Tunnel constructed by cut and cover	Permanent land-take from the existing streetscapes. There will be substratum permanent land-take beneath the Ballymun Road. This will have no impact on the existing surrounding landuses, but limit's the future landuses above it.	very high	As little land as possible will be taken. The tunnel will be constructed at such a depth so that it will not impact on the current surface level landuses.	low	Low

Impact ID	Location	Source of impact	Impact description	Functional Value (FV) of affected area	Mitigation measure	Post mitigation	
						Magnitude	Significance
MN105/ OP-05	LA 15 South of Ballymun as far as Griffith Avenue: Residential Areas on lands classified as Residential areas/users, Open Spaces and Recreational Uses and Brownfield/ Vacant/Derelict	DCU Stop buildings, vents, emergency exhaust vents and maintenance access stairs	Permanent land-take from Residential Areas, Open Spaces and Recreational Use and Brownfield/Vacant/Derelict lands. The above ground features will occupy the space previously occupied by buildings and Open Space. There is to be demolition of two existing buildings. The permanent land-take is approximately 0.4ha in size and is from mostly open space between the houses of the Albert College Estate and the Ballymun Road.	very high	Existing gardens, boundaries and footpaths to be reinstated on completion. The above ground Stop features will be finished to a high quality and will be designed to fit in with the existing built environment. Compensation will be made to those whose properties will be demolished.		Medium

03 HUMAN BEINGS: SOCIO-ECONOMICS

This chapter of the EIS evaluates the potential socio-economics impacts arising from the construction and operation of the proposed scheme in Area MN105.

The socio-economic assessment will examine the potential impacts on:

- Demography;
- Unemployment;
- Employment classification;
- Travel to work data and commuting;
- Economic benefits and employment creation.

3.1 IMPACT ASSESSMENT METHODOLOGY

The impact assessment methodology in this section is set out in a number of steps:

- Impact identification
- Impact assessment
- Derivation of mitigation measures
- Assessment of residual impacts

3.1.1 Study area

The study area for this assessment is set out in Table 3.1.

Table 3.1 Study area

Criteria	Width of study area (on both sides of the alignment)
General/scheme-wide impacts	Greater Dublin Area and the Irish State
Localised impacts	Electoral Districts (EDs) in Area MN105 and which are within 500m of the alignment

3.1.2 Impact identification

3.1.2.1 General/scheme-wide impacts

These impacts address the overall or 'global' socio-economic impacts and will focus on the proposed scheme as a piece of transport infrastructure. This section will examine the proposed scheme-wide positive and negative impacts of the construction and operation of the proposed scheme, which include the cumulative impacts of relevant localised impacts.

3.1.2.2 Localised (MN105) impacts

These impacts will focus on the location of key construction activities along the alignment. The construction methodology will also be of direct interest.

Localised impacts will also focus on the potential impacts which may arise from the operation of the proposed scheme.

EDs of particular interest (e.g. those with higher than average unemployment rate or those with a higher than average car ownership rate) will also be highlighted.

3.1.3 Impact assessment

3.1.3.1 Magnitude

The criteria used to assess the different impacts associated with this scheme are shown in Table 3.2.

Table 3.2 Criteria for assessment of impact magnitude

Criteria	Impact magnitude
Long-term (15+ years) and/or substantial change in population levels, employment, employment classification or mode of travel to work (i.e. reduced congestion and commuting delays). Long-term economic disruption to residents, businesses and commuters from construction activities. Substantial improvements in quality of life due to significantly reduced commuting times, improved commuting experience and reliability of service.	very high
Long-term and significant change in population levels, employment, employment classification or mode of travel to work. Short-term (1 - 5 years) economic disruption to residents, businesses and commuters from surface-construction activities. Significant improvements in quality of life due to reduced commuting times, improved commuting experience and reliability of service.	high
Long-term and moderate change in population levels, employment, employment classification or mode of travel to work. Short-term and substantial change in population levels, employment, employment classification or mode of travel to work. Temporary (less than 1 year) economic disruption to residents, businesses and commuters from surface-construction activities. Moderate improvements in quality of life due to reduced commuting times, improved commuting experience and reliability of service.	medium
Long-term and minor change in population levels, employment, employment classification or mode of travel to work. Short-term and significant change in population levels, employment, employment classification or mode of travel to work. Minor improvements in quality of life due to reduced commuting times, improved commuting experience and reliability of service.	low
Long-term and insignificant change in population levels, employment, employment classification or mode of travel to work.	very low

3.1.3.2 Significance

The matrix used to define the significance of impacts is shown in Table 3.3.

All socio-economic receptors along the alignment have been classified as having a very high functional value. Socio-economic receptors in this case refer to the key socio-economic factors and data sets (employment level, demographics etc.).

Table 3.3 Criteria for assessment of impact significance

		Magnitude of impact				
		very low	low	medium	high	very high
Functional value of affected receptor	very high	Not significant	Low significance	Medium significance	High significance	Very high significance

3.1.4 Derivation of mitigation measures

Mitigation measures are only defined for any impacts that are deemed to be of Medium significance, and greater, in Table 3.3. The extent to which mitigation is needed increases as the significance of the impact increases. The logical basis for providing mitigation for impacts of Medium significance and above is that such measures should only be focused on significant environmental effects of the proposed scheme.

3.1.5 Assessment of residual impacts

Residual impacts that will persist after mitigation measures have been put in place are summarised in Table 3.7.

3.2 IMPACT ASSESSMENT

3.2.1 Project scenario: construction phase

3.2.1.1 General/scheme-wide impacts

Direct economic impacts

The expenditure of construction workers' wages will result in a considerable portion of this expenditure being spent in the regional economy of the Greater Dublin Area over the approximate 5 year construction period, thereby resulting in indirect/secondary economic benefits. The estimated level of average direct employment during the 5 year construction programme is approximately 3,100.

Table 3.4 provides a breakdown of this estimated level of employment during construction.

Table 3.4 Estimated average construction employment for the proposed scheme

Construction Year	Average direct construction employment
1	4,000
2	4,000
3	3,500
4	2,500
5	1,500
Annual average	3,100

Although the direct employment is short-term (approximately 5 years), it is possible to equate this short-term employment to a level of permanent employment. The EIS for Crossrail (a major rail scheme in London which consists of a twin-bore tunnel on a west-east alignment under central London and the upgrading of existing National Rail lines to the east and west of central London) uses an employment multiplier of 10 employment years during construction as being the equivalent of one permanent job. Using this employment ratio, the equivalent level of permanent employment/full-time employment (FTE is provided in Table 3.5. In total, the full time equivalent direct employment (FTE) generated by the construction phase is 1,550 jobs.

Table 3.5 Permanent equivalent level of construction employment

Construction Year	Person years equivalent	Permanent years employment equivalent
1	4,000	400
2	4,000	400
3	3,500	350
4	2,500	250
5	1,500	150

It is likely that the majority of the construction workforce will be resident in the Greater Dublin Area, given the fact that this is where the majority of construction workers resided during the recent period of high-levels of construction activity in Greater Dublin.

However, there has been a reduction in levels of activity in the construction sector since 2007 and the fall-off in construction activity has accelerated since late 2007 and is continuing. The Quarterly National Household Survey (CSO, 5th March 2008) notes that construction employment in Q4 (Sept. – Nov. '07) fell by 5,600 (-2.0%) and that the overall decrease in construction employment fell by 15,200 during 2007, and stood at 279,000 at the end of November 2007. Provisional 2008 data has indicated ongoing significant fall in construction-related employment in Ireland and a rise in overall unemployment. In the context of the significant fall in construction-related employment (and rising overall unemployment), and given the fact that the Greater Dublin Area is the largest urbanised area of Ireland, it is likely that the majority of construction workers will be sourced from the Greater Dublin Area.

Overall it is likely that there will be more than sufficient capacity in the construction sector of the Greater Dublin Area to build the proposed scheme and construction will not result in displacement of construction employees away from other large-scale infrastructural projects. Thus, the proposed scheme will not delay or impede the development of other strategic infrastructure projects in the Greater Dublin Area.

Overall, the proposed scheme will result in positive impacts due to direct employment creation and this is a positive impact of very low magnitude and Very low significance.

Indirect socio-economic impacts

Particular sectors of the regional economy (i.e. the economy of the GDA of Dublin, Wicklow, Kildare and Louth) also likely to benefit from the proposed scheme such as those in construction (and related industries) and the material supplying industry (steel, concrete etc.). There will also be secondary/ spin off impacts due to expenditure of wages and salaries in the local economy by the construction workforce. These sectors are likely to include accommodation (e.g. B&Bs) and daily subsistence (e.g. lunch and evening meals) providers. The assessment of socio-economic effects in the Crossrail EIS assumed an employment multiplier of 1.5 (i.e. each permanent job (or equilivalent) will generate an additional 0.5 permanent jobs). The Crossrail EIS multiplier of 1.5 is based on multipliers used in other recent major rail schemes in the UK, such as:

- Thameslink 2000: 1.5;
- Channel Tunnel Rail Link: 1.4.

Other construction-related employment multipliers used in recent studies for the Scottish Executive were:

- Manufacture of structural metal products: 1.52;
- Manufacture of other general purpose machinery: 1.51;
- Manufacture of special purpose machinery: 1.63;
- Manufacture of other transport equipment: 1.33;
- Construction: 1.86.

Following a consideration of these comparable multipliers, it was decided that a multiplier of 1.5 was appropriate for the proposed scheme. Table 3.6 contains information regarding indirect employment creation due to the construction of the proposed scheme.

Table 3.6 Permanent- equivalent level of construction employment

Construction Year	Permanent years employment equivalent	Indirect employment creation	Total direct and indirect FTE
1	400	200	600
2	400	200	600
3	350	175	525
4	250	125	375
5	150	75	225

Overall, the construction of the proposed scheme will provide an annual average direct employment of 3,100 for the 5-year construction programme. This equates to 1,550 full-time equivalents, with a further 775 FTE arising as indirect impacts. Overall, the proposed scheme will result in positive impacts due to overall employment creation and this is a positive impact of low magnitude and Low significance.

Impacts due to traffic congestion and diversion
This impact is addressed in the Traffic chapters of this EIS (Volume 2, Chapter 7). However, a brief summary is provided below.

Generally there is an increase in journey times on most of the roads/routes assessed during the five year construction programme. Traffic modelling data (MVA, 2007) indicates that some routes experience significant journey time deterioration, particularly the R132 through Swords, Ballymun Road, N2, Collins Avenue, Church Street and Baggot Street. Overall the impact on journey time can be classified as Medium to significant on the routes assessed.

Traffic modelling results have shown that traffic speeds across the GDA will decrease by over 11%, or drop by 3kph. This represents a situation where traffic movement for all modes will be very difficult with significant delays at key areas. Drivers will travel further distances to avoid construction areas compounding the congestion levels on other parallel routes and affecting the operation of buses through the city. Other traffic modelling statistics such as impact on bus speeds and journey time on key routes further demonstrate the significance of the construction impact. Overall this will result in negative socio-economic impacts on the Greater Dublin Area's commuters and freight movements. These negative impacts are of medium to high magnitude and Medium to High significance, since the duration of these impacts ranges from temporary to short-term.

3.2.1.2 Localised socio-economic impacts

The localised socio-economic impacts will be a consequence of the landuse impacts (MN101 to MN107) and are addressed in the Landuse chapters of this EIS (Volume 2, Chapter 2). Similarly localised traffic disruption during construction is addressed in the respective Traffic chapters of this EIS (Volume 2, Chapter 7).

3.2.2 Project scenario: operational phase

3.2.2.1 General/scheme-wide impacts

Facilitating future development and employment creation
Overall the proposed scheme will facilitate a significant amount of future development along the whole alignment and across the wider northern part of the Greater Dublin Area. While the proposed scheme will not directly result in additional development in the proximity of the alignment the proposed scheme will, indirectly, allow the relevant planning authorities to plan for and grant consent for additional development at key locations.

Essentially, the proposed scheme will permit higher-residential densities (planning policy in Dublin City and Fingal County Councils envisage higher-density development along key transport corridors and close to key transport nodes) thereby maximising the transport and socio-economic benefits of the proposed scheme (Department of the Environment, Heritage and Local Government, 2008). The basis for higher-density zoning adjacent to key transport corridors is that this will provide a realistic and attractive alternative to private-car based commuting, thereby resulting in greater use of public transport (the proposed scheme in this case) with corresponding reductions in journey time and greater access to employment and other key destinations.

Fingal County Council commissioned a report titled 'Economic Development Strategy for the the proposed scheme Economic Corridor (MNEC)' (Indecon International Economic Consultants, 2008) which outlines a long-term development strategy for a period up to 2025/2030. The Strategy has assumed that the MNEC is a 1km corridor on either side of the alignment of the proposed scheme (which corresponds to the width of Fingal County Council's the proposed scheme Development Contributions Scheme) and extends from the terminus of the proposed scheme in the townland of Belinstown to the Fingal County Council-Dublin City Council administrative boundary at Santry Avenue.

In summary, this Strategy envisages an increase in the MNEC population from 59,000 (2006 data) to 128,100 by the period 2025/2030. This represents an increase in residents within this 2km-wide corridor of 69,100, an increase of over 117% over 2006 levels. The basis for this proposed increase in MNEC population is that the attractiveness of the MNEC which will be greatly enhanced by the transport advantages provided by the proposed scheme.

The Strategy recommends that three specific locations within the MNEC will be the focus of the majority of overall new development and growth. These three areas are: Swords-Lissenhall, Dublin airport (Eastlands) and Metropark. The proposed scheme is a key piece of infrastructure which will facilitate the implementation of the Indecon Strategy. Without the proposed scheme many of the elements outlined in the Strategy will not arise. It should be noted that the various targets in the Strategy are acknowledged by Indecon as being ambitious and that they 'will be a major challenge and will require innovative policy initiatives' to ensure its implementation.

The overall objectives of the MNEC Strategy have been adopted by Fingal County Council, it is their intention to prepare a number of variations to the Fingal County Development Plan to facilitate implementing the MNEC Strategy. In May 2008, Fingal County Council published a document titled 'Your Swords: An Emerging City – Strategic Vision 2035'. This states (p.15) that 'the identification and promotion of Metro Economic Corridor(s) will be of strategic importance to the economy and well-being of the county's residential and business/ employment population'. Fingal County Council also intends to prepare additional planning policy documentation to support the implementation of the MNEC Strategy as required in future years.

Dublin City Council also sees the proposed scheme as facilitating future development activity in their administrative area. However, in Dublin City Council's area, adjoining lands are predominantly already developed; whereas in Fingal, significant undeveloped sites existing, and it is these locations where the large quantum of future development (as envisaged in the MNEC) is likely to arise.

The proposed scheme will assist Dublin City Council with its development aspirations and objectives at key locations such as Ballymun (currently the focus of one of Europe's largest regeneration projects) and the north inner city. It will also assist with the implementation of the Phibsborough/Mountjoy Local Area Plan – which specifically refers to the proposed scheme and the role it will play on future development patterns and landuses.

In conclusion, the proposed scheme is essential to the planning and development aspiration of both Dublin City Council and Fingal County Council and this is strongly reflected in both of their respective development and planning policies. The proposed scheme will facilitate and greatly assist a more sustainable development pattern in future years and this is a positive impact of high magnitude and High significance.

The proposed scheme will also result in positive development and economic impacts for the Greater Dublin Area and beyond, through creating a positive image of the city – both for national and international markets – and result in wider economic benefits through assisting people move through and around the Greater Dublin Area. A report ('What Light Rail Can Do For Cities - A review of the evidence, prepared by Steer Davies Gleave, February 2005) for pteg (Passenger Transport Executive Group, based in the UK) noted that:

'there is real evidence that UK light rail schemes have provided business with better access for customers; giving better access to labour markets, supporting business expansion and providing the confidence to make investment decisions based on the evident commitment to improved public transport. Increased development activity has brought a 'buzz' to areas served by the tram schemes.'

Dublin Transport Office (DTO) commissioned a study which surveyed household's attitudes to the Luas service (Millward Brown IMS, 2006). The survey was published in November 2006, over two years after the Luas service was introduced. The key findings of the survey were:

- Luas has contributed to people's overall satisfaction within their local area, with higher satisfaction levels in both Luas catchments.
- Luas is widely seen as a quicker way to travel than the car and, in particular, the bus. Many Luas users who have cars still opt for the Luas as the service offers speed and reliability (although the survey did highlight that there was a portion of car-users who were not willing to give-up car-based travel in favour of the Luas).
- Luas has contributed to increased shopping and employment opportunities. Luas also generated incremental shopping trips (i.e. shopping-related trips that would not normally have been made in the absence of Luas). This finding is also reported in another economic paper (Graham, 2003).

In 2006, the DTO commissioned another study ('LUAS 'After' Study: Employers & Retailers, Dublin Transportation Office: prepared by Millward Brown IMS, 2006) November 2006') which examined a range of public attitudes to the Luas light rail system. The study was undertaken from April to May 2006, approximately two years after the service was operational. The study had a number of key findings:

- Positive impact of the Luas on ease of travel around Dublin is widely acknowledged.
- The problem of staff punctuality as a result of inadequate public transport has been eased, in both the Red and Green line catchments.

- One in every four businesses, overall, and three in every ten located in the Luas catchments, believe Luas has been advantageous for their business. Businesses in the Green Line catchment are the most positive. Green Line businesses noted that improved staff access to work was the main advantage while Red Line businesses noted easier and better access for customers and clients.
- Significant satisfaction with improved access to and from the city centre.

Overall, the proposed scheme is likely to result in positive direct and indirect economic benefits for Dublin city, the Greater Dublin Area and the Irish economy through increasing accessibility to the city centre as well as induced/secondary/incremental economic and employment opportunities. It is noted by the pteg report that while it is difficult to quantify the wider economic impacts of rail schemes, 'there is clear empirical evidence of positive effects that light rail has had on the cities where it has been implemented in the UK'.

The proposed scheme will also go some way to reducing the wider costs of congestion and delays in commuting to work. The negative impacts of congestion to Dublin's (and thus, Ireland's) economy are significant: Dublin Chamber of Commerce estimates that 'the cost of congestion to the Greater Dublin Area in 2005 was €2.5bn' (Dublin Chamber of Commerce, 2005).

Overall, the proposed scheme will result in a positive impact to the wider economy in terms of development and reduced congestion of high magnitude, which is of High significance.

Improving accessibility to increased employment opportunities

Fingal County Council's MNEC Strategy will, through the Council's various planning policy documents, facilitate the creation of 37,000 additional jobs in the MNEC, up to the period 2025/2030. This represents an increase of 125% over the level of 2006 employment in the MNEC (which stands at 29,600 jobs). Additionally, the MNEC will have a resident population in excess of 128,000 and over 69% of these people will also work in the MNEC.

The Strategy envisages that most of these additional jobs will be within the services sector and target industries include corporate head offices, IT services, financial and business services, science and technology projects and environmental products and services. The strengths of MNEC, sourced from the MNEC Report, are:

- A high employment rate;
- A low dependency rate (i.e. retired, unable to work etc.);
- Large proportion of young population (25-44 age group);
- High educational attainment;
- Close proximity to Dublin Airport;
- Access to national and international markets via the national road network;
- Proximity to major seaports, including Dublin Port and the proposed Bremore Port;
- Existing base of foreign and indigenous firms;
- Access to major 3rd & 4th-level institutions in the Dublin area;
- A high quality of life.

The MNEC Strategy predicts that the majority of these jobs will be higher skilled and in the Market Services sector (76%: 28,200 additional jobs), followed by Non-Market Services (13%: 4,900) and Industrial jobs (11%: 3,900). Market Services jobs will entail financial and other international services, transport and communications services, and distribution. Industrial jobs comprise manufacturing, utilities and building. The principal future employment areas will be: Swords-Lissenhall, Dublin airport (Eastlands) and Metropark.

In Dublin City Council, the proposed scheme will result in the creation of new employment opportunities, although not to the same extent as the potential additional employment creation in Fingal County Council. Additional employment creation is likely to be focused at Ballymun (as part of the ongoing regeneration) and in the suburban retail and office concentrations, such as Drumcondra and Phibsborough.

Overall, the proposed scheme will assist with the creation of major employment opportunities in the long-term and this is a positive impact of high magnitude and High significance.

Improving accessibility to community and social facilities

The proposed scheme will provide high-quality and frequent access to community and social facilities, such as typical city and town centre facilities (e.g. banking, post-offices, public sector services, retail, financial and professional services, medical and dental services and educational facilities). Examples of the key locations to which access will be provided include: Swords town centre, Airside Retail Park, Dublin Airport, Metropark, Ballymun Town Centre, Dublin City University, Mater Hospital, Drumcondra high street, Trinity College, Dublin city centre and St. Stephen's Green. Additionally, access will be provided Dublin's wider rail and Luas network, thus opening up similar facilities all over the Greater Dublin Area, such as Dublin Docklands, Harcourt street business area, Dundrum Town Centre, Sandyford Industrial Estate, Heuston Station, Connolly Station and Tallaght Town Centre.

Overall, the proposed scheme will result in positive impacts with respect to access to the key social and community facilities in Dublin and this is a positive impact of high magnitude and High significance.

Assisting regeneration and social-improvement activities

The proposed scheme will greatly assist with the many ongoing regeneration initiatives in proximity the proposed scheme's alignment. The largest regeneration project is Ballymun and this is being managed by Ballymun Regeneration Ltd, a company set up by Dublin City Council to oversee the overall project. The proposed scheme will greatly assist with all of the regeneration and renewal objectives for this area of Dublin which has suffered socially challenging conditions for generations. The proposed scheme will provide the resident population (significant percentages of who are unemployed and with minimal educational qualifications) with direct, high-frequency and regular transport options to the key employment and other landuse areas of the Greater Dublin Area, thereby assisting with the regeneration objectives. The proposed scheme will also greatly assist the development of Ballymun Town Centre through providing direct, high-frequency and regular transport connectivity to the planning and future employment opportunities and town centre landuses. Thus, Ballymun will become a key town centre, underpinning the future vitality and community of Ballymun.

The proposed scheme will also assist with other regeneration and social-improvement programmes. In total, there are five designated RAPID areas, four Integrated Action Plans (under the Urban Renewal Scheme), 16 primary schools and three post-primary schools in the Department of Education and Science's social inclusion programme, 'Delivering Equality of Opportunity in Schools' (DEIS). Many of these are located within the study area, as described in the baseline Socio-economic chapter of this EIS (Volume 1, Chapter 11).

Overall, the proposed scheme will greatly assist with current and future regeneration programmes, a positive impact of high magnitude and High significance.

Improved access to employment through commuting improvements

The proposed scheme will deliver a fast, reliable, regular and efficient transport option through the north of Dublin city and on to Dublin Airport and beyond Swords. The journey time from Dublin Airport to the city centre (St. Stephens Green) is estimated at approximately 20 minutes and the journey from city centre to the terminus north of Swords is estimated to be approximately 30 - 35 minutes. Annual patronage (total journeys) is estimate to be 34 million, in excess of an average of 93,000 journeys per day. The initial peak service (broadly 0700 – 1000 and 1530 – 1930) is expected to be a 90m LMV every four minutes, providing capacity for 10,000 passengers per direction per hour. The off-peak service will be less frequent and possibly with shorter vehicles (45m).

The proposed scheme has been specified to be capable of carrying 20,000 passengers per direction per hour, with LMVs up to 90m long running at frequencies up to every two minutes. The capacity specified is around four times the forecast peak demand on the line when it is expected to open in 2014 and around six times the current peak demand on the Luas Green line.

In comparison to the other public transport option, which is primarily bus along the alignment, the proposed scheme will provide substantial improvement in journey frequency and times. Currently, a sample bus journey from Swords to the city centre (bus number 41) takes approximately 75 minutes, with four such services per hour. This is predicted to increase to approximately 91 minutes in 2014 and 100 minutes in 2029, all without the proposed scheme. When operational in 2014, the proposed scheme will provide an average journey time of approximately 30 minutes with up to 15 services per hour during peak periods. In comparison to the current level of bus service, this represents a substantial improvement in the peak commuting journey times. Such bus versus the proposed scheme journey time savings exist along the whole scheme.

Regarding improvements to car-based journeys, the proposed scheme will positively impact on these, thus providing these car-based commuters with reduced journey times and improved quality of life (e.g. shorter and less-stressful commutes). The modal shift from car to Metro improves the average speed across the GDA by 2kph and 3kph in 2014 and 2029 respectively. Time spent queuing decreases, distance travelled decreases and also time spent travelling decreases. Journey time assessments (MVA, 2007) on key routes further demonstrate the positive nature of the impact as the majority in both 2014 and 2029 show decreases. In both operational years 2014 and 2029 there is a general reduction in journey times on most of the routes assessed.

Journey time reductions of note include on the R132, Ballymun Road, M1, N2, Collins Avenue and Santry Avenue. There is a decrease in journey time of 19.8% on the R132 northbound from the city centre to the airport. There is a decrease in journey time of 17.2% using the Port tunnel northbound. There is a decrease in journey time of 14.3% using the South Quays – Georges Quay to O'Connell Bridge. There is a reduction in journey time on all routes on the M1 and N2 northbound and southbound from Dublin city centre to Swords and on the M50 in both directions. The most significant increase in journey time is anticipated to be 8.9% on the North Quays – from Heuston to O'Connell Bridge. However the majority of journey times are reduced along the routes. The journey time assessment for the operational years illustrates the significance of the positive impact that the proposed scheme will have on traffic movement particularly in the vicinity of the alignment.

The result of the proposed scheme is that it will provide a significant improvement to transport options and accessibility to a large portion of the population along the alignment. The net result of the proposed scheme is that the quality of life for a large portion of the residents living along the commuting corridor of the proposed scheme will be significantly improved due to significantly reduced journey times, improved journey reliability, frequency, comfort and safety. This represents a positive impact of very high magnitude and Very high significance.

With the provision of three Park & Ride sites as part of the proposed scheme, improvements to the many commuters' quality of life will be extended to commuters living in the towns and villages of North County Dublin and Counties Louth, Meath, Cavan, Westmeath and Longford (i.e. long-distance commuters). The current prevalence of long-distance commuting in the 'outer' counties of the Greater Dublin Area (and beyond) can be seen in the average distances of journeys travelled to work data from the 2006 Census. For Dublin City, the greatest percentage of journeys travelled (25.03%) is in the 2-4 km distance. For Dun-Laoghaire, the greatest journey to work travelled is in the 5-9km category (25.24%). However, significantly fewer percentages of similar (i.e. shorter) journeys are travelled in the outer counties and proportionally a greater volume of longer journeys (15km+) are undertaken instead. For example, in Kildare and Meath, 15.28% and 17.44% respectively of journeys travelled are 25 - 49kms, as against an average for Leinster of 7.4% for the same distance of journey.

While the proposed scheme will not reduce the commuting distances, it will reduce the commuting time and provide a more regular and improved commuting journey, resulting in an overall improvement to many long-distance commuters' quality of life. Overall, the proposed scheme will result in a positive impact to the quality of life of the commuters along the proposed scheme, and to those from the wider region who will use the Park & Ride sites. This positive impact is of high magnitude and is of High significance.

Direct employment creation

The proposed scheme will generate direct employment opportunities. RPA estimate that a total of 350 people will be required to operate the service in the first nine years of operation, with approximately 220 staff being employed in the operation of the service (LMV drivers, customer service staff, Park & Ride attendants, station staff, management etc.) and approximately 130 staff being employed in the maintenance of the system and infrastructure.

The level of direct employment will increase in year 10 due to the increased frequency of service and greater capacity on the system. It is estimated that 420 staff will be directly employed for the operation and maintenance of the proposed scheme after year 10.

It is not possible to estimate where future employees will come from. However, it can be assumed that a portion will be from the the proposed scheme catchment area. Given the higher unemployment levels in specific EDs (such as those in Ballymun and the north inner city of Dublin) within the proposed scheme study area, it is likely that employment of residents could be directly boosted in these EDs with some reduction of in unemployment rates.

The creation of this quantum of employment associated with the operation and management of the proposed scheme will also result in indirect socio-economic benefits, through expenditure of salaries by employees of the proposed scheme. Additional job creation will also result. This is difficult to quantify, but it will result in some further socio-economic benefits to the Greater Dublin Area.

It should be noted that these jobs will be new jobs and will not be as a result of displacement of employment from other sectors of public transport. Thus, there will be no impact on existing levels of employment in public transport.

Overall, direct employment from the proposed scheme will result in a positive impact of Very Low magnitude and, coupled with the very high functional value, this results in a positive impact of Very low significance.

3.2.2.2 Localised (MN105) socio-economic impacts

Facilitating future development

While the proposed scheme will not directly result in increased population levels proximate to the proposed scheme it will, indirectly, allow the relevant planning authorities to plan for and grant consent for higher residential densities of development due to the greater public transport capacities provided by the proposed scheme.

Dublin City Council has a number of planning policy documents of relevance to MN105. The key policy with regards to MN105 is the ongoing regeneration of Ballymun, a relatively modern (1950's) suburb to the north of the city and one which has significant social challenges (including some of the highest level of long-term unemployment in Ireland and the lowest levels of education attainment). In 1997 Ballymun Regeneration Ltd was set up by Dublin City Council to plan and implement a regeneration programme which will result in a new town with new and improved facilities for the 30,000 people who will live there. The population in 2006 was in excess of 22,000. A number of Area Action Plans have been prepared to assist with the ongoing regeneration of Ballymun. These are:

- Balcurris/Balbutcher Area Action Plan (AAP);
- Coultry AAP;
- Poppintree AAP;
- Shangan AAP;
- Silloge/Sandyhill AAP.

The regeneration of Ballymun is one of the largest regeneration projects in Europe and will be an ongoing project for the immediate future. The proposed scheme (or the Luas system – which is referenced in the Ballymun Masterplan) is the central element of transport infrastructure for the ongoing regeneration of Ballymun and is essential to the future economic development and growth of Ballymun.

The information presented in Chapter 11 (Baseline Socio-economics) shows that area MN105 is made up of seven EDs, which are:

- Ballymun B;
- Ballymun C;
- Ballymun D;
- Ballymun E;
- Whitehall B;
- Whitehall A (also partially in MN106);
- Ballygall C (also partially in MN106).

The populations of each of the EDs in MN105 in this area remained relatively constant between 2002 and 2006 (<12% increases/decreases over this period). Overall, the population has grown from 26,491 in 2002 to 26,596 in 2006, an increase of 0.4%. However, there were some population decreases in three of the seven EDs: Ballymun C (-2.5%), Ballymun D (-5.1%) and Ballygall C (-5.6%). These are likely to be a result of the demolition and relocation of Ballymun's resident populations as part of the ongoing regeneration project.

Part of the regeneration project involves the development of a town centre with community, retail, social and recreational facilities as the original design of Ballymun was lacking in such essential community facilities. The proposed location for the Ballymun Stop is in the centre of this developing town centre. Ballymun Regeneration Ltd. is of the view that the proposed scheme is essential to assisting with the social and financial success of the town centre, and the wider Ballymun community through providing a high-quality, rapid and frequent public transport option to the key socio-economic locations (either directly or through direct access to Dublin's wider rail network) in the Greater Dublin Area, such as Dublin Airport, Dublin City centre, Dublin Docklands, Sandyford Industrial Estate, key medical facilities and 3rd & 4th-level institutions. The proposed scheme will also provide the same transport and accessibility benefits to commuters who will be able to travel to work in Ballymun (a key part of the overall regeneration project is the development of employment within Ballymun).

Thus, the proposed scheme will facilitate future development and growth of the the proposed scheme corridor through Ballymun in a planned and sustainable manner. This is a positive impact of very high magnitude and Very high significance.

Employment creation

As with the future planning of economic development in Fingal, the proposed scheme will permit Dublin City Council to plan for a significantly greater level of employment along the corridor defined by the proposed scheme. However, the segment of the proposed scheme in the administrative area of Dublin City Council is more developed than the corresponding corridor in Fingal, which currently has large undeveloped areas (which, as noted in the impact assessment sections MN101 to MN104 inclusive, will be subject to future development as part of the the proposed scheme Economic Corridor (MNEC) Strategy). Thus, the quantum of future employment creation to be indirectly created and assisted by the proposed scheme will be much lower than the corresponding employment creation in Fingal.

While it is difficult to estimate the level of potential employment to be indirectly created within MN105, it is still likely that the positive impact of indirect employment creation will be of high magnitude and High significance in the long-term for MN105.

Improving accessibility to and availability of employment opportunities

The rate of employment in MN105 is amongst some of the lowest in the Greater Dublin Area, ranging from 42.1% to 48.7%, as against an average in Dublin City Council of 56.9%, a Greater Dublin Area average of 59.9% and a State average of 57.2%. Correspondingly, unemployment rates are very high in MN105, ranging from 2.9% (Ballymun E: please note that this ED has a relatively low labour participation rate, which may explain the low unemployment rate) to 25.8% (Ballymun B).

The proposed scheme will improve access to employment opportunities across the Greater Dublin Area and it will also result in significantly positive employment impacts for MN105, through providing a high-quality, rapid and frequent mode of transport to the major employment areas of Dublin.

Regarding improving transport options for those with no access to a car, the proposed scheme will provide significant improvements to accessibility EDs within MN105, especially Ballymun B (51.8% of whom do not have access to a car), Ballymun D (59.5% of whom do not have access to a car) and Ballymun C (46.3%) – all of which have above or close to the average for no car access in Dublin City Council's functional area (40.5%).

The proposed scheme will provide significant improvements regarding commuting times and journey quality for the residential population of MN105. This is evident in comparing comparable bus journeys to that of the proposed route for the proposed scheme. A relevant example re MN105 is the bus journey from Ballymun to the city centre (bus number 13). This takes approximately 56.2 minutes, with four such services per hour. This is predicted to decrease to 54.8 minutes in 2014 but increase to 73.2 minutes in 2029, all without the proposed development.

When operational in 2014, the proposed scheme will provide an average journey time of approximately 15-18 minutes with up to 15 services per hour during peak periods. In comparison to the current level of bus service, this represents a substantial improvement in the peak commuting journey, which is an impact of very high magnitude and Very high significance.

In relation to improving the type of employment opportunities, the proposed scheme will result in considerably greater access to professional and technical employment for the population of MN105, especially the following five (of seven) EDs (which have significantly lower than average professional employment and higher than average unskilled employment): Ballymun B (9.3% professional occupations), Ballymun C (13.0%), Ballymun D (7.8%) and Whitehall B (24.6) - against a Dublin City average of professional occupations of 30.4% and a State average of 32.9%.

Overall, the proposed scheme will increase access to more and better employment opportunities for MN105, a positive impact of very high magnitude and Very high significance.

Improving accessibility to community and social facilities

This section is focusing on the benefits that the proposed scheme will provide in relation to access to community and social facilities, such as typical city and town centre facilities (e.g. banking, post-offices, public sector services, retail, financial and professional services, medical and dental services and educational facilities).

The proposed scheme will provide significantly faster and direct access to some key community and social facilities along the alignment, such as Swords town centre, Airside Retail Park, Dublin Airport, Metropark, Ballymun Town Centre, Dublin City University, Mater Hospital, Drumcondra high street, Trinity College, Dublin city centre and Dublin Docklands. Additionally, access will be provided Dublin's wider rail and Luas network, thus opening up similar facilities all over the Greater Dublin Area.

Overall, proposed scheme will improve access to community services, a positive impact of high magnitude and High significance.

Assisting regeneration and social-improvement activities

Ballymun B, Ballymun C and Ballymun D are included in the Dublin City Ballymun RAPID Area. Area MN105 also contains the Ballymun IAP (Integrated Action Plan) area under the Urban Renewal Scheme. Also located within Area MN105 and within 500m of the alignment, are 9 primary schools and 1 post-primary school included in the Department of Education and Science's Delivering Equality of Opportunity in Schools (DEIS) programme. The proposed scheme will greatly assist with these regeneration and social improvement programmes, as well as greatly assisting Ballymun Regeneration Ltd. in its long term objective of the regeneration of Ballymun and addressing the historical and inter-generational unemployment issues.

Overall, the proposed scheme will greatly assist with current and future employment development objectives, a positive impact of very high magnitude and Very high significance.

3.3 DERIVATION OF MITIGATION MEASURES

3.3.1 Construction phase

All relevant construction mitigation measures for socio-economic impacts are linked to the general construction measures proposed within this EIS, which outlines a range of measures to minimise environmental impacts which might arise during the construction stage of the project. Access to businesses and key retail, employment and commercial areas will be maintained during the construction phase and the public and local receptors will be fully aware of construction plans in advance. However there is likely to be traffic disruption associated with the construction phase.

3.3.2 Operational phase

All of the operational impacts are positive and, thus, no mitigation is proposed.

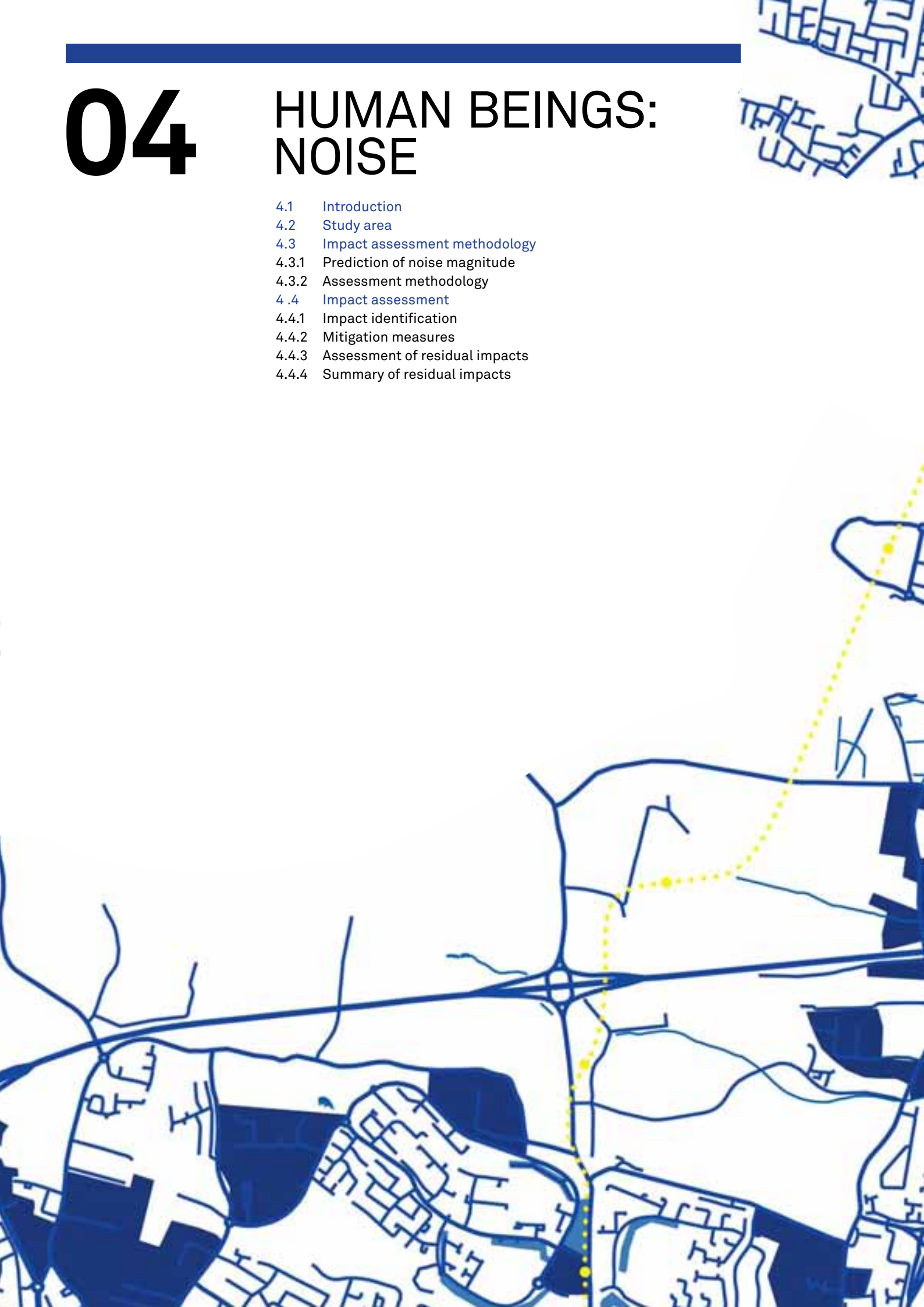
3.4 ASSESSMENT OF RESIDUAL IMPACTS

A summary of the residual impacts associated with the proposed scheme is provided in Table 3.7.

Table 3.7 Summary of residual impacts

	Magnitude of impact taking into account mitigation	Functional value of area affected	Significance of impact
General/scheme-wide impacts: construction phase			
Direct economic impacts	very low	very high	Very low
Indirect economic impacts	low	very high	Low
Impacts due to traffic congestion and diversion	high	very high	High
General/scheme-wide impacts: Operational phase			
Facilitating future development and employment creation	high	very high	High
Improving accessibility to employment opportunities	high	very high	High
Improving accessibility to community and social facilities	high	very high	High
Assisting regeneration and social-improvement activities	high	very high	High
Improved access to employment through commuting improvements	very high	very high	Very high
Improved commuting journeys for long-distance commuters	high	very high	High
Direct employment creation	very low	very high	Very low
Localised (MN105) impacts: Construction phase			
Refer to respective Landuse and Traffic chapters of this EIS (Volume 2, Chapters 2 and 7 respectively)			
Localised (MN105) impacts: Operational phase			
Facilitating future development	very high	very high	Very high
Employment creation	high	very high	High
Improving accessibility to and availability of employment opportunities	very high	very high	Very high
Improving accessibility to community and social facilities	high	very high	High
Assisting regeneration and social-improvement activities	very high	very high	Very high

04 HUMAN BEINGS: NOISE



This chapter of the EIS evaluates the potential noise impacts arising from the construction and operation of the proposed scheme in Area MN105.

4.1 INTRODUCTION

This chapter of the EIS evaluates the potential noise impacts arising from the construction and operation of the proposed scheme in Area MN105. Groundborne noise and vibration impacts are reported in Chapter 5.

4.2 STUDY AREA

The study area for this assessment is defined in the baseline chapter and comprises the nearest noise sensitive receptors to the alignment corridor, construction compounds and adjacent roads where traffic flows may be changed up to 500m from the alignment.

4.3 IMPACT ASSESSMENT METHODOLOGY

The source and type of all potential impacts is described in Section 4.4.1. Mitigation measures to be put in place are defined in Section 4.4.2. The extent to which mitigation is needed increases as the magnitude of the impact increases. Unmitigated impacts and residual (mitigated) impacts are evaluated in Section 4.4.3. Annex C Noise Assessment Details (Volume 3, Book 2 of 2), provides details of the noise modeling methods and results, including predicted levels of noise without mitigation for both the construction and operational phases.

4.3.1 Prediction of noise magnitude

4.3.1.1 Construction

The magnitude of construction noise impacts is predicted by considering noise emissions data for typical construction equipment based on the expected methods of construction for each phase of work on each worksite. The plant teams used are listed in Section 6 of Annex C Noise Assessment Details (Volume 3, Book 2 of 2). The prediction method follows that recommended in BS 5228 Noise and vibration control on construction and open site, part 1, 2, 3, 1997.

4.3.1.2 Noise from the metro vehicles

Noise levels associated with the operation of the proposed scheme have been modeled using a 3-dimensional noise model, Soundplan®. Baseline noise levels have been measured directly, as reported in the baseline Noise chapter of this EIS (Volume 1, Chapter 12). The predicted noise levels from the light metro vehicles (LMVs) have been compared to the baseline noise levels to estimate likely changes in noise.

Noise from road traffic

For road traffic noise on the surrounding roads a similar approach to that described for LMVs is used. Significant changes in road traffic noise have been identified by analysis of the available road traffic modeling results. Changes in noise levels have been predicted using CRTN (Calculation of Road Traffic Noise, UK DoE, 1988) based on the traffic flows, speeds and percentage of the flow which is Heavy Goods Vehicles (HGVs) in the do minimum and do something scenarios for 2014 (year of opening) and 2029 (design year). These have then been compared. Also, where junction realignments take place that will bring road elements closer to receptors and will lead to increases in noise these have been calculated. Where an increase is expected, the functional value of the receptor is considered as described in the following section.

4.3.2 Assessment Methodology

4.3.2.1 Construction

The predicted levels are compared to the assessment criteria given in Table 4.1. Any predicted noise levels exceeding the criteria given in Table 4.1 at a noise sensitive receptor are deemed to be an impact, unless they occur for very short periods of time. Where exceptions occur in this regard, they are discussed on a case by case basis.

The National Roads Authority (NRA) has published construction noise targets guidelines for L_{Aeq} in 'Guidelines for the Treatment of Noise and Vibration in National Roads Schemes'. The NRA guidelines are based on UK guidance which described daytime noise levels for rural areas or areas away from major roads. These criteria are summarised in Table 4.1. As shown in the table, the evening targets are taken as 10 dB lower than the daytime levels based on guidance given in BS5228. The daytime criteria given in Table 4.1 may be appropriate for interurban road schemes undertaken by the NRA, but are not necessarily appropriate for the urban situation through which the majority of the proposed scheme is to be constructed. For the urban area, or near to main roads, the 75 dB value is used, taken directly from the UK guidance and common practice.

In addition, a level of 65 dB is used specifically for schools, again drawn from common practice in the UK for urban developments.

The criteria given in Table 4.1 have been applied to all areas with a functional value of ≥(III). Areas with a functional value of <(III) are not considered to be sensitive to noise.

Table 4.1 Noise criteria during the construction phase (at 1m from the façade)

Period over which criterion applies	Noise Impact Criterion ($L_{Aeq, period}$)
- Monday to Friday:	
Urban areas or near main roads; Day: 07.00 to 19.00	75 dB
Rural areas away from main roads Day: 07.00 to 19.00	70 dB
- Monday to Friday: Evening: 19.00 to 22.00	65 dB
- Monday to Friday: Night: 22.00 to 07.00	The higher of 45 dB or the ambient level.
- Saturday: Day: 08.00 to 16.30 (work outside these hours will be subject to Monday to Friday night time noise levels i.e. the higher of 45dB or the ambient level)	65 dB
- Sundays and Bank Holidays: Day: 08.00 to 16.30 (work outside these hours will be subject to Monday to Friday night time noise levels i.e. the higher of 45dB or the ambient level)	60 dB

Table 4.2 defines the impact ratings that are used in this assessment.

Table 4.2 Definition of noise magnitude ratings

Extent of Noise Impact (Exceedance of Assessment Criteria)	Noise Impact Magnitude	Magnitude Rating
>10dB	Severe	very high
5 to 10dB	Substantial	high
3 to 5dB	Moderate	medium
1 to 3dB	Slight	low
<1dB	No Impact	very low

4.3.2.2 Operation

When judging noise impact, the functional value of each receptor is considered. In terms of noise assessment, the functional value relates primarily to the noise sensitivity of the activity taking place in the building. Most receptors will fall into two groups: those that are sensitive at all times to noise and those that are only sensitive during the day. However, there are also receptors that have unique sensitivities.

The criteria that are applied are summarised in Table 4.3 and Table 4.4. These criteria are applied to areas with a functional value of ≥(III). Areas with a functional value of <(III) have not been assessed because they are not considered to be sensitive to noise. The threshold criteria given in Table 4.3 are threshold noise levels below which environmental noise has insignificant effects. The noise levels in Table 4.3 are 'free-field' i.e. away from reflective surfaces. Changes in noise below these thresholds may be noticeable but would not result in significant environmental noise impacts.

Table 4.3 Threshold criteria for assessment of impacts during the operational phase

Area description	Functional value	Noise impact threshold during operation
Locations that are highly sensitive during both night and day: - Residential areas, medical facilities (hospitals, nursing homes etc)	very high	Daytime: 55 dB L_{Aeq} Night-time: 45 dB L_{Aeq}
Locations that are only sensitive during the day, where the activities that are carried out require an acceptable noise environment: - Educational/Institutional uses, theatres and religious buildings.	high	Daytime: 55 dB L_{Aeq} Night-time: Not applicable: Locations are not sensitive at night
Locations that are only sensitive during the day and where the activities that are carried out can be carried out in the presence of some noise, but not high levels of noise: - Outdoor recreational areas. - Cinemas. - Offices.	medium	Assessed on a case by case basis, depending on the sensitivity of the specific use and the level of protection that may be afforded by the building.

Where noise from the LMVs is above the threshold values, the impact depends directly on the change in noise levels or the extent to which the noise levels exceed the threshold values. For example, if the ambient noise level is currently high (well above the threshold), a small change in noise levels may be unnoticeable and a larger change may cause disturbance and be significant. In such cases the scale of the impact will depend on the degree of noise change. If the ambient noise level is currently low (below the thresholds) then the scale of the impact is dependent on the extent to which the predicted noise levels exceed the thresholds.

In this way the significance of noise impact has been assessed with reference to both the change in noise and the threshold values previously described. The magnitude ratings used in the assessment are summarised in Table 4.4. 3. dB is generally the smallest change in environmental noise that would be noticeable under typical listening conditions. A change of 10 dB is generally considered to be a doubling in loudness.

Table 4.4 Definition of noise magnitude ratings

Extent of Noise Impact (Exceedance of Threshold Criteria or Increase in Baseline Levels When Above Threshold)	Noise Impact Magnitude	Magnitude Rating
>10dB	Severe	very high
5 to 10dB	Substantial	high
3 to 5dB	Moderate	medium
1 to 3dB	Slight	low
<1dB	No Impact	very low

Traffic noise impacts are assessed using the same methodology. Noise from fixed plant is considered in the same manner; however, it has been assumed insignificant if noise is less than NC25 inside neighboring buildings at night (to avoid sleep disturbance) or to not exceed the existing L_{A90} background noise. Noise Criteria (NC) curves are used to specify sound levels across a range of frequencies, and NC25 dB is an acceptable level for internal areas. Since all fixed plant is to be designed to meet these standards, it has not been necessary to define magnitudes of impact since no significant residual effects are expected.

4.4 IMPACT ASSESSMENT

4.4.1 Impact identification

4.4.1.1 Construction

The key noise sources during construction are likely to be from the construction of the alignment in cut-and-cover tunnel beneath the Ballymun Road. Underground stops will be included at Ballymun and DCU, and will be constructed by cut-and-cover techniques.

To assess the construction noise impacts in this section of route, noise predictions have been carried out at 18 noise sensitive receptors around these works areas. These receptors are illustrated on maps (Noise Impact) Volume 3, Book 1 of 2. Each receptor represents the group of properties most likely to be affected by the works nearby.

4.4.1.2 Operation

During operation of the proposed scheme, noise sources will include traffic changes in the area of the alignment, people at metro stops, and ancillary systems such as power supply facilities. There will also be occasional maintenance activities along the route. Tunnel emergency fan vents will also be required at Ballymun Stop and DCU Stop.

Noise impacts from traffic may result due to:

- road closures or the remodeling of junctions or
- modal shift from the private car may help to reduce the number of vehicles on the highway network

It is noted that substantial changes in road traffic flow, speed, and/or composition are required to produce noise changes greater than 3dB.

People at metro stops may cause noise, but in general stops with nearby noise sensitive receptors are located in busy areas where ambient noise levels are relatively high, and any such affects will be small.

4.4.2 Mitigation measures

4.4.2.1 Construction

Mitigation will include the following measures:

Best practical means will be used to minimise construction noise through implementation of BS 5228. In particular, the following noise mitigation measures will be implemented:

- Proper use of plant with respect to minimising noise emissions and regular maintenance will be required. All vehicles and mechanical plant will be fitted with effective exhaust silencers and will be maintained in good efficient order.
- The use of inherently quiet plant where appropriate - all major compressors and generators will be 'sound reduced' models fitted with properly lined and sealed acoustic covers, which will be kept closed whenever the machines are in use, and all ancillary pneumatic percussive tools will be fitted with mufflers or silencers of the type recommended by the manufacturers.
- Machines in intermittent use will be shut down in the intervening periods between work or throttled down to a minimum.
- All ancillary plant such as generators and pumps will be positioned so as to cause minimum noise disturbance, and where necessary, acoustic enclosures will be provided.
- Where practicable the use of noisy plant will be limited to core daytime periods.
- Channels of communication will be established between the contractor/ developer, local authority and residents.
- A site representative will be appointed responsible for matters relating to noise.
- Typical levels of noise will be monitored during critical periods and at sensitive locations.
- A 2m high solid site hoarding along the site boundaries will be erected where practical and feasible.
- Localised noise barriers will be erected as necessary around items such as generators or high duty compressors.
- Construction compounds will be laid out so as to minimise noise impacts to neighbouring noise sensitive receptors, by locating noisy operations well away from receptors and using on-site structures and materials to screen noise where practicable and necessary.

Additionally, all contractors will be required to comply with S.I. No 632 of 2001 European Communities (Noise Emission by Equipment for Use Outdoors) Regulations 2001, amended by S.I. No 241 of 2006.

4.4.2.2 Operation

Ventilation fans

The tunnel ventilation fans will be fitted with exhaust silencers. The following sound power limits for the ventilation shaft fans and their minimum performance will be:

(a) Sound Requirements

(i) in relation to emergency ventilation axial fans the total sound power generated by the fan shall not exceed the following decibel ratings at source when operating in the normal mode at rated speed

(ii) it is proposed that attenuation shall be included after the fans in the form of a silencer with the appropriate fire/heat rating. The sound attenuation shall be able to achieve a minimum noise reduction of NR 20 decibel reduction compared with the ratings in Table 4.5 in the nearest openable window of any habitable space.

This indicates that the fan noise levels immediately outside the discharge opening of the ventilation and intervention shafts will be no higher than 70-75dB(A).

Table 4.5 – Sound at Source – axial fans

Hz	63	125	250	500	1000	2000	4000	8000
Sound Power Level at fan (dBA) (referred to 10-12 watts)								
dB(A)	96	102	103	98	97	95	91	87

In addition the RPA has committed to the following noise limit inside buildings near vents shafts:

> The fans will be attenuated to ensure that the noise levels in adjacent buildings will not exceed Noise Criteria level NC25.

This will preferably be achieved by increasing the fan silencer performance, but if necessary other measures including providing noise insulation to affected buildings if necessary (see below) will

LMV Noise
The LMVs run in cut-and-cover tunnel in this section, and no airborne noise mitigation is required.

4.4.3 Assessment of residual impacts

4.4.3.1 Project scenario: construction phase

Alignment
The route section comprises cut-and-cover tunnel sections. The predicted noise levels for these activities are shown in Table 7.28 of Annex C Noise Assessment Details (Volume 3, Book 2 of 2).

Without mitigation noise impacts are predicted at all 13 of the representative receptors that face the alignment section with noise levels exceeding impact assessment criteria by 1 to 14dB at residential and commercial receptors and by 11 to 17dB at the three educational receptors (MN105-C7, MN105-C9 and the parts of Our Lady of Victories Church, that are used for education as represented by MN105-C12 that have been considered.

Taking into account the degree of mitigation that may be available for cut-and-cover alignment works, it is likely that noise levels could be reduced to below the impact assessment criterion and no significant residual noise impacts are expected, except at Ballymun Civic Centre (MN105-C5), residential receptors on Ballymun Road (MN105-C10) and No 158 and 160 Ballymun Road (MN105-C12). At (MN105-C5) and (MN105-C10) a Low residual impact of 1dB above the criterion is expected during construction. At (MN105-C12) a Medium residual impact of 4dB is predicted.

At the educational receptors the construction will result in residual impacts at the Our Lady of Victories School (MN105-C7) of 1dB which is a Low impact, and at the library and Scoil An Tseachtar Laoch (MN105-C9) of 5dB which is a Medium impact. A residual impact is also predicted in the parts of Our Lady of Victories Church, on Ballymun Road that are used for educational purposes (MN105-C12) of 7dB which is a High impact.
In order to assess the potential duration of the impacts it has been assumed that the closest receptors are not significantly affected when works are more than about 100m from the receptors. The impacts are not expected to last for more than approximately 30 days on this basis.

Stops
The predicted noise levels for construction of stops are shown in Table 7.28 of Annex C Noise Assessment Details (Volume 3, Book 2 of 2).

Noise levels of between 6 to 17dB above the 75dB criterion have been predicted at the nine receptors that are located close to stops. Residual impacts of 7dB (Medium are expected at Ballymun Civic Centre (MN105-C5) as a result of works on the Ballymun Stop. Residual impacts of 5dB (Medium are expected at the offices south of Albert College Drive (MN105-C12), 5dB (Medium at residential properties on Ballymun Road (MN105-C13), 3dB (Medium) at Albert College Grove (MN105-C15) and 4dB (Medium at Albert College Crescent (MN105-C17) as a result of works on the DCU Stop.

Construction compounds
Construction Compounds 11 and 11A are located in area MN105. Compound 11 is the worksite for the permanent works for Ballymun Stop, and is not considered further in this section. It is proposed that Compound 11A will accomodate a Bentonite batching plant in support of Compound 11. Based on worst case distance to the compound a batching plant would be likely to result in noise impacts 7 dB above the assessment criterion at the nearest receptors which are blocks of flats on Ballymun road/Balcurris Road (MN105-C1). With mitigation the noise levels from Bentonite batching are not expected to result in significant noise impacts.

Works at night
Concrete pours outside of core hours may be required for the underground stops. This activity is not likely to be standard practice and the assessment therefore represents a worst case scenario. However, where required there will be liasion with the local community and agreement with the relevant local authority in advance of these works proceeding.

In the worst case this would result in a noise impact 20 to 28dB above the 45dB assessment criterion around Ballymun Stop at James Connolly Tower flats (MN105-C4) and Ballymun Civic Centre (MN105-C5).

Impacts 17 to 32dB above the 45dB criterion are predicted at MN105-C13 to MN105-C17, these receptors represent Ballymun Road, Albert College Road, Ballymun Road/St Pappins Road and Albert College Crescent.

Baseline noise levels are relatively high at night in this area (55 to 60dB) so residual noise impacts are likely to be lower than predicted above. The level of impact will depend on the baseline noise levels at specific receptors at the time that work will be carried out, and assessment criteria higher than 45dB could reasonably be applied where existing noise levels are already above 45dB. However, Very high impacts are likely even taking this into account.

Construction traffic
Due to construction of the proposed scheme significant changes in traffic flows are expected to occur along St. Pappin's Road from Ballymun Road to the junction with Dean Swift Road, increasing traffic noise levels by approximately 4dB. Residential properties border this 500m section of road, and could experience Medium impacts for up to approximately 16 months.

4.4.3.2 Project scenario: operational phase

Introduction

The route runs southwards in a cut and cover tunnel beneath the Ballymun Road, and no airborne noise impacts are predicted. Groundborne noise and vibration impacts are reported in the Vibration chapters of this EIS (Volume 2, Chapter 5).

Ventilation Shafts

Noise from testing of ventilation fans may be at levels of up to 70-75dB immediately next to the shaft discharge. Testing will take place for about 30 minutes once every two weeks. In general where the shaft discharges are on busy streets the noise will be audible above ambient noise, but given its short duration will not constitute a significant noise impact. The specific affects at two stops and associated shafts are discussed below.

At the Ballymun Stop the nearest residential receptors are on the corner of Silloge Road and Ballymun Road at least 15m from the nearest shaft. Noise from fan testing during the day should be below ambient noise at these receptors. If testing is required at night additional noise attenuation may be necessary to achieve the NC25 standard within buildings. It is expected that additional fan silencers and design measures at source could achieve this.

At the DCU Stop the nearest residential receptors are at Ballymun Road 7m from the vent and Albert College Lawn which is at least 24m from vent. Noise from fan testing during the day should be below ambient noise at these receptors. If testing is required at night additional noise attenuation may be necessary to achieve the NC25 standard within buildings. It is expected that additional fan silencers and design measures at source could achieve this.

4.4.4 Summary of residual impacts

A summary of the residual impacts associated with this section of the proposed scheme is provided in Table 4.6.

Table 4.6 Summary of residual impacts

	Magnitude of impact taking into account mitigation	Functional value of area affected	Significance of impact
Construction phase			
Construction Noise During Day	high at Our Lady of Victories Church, on Ballymun Road (MN105-C12).	very high for residential buildings	Significant
	medium at the library and Scoil An Tseachtar Laoch on Ballymun Road (MN105-C9), Ballymun Civic Centre (MN105-C5), 158 and 160 Ballymun Road (MN105-C12), residential properties on Ballymun Road (MN105-C13), Albert College Grove (MN105-C15), and Albert College Crescent (MN105-C17).	high for educational buildings	Significant
	medium road traffic noise affecting properties on St. Pappin's Road.	medium for offices	Significant
	Other impacts are not significant.		
Construction Noise During Night	very high over periods when concrete pours cannot be completed during the day at James Connolly Tower flats (MN105-C4), Ballymun Civic Centre (MN105-C5), receptors representing Ballymun Road (MN105-C13 and C14), Albert Colllege Grove (MN105-C15), Ballymun Road/St Pappins Road (MN105-C16) and Albert College Crescent (MN105-C17). This activity is not likely to be standard practice and the assessment therefore represents a worst case scenario.	very high	Significant
Operational phase			
Airborne Noise from LMVs	very low	not applicable	Not applicable
Emergency Ventilation fans	very low	very high	Not significant

05 HUMAN BEINGS: VIBRATION

This chapter of the EIS evaluates the potential vibration impacts arising from the construction and operation of the proposed scheme within Area MN105.

5.1 INTRODUCTION

This chapter of the EIS evaluates the potential vibration impacts arising from the construction and operation of the proposed scheme within Area MN105.

5.2 STUDY AREA

The study area for this assessment is set out in Table 5.1.

Table 5.1 Study area

Criteria	Width of study area (on both sides of thealignment)
Construction Groundborne Noise – human perception	50m
Construction Groundborne Noise – effects on sensitive faculties	100m
Construction Vibration – building damage	50m
Construction Vibration – human perception	80m
Construction Vibration – effect on sensitive equipment	1,000m
Operational Vibration – human perception	50m
Operational Vibration – effect on sensitive equipment	100m
Operational Groundborne Noise – human perception	50m
Operational Groundborne Noise – effects on sensitive facilities	100m

5.3 IMPACT ASSESSMENT METHODOLOGY

5.3.1 Construction phase methodology

The source and type of all potential impacts is described in Section 5.4.1. Mitigation measures to be put in place are defined in Section 5.4.2 for any adverse impacts that are deemed to be of Medium or greater significance prior to mitigation. The extent to which mitigation is needed increases as the significance of the impact increases. The residual impact is then evaluated in Section 5.4.3 in terms of magnitude and significance.

5.3.1.1 Magnitude

The criteria used to assess the different impacts associated with the proposed scheme are discussed below and summarised in Table 5.2.

Groundborne Noise
The metric which is widely used for the assessment of groundborne noise is the maximum A-weighted sound level using 'slow' time response, $L_{Amax,S}$.

The symbol 'L' indicates a value expressed in decibels (abbreviated dB). The dB scale measures relative magnitudes of sound power or intensity (sound power per unit area) a property proportional to the mean squared value of the amplitudes of the air pressure oscillations that cause sound. Every doubling of intensity is a 3dB increase and every tenfold increase in intensity is a 10dB increase. A standard reference level (0dB = 20μPa of root mean square sound pressure) is used so that the dB scale can measure absolute levels as well as relative levels. The symbol 'A' signifies that the measured sound pressure has been subjected to frequency weighting using the standard 'A-weighting scale', to approximate the frequency response of the human ear—relatively insensitive at low frequencies and very high frequencies. Every 10dB increase in A-weighted sound level is perceived as approximately a doubling of loudness—slightly more than a doubling for sound of low frequency. The symbol 'S' specifies a method of averaging the oscillating sound pressure, by exponential averaging as defined in IEC 61672 (2002), using the standard 'slow' time constant of one second - the alternative being the 'F' or 'fast' time constant of 1/8 second. 'S' has a greater smoothing effect on sound that varies in level. The symbol 'max' means the highest averaged value reached during an event such as the passage of a train. The value of $L_{Amax,S}$ nearly equals the value of $L_{Amax,F}$ for a steady sound that lasts for one second or more, otherwise $L_{Amax,F}$ levels exceed $L_{Amax,S}$ levels by an amount dependent on the rapidity and magnitude of the variations. For groundborne noise from a modern underground railway $L_{Amax,S}$ levels are typically 2dB lower than $L_{Amax,F}$ levels. $L_{Amax,S}$ can alternatively be written as L_{Asmax} and is defined in IEC 61672 (2002).

Vibration
The metric which is used for the assessment of vibration is the KB value from DIN 4150-2, which is assessed using three different criteria, A_u, A_o and A_r. The KB value is a frequency weighted measure of vibration velocity in units of mm/s, using the 'F' time constant, obtained for each 30-second cycle in a sequence of contiguous 30-second cycles. Two types of parameters are defined based on the KB value:

- KB_{Fmax} the maximum value for the time varying KB value during the evaluation period;
- KB_{FTr} an evaluation parameter that is weighted according to the number of vibration events and the duration of these events during the evaluation period.

For daytime vibration other than blasting, if KB_{Fmax} is lower than or equal to Au DIN 4150-2 states that 'the requirements of the standard have been met'. If KB_{Fmax} is greater than A_o 'the requirements of the standard have not been met'. In other cases, where the KB_{Fmax} value is between A_u and A_o, KB_{FTr} is calculated as the root-mean square of the 30-second KB values, and if it does not exceed Ar the 'requirements of the standard have been met'.

For construction vibration three levels are defined by DIN 4150-2:

Level I: With vibration below this level, it can be assumed even without any previous knowledge, that there will be no considerable discomfort.

In this assessment daytime vibration impact above Level I and not above Level II is classed as 'Low'.

Level II: Vibration below this level is also not likely to produce considerable discomfort, as long as the measures specified in items a) to e) (and if necessary, item f) of DIN 4150-2 are taken. As this level is exceeded, the probability increases that there will be considerable discomfort. According to DIN 4150-2 'If it is expected that level II will be exceeded, an attempt shall be made to use construction methods that produce less vibration'.

In this assessment daytime vibration impact above Level II and not above Level III is classed as 'high'.

Level III: The effects produced by vibration above this level are unacceptable. In this case, special measures that go beyond those specified in items (a) to (f) of DIN 4150-2 shall be agreed upon.

In this assessment daytime vibration impact above Level III is classed as 'Very high'

For construction vibration at night, the same guideline values used for operational vibration apply. In this context DIN 4150-2 defines criteria for five receptor types and the most stringent criteria have been used to define the 'very low' impact category. The criteria for less sensitive receptors defined in DIN 4150-2 have been used to define the higher impact magnitudes in the absence of other guidance. All impact magnitudes above 'very low' are defined as significant at night.

For assessment of vibration from construction plant the metric conventionally used is peak particle velocity (PPV). The Irish EPA recommends that to avoid any risk of damage to properties in the vicinity of a quarry, the vibration levels from blasting should not exceed a peak particle velocity of 12mm/s as measured at a receiving location when blasting occurs at a frequency of once per week or less. In the rare event of more frequent blasting, the peak particle velocity should not exceed 8mm/s.

DIN 4150-2 uses KB_{Fmax} for the assessment of human exposure to vibration from blasting, using only the A_o values from the set of limits (A_o, A_u and A_r) used for general vibration assessment.

For human response, a relationship between PPV and KB_{Fmax} is required. The relationship depends on the frequency spectrum and the duration of the blast. The KB frequency weighting is almost flat between 16Hz and 63Hz, between which limits it is effectively an F-weighted exponential average of velocity in mm/s. While blasting vibration can occur significantly outside this range, often the dominant frequency is between 16Hz and 63Hz. The ratio of PPV to KB_{Fmax} in the example given in DIN 4150-2 is 2:1. Based on typical examples from blast monitoring of the Dublin Port Tunnel this would appear to be very conservative, and the ratio may be higher. However, the relationship PPV = 2 x KB_{Fmax} is used in this assessment.

A daytime PPV of 12mm/s, taken as A_o = 6, is equated in this assessment to the threshold of 'High impact'. The threshold of 'Medium impact' is A_o = 5 and 'Low impact' is A_o = 3, being the daytime A_o value given in DIN 4150-2 for the two most sensitive classes, 'Buildings which are predominantly or purely residential' and 'Buildings in specially protected areas'.

Vibration from construction plant operating on above-ground worksites is assessed in the same way as vibration from the tunnelling, based on measured PPV levels for the relevant plant, converted to KB_{Fmax} using the same ratio of 2:1.

Table 5.2 Criteria for assessment of impact magnitude during construction phase

Criteria		Impact magnitude
Dwellings, Offices, Hotels, Schools, Colleges, Hospital Wards, Libraries		
Groundborne noise (tunnel boring machine (TBM))	Night $L_{Amax,S}$ >50dB	very high
	Day $L_{Amax,S}$ >55dB	
	Night 45dB >$L_{Amax,S}$ ≤ 50dB	high
	Day 50dB >$L_{Amax,S}$ ≤ 55dB	
	Night 40dB >$L_{Amax,S}$ ≤ 45dB	medium
	Day 45dB >$L_{Amax,S}$ ≤ 50dB	
	Night 35dB >$L_{Amax,S}$ ≤ 40dB	low
	Day 40dB >$L_{Amax,S}$ ≤ 45dB	
	Night $L_{Amax,S}$ ≤ 35dB	very low
	Day $L_{Amax,S}$ ≤ 40dB	
Vibration effect on people (TBM and construction plant)	Night A_u > 0.2, A_o > 0.4, A_r > 0.1	very high
	Day A_u > 1.6, A_o > 5, A_r > 1.2	
	Night A_u ≤ 0.2, A_o ≤ 0.4, A_r ≤ 0.1	high
	Day A_u ≤ 1.6, A_o ≤ 5, A_r ≤ 1.2	
	Night A_u ≤ 0.15, A_o ≤ 0.3, A_r ≤ 0.07	medium
	Day A_u ≤ 1.2, A_o ≤ 5, A_r ≤ 0.8	
	Night A_u ≤ 0.1, A_o ≤ 0.2, A_r ≤ 0.05	low
	Day A_u ≤ 0.8, A_o ≤ 5, A_r ≤ 0.4	
	Night A_u ≤ 0.1, A_o ≤ 0.15, A_r ≤ 0.05	very low
	Day A_u ≤ 0.4, A_o ≤ 3, A_r ≤ 0.2	

Criteria		Impact magnitude
Vibration effect on people (blasting)	Night $A_o > 0.4$ Day $A_o > 6$	very high
	Night $A_o \leq 0.4$ Day $A_o \leq 6$	high
	Night $A_o \leq 0.3$ Day $A_o \leq 5$	medium
	Night $A_o \leq 0.2$ Day $A_o \leq 3$	low
	Night $A_o \leq 0.15$ Day $A_o \leq 2$	very low
Vibration – building damage	>50mm/s ppv	very high
	≤ 50mm/s ppv	high
	≤ 12mm/s ppv	medium
	≤ 5mm/s ppv	low
	≤ 3mm/s ppv	very low
Places of meeting for religious worship, courts, lecture theatres, small auditoria –Sensitive During Daytime Only		
Groundborne noise (TBM)	$L_{Amax,S}$ >55dB	very high
	50dB >$L_{Amax,S} \leq$ 55dB	high
	45dB >$L_{Amax,S} \leq$ 50dB	medium
	40dB >$L_{Amax,S} \leq$ 45dB	low
	$L_{Amax,S} \leq$ 40dB	very low
Vibration effect on people (TBM and construction plant)	$A_u > 1.6, A_o > 5, A_r > 1.2$	very high
	$A_u \leq 1.6, A_o \leq 5, A_r \leq 1.2$	high
	$A_u \leq 1.2, A_o \leq 5, A_r \leq 0.8$	medium
	$A_u \leq 0.8, A_o \leq 5, A_r \leq 0.4$	low
	$A_u \leq 0.4, A_o \leq 3, A_r \leq 0.2$	very low
Vibration effect on people (blasting)	$A_o > 6$	very high
	$A_o \leq 6$	high
	$A_o \leq 5$	medium
	$A_o \leq 3$	low
	$A_o \leq 2$	very low
Vibration – building damage	>50mm/s ppv	very high
	≤ 50mm/s ppv	high
	≤ 12mm/s ppv	medium
	≤ 5mm/s ppv	low
	≤ 3mm/s ppv	very low
Sensitive Equipment		
Vibration	Computer equipment 0.25g peak acceleration	Must not exceed

5.3.1.2 Significance

The significance of all impacts is assessed by considering the magnitude of the impact and the functional value of the area upon which the impact has an effect. The functional value of the receptor relates to its sensitivity which has been taken account of in the assessment criteria that have been adopted.

5.3.2 Operational phase methodology

5.3.2.1 Magnitude

The criteria used to assess the different impacts associated with the proposed scheme are shown in Table 5.3.

Table 5.3 Criteria for assessment of impact magnitude during operational phase

Criteria		Impact magnitude
Dwellings, Offices, Hotels, Schools, Colleges, Hospital Wards, Libraries		
Groundborne noise	$L_{Amax,S}$ >45dB	very high
	40dB >$L_{Amax,S}$ ≤ 45dB	high
	35dB >$L_{Amax,S}$ ≤ 40dB	medium
	30dB >$L_{Amax,S}$ ≤ 35dB	low
	$L_{Amax,S}$ ≤ 30dB	very low
Vibration	Night A_u = <0.2, A_o = <0.4, A_r = >0.1	very high
	Day A_u = 0.4, A_o = 6, A_r = 0.2	
	Night A_u = 0.2, A_o = 0.4, A_r = 0.1	high
	Day A_u = 0.3, A_o = 6, A_r = 0.15	
	Night A_u = 0.15, A_o = 0.3, A_r = 0.07	medium
	Day A_u = 0.2, A_o = 5, A_r = 0.1	
	Night A_u = 0.15, A_o = 0.2, A_r = 0.05	low
	Day A_u = 0.15, A_o = 3, A_r = 0.07	
	Night A_u = 0.1, A_o = 0.15, A_r = 0.05	very low
	Day A_u = 0.1, A_o = 3, A_r = 0.05	
Places of meeting for religious worship, courts, lecture theatres, small auditoria – Sensitive During Daytime Only		
Groundborne noise	$L_{Amax,S}$ > 40dB	very high
	35dB > $L_{Amax,S}$ ≤ 40dB	high
	30dB > $L_{Amax,S}$ ≤ 35dB	medium
	25dB > $L_{Amax,S}$ ≤ 30dB	low
	$L_{Amax,S}$ ≤ 25dB	very low
Vibration	A_u = 0.3, A_o = 0.6, A_r = 0.15	very high
	A_u = 0.2, A_o = 0.4, A_r = 0.1	high
	A_u = 0.15, A_o = 0.3, A_r = 0.07	medium
	A_u = 0.15, A_o = 0.2, A_r = 0.05	low
	A_u = 0.1, A_o = 0.15, A_r = 0.05	very low

5.3.2.2 Significance

The significance of all impacts is assessed by considering the magnitude of the impact and the functional value of the area upon which the impact has an effect. The functional value of the receptor relates to its sensitivity which has been taken account of in the assessment criteria that have been adopted.

5.4 IMPACT ASSESSMENT

5.4.1 Impact identification

5.4.1.1 Construction phase

Most construction plant is not likely to generate vibration that will be perceptible at off-site locations. Therefore, vibration impacts have been considered from the particular plant items that have the potential to generate perceptible levels of vibration. The activity that is most likely to fall into this category is bored piling. Vibration from bored piling is unlikely to take place outside of daytime working hours.

The vibration levels from bored piling typically decay rapidly and meet the DIN standards for construction within about 10m (resulting in Low or Very low impacts beyond this point). The assessment criteria that have been adopted apply to construction work carried out for up to 26 days. However, piling is not likely to be sustained throughout the scheduled construction period and is likely to be limited to periods of less than this in a given location.

5.4.1.2 Operational phase

Vibration and groundborne noise are aspects of the same phenomenon, perceived differently or in different media. Vibration is movement of a surface or structure perceived by humans by the tactile sense or which directly affects the function of an item of equipment such as an electron microscope. Groundborne noise is vibration of a surface or structure perceived by humans by the sense of hearing, or by equipment such as microphones in, for example, recording studios, as a result of radiation of the vibration into air between the surface and the ear, causing sound.

Sources of vibration and groundborne noise in the operation of the proposed scheme are:

- Wheel/rail interaction during the movement of LMVs
- Over plain line
- Over switches and crossings
- Operation of equipment such as escalators and mechanical services plant at stops

Escalators and mechanical services plant will be designed to ensure that they do not give rise to significant effects at offsite receptors. This will involve ensuring that mitigation will be incorporated to avoid exceeding significant impact levels as defined above. Mitigation measures will include well established techniques such as vibration isolating bearings to control vibration from this type of source if required. Therefore, it has not been necessary to consider these in detail in this assessment.

5.4.2 Mitigation measures

5.4.2.1 Construction phase

Bored piling has been identified as the plant most likely to create vibration impacts in the form of disturbance to the occupiers of adjacent properties. Bored piling is a low vibration piling method, so where piling is necessary there may be limited scope to use alternative methods. Vibration levels will be monitored and advanced warning of the relevant works will be given.

5.4.2.2 Operational phase

A particular feature of the operation of a newly designed railway is that the incorporation of resilient rail support and the use of welded rail have the result that significant effects due to vibration and groundborne noise are completely avoided provided that the appropriate form of track support is selected, and an adequate maintenance regime is followed. Resilient rail support has been established as the standard trackform for non-ballasted track on Luas and is the normal method of standard rail support for modern urban underground railways throughout the world. While resiliently embedded rail is used for street-running, resilient baseplates or other rail support systems, or booted blocks are typical modern designs.

The assessment of vibration and groundborne noise from a new railway therefore consists entirely of a consideration of the likely nature of incorporated mitigation in the design and operation (including maintenance) of the system. The project description as described in the Description of Scheme chapter of this EIS (Volume 1, Chapter 6). states that a floating trackbed system will be provided in the twin bore running tunnels between St. Stephen's Green and Albert College Park.

It is assumed that the following specification will be imposed:

(a) To ensure that noise disturbance during operation of the proposed scheme is minimised, InfraCo shall ensure that the maximum permissible level of groundborne noise that may be generated during operation does not exceed 40dB $L_{Amax,S}$ determined near the centre of any occupied sensitive room of an inhabited building, except at the following locations:

  (i) Between Parnell Street and Albert College Park the maximum permissible Groundborne noise that may be generated during operation does not exceed 25dB $L_{Amax,S}$ determined near the centre of any occupied sensitive room of an inhabited building.

(b) An inhabited building is a building which is in whole or in part lawfully used either temporarily or permanently as a dwelling, hospital, hostel or hotel. An occupied sensitive room is a room in an inhabited building that is a hospital ward, living room, or bedroom which is not a kitchen, bathroom, WC or circulation space that is in use as a living room or bedroom at the time the works are being carried out.

Mitigation measures primarily consist of the design of the track support system, and the choices available broadly fall into two categories, namely resilient rail support and floating slab track. Generally speaking, the parameter that controls the isolation performance of the system is the mass-spring natural frequency of the effective mass of the rail plus bogie unsprung mass on the spring provided by the resilience of the support system below the rail. Limitations on allowable dynamic rail deflection place a lower bound on the achievable dynamic stiffness of the support.

Resilient rail support means support of the rail from the second stage concrete by a system with a vertical dynamic stiffness below about 20MN/m (systems are available with vertical dynamic stiffnesses as low as 7MN/m). This may be in the form of a resilient baseplate supporting the rail foot, a resilient support for the rail web instead of the rail foot, or the provision of a resilient boot to a concrete block to which the rail is fastened.

Floating slab track (FST) means the support of the rail from a concrete slab which is mounted on resilient bearings. FST achieves greater isolation of vibration and groundborne noise largely because the mass of the concrete slab enables a lower natural frequency to be achieved without excessive dynamic deflection. Some of the vibration is also stored and dissipated in the slab and components above the slab.

5.4.3 Assessment of residual impacts

5.4.3.1 Project scenario: construction phase

The results of this assessment are as follows. For each group of receptors the potential impact with no mitigation has been predicted. The extent of committed mitigation is described and the resultant residual impact expected with that mitigation adopted is reported.

The depth of the tunnel may reduce somewhat due to the proposed limits of deviation. In each case, this is not expected to change the predicted impact categories.

The route runs in a cut and cover tunnel beneath the Ballymun Road, to a shallow underground stop at Ballymun, then passing 20m from the nearest house in Gateway View. The route continues along the Ballymun Road, crossing under Collins Avenue, passing approximately 5m from the nearest house in Ballymun Road, then southwards to the DCU Stop where the nearest house, 2 Albert College Lawn is approximately 2.5m from the tunnel. The use of piling equipment here is expected to produce vibration levels (KB_{Fmax}) of approximately 0.5mm/s, resulting in a Medium impact. There are likely to be Medium vibration and groundborne noise impacts from the excavation of the cut-and-cover tunnel because of the short distances. Mitigation will involve selection of low-vibration methods of work, liaison with residents and monitoring.

5.4.3.2 Project scenario: operational phase

For the purposes of this assessment the vibration performance of the track and LMVs have been assessed by numerical modelling. For track laid without rail joints (except at switches and crossings) and with modern standards of rail alignment, groundborne noise is the determining impact, and tactile vibration is normally at levels below the threshold of human perception. Vibration only requires special consideration in the case of highly sensitive equipment as further explained below.

For the standard case of resilient rail support, three generic models have been created, one for the case of the tunnel in limestone with glacial till (boulder clay) above, one for the case of the tunnel in the clay above the limestone and one for cut-and-cover tunnel sections. The basic models are unbounded, and a further model was created including a ground surface to determine the effect of multiple reflections between the ground surface and the limestone rockhead. This was found to increase dB(A) levels by an average of 5dB(A), and this has been added to the unbounded results. The results are speed dependent at the rate of approximately 1dB per 8% change in speed. It is noted that the highest levels are not directly above the tunnel.

Because it will be for the appointed contractor to select the trackform at a future stage in the programme, and the procurement process for the LMVs will take place after the writing of this Environmental Impact Statement, it is not possible to model the performance of the actual track and LMVs. The approach that has been taken is to model the rail support dynamic stiffnesses for resiliently supported rail as 13MN/m per metre run of rail, to yield the likely significant effect of the proposed scheme. The vehicle characteristics used have been those for the vehicle with the highest unsprung mass among those likely to be offered by the contractor, and an allowance of 5dB(A) for vehicle and rail support stiffness uncertainty has been added to the results.

The results of the modelling are shown in Figure 5.1 to Figure 1.3. These figures illustrate that generally the groundborne noise will reduce for higher depths of ground cover. They also show that the groundborne noise is dependent on transverse distance from the tunnel, and that it does not follow a simple linear decay.

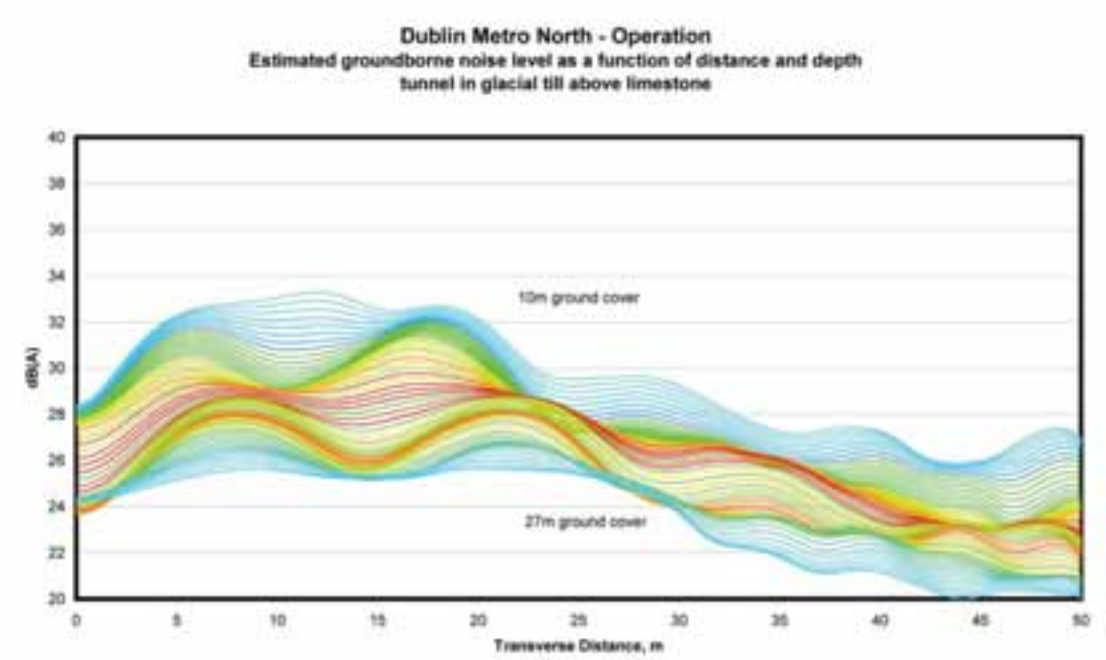


Figure 5.1 Groundborne noise from LMV in bored tunnel in glacial till above limestone

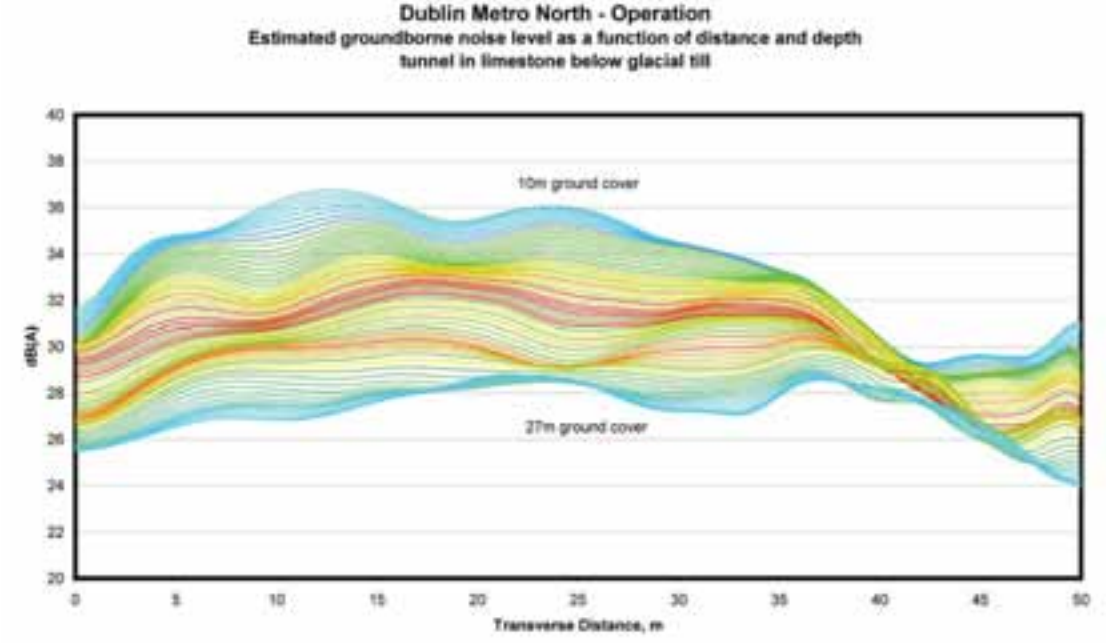


Figure 5.2 Groundborne noise from LMV in bored tunnel in limestone below glacial till

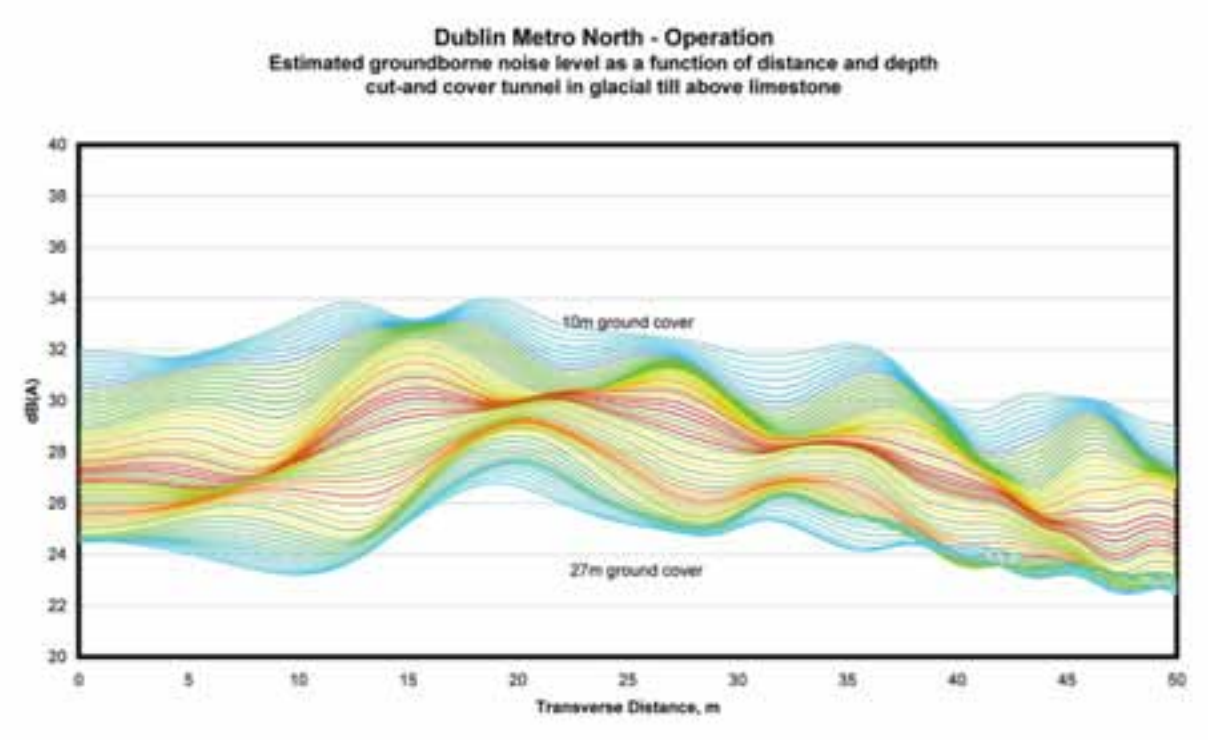


Figure 5.3 Groundborne noise from LMV in cut-and-cover tunnel in glacial till above limestone

In any case where either a Medium, High or Very high significant impacts for groundborne noise are identified in this way, or where 'not to exceed' limits for sensitive equipment would be exceeded, incorporated mitigation in the form of floating slab track is assumed.

The route runs in a cut and cover tunnel beneath the Ballymun Road, passing 24m from the nearest house in Gateway View and 4m from the nearest house in Ballymun Road. At the DCU Stop the nearest house, 2 Albert College Lawn, is 2m from the near rail. There are likely to be Medium vibration and groundborne noise impacts with standard resilient rail support. The specification of floating slab track in the vicinity of the DCU Stop will result in no significant groundborne noise or vibration impacts.

5.4.4 Summary of residual impacts

The potential noise and vibration effects from construction and operation of the proposed scheme have been assessed. An assessment of the requirements for mitigation has been undertaken. A summary of the residual impacts associated with the proposed scheme is provided in Table 5.4.

Table 5.4 Summary of residual impacts

	Magnitude of impact taking into account mitigation	Functional value of area affected	Significance of impact
Construction phase			
Goundborne noise	medium	very high	Significant
Vibration affecting humans	medium	very high	Significant
Vibration affecting buildings	low	very high	Not significant
Vibration affecting sensitive equipment	low	very high	Not significant
Operational phase			
Groundborne noise	low	very high	Not significant
Vibration affecting humans	very low	very high	Not significant
Vibration affecting sensitive equipment	very low	very high	Not significant