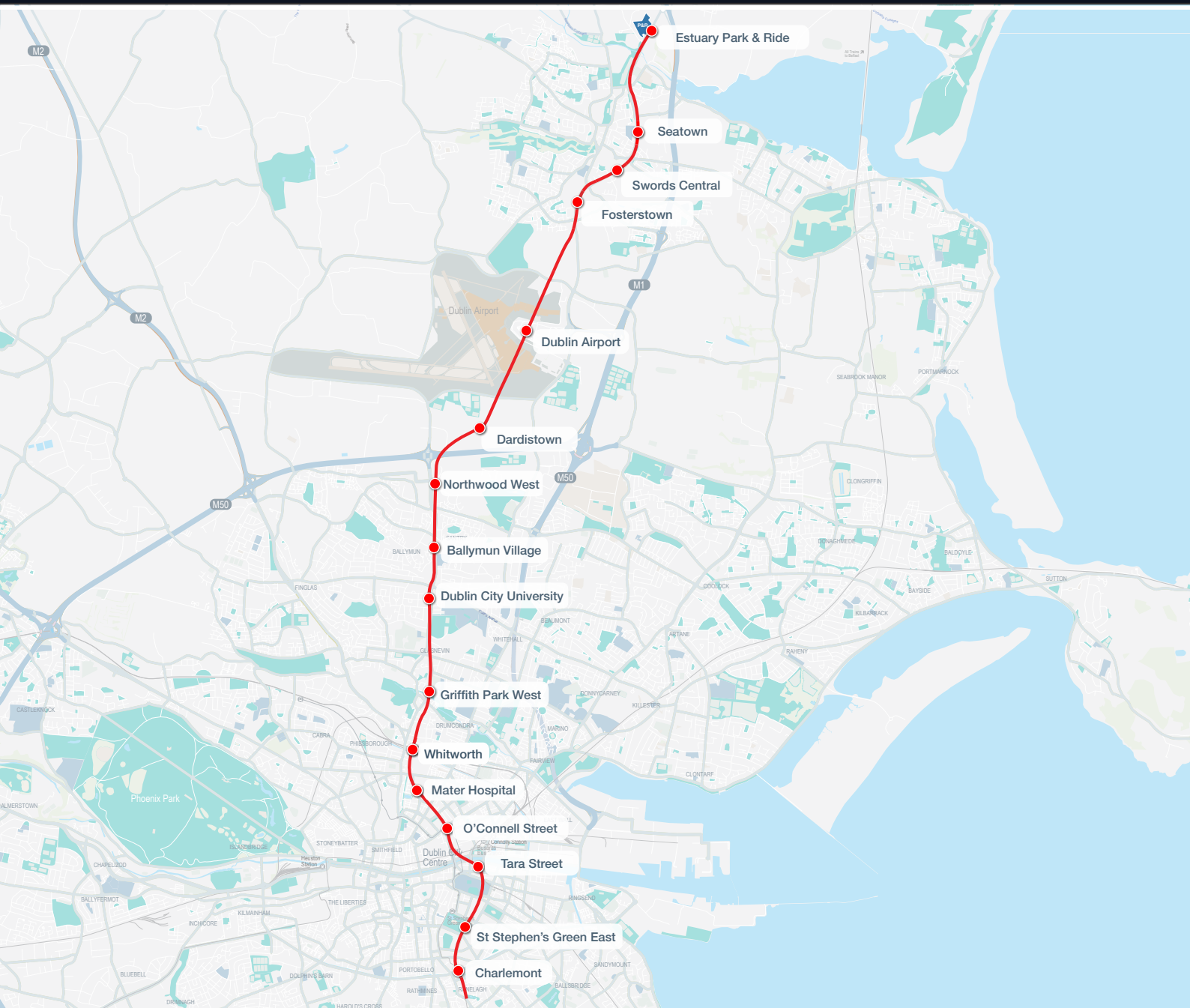


New Metro North

Alignment Options Report

Volume 4A: Environmental Constraints Reports



National Transport Authority /
Transport Infrastructure Ireland
NMN Route Selection Report
Volume 4A Environmental
Constraints Report

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This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

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1 Environmental Constraints Study

1.1 Introduction

An Environmental Constraints Study was undertaken in order to identify all constraints within the scheme study area of the NMN Project, in order to inform the development of route options.

The objective of the Constraints Study is to identify the international, national, county and local issues that must be taken into account when planning and designing the scheme so that the phases which follow (options development, emerging preferred route and environmental impact studies) can be properly informed.

This report has been prepared in accordance with the National Roads Authority's (NRAs) Planning Guidelines and other relevant guidance as noted and has been informed and compiled based on desk studies.

The constraints are divided into Natural Constraints and Artificial Constraints. Natural constraints are those which are naturally occurring landscapes and features and are detailed in **Sections 1.2 to 1.8** of this study. Artificial constraints are those which are forming part of the built environment, and are detailed in **Section 1.9** of this study.

1.1.1 Identification of Scheme Study Area

The scheme study area is shown in the **Alignment Options Report, Chapter 2, Section 2.2**.

The overall study area was broken down into three sub-areas, as set out below.

- Study Area A – City Centre;
- Study Area B – Ballymun/Airport; and
- Study Area C – Swords.

1.2 Natural Constraints

Natural Constraints are those which are naturally occurring landscapes and features, namely:

- Biodiversity which is detailed in **Section 1.3 Biodiversity**;
- Soils and Geology and Spoil Waste which is detailed in **Section 1.4 Soils and Geology** and **Section 1.5 Waste**;
- Hydrogeology which is detailed in **Section 1.6 Hydrogeology**;
- Hydrology which is detailed in **Section 1.7 Hydrology**; and
- Landscape and Visual which is detailed in **Section 1.8 Landscape and Visual**.

1.3 Biodiversity

1.3.1 Introduction

This section describes the biodiversity constraints identified within the scheme study area for the NMN Project. The specific objective of the biodiversity constraints study is to identify the international, national, county and local constraints that must be taken into account for the proposed scheme.

Biodiversity constraints are presented on Volume 4C **Figures 1.3.2 to 1.3.4**.

Section 1.3.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.3.3** describes the biodiversity constraints identified within the scheme study area. A summary is presented in **Section 1.3.4** and references are listed in **Section 1.3.6**.

1.3.2 Methodology and Sources of Information

1.3.2.1 Methodology

The biodiversity constraints study has had regard to the following guidance documents:

- Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities (Environment, Heritage and Local Government, 2010);
- A Guide to Habitats in Ireland (The Heritage Council, 2000);
- Guidelines on the Information to be contained in Environmental Impact Statements (Environmental Protection Agency, 2002);
- Advice Notes on Current Practice (in the preparation of Environmental Impact Statements) (Environmental Protection Agency, 2003);
- Best Practice Guidance for Habitat Survey and Mapping (The Heritage Council, 2011);
- Advice Notes for Preparing Environmental Impact Statements Draft (Environmental Protection Agency, September 2015);
- Draft Guidelines on the Information to be contained in Environmental Impact Assessment Reports. (Environmental Protection Agency, August 2017);
- The National Roads Authority's Environmental Planning and Construction Guidelines Series (2004 – 2009) including in particular:
 - Environmental Impact Assessment of National Road Schemes – A Practical Guide (National Roads Authority, 2008); and
 - Guidelines for Assessment of Ecological Impacts of National Road Schemes (National Roads Authority, 2009);

1.3.2.2 Sources of Information

The desktop study involved collection and review of relevant published and unpublished sources of data and collection of existing information on the ecological environment.

Desktop Data Sources

The following sources were consulted during the desktop study and informed the constraints study:

- Online data available on Natura 2000 sites (hereafter referred to as European sites)¹ and designated sites protected at the national level (i.e. Natural Heritage Areas, or NHAs, and proposed Natural Heritage Areas, or pNHAs) as held by the National Parks and Wildlife Service (NPWS). Available online at (<https://www.npws.ie/protected-sites>) and (<http://webgis.npws.ie/npwsviewer>);
- National Biodiversity Data Centre (NBSC) Online Database. Available online at (<http://www.biodiversityireland.ie/#/Map>);
- Ordnance Survey Ireland (OSI) maps;
- OSI, Google & Bing Aerial photography (1995 - 2017);
- Records of rare and protected species from 10 km of the scheme study area; and
- Habitat and species GIS datasets provided by the NPWS.

It should be noted that data provided by the NPWS (including Article 17 Habitats and Species) may in certain instances be considered sensitive biodiversity data and is not mapped in this study.

Sensitive biodiversity data are defined as any data that NPWS does not wish to make publicly available, e.g. precise localities of endangered species. NPWS acknowledge that in some cases the threat to species from releasing such data may be negligible. However, NPWS are applying the precautionary principle in terms of access to sensitive data until the threat can be quantified.

Data obtained from the National Biodiversity Data Centre are not mapped at this Constraints Study level given the information provided can only be considered a guide to the conservation importance or value of a given area, as the available data is unlikely to be systematic or complete.

¹ European sites, are defined under the Habitats Directive (Article 3) as a European ecological network of Special Areas of Conservation and Special Protection Areas, composed of sites which host the natural habitat types listed in Annex I and habitats of the protected species listed in Annex II. The aim of the network is to aid the long-term survival of Europe's most vulnerable and threatened species and habitats. In Ireland these sites are designated as European sites – defined under the Planning Acts and/or Birds and Habitats Regulations as (a) a candidate site of Community importance, (b) a site of Community importance, (c) a candidate special area of conservation, (d) a special area of conservation, (e) a candidate special protection area, or (f) a special protection area. They are commonly referred to in Ireland as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs).

While use of this information is encouraged for decision making, research and sharing knowledge on Ireland’s biodiversity, when using this information, it should be noted that absence of records of threatened or protected species from an area does not imply that they are not present within the given area. Their absence may be due to lack of adequate surveys of the area.

1.3.3 Existing Environment

This section describes the ecological constraints identified within and beyond the scheme study area. The Department of Environment, Heritage and Local Government Report (2010) *Appropriate Assessment for Plans and Projects in Ireland – Guidance for Planning Authorities* suggests an assessment of Natura 2000 sites within a zone of influence of 15 km, which can be revised down depending on the proposed development and location of Natura 2000 sites. A conservative approach of 15 km zone of influence was used for this constraints study.

1.3.3.1 Desktop Study

There are **60** designated areas of nature conservation within 15km of the scheme study area: **14 Special Areas of Conservation (SACs)**, **12 Special Protection Areas (SPAs)**, **1 National Heritage Area (NHA)** and **33 proposed Natural Heritage Areas (pNHAs)**. 5km, 10km and 15km zones from the scheme study area are shown on Volume 4C **Figure 1.3.1**.

The locations of the designated areas for nature conservation are listed below in **Table 1.3.1** and **Table 1.3.2**, along with their location in relation to the scheme study area and a summary of the reasons for site designation. The locations in close proximity to the scheme study area are also shown on Volume 4C **Figures 1.3.2 to 1.3.4**.

Table 1.3.1: European Sites (SACs and SPAs) within 15km of the scheme study area

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
Baldoyle Bay SAC (Site Code 000199)	5.39	[1140] Mudflats and sandflats not covered by seawater at low tide [1310] Salicornia and other annuals colonizing mud and sand [1330] Atlantic salt meadows (<i>Glauco-Puccinellietalia maritima</i>) [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>)
Howth Head SAC (Site Code 000202)	9.64	[1230] Vegetated sea cliffs of the Atlantic and Baltic coasts [4030] European dry heaths
Lambay Island SAC (Site Code 000204)	11.24	[1170] Reefs [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts [1364] Grey seal <i>Halichoerus grypus</i>

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
		[1365] Harbour seal <i>Phoca vitulina</i>
Malahide Estuary SAC (Site Code 000205)	Intersects Study Area	[1140] Mudflats and sandflats not covered by seawater at low tide [1310] Salicornia and other annuals colonising mud and sand [1320] Spartina swards (<i>Spartinion maritimae</i>) [1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [2120] Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) *
North Dublin Bay SAC (Site Code 000206)	4.04	[1140] Mudflats and sandflats not covered by seawater at low tide [1210] Annual vegetation of drift lines [1310] Salicornia and other annuals colonising mud and sand [1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) [1395] Petalwort <i>Petalophyllum ralfsii</i> [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [2110] Embryonic shifting dunes [2120] Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) * [2190] Humid dune slacks
Rogerstown Estuary SAC (Site Code 000208)	1.73	[1130] Estuaries [1140] Mudflats and sandflats not covered by seawater at low tide [1310] Salicornia and other annuals colonising mud and sand [1330] Atlantic salt meadows (<i>Glaucopuccinellietalia maritimae</i>) [1410] Mediterranean salt meadows (<i>Juncetalia maritimi</i>) [2120] Shifting dunes along the shoreline with <i>Ammophila arenaria</i> (white dunes) [2130] Fixed coastal dunes with herbaceous vegetation (grey dunes) *
South Dublin Bay SAC (Site Code 000210)	2.03	[1140] Mudflats and sandflats not covered by seawater at low tide
Ballyman Glen SAC (Site Code 000713)	13.79	[7220] Petrifying springs with tufa formation (Cratoneurion)*

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
		[7230] Alkaline fens
Knocksink Wood SAC (Site Code 000725)	12.47	[7220] Petrifying springs with tufa formation (Cratoneurion)* [91E0] Alluvial forests with <i>Alnus glutinosa</i> and <i>Fraxinus excelsior</i> (Alno-Padion, Alnion <i>incanae</i> , Salicion <i>albae</i>)*
Glenasmole Valley SAC (Site Code 001209)	9.97	[6210] Semi-natural dry grasslands and scrubland facies on calcareous substrates (Festuco Brometalia)(* important orchid sites)* [6410] Molinia meadows on calcareous, peaty or clayey-silt-laden soils (<i>Molinion caeruleae</i>) [7220] Petrifying springs with tufa formation (Cratoneurion)*
Rye Water Valley/Cartron SAC (Site Code 001398)	13.64	[7220] Petrifying springs with tufa formation (Cratoneurion)* [1014] Narrow-mouthed Whorl Snail <i>Vertigo angustior</i> [1016] Desmoulin's Whorl Snail <i>Vertigo moulinsiana</i>
Wicklow Mountains SAC (Site Code 002122)	9.41	[3110] Oligotrophic waters containing very few minerals of sandy plains (<i>Littorelletalia uniflorae</i>) [3160] Natural dystrophic lakes and ponds [4010] Northern Atlantic wet heaths with <i>Erica tetralix</i> [4030] European dry heaths [4060] Alpine and Boreal heaths [6130] Calaminarian grasslands of the <i>Violetalia calaminariae</i> [6230] Species-rich <i>Nardus</i> grasslands, on siliceous substrates in mountain areas (and submountain areas, in Continental Europe) * [7130] Blanket bogs (* if active bog) [8110] Siliceous scree of the montane to snow levels (<i>Androsacetalia alpinae</i> and <i>Galeopsietalia ladani</i>) [8210] Calcareous rocky slopes with chasmophytic vegetation [8220] Siliceous rocky slopes with chasmophytic vegetation [91A0] Old sessile oak woods with <i>Ilex</i> and <i>Blechnum</i> in the British Isles [1355] Otter <i>Lutra lutra</i>
Ireland's Eye SAC (Site Code 002193)	9.94	[1220] Perennial vegetation of stony banks [1230] Vegetated sea cliffs of the Atlantic and Baltic coasts

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
Rockabill to Dalkey Island SAC (Site Code 003000)	8.7	[1170] Reefs [1351] Harbour porpoise <i>Phocoena phocoena</i>
North Bull Island SPA (Site Code 004006)	4.03	[A046] Light-bellied Brent Goose <i>Branta bernicla hrota</i> [A048] Shelduck <i>Tadorna tadorna</i> [A052] Teal <i>Anas crecca</i> [A054] Pintail <i>Anas acuta</i> [A056] Shoveler <i>Anas clypeata</i> [A130] Oystercatcher <i>Haematopus ostralegus</i> [A140] Golden Plover <i>Pluvialis apricaria</i> [A141] Grey Plover <i>Pluvialis squatarola</i> [A143] Knot <i>Calidris canutus</i> [A144] Sanderling <i>Calidris alba</i> [A149] Dunlin <i>Calidris alpina alpina</i> [A156] Black-tailed Godwit <i>Limosa limosa</i> [A157] Bar-tailed Godwit <i>Limosa lapponica</i> [A160] Curlew <i>Numenius arquata</i> [A162] Redshank <i>Tringa totanus</i> [A169] Turnstone <i>Arenaria interpres</i> [A179] Black-headed Gull <i>Chroicocephalus ridibundus</i> [A999] Wetlands
Rockabill SPA (Site Code 004014)	13.31	[A148] Purple Sandpiper <i>Calidris maritima</i> [A192] Roseate Tern <i>Sterna dougallii</i> [A193] Common Tern <i>Sterna hirundo</i> [A194] Arctic Tern <i>Sterna paradisaea</i>
Rogerstown Estuary SPA (Site Code 004015)	2.31	[A043] Greylag Goose <i>Anser anser</i> [A046] Brent Goose <i>Branta bernicla hrota</i> [A048] Shelduck <i>Tadorna tadorna</i> [A056] Shoveler <i>Anas clypeata</i> [A130] Oystercatcher <i>Haematopus ostralegus</i> [A137] Ringed Plover <i>Charadrius hiaticula</i> [A141] Grey Plover <i>Pluvialis squatarola</i> [A143] Knot <i>Calidris canutus</i> [A149] Dunlin <i>Calidris alpina alpina</i> [A156] Black-tailed Godwit <i>Limosa limosa</i> [A162] Redshank <i>Tringa totanus</i> [A999] Wetlands
Baldoyle Bay SPA (Site Code 004016)	5.38	[A046] Brent Goose <i>Branta bernicla hrota</i> [A048] Shelduck <i>Tadorna tadorna</i> [A137] Ringed Plover <i>Charadrius hiaticula</i> [A140] Golden Plover <i>Pluvialis apricaria</i> [A141] Grey Plover <i>Pluvialis squatarola</i> [A157] Bar-tailed Godwit <i>Limosa lapponica</i>

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
		[A999] Wetlands
South Dublin Bay and River Tolka Estuary SPA (Site Code 004024)	0.91	[A046] Brent Goose <i>Branta bernicla hrota</i> [A130] Oystercatcher <i>Haematopus ostralegus</i> [A137] Ringed Plover <i>Charadrius hiaticula</i> [A141] Grey Plover <i>Pluvialis squatarola</i> [A143] Knot <i>Calidris canutus</i> [A144] Sanderling <i>Calidris alba</i> [A149] Dunlin <i>Calidris alpina alpina</i> [A157] Bar-tailed Godwit <i>Limosa lapponica</i> [A162] Redshank <i>Tringa totanus</i> [A179] Black-headed Gull <i>Chroicocephalus ridibundus</i> [A192] Roseate Tern <i>Sterna dougallii</i> [A193] Common Tern <i>Sterna hirundo</i> [A194] Arctic Tern <i>Sterna paradisaea</i> [A999] Wetlands
Broadmeadow/Swords Estuary SPA (Site Code 004025)	Intersects Study Area	[A005] Great Crested Grebe <i>Podiceps cristatus</i> [A046] Brent Goose <i>Branta bernicla hrota</i> [A048] Shelduck <i>Tadorna tadorna</i> [A054] Pintail <i>Anas acuta</i> [A067] Goldeneye <i>Bucephala clangula</i> [A069] Red-breasted Merganser <i>Mergus serrator</i> [A130] Oystercatcher <i>Haematopus ostralegus</i> [A140] Golden Plover <i>Pluvialis apricaria</i> [A141] Grey Plover <i>Pluvialis squatarola</i> [A143] Knot <i>Calidris canutus</i> [A149] Dunlin <i>Calidris alpina alpina</i> [A156] Black-tailed Godwit <i>Limosa limosa</i> [A157] Bar-tailed Godwit <i>Limosa lapponica</i> [A162] Redshank <i>Tringa totanus</i> [A999] Wetlands
Wicklow Mountains SPA (Site Code 004040)	9.68	[A098] Merlin <i>Falco columbarius</i> [A103] Peregrine <i>Falco peregrinus</i>
Lambay Island SPA (Site Code 004069)	11.25	[A009] Fulmar <i>Fulmarus glacialis</i> [A017] Cormorant <i>Phalacrocorax carbo</i> [A018] Shag <i>Phalacrocorax aristotelis</i> [A043] Greylag Goose <i>Anser anser</i> [A183] Lesser Black-backed Gull <i>Larus fuscus</i> [A184] Herring Gull <i>Larus argentatus</i> [A188] Kittiwake <i>Rissa tridactyla</i> [A199] Guillemot <i>Uria aalge</i> [A200] Razorbill <i>Alca torda</i> [A204] Puffin <i>Fratercula arctica</i>

Site Details	Distance (km)	Reasons for Designation – Qualifying Interests or Special Conservation Interests
Howth Head Coast SPA (Site Code 004113)	11.81	[A188] Kittiwake <i>Rissa tridactyla</i>
Ireland's Eye SPA (Site Code 004117)	9.69	[A017] Cormorant <i>Phalacrocorax carbo</i> [A184] Herring Gull <i>Larus argentatus</i> [A188] Kittiwake <i>Rissa tridactyla</i> [A199] Guillemot <i>Uria aalge</i> [A200] Razorbill <i>Alca torda</i>
Skerries Islands SPA (Site Code 004122)	12.16	[A017] Cormorant <i>Phalacrocorax carbo</i> [A018] Shag <i>Phalacrocorax aristotelis</i> [A046] Light-bellied Brent Goose <i>Branta bernicla hrota</i> [A148] Purple Sandpiper <i>Calidris maritima</i> [A169] Turnstone <i>Arenaria interpres</i> [A184] Herring Gull <i>Larus argentatus</i>
Dalkey Islands SPA (Site Code 004172)	11.12	[A192] Roseate Tern <i>Sterna dougallii</i> [A193] Common Tern <i>Sterna hirundo</i> [A194] Arctic Tern <i>Sterna paradisaea</i>

Table 1.3.2: Natural Heritage Areas (and Proposed Natural Heritage Areas) within 15km of the Scheme study area

Site Details	Distance (km)	Features of Interest ¹
Skerries Islands NHA (Site Code 001218)	12.16	Also intersects Skerries SPA (Site Code 004122)
Liffey Valley pNHA (Site Code 000128)	5.13	Site specific data unavailable
Santry Demesne pNHA (Site Code 000178)	Intersects Study Area	Site specific data unavailable
Baldoyle Bay pNHA (Site Code 000199)	5.39	See above Baldoyle Bay SAC (Site Code 000199), also intersects Baldoyle Bay SPA (Site Code 004016)
Dolphins, Dublin Docks pNHA (Site Code 000201)	3.12	Site Specific data unavailable Also intersects South Dublin Bay and River Tolka Estuary SPA (Site Code 004024)
Howth Head pNHA (Site Code 000202)	9.18	See above - Howth Head SAC (Site Code 000202), also intersects Rockabill to Dalkey Island SAC (Site Code 003000), North Dublin Bay SAC (Site Code 000206), Howth Head Coast SPA (Site Code 004113) and North Bull Island SPA (Site Code 004006)
Ireland's Eye pNHA	9.94	Site Specific data unavailable

¹ Information taken from the site synopses, where available, from <https://www.npws.ie/protected-sites>

Site Details	Distance (km)	Features of Interest ¹
(Site Code 000203)		Also intersects Ireland's Eye SAC (Site Code 002193), Rockabill to Dalkey Island SAC (Site Code 003000) and Ireland's Eye SPA (Site Code 004117)
Lambay Island pNHA (Site Code 000204)	11.24	See above Lambay Island SAC (Site Code 000204), also intersects Rockabill to Dalkey Island SAC (Site Code 003000) and Lambay Island SPA (Site Code 004069)
Malahide Estuary pNHA (Site Code 000205)	Intersects Study Area	See above Malahide Estuary SAC (Site Code 000205), also intersects Broadmeadow/Swords Estuary SPA (Site Code 004025)
North Dublin Bay pNHA (Site Code 000206)	0.65	See above North Dublin Bay SAC (Site Code 000206), also intersects South Dublin Bay and River Tolka Estuary SPA (Site Code 004024) and North Bull Island SPA (Site Code 004006)
Rogerstown Estuary pNHA (Site Code 000208)	1.73	See above Rogerstown Estuary SAC (Site Code 000208), also intersects Rogerstown Estuary SPA (Site Code 004015)
South Dublin Bay pNHA (Site Code 000210)	2.03	See above South Dublin Bay SAC (Site Code 000210), also intersects South Dublin Bay and River Tolka SPA (Site Code 004024)
Slade of Saggart and Crooksling Glen pNHA (Site Code 000211)	13.75	Site specific data unavailable
Ballyman Glen pNHA (Site Code 000713)	13.79	See above Ballyman Glen SAC (Site Code 000713)
Knocksink Wood pNHA (Site Code 000725)	12.47	See above Knocksink Wood SAC (Site Code 000725)
Dodder Valley pNHA (Site Code 000991)	5.87	Site specific data unavailable
Ballybetagh Bog pNHA (Site Code 001202)	11.12	Site specific data unavailable
Knock Lake pNHA (Site Code 001203)	10.79	Site specific data unavailable
Bog of The Ring pNHA (Site Code 001204)	9.97	Site specific data unavailable
Boosterstown Marsh pNHA (Site Code 001205)	3.19	Site specific data unavailable, also intersects South Dublin Bay and River Tolka SPA (Site Code 004024)
Dalkey Coastal Zone and Killiney Hill pNHA (Site Code 001206)	8.41	Site specific data unavailable, also intersects Rockabill to Dalkey Island SAC (Site Code 003000) and Dalkey Island SPA (Site Code 004172)
Dingle Glen pNHA (Site Code 001207)	9.95	Site specific data unavailable
Feltrim Hill pNHA	1.05	Site specific data unavailable

Site Details	Distance (km)	Features of Interest ¹
(Site Code 001208)		
Glenasmole Valley pNHA (Site Code 001209)	9.97	See above Glenasmole Valley SAC (Site Code 001209)
Loughlinstown Woods pNHA (Site Code 001211)	11.25	Site specific data unavailable
Lugmore Glen pNHA (Site Code 001212)	11.18	Site specific data unavailable
Portraine Shore pNHA (Site Code 001215)	5.85	Site specific data unavailable, also intersects Malahide Estuary SAC (Site Code 000205), Rogerstown Estuary SAC (Site Code 000208) and Rogerstown Estuary SPA (Site Code 004015)
Rye Water Valley/Carton pNHA (Site Code 001398)	13.64	See above Rye Water Valley/Carton SAC (Site Code 001398)
Fitzsimon's Wood pNHA (Site Code 001753)	5.94	Site specific data unavailable
Glencree Valley pNHA (Site Code 001755)	14.87	Site specific data unavailable
Sluice River Marsh pNHA (Site Code 001763)	4.32	Site specific data unavailable
Loughshinny Coast pNHA (Site Code 002000)	11.53	Site specific data unavailable
Royal Canal pNHA (Site Code 002103)	Intersects Study Area	Site specific data unavailable, also intersects Rye Water Valley/Carton SAC (Site Code 01398)
Grand Canal pNHA (Site Code 002104)	Intersects Study Area	Site specific data unavailable

1.3.3.2 Record of Protected, Rare and Other Notable Species

Desktop records of protected, rare or other notable plant species recorded after 1990, from the NPWS, within the study area are listed in **Table 1.3.3** and records of rare or protect fauna are presented in **Table 1.3.4**.

Table 1.3.3: Records of Protected, Rare or other Notable Flora within the scheme study area

Latin Name	Common Name	Sample Location	Sample Year
<i>Agrostemma githago</i>	Corncockle	E. side of River Dodder	1993
<i>Groenlandia densa</i>	Opposite-leaved Pondweed	Grand Canal	1991
<i>Groenlandia densa</i>	Opposite-leaved Pondweed	Royal Canal	2010

Latin Name	Common Name	Sample Location	Sample Year
<i>Hypericum hirsutum</i>	Hairy St John's-wort	Santry Court	1991
<i>Hypericum hirsutum</i>	Hairy St John's-wort	W Santry Road, S of lake	1991
<i>Kickxia elatine</i>	Sharp-leaved Fluellen	Glasnevin, National Botanic Gardens	1991
<i>Scrophularia umbrosa</i>	Green Figwort	Chapelizod	1990
<i>Viola hirta</i>	Hairy Violet	Phoenix Park	1990

Table 1.3.4: Records of Protected, Rare or other Notable Fauna within the scheme study area

Latin Name	Common Name	Sample Location	Sample Year
<i>Lepus timidus subsp. hibernicus</i>	Irish Hare	Dublin International Airport	2006
<i>Lutra lutra</i>	Otter	Broadmeadow River in Swords	2009
<i>Lutra lutra</i>	Otter	River Tolka, Botanical gardens	2010
<i>Lutra lutra</i>	Otter	Milltown Bridge, Co. Dublin	2010
<i>Rana temporaria</i>	Common Frog	Various	Various

The following protected species are noted in the NPWS's Site Synopsis Portfolio for pNHAs and are relevant to pNHAs that are intersected by the scheme study area:

Royal Canal (Site Code 002103) Site Synopsis (09/12/2009)

Otter spraints are found along the towpath, particularly where the canal passes over a river or stream.

The rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1987) is present at one site in Dublin, between Locks 4 and 5. *Tolypella intricata* (a stonewort listed in the Red Data Book as being vulnerable) is also in the Royal Canal in Dublin, the only site in Ireland where it is now found.

Grand Canal (Site Code 002104) Site Synopsis (09/12/2009)

Otter spraints are found along the towpath, particularly where the canal passes over a river or stream.

The Smooth Newt (*Lissotriton vulgaris*) breeds in the ponds on the bank at Gollierstown in Co. Dublin.

The rare and legally protected Opposite-leaved Pondweed (*Groenlandia densa*) (Flora Protection Order 1987) is present at a number of sites in the eastern section of the Main Line, between Lowtown and Ringsend Basin in Dublin.

The following Article 17 Habitats intersect the scheme study area:

- Estuaries [1130] – associated with Malahide Estuary, Tolka River Estuary the Liffey River Estuary; and
- Mud Flats [1140] – associated with Malahide Estuary.

The following Article 17 Species are found in or in the vicinity of the scheme study area:

- [1213] Common frog (*Rana temporaria*)
- [1309] Common pipistrelle (*Pipistrellus pipistrellus*)
- [1314] Daubenton's bat (*Myotis daubentonii*)
- [1317] Nathusius' pipistrelle (*Pipistrellus nathusii*)
- [1322] Natterer's bat (*Myotis nattereri*)
- [1326] Brown long-eared bat (*Plecotus auritus*)
- [1330] Whiskered bat (*Myotis mystacinus*)
- [1331] Leisler's bat (*Nyctalus leisleri*)
- [1334] Irish hare (*Lepus timidus*)
- [1355] Otter (*Lutra lutra*)
- [1357] Pine marten (*Martes martes*)
- [5009] Soprano pipistrelle (*Pipistrellus pygmaeus*)

Aquatic habitats

The scheme study area includes several watercourses of conservation value in terms of their value as ecological corridors of having potential county or higher value local importance and having connectivity with coastal designated sites, these include:

- Broadmeadow River
- Ward River
- Sluice River
- Mayne River
- Santry River
- Tolka River
- Royal Canal
- River Liffey
- Grand Canal

Other known aquatic faunal species located in habitats that are hydrologically connected to the proposed study area include:

- Fish – Atlantic salmon, lamprey species

1.3.4 Summary

Study Area A is comprised for the most part of buildings and artificial surfaces in the urban areas of Dublin City. These areas are interspersed with treelines and private gardens which all contribute to the overall biodiversity of the study area. Larger green areas occur where parkland is present including landscaped areas such as St. Stephens Green, Trinity College playing fields and Mountjoy Square. Study Area A geographically includes water features such as the Grand Canal pNHA, River Liffey and Royal Canal pNHA. The River Liffey is the main ecological corridor with hydrological connectivity to Dublin Bay which is designated as a UNESCO Biosphere and includes several international and national designations, covering much of Dublin Bay, to ensure the protection of its water quality and biodiversity.

Study Area B is characterised by more suburban areas between Drumcondra and Ballymun which also include green areas as such as Mountjoy Square and Santry Demesne pNHA. There are also remnant old demesnes in north Dublin, e.g. near DCU, Albert College Park and Hillside Farm near Whitehall which present large green fields with associated treelines and grown-out Hedgerows. The Tolka and Santry Rivers are important ecological corridors which flow into North Dublin Bay.

Moving further north on either side of Dublin Airport there are open arable and improved grassland areas of working farms before crossing into the urban area of Swords which includes Study Area C. The main ecological corridors correspond to the main water courses in the study area including the Sluice River, River Mayne, Ward River and Broadmeadow River. Each of these have varying characteristics in terms of water quality, presence of fauna such as salmonids and otters. However, the main consideration with these water courses is their hydrological connectivity to the coastal receiving environments, particularly those which are designated as European sites in Baldoyle Bay and the Broadmeadow/Malahide Estuary.

The results of the desktop review highlight the range of habitats and species and the ecological constraints in the scheme study area and the connectivity of water courses with areas of conservation concern, which are likely to affect route options being considered for the NMN Project.

1.3.5 Mapping of all Constraints

Ecological constraints are presented on Volume 4C **Figures 1.3.2 to 1.3.4**. These include European Sites (SACs and SPAs). In addition, further constraints, which may not be subject to statutory protection, but should none the less be considered as ecological constraints, were also added. These include sites of National Heritage importance such as the Royal Canal and Grand Canal which are both proposed Natural Heritage Areas and the River Liffey which is not designated as a conservation area, but is considered as an Annexed Habitat (1130 Estuaries) from Dublin Bay up to Chapelizod Weir at Islandbridge, the point to which highest tides reach. Rivers and streams with connectivity to coastal areas of conservation are also included.

1.3.6 References

Department of the Environment, Heritage and Local Government. (2009) *Appropriate Assessment of Plans and Projects in Ireland. Guidance for Planning Authorities (as amended February 2010)*.

Environmental Protection Agency. (2002) *Guidelines on the Information to be contained in Environmental Impact Statements*. Environmental Protection Agency, Wexford.

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Fossitt, J. (2000) *A Guide to Habitats in Ireland*. The Heritage Council.

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National Roads Authority. (2008) *Environmental Impact Assessment of National Road Schemes – A Practical Guide*. National Roads Authority.

Parnell, J. & Curtis, T. (2012) *Webbs An Irish Flora*. Cork University Press.

Smith, G.F., O'Donoghue, P., O'Hora, K., & Delaney, (2011) *E. Best Practice Guidance for Habitat Survey and Mapping*. The Heritage Council.

1.4 Soils and Geology

1.4.1 Introduction

This section identifies the soils and geological constraints identified within the scheme study area for the NMN Project.

Soils and Geology constraints are presented on Volume 4C **Figures 1.4.1 to 1.4.24**.

Section 1.4.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.4.3** describes the soils and geology constraints identified within the scheme study area. A summary is presented in **Section 1.4.4** and references are listed in **Section 1.4.5**.

1.4.2 Methodology and Sources of Information

The study has been carried out in accordance with National Roads Authority (NRA) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA, 2009*.

1.4.2.1 Methodology

The assessment is based on the results of a desk study and ground investigation results. The desk study included a review of the information sources listed in **Section 1.4.2.2** to identify the constraints associated with soils and geology within the scheme study area.

The NRA guidelines provide useful criteria for ranking the importance of the identified soils and geological constraints and these criteria are presented in **Table 1.4.1**. This assessment is generally consistent with the approach presented in the NRA guidelines and is undertaken using the criteria for rating the importance of identified features.

Table 1.4.1: Criteria for rating the importance of identified features (based on NRA Guidelines; Box 4.1 entitled ‘Criteria for Rating Site Attributes - Estimation of Importance of Soil and Geology Attributes’)

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource.
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying route is significant on a local scale	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes. Geological feature of high value on a local scale (County Geological Site). Well drained and/or high fertility soils.
Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying route is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit.

Importance	Criteria	Typical Example
Low	<p>Attribute has a low quality, significance or value on a local scale.</p> <p>Degree or extent of soil contamination is minor on a local scale.</p> <p>Volume of peat and/or soft organic soil underlying route is small on a local scale*.</p>	<p>Large historical and/or recent site for construction and demolition wastes.</p> <p>Small historical and/or recent landfill site for construction and demolition wastes.</p> <p>Poorly drained and/or low fertility soils.</p> <p>Uneconomically extractable mineral resource.</p>

* relative to the total volume of inert soil disposed of and/or recovered

1.4.2.2 Sources of Information

Research for the constraints study was undertaken as a desktop exercise. The following sources were consulted in order to identify soils and geological constraints:

- Current and historical Ordnance Survey maps available for the scheme study area (1:2,500 and 1: 10,000 scales);
- Aerial photography (1995, 2000 and 2005) of the scheme study area;
- Aerial imagery from Google (imagery from 2002 to 2017) and Bing accessed in 2017;
- Mapping data within the scheme study area produced by the Geological Survey of Ireland (GSI) (www.dcenr.gov.ie):
 - Bedrock Geology;
 - Quaternary Sediments and Geomorphology;
 - Karst Features;
 - National Draft Generalised Bedrock map;
 - Aggregate Potential;
 - Geological Heritage;
 - Landslides susceptibility;
 - Mineral Locations and 2014 Quarry Directory;
 - Dublin City County Geological Sites; and
 - Fingal County Geological Sites.
- McConnell B. and Philcox M.E. (1994) *Geology of Kildare-Wicklow: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 16, Kildare - Wicklow*;
- McConnell B., Philcox M., & Geraghty M. (2001) *Geology of Meath: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 13, Meath*;
- Teagasc and the Environmental Protection Agency Irish Soil Information System (<http://gis.teagasc.ie/soils/index.php>);
- Datasets from Environmental Protection Agency (EPA):

- Waste licenced facilities; and
- Licensed industrial and agricultural facilities;
- Ground investigation reports held by the Geological Survey of Ireland for the scheme study area;
- Preliminary and main ground investigations commissioned for the previous Metro North Scheme study;
- Historical ground investigation records collated by the previous Metro North Scheme study;
- Ground investigation reports held by Arup from other projects located within the scheme study area;
- Lidar elevation data from previous Metro North Scheme study;
- Geotechnical Interpretative Report from the previous Metro North Scheme study; and
- Constraints reports from Greater Dublin Drainage Scheme project.

Consultation was carried out with the following authorities:

- Office of Public Works (OPW);
- Fingal County Council (FCC);
- Dublin City Council (DCC); and
- Environmental Protection Agency (EPA).

Topographical Maps

The GSI WMS (Web Map Service) 10m-interval contour data, imported as a dataset into Geographical Information System (GIS), were reviewed in relation to the proposed scheme.

Lidar elevation data obtained during the previous Metro North Scheme study was also reviewed in GIS for topographic information.

A number of historical maps for the scheme location were also available through Ordnance Survey Ireland:

- Ordnance Survey Ireland (OSI) 6 inch mapping series, DN011, DN014 and DN018, 1:10,560, 1837 – 1842; and
- Ordnance Survey Ireland (OSI) 25 inch mapping series, DN011, DN014 and DN018, 1:2,500, 1888 – 1913.

Geological Maps and Memoirs

A series of geological maps were available through Geological Survey Ireland (GSI) (www.gsi.ie) and Environmental Protection Agency.

Drift Maps

The following drift maps were reviewed:

- Subsoil map (Teagasc Classification) and *Soil Parent Material Classification and Map Codes* (Teagasc 2004); and
- 1:575,000 general soil map of Ireland and the accompanying soil survey bulletin (Gardiner and Radford, 1980), *The National Soil Survey, An Fóras Taluntais*.

The following datasets from the Geological Survey of Ireland (GSI) (<http://www.dccae.gov.ie/en-ie/natural-resources/topics/Geological-Survey-of-Ireland/data/Pages/Data-Downloads.aspx>) were used:

- Quaternary Geology of Ireland (1:50,000 scale).

The following datasets from Teagasc and the Environmental Protection Agency (EPA) (<http://gis.epa.ie/GetData/Download> [30 September 2014]) were used:

- Teagasc-EPA Soils; and
- Teagasc-EPA Subsoils.

Solid Geology

The following datasets and maps were available through the GSI (<http://www.dccae.gov.ie/en-ie/natural-resources/topics/Geological-Survey-of-Ireland/data/Pages/Data-Downloads.aspx> [30 September 2014]):

- Bedrock Geology of Ireland (1:100,000 scale);
- Grouped Rock Units / National Draft Generalised Bedrock Map for Groundwater;
- Geological Map – Sheet 16 Geology of Kildare - Wicklow (Geological Survey of Ireland 1:100,000 Bedrock Geology Map);
- Geological Map – Sheet 13 Geology of Meath (Geological Survey of Ireland 1:100,000 Bedrock Geology Map);
- McConnell B. and Philcox M.E. (1994) *Geology of Kildare-Wicklow: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 16, Kildare – Wicklow; and*
- McConnell B., Philcox M., & Geraghty M. (2001) *Geology of Meath: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 13, Meath.*

Aerial Photographs

Aerial photography of the scheme study area dating from 1995, 2000 and 2005 was available from the Ordnance Survey of Ireland records.

Aerial photography from Bing and Google maps has been used as a preliminary source to study the geomorphology and site history.

A comparison was carried out between the historic aerial photography from OSI and with recent images from Bing and Google to look for any changes in the land form (surface anomalies, unusual features) between aerial photography.

Records of Mines and Mineral Deposits

In order to identify aggregate, mineral extraction sites as well as active quarries within the scheme study area and to establish any that may have an impact on the construction works, the following datasets from the Minerals Ireland online database, available through Geological Survey of Ireland (<http://www.dccae.gov.ie/en-ie/natural-resources/topics/Geological-Survey-of-Ireland/data/Pages/Data-Downloads.aspx>) were examined:

- GSI Quarry Directory; and
- Mineral locations.

Land Use and Soil Survey Information

Land use in the area has been identified by co-ordinated Information on the Environment (CORINE) (<http://gis.epa.ie/GetData/Download>).

Existing Ground Investigations

A schedule of previous ground investigation reports has been compiled during the previous Metro North Scheme study, from the Client, GSI, Arup and other consultants and these documents were reviewed.

1.4.3 Existing Environment

This section describes the soils and geological constraints identified within the scheme study area. Constraints associated with geomorphology, solid geology, soils and superficial deposits, manmade geological features, landfills, contaminated land, licensed facilities and geological heritage within the scheme study area are described. Soils and geological constraints are presented on Volume 4C **Figures 1.4.1 to 1.4.3**.

1.4.3.1 Geomorphological Study

Geomorphology is the study of the landforms which comprise the earth's surface, the processes which have modified and shaped it in the past and which continue to modify and shape it at the present time. The majority of Irish landforms are derived from mountain building events which occurred in the geological past and more recently during the last ice age. The geomorphic processes in action at the present time are erosion and deposition which are driven by ice, water and wind.

The current geomorphology of the Greater Dublin area has been significantly affected by the last two glaciation events. As extensive ice sheets flowed through the Greater Dublin area it ground down the underlying bedrock, breaking off protruding outcrops and further grinding these down. Glacial erosion like this produced a till (also known as boulder clay) comprising particles of all sizes from clay (<0.002mm) to boulders (>630mm). Boulder clay in Dublin is generally thick to very thick, with the greatest extent seen towards the city centre, and is minimal around the Airport area where bedrock is very close to or at the ground surface. Major geomorphological features in the bedrock would have been destroyed by glacial erosion or are masked by the thick Dublin Boulder Clay.

Glacial related geomorphic processes are the most recent geological processes which shape the land surface and are observable now. GSI have carried out detailed mapping nationwide of Quaternary geology, including Teagasc subsoil mapping, subsoils, permeability mapping, depth to bedrock mapping and geomorphology mapping. The mapping is a result of a comprehensive, integrated study of aerial photograph interpretation, desk studies of historic maps, academic papers and studies, GIS DEMs (Digital Elevation Model), field mapping, etc. Geomorphological features formed during glacier expansion (subglacial), during ice retreat (deglacial) and after glacial retreat (postglacial) are available in the mapping dataset.

Three major types of geomorphological features are present within the scheme study area:

- Subglacial lineations, in forms of drumlin and mega scale glacial lineation;
- Meltwater channels; and
- Deglacial landforms, in forms of glaciofluvial terrace and hummocky sand and gravel.

All the above features exhibit a consistent NW-SE to E-W orientation, suggesting the overall direction of ice flow and glacial retreat from and towards the Irish Sea. Volume 4C **Figures 1.4.4 to 1.4.6** present the locations of geomorphological features within the scheme study area.

Study Area A

Study Area A covers the Dublin City Centre area, from Ranelagh in the south to Drumcondra in the north, locating at the western part of the deltaic region where River Liffey enters into the sea at Dublin Bay. Study Area A is a highly developed city area. Any geomorphological features would have been modified by urban development so there is limited information to the subsurface ground conditions or geological features. Noted from the aerial photographs, Study Area A overall is a low-lying, very flat E-W oriented river valley with the River Liffey at the centre. The topography rises slowly from sea level to about 20mOD at Ranelagh in the south and about 20mOD at Drumcondra in the north.

Quaternary geomorphological mapping indicates a meltwater channel along the current River Liffey, associated with isolated patches of glaciofluvial terraces. Pockets of hummocky sand and gravels, which compose of extremely poorly sorted clay to gravel sized sediment deposited during deglaciation, are present near St. Stephen's Green park, near Dean Street / Kevin Street and near Leeson Street Upper. A meltwater channel is present along the Dodder River around the south-most boundary of Study Area A.

Study Area B

Study Area B stretches from Drumcondra in the south to Dublin Airport in the north. The majority of Study Area B is quite urban, except for some fields around the Airport area. The topography of Study Area B decreases gradually from about 70mOD in the north-west to about 50mOD in the east and to about 10mOD in the south. The Dublin Airport area is the topographic high point of Study Area B.

Identified Quaternary geomorphological features within Study Area B demonstrate a very prominent NW-SE trend of glacial processes. There are five mega scale glacial lineation features, three west to westnorthwesterly trending subglacial striae and two south-easterly flowing meltwater channels along the current Tolka River and Santry River. Glaciofluvial terrace deposits and hummocky sand and gravels have been identified near Griffith Park adjacent to Tolka River. Hummocky sand and gravels are also mapped on both sides of Santry River near Silloge Park. Two subglacial striae have been recorded at Dublin Airport, indicating ice sheet movement from the sea inland in a westerly direction.

Study Area C

Study Area C comprises the entirety of Swords from Dublin Airport in the south to Lisenhall in the north. Study Area C consists of a combination of residential and commercial land uses. The northern portion is relatively rural, comprising mostly agricultural fields. A prominent valley feature of about 1.5km long, 200 – 250m wide and some 20m deep is noted at the Ward River in Swords. The E-W Trending Ward Valley, probably formed during a glacial period, stretches from the centre of Study Area C to the western boundary. The topography of Study Area C descends steadily from about 70mOD at the Airport in the south to about 10m to 30mOD at Swords.

Quaternary geomorphological features within Study Area C again display the strong regional NW-SE trend, including a drumlin, a mega scale glacial lineation and three meltwater channels (along the current Sluice, Ward and Broadmeadow Rivers). Extensive glaciofluvial terraces have been recorded on both sides of Sluice River and Broadmeadow River. Pockets of hummocky sand and gravel deposits are recorded at Pinnockhill area, to the south of Swords.

Summary

Due to the overall low-lying, flat to gently sloping topography over the entire study area, landslide geohazards are not expected to be a major constraint. No landslide scars, dynamic river banks or dynamic estuaries have been noted from the reviewed aerial photographs.

The presence of numerous rivers and streams across the scheme study area however may impose a number of environmental constraints to the scheme. The discussion of this aspect is detailed in **Chapter 1.6, Hydrogeology** and **Chapter 1.7 Hydrology**.

Unconsolidated, soft alluvial sediments, expected to be present along the rivers and streams, are likely to impose settlement problems on geotechnical earthworks as well as tunnelling works undertaken. They are further discussed in **Section 1.4.3.3**.

1.4.3.2 Solid Geology

Much of the bedrock in Dublin is contained within the fault-bounded Dublin Basin.

Carboniferous Limestone is the predominant rock type within the scheme study area and has been distinguished into the following four formations (as shown on Volume 4C **Figures 1.4.7 to 1.4.9**), from youngest to oldest.

- Calp/Lucan Formation (varied dark grey to black fine grained, graded limestone interbedded with poorly fossiliferous shale in several different formations that are undifferentiated on the geological map) underlies from south of the M50 towards the city centre, i.e. most of the southern part of Study Area B and entire Study Area A;
- Tober Colleen Formation (dark grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones) extends from the M50 north to Dublin Airport. It also underlies locally at the northwestern part of Study Area C;
- Waulsortian Limestones (massive unbedded reef limestones) underlie only the Study Area Around Dublin Airport, the north-most part of Study Area B; and
- Malahide Formation (Calcareous shales, siltstones and sandstone, and thin limestones; pedoidal and onchotic, occasionally nodular, micrites; fossiliferous limestones and shales, with oolites and sandstone; argillaceous limestones, nodular limestones and shales) underlies most of Study Area C.

During the Caledonian mountain building episode with the closure of the Iapetus Ocean (c. 400 Ma) Palaeozoic rocks were folded and thrust significantly. They were also intruded by granite causing doming of the Silurian meta-sediments. These sediments then endured prolonged erosion during the Devonian period exposing the intruded granite resulting in a major unconformity in the rock succession by the Lower Carboniferous (McConnell et. al, 1994).

By the start of the Lower Carboniferous period (c.360 to 320 Ma) the rocks that are present in Dublin today were deposited in a warm, tropical environment near the equator prior to moving northwards by continental drift.

After the Caledonian orogeny a general subsidence occurred allowing a rise in sea level and subsequent invasion of the land. The areas which had been intruded by granite formed positive blocks, the Balbriggan Block and Leinster Massif to the North and South of the Greater Dublin Study Area Causing the intervening region to subside more rapidly forming part of the Dublin Basin (Nolan, S.C, 1985).

Malahide Formation

The Malahide Formation was the first to deposit upon the Dublin Basin subsidence. The lower part of the formation consists of marine sandstones and shales which were likely to have been land derived. With increasing subsidence and deposition, the rising sea level created a peritidal environment with increasing fauna resulting in the deposition of micritic and oncolitic limestone. The upper part of the formation indicates deposition in a low energy open marine shelf in a tropical environment.

Waulsortian Limestones

The Malahide Formation is overlain by Waulsortian Limestones which are described as pale grey, poorly bedded limestones with cavity-filling stromatitic structures. These limestones were deposited in the form of mounds in a tropical shallow reef environment. The Waulsortian Limestone is overlain and in places interdigitated by the Tober Colleen Formation.

Tober Colleen Formation

Tober Colleen Formation comprised of dark grey, calcareous, commonly bioturbated and subordinate thin micritic limestones. The limestones of the Tober Colleen formation are typical of limestones deposited in a basinal environment in a deeper sea environment moving away from the slopes and banks of the surrounding coast due to the rising sea level.

Lucan Formation

The Lucan Formation known colloquially as ‘Calp’ found overlying the Waulsortian and Tober Colleen Formations are the youngest rocks in the area. This formation comprises thinly bedded argillaceous micritic limestones and calcareous shales which were likely deposited in a basinal and ramp environment in deeper water with limited fauna. The widespread presence of graded bedding suggests that much of the limestone was deposited by turbidity currents (McConnell et al., 1994).

The GSI bedrock geology map and major regional geological faults are shown on Volume 4C **Figures 1.4.7 to 1.4.9**. The faults impose no major environmental constraint to the works. They are however probably one of the major geotechnical engineering constraints to the scheme on tunnelling, due to the potentially difficult ground conditions, such as highly fractured rocks, groundwater ingress and soft ground, along faults and fault zones.

According to the published geological memoirs the aforementioned four limestone formations are not recognised to be susceptible to karst development. The GSI karst mapping dataset also indicates no karst related feature recorded within the entire study area. The potential for karst to be encountered should not be ruled out, however it is not identified as an environmental constraint at this stage.

Study Area A

There is no recorded fault within the Lucan Formation in Study Area A. The depth to rock generally varies from 5 to 10mBGL at the southern part, becoming deeper as you move north with the greatest depth of 25 to 30mBGL around the Rotunda Hospital area, north of the River Liffey. The deepened bedrock level is due to the presence of the Pre-Glacial Liffey Channel, which will be further discussed in **Section 1.4.3.3**.

Study Area B

Lucan Formation underlies majority of Study Area B from the southernmost boundary at Drumcondra to near the M50. North of the M50 bedrock is comprised mainly of the Tober Colleen Formation except for a small section of Waulsortian Limestones cropping out in the Dublin Airport area.

A nearly N-S trending fault cuts across the centre of Study Area B from the M50, through Ballymun to near DCU. A NE-SW oriented synclinal fold is recorded in the eastern part of Study Area B, from around the M50/M1 roundabout, through Northwood, to Santry Village area. Another NE-SW oriented fault intercepts the north-most boundary of Study Area B at the Airport.

The depth to bedrock in the central part of Study Area B is indicated as 10 to 15mBGL and locally 1 to 5mBGL in the Griffith Park area in the south, around Glasnevin and in the Ballymun area in the west, as well as at Dublin Airport area in the north. Bedrock levels at the eastern side of Study Area B are indicatively deeper, about 15 to 25mBGL.

Study Area C

Bedrock underlying Study Area C is fault-bounded, with the Tober Colleen Formation underlying the northwest and the Malahide Formation in the remaining area. Two NE-SW trending faults are recorded across Study Area C near the Airside Retail Park area and to the west of Swords. The GSI indicates the presence of three anticlinal folds to the south and to the west of the Airside Retail Park area, and to the northeast of Swords respectively.

The depth to bedrock generally varies in Study Area C, from at surface to 5mBGL at the Airport in the south, to approximately 5 to 10mBGL near the Airside Retail Park area, and to about 1 to 5mBGL around Swords.

Table 1.4.2: Rock formations within Study Area A

Geological period	Formation	Description
Carboniferous	Lucan Formation	Dark grey to black fine grained, graded limestone with interbedded poorly fossiliferous shale

Table 1.4.3: Rock formations within Study Area B

Geological period	Formation	Description
Carboniferous	Lucan Formation	Dark grey to black fine grained, graded limestone with interbedded poorly fossiliferous shale
	Tober Colleen Formation	Dark grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones
	Waulsortian Limestones	Massive unbedded reef limestones

Table 1.4.4: Rock formations within Study Area C

Geological period	Formation	Description
Carboniferous	Tober Collen Formation	Dark grey, calcareous, commonly bioturbated mudstones and subordinate thin micritic limestones
	Waulsortian Limestones	Massive unbedded reef limestones
	Malahide Formation	Calcareous shales, siltstones and sandstone, and thin limestones; pedoidal and oncholotic, occasionally nodular, micrites; fossiliferous limestones and shales, with oolites and sandstone; argillaceous limestones, nodular limestones and shales

Summary

The bedrock geology itself presents no potential environmental constraints within the scheme study area. The bedrock is considered not to be susceptible to karst development. There is also no known record of karst related features from the GSI present within the scheme study area. Karst features were not detected during ground investigations carried out for the previous Metro North Scheme (Arup 2008).

1.4.3.3 Soils and Superficial Geology***Soils (Teagasc Classification)***

As the scheme study area is overall quite urban, Made Ground is the predominant surface soil within the scheme study area, with the following mix of other soil types within each area:

- Localised pockets of grey brown podzolics, surface water gleys and lithosols near Drumcondra in Study Area A;
- Local zones of grey brown podzolics, surface water gleys and lithosols near Drumcondra, DCU and Santry in Study Area B; and
- Extensive grey brown podzolics and surface water gleys at Swords, around River Ward and near Applewood in Study Area C.

The subsoils in the scheme study area generally consist of material derived from the underlying bedrock. The majority of the scheme study area is therefore underlain by till derived from limestone. Alluvium and sometimes fluvioglacial gravels derived from limestones are present along the vicinity of rivers and streams. The Environmental Protection Agency (EPA) and Teagasc have produced soils and subsoils maps for Ireland. These maps are presented on Volume 4C **Figures 1.4.10 to 1.4.12** and Volume 4C **Figure 1.4.13 to 1.4.15** respectively for the scheme study area.

Over the majority of Study Area A and Study Area B, within the extents of Dublin City centre, the soils are primarily composed of Made Ground and have no agricultural value.

In the wider study area, the composition of the soils generally reflects the underlying bedrock parent material. As part of the groundwater recharge mapping project the Geological Survey of Ireland (GSI) has assessed the soil drainage properties and this has been incorporated into the importance ranking presented in **Table 1.4.5**.

Table 1.4.5: GSI Groundwater Recharge Importance ranking of soil for Study Area A to Study Area C

Soil type	Description	Constraints Importance Ranking
AlluvMIN	Mineral alluvium	Medium
BminDW	Deep well drained mineral soils Derived from mainly calcareous parent materials	High
BminPD	Poorly drained mineral soils Derived from mainly calcareous parent materials	Low
BminSW	Shallow well drained mineral Derived from mainly calcareous parent materials	Medium
Made Ground	Assorted sand, gravel, rubble and organic materials	Low

Superficial Deposits (Geotechnical Classification)

Superficial deposits comprise the unconsolidated geological deposits which cover the solid geology. The superficial deposits within the scheme study area include estuarine and alluvial deposits, fluvioglacial sands and gravels derived from limestone and glacial till derived from limestone. Glacial till materials within the scheme study area are also colloquially and collectively known as Dublin Boulder Clay.

During the Pleistocene epoch of the Quaternary two glaciations covered the Dublin region. The glaciation, which gave rise to the Dublin Boulder Clay was presumably not continuous. Local withdrawal and re-advance of the ice sheet and associated meltwater channels led to the formation of fluvioglacial sediments (gravel and sand lenses). The glacial deposits can exhibit significant lateral and vertical variations in grain size distributions over short distances.

A buried Pre-Glacial Liffey Channel (Farrington, 1929; Farrell and Wall, 1990) is estimated to be orientated in an East – West direction around the Parnell Square / Rotunda Hospital area up to around Connolly Station before changing to a northwest – southeast trending direction through the Dublin Port area (refer to Volume 4C **Figure 1.4.13**). The extent of the pre-glacial channel is interpreted from desk study information comprising a combination of ground investigations from the previous Metro North study, historic and recent Arup projects at Dublin Port, as well as the ground model produced by the GSI. Considerable thicknesses of glacial sand and gravels have been encountered in the buried pre-glacial channel at Parnell Square, near the Rotunda Hospital and at Dublin Port.

There are also a number of Quaternary meltwater channels indicated along the current River Liffey, Tolka River, Santry River, Sluice River, Ward River. Glacial sand and gravel lenses are also expected within these meltwater channels, though may not be present in as substantial a thickness as the buried Pre-Glacial Liffey channel which is a relatively much larger scale geological feature.

After the end of the glaciation, a rising sea level related to changing climatic conditions, led to the deposition of raised beach deposits and terrace gravel sediments around the Liffey estuary. Recent alluvial sediments were also deposited along the rivers and approaching the river estuaries.

Young estuarine sediments were formed along the old shorelines in the vicinity of and within the Tolka and Liffey river estuaries.

In more recent times large parts of tidal areas along the natural shoreline and along the rivers Liffey and Tolka were reclaimed by man and infilled with various forms of made ground and engineering fill. Made Ground is present extensively in urban areas.

The thickness of the subsoils underlying the scheme study area is variable with the thickest subsoils underlying north of the City Centre area in Study Area A around the Rotunda Hospital with shallow to outcropping bedrock recorded around Dublin Airport in Study Area B.

The natural superficial deposits generally present no constraints for any potential options within the scheme study area. However, where glacial sand and gravels, glacial meltwater channels or buried pre-glacial river channels are present, groundwater conditions for tunnelling or station excavation are potentially more difficult compared to the more homogenous glacial till deposits.

Soft ground

Soft compressible deposits within the scheme study area are indicated on Volume 4C **Figures 1.4.16 to 1.4.18**. These include alluvial, lacustrine and estuarine silts and clays mainly found around river/streams, lake and estuary locations.

Geotechnical engineering issues due to encounters with unconsolidated soft deposits during the construction of Dublin Port Tunnel have been described in the Geotechnical Interpretative Report of the previous Metro North study. Settlements of 20mm were recorded at the surface in an area which contained a deep relic stream filled with saturated soft soils even though the TBM was driven deep within limestone bedrocks. It is considered that the settlement was caused by consolidation of sediment due to tunnel boring vibrations. Soft soils are characterised by their low strength and permeability. The presence of these soil deposits would probably require special construction measures such as ground improvement or removal.

Soft ground presents a minor environmental constraint for any potential options within the scheme study area. Where these soft or 'unconsolidated' soils are present, they can pose geotechnical engineering challenges to construction solutions and engineering designs.

Karst solution features

According to the published geological memoirs the limestone formations within the scheme study area are recognised as being minimally susceptible to karst development. The GSI karst feature mapping also indicates no karst related feature recorded within the entire study area.

Slope stability

The GSI has developed a landslide susceptibility map for the East Coast and Greater Dublin area where the susceptibility of a landslide occurring is assessed and categorised. The majority of the scheme study area is classified into low to moderately low susceptibility as the scheme study area is overall quite flat or with a gentle gradient, except locally around the Ward River where landslide susceptibility is classified to be moderately high. The topography of the embankments of Ward River Valley has been recognised to be quite high and steep (**Section 1.4.3.1**) but no visible previous landslide scars or relict slopes can be noted from the available aerial images.

1.4.3.4 Contaminated Sites

Ground contamination typically impacts the superficial deposits or shallow soils. The majority of the scheme study area is underlain by a moderate to thick cover of low permeability Dublin Boulder Clay which acts as an effective barrier from contaminants affecting the bedrock and bedrock aquifer. For the New Metro North Project, ground contamination is typically not an environmental concern for tunnelling works but it imposes environmental constraints to station box excavation, portal and access construction as well as at-grade route section shallow earthworks.

Sources of contamination within the scheme study area have been investigated and identified into the following four categories:

- Landfills (licensed and historical);
- Pits, quarries and mines (active and historical);
- Industrial facilities (licensed and historical); and
- Historical land use contamination.

Landfills

In 1996 the EPA began licensing certain activities in the waste sector. These include landfills, transfer stations, hazardous waste disposal and other significant waste disposal and recovery activities. These are potential geological constraints as they may act as areas of contamination. There is however no EPA licensed waste facility recorded within the scheme study area.

According to the EPA website (accessed 24 May 2017), there is no known historical (or ‘legacy’) landfill within the scheme study area.

The Fingal County Council, Dublin City Council and Environmental Protection Agency have been consulted for their records of landfills and waste related sites.

A number of historic unregulated landfill, illegal dumping sites and burial grounds are recorded within the scheme, in Study Area B and Study Area C as outlined in **Table 1.4.6** and **Table 1.4.7** and presented on Volume 4C **Figures 1.4.19** to **1.4.21**. Further details on waste constraints are discussed in **Section 1.5 Waste**.

Table 1.4.6: Unlicensed waste facilities within Study Area B

ID	Ownership	Name of Facility	Site Status	Constraints Importance ranking
D1	Dublin City Council	St. Margaret Road dumping site	Disused but cleared regularly by the council	High
L1	Fingal County Council / Private	Ballymun unregulated historic landfill site	Disused	High
L2	Private	Dardistown historic landfill	Disused	High
B1	Private	Dardistown burial ground	Current	High

Table 1.4.7: Unlicensed waste facilities within Study Area C

ID	Ownership	Name of Facility	Site Status	Constraints Importance ranking
B2	Private	Chapel Lane burial ground	Current	High
L3	Private	Townspark landfill	Disused	High

Pits, Quarries and Mines

Historical pits and quarries are potential sources of ground contamination as the nature of backfill materials is generally highly variable and unregulated. According to the GSI records, historical pits and quarries within the scheme study area have been identified as below:

- Study Area A: **1** historic pit;
- Study Area B: **5** historic pits and **1** historic quarry; and
- Study Area C: **10** historic pits and **1** historic quarry.

The GSI 2014 Quarry Directory was consulted. There is no recorded active pit, mine or quarry located within the scheme study area.

The majority of the historic pits and quarries are clustered around Griffith Park, near Dublin Airport and around Swords which are limited in volume according to their footprint.

The historic pits and quarries identified within each area of the scheme are shown on Volume 4C **Figures 1.4.19 to 1.4.21** and summarised in **Table 1.4.8, Table 1.4.9** and **Table 1.4.10**.

Investigations are required to determine the exact location of these historic pits and quarries where station box or access shaft excavation will be needed. The nature of the backfill materials shall also be characterised during the investigation.

Table 1.4.8: Historic pits and quarries within Study Area A

ID	Type	Description	Constraints Importance Ranking
HP01	Small historic pit	GSI Quaternary mapping 1992 – 2009: disused pits	Low
HQ01	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HQ02	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium

Table 1.4.9: Historic pits and quarries within Study Area B

ID	Type	Description	Constraints Importance Ranking
HP02	Small historic pit	GSI Quaternary mapping 1992 – 2009: disused pits	Low
HP03	Small historic pit	GSI Quaternary mapping 1992 – 2009: disused pits	Low
HP04	Small historic pit	GSI Quaternary mapping 1992 – 2009: disused pits	Low
HP05	Small historic pit	GSI Quaternary mapping 1992 – 2009: disused pits	Low
HP06	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HQ03	Historic quarry	OSI/GSI Six-inch mapping 1833 – 1946: quarries	Medium
HQ04	Historic quarry	OSI/GSI Six-inch mapping 1833 – 1946: quarries	Medium
HQ05	Historic quarry	OSI/GSI Six-inch mapping 1833 – 1946: quarries	Medium

Table 1.4.10: Historic pits and quarries within Study Area C

ID	Type	Description	Constraints Importance Ranking
HQ05	Historic quarry	OSI/GSI Six-inch mapping 1833 – 1946: quarries	Medium
HP07	Small historic pit	OSI/GSI Six-inch mapping 1833 – 1946: small pits	Low

ID	Type	Description	Constraints Importance Ranking
HP08	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP09	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP10	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP11	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP12	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP13	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP14	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP15	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP16	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium
HP17	Historic pit	OSI/GSI Six-inch mapping 1833 – 1946: pits	Medium

Industrial facilities

Existing industrial sites may be the source of locally contaminated land due to site activities. However, these sites operate within the EPA Integrated Pollution Control (IPC) licence framework and due to the regulated nature of their activities, the risk of contamination is low. The IPC licenced sites within the scheme study area are listed in **Table 1.4.11** and **Table 1.4.12** and are shown on Volume 4C **Figures 1.4.19 to 1.4.21**. There is no IPC licenced industrial facility within Study Area A.

Table 1.4.11: IPC licenced industrial facilities within Study Area B

ID	Licence Holder	Licence Status	Constraints Importance Ranking
IP01	Lithographic Web Press Limited	Surrendered	Low
IP02	Lithographic Web Press Limited	Licenced	Low
IP03	Rentsch Dublin Limited	Licenced	Low
IP04	Computer Plating Specialists Limited	Surrendered	Low

Table 1.4.12: IPC licenced industrial facilities within Study Area C

ID	Licence Holder	Licence Status	Constraints Importance Ranking
IP05	Eirtech Aviation Limited	Licenced	Low

ID	Licence Holder	Licence Status	Constraints Importance Ranking
IP06	Arch Chemicals BV	Licensed	Low
IP07	Swords Laboratories	Licensed	Low
IP08	Evode Industries Limited	Surrendered	Low

Similarly, sites which have been granted a wastewater discharge licence may be a source of contamination. There is only one wastewater discharge site licenced by the EPA within the scheme study area as outlined in **Table 1.4.13** and shown on Volume 4C **Figures 1.4.19 to 1.4.21**.

Table 1.4.13: Wastewater discharge licence recorded by EPA within the scheme study area

Location	ID	Licence Holder	Type of Facility	Licence Status	Constraints Importance ranking
Study Area C	WL1	Fingal County Council	Wastewater treatment plant discharge point	Licensed	Low

Fingal County Council also holds a number of wastewater discharge licences within the county. The details are listed out in **Table 1.4.14** and **Table 1.4.15**. There is however no exact address of these licenced sites nor GIS data available to be shown on figures.

There is no wastewater discharge licence within the scheme study areas held by the Dublin City Council.

Table 1.4.14: Wastewater discharge licence recorded by Fingal County Council within Study Area B

ID	Licence Holder	Effluent Type	Licence Reference	Constraints Importance ranking
<i>Dublin Airport Area</i>				
WL2	M50 GSE Garage	Carwash	WPS/F/487	Low
WL3	Esso Garage	Oil and grease	WPS/F/203	Low
WL4	DAA Pollution Prevention Facility	Trade effluent	WPS/F/339	Low
WL5	Crystal Clean	Carwash	WPS/F/132	Low
WL6	Maldron Hotel	Oil and grease	WPS/F/362	Low
WL7	Dooley Car Rentals	Carwash	IW 712035	Low
WL8	Carlton Hotel	Oil and grease	IW 732329	Low
WL9	Flute Bar	Oil and grease	IW 699298	Low
WL10	Angel Shore Bar	Oil and grease	IW 690712	Low
WL11	Enterprise Rent a Car	Carwash	WPS/F/456	Low
WL12	City Jet	Aircraft cleaning	WPS/F/156	Low

ID	Licence Holder	Effluent Type	Licence Reference	Constraints Importance ranking
WL13	McDonalds	Oil and grease	WPS/F/135	Low
WL14	Dublin Aerospace	Aircraft Maintenance	IPPC 480	Low
WL15	Gate Gourmet	Oil and grease	WPS/F/139	Low
WL16	Flyers café	Oil and grease	WPS/F/140	Low
WL17	Ethiad Airways T2	Oil and grease	WPS/F/383	Low
WL18	Sixt Car Rentals	Carwash	WPS/F/483	Low
WL19	Raddison Hotel	Oil and grease	WPS/F/143	Low
Santry / Ballymun Area				
WL20	Topaz Ballymun	Carwash	WPS/F/118	Low
WL21	Kuhne & Nagle Santry	Trade effluent	WPS/F/118	Low

Table 1.4.15: Wastewater discharge licence recorded by Fingal County Council within Study Area C

ID	Licence Holder	Effluent Type	Licence Reference	Constraints Importance ranking
Swords Area				
WL22	BMS Swords laboratories	Pharmaceutical effluent	IPPC 492	Low
WL23	Siemens Diagnostics	Trade eff	WPS/F/004	Low
WL24	Applegreen Swords	Carwash, Oil and grease	WPS/F/484	Low

Historic land use contamination

Land contamination is highly related to site history and previous land use which can leave contaminants in the ground depending on historic site activities. The OSI historic maps were assessed to determine land uses within the scheme study such as factories, railway works, *etc.* that may provide a potential source of historic contamination. Dublin City Centre area has been a heavily industrial area so there are a significant number of areas with potential historic land use contamination recorded within Study Area A. Conversely, Study Area B and Study Area C have relatively less sources of potential historic land use contamination.

The extent of soil contamination by these historic land uses are typically localised. The constraint importance is therefore ranked by the potential degree of soil contamination, such as in categories of previously heavy or light industrial usage. The NRA guidelines do not define specifically for heavy and light industries. In this report, they are categorised as follows:

Heavy industries:

- Medium to large scale industries, such as power station, wastewater treatment plant, other municipal facilities, etc.; and
- Industries that involve significant amount of harmful chemicals or metals, such as dry cleaning, soap works, smithy, foundry, lime kilns, etc.

Light industries:

- Food processing industries;
- Small scale industries and factories; and
- Industries that involve relatively less amount of harmful substances, such as printing works, glass factory, textile factory, etc.

They are outlined in **Table 1.4.16**, **Table 1.4.17**, **Table 1.4.18** and shown on Volume 4C **Figures 1.4.19** to **1.4.21**.

Table 1.4.16: Potential historic land use contaminations within Study Area A

ID	Type	Description	Constraints Importance Ranking
HC01	Chemical	Dry Battery Manufactory	High
HC02	Others	Engine Shed	High
HC03	Municipal Facilities	Water Works Pressure Station	High
HC04	Textile	Laundry	High
HC05	Others	Pipe Factory	High
HC06	Metal Industry	Smithy	High
HC07	Drinks Industry	Mineral Water Works	Medium
HC08	Others	Factory	High
HC09	Metal Industry	Smithy	High
HC10	Drinks Industry	Brewery	High
HC11	Metal Industry	Smithy	High
HC12	Food	Biscuit Factory	Medium
HC13	Metal Industry	Smithy	High
HC14	Metal Industry	Smithy	High
HC15	Drinks Industry	Maltings	High
HC16	Metal Industry	Smithy	High
HC17	Metal Industry	Smithy	High
HC18	Minerals & Aggregate	Lime Kilns	High
HC19	Textile	Clothing Factory	Medium
HC20	Textile	Shirt and Collar Factory	Medium
HC21	Pulp-Paper Industry	Saw Mill	Medium

ID	Type	Description	Constraints Importance Ranking
HC22	Chemical	Sheep Dip Factory	High
HC23	Metal Industry	Smithy	High
HC24	Chemical	Printing Works	High
HC25	Others	Railway Station	High
HC26	Chemical	Printing Works	High
HC27	Others	Engineering Works	High
HC28	Chemical	Printing Works	High
HC29	Chemical	Printing House	High
HC30	Metal Industry	Iron and Brass Works	High
HC31	Metal Industry	Smithy	High
HC32	Municipal Facilities	Corporation Depot	Medium
HC33	Chemical	Printing Works	High
HC34	Power Generation	Electricity Works	High
HC35	Metal Industry	Bedstead Factory	High
HC36	Metal Industry	Foundry	High
HC37	Others	Coal Yard	High
HC38	Municipal Facilities	Corporation Yard	Medium
HC39	Others	Coal Yard	High
HC40	Others	Coal Yard	High
HC41	Drinks Industry	Brewery	High
HC42	Food	Corn Kiln	Medium
HC43	Drinks Industry	Brewery	High
HC44	Minerals & Aggregate	Tile Factory	High
HC45	Metal Industry	Foundry	High
HC46	Chemical	Printing works	High
HC47	Food	Corn Exchange	Medium
HC48	Textile	Carpet Mills	Medium
HC49	Drinks Industry	Rectifying Distillery	High
HC50	Pulp-Paper Industry	Saw Mill	Medium
HC51	Chemical	Printing Works	High
HC52	Animal Products	Hair Works	Medium
HC53	Textile	Underwear Factory	Medium
HC54	Textile	Corset Factory	Medium
HC55	Others	Factory	High
HC56	Textile	Tape Mills	Medium
HC57	Food	Bakery	Medium

ID	Type	Description	Constraints Importance Ranking
HC58	Textile	Bedding Factory	Medium
HC59	Chemical	Printing Works	High
HC60	Drinks Industry	Mineral Water Works	High
HC61	Textile	Clothing Factory	Medium
HC62	Metal Industry	Brass Works	High
HC63	Chemical	Printing Works	High
HC64	Chemical	Glass House Factory	High
HC65	Food	Sugar Store	Medium
HC66	Chemical	Glass House Factory	High
HC67	Food	Tobacco Warehouse	High
HC68	Pulp-Paper Industry	Cooperage	Medium
HC69	Food	Tobacco Warehouse	High
HC70	Food	Tobacco Warehouse	High
HC71	Chemical	Glass House Factory	High
HC72	Pulp-Paper Industry	Saw Mill	Medium
HC73	Chemical	Glass Works	High
HC74	Chemical	Printing Works	High
HC75	Textile	Dye works	Medium
HC76	Textile	Velvet Manufactory	High
HC77	Textile	Comb and Button Works	High
HC78	Textile	Polish Factory	High
HC79	Textile	Rope Walk	High
HC80	Minerals & Aggregate	Brick Field	High
HC81	Pulp-Paper Industry	Envelope works	Medium
HC82	Chemical	Soap Works	High
HC83	Food	Confectionery Works	Medium
HC84	Chemical	Soap Works	High
HC85	Chemical	Printing Works	High
HC86	Food	Bakery	Medium
HC87	Chemical	Printing works	High
HC88	Chemical	Printing Works	High
HC89	Food	Bakery	Medium
HC90	Food	Bakery	Medium
HC91	Chemical	Printing Works	Medium
HC92	Metal Industry	Foundry	High
HC93	Metal Industry	Smithy	High

ID	Type	Description	Constraints Importance Ranking
HC94	Food	Jam Factory	Medium
HC95	Food	Tobacco Factory	Medium
HC96	Metal Industry	Coach Factory	High
HC97	Chemical	Chemical Works	High
HC98	Metal Industry	Metal Works	High
HC99	Drinks Industry	Maltings	High
HC100	Textile	Laundry	High
HC101	Metal Industry	Wire Works	High
HC102	Drinks Industry	Brewery	High
HC103	Drinks Industry	Distillery	High

Table 1.4.17: Potential historic land use contaminations within Study Area B

ID	Type	Description	Constraints Importance Ranking
HC104	Food	Sweet Factory	Medium
HC105	Minerals & Aggregate	Gravel Pit	High
HC106	Municipal Facilities	Sewage Farm	High
HC107	Minerals & Aggregate	Quarry	High
HC108	Minerals & Aggregate	Quarry	High
HC109	Minerals & Aggregate	Lime Kiln	High

Table 1.4.18: Potential historic land use contaminations within Study Area C

ID	Type	Description	Constraints Importance Ranking
HC110	Minerals & Aggregate	Gravel Pit	High
HC111	Metal Industry	Smithy	High
HC112	Food	Corn Mill	Medium
HC113	Municipal Facilities	Water Works	High
HC114	Food	Windmill Stump	Medium
HC115	Minerals & Aggregate	Quarry	High
HC116	Minerals & Aggregate	Quarry	High
HC117	Food	Corn Mill	Medium
HC118	Minerals & Aggregate	Gravel Pits	High

ID	Type	Description	Constraints Importance Ranking
HC119	Minerals & Aggregate	Gravel Pit	High
HC120	Minerals & Aggregate	Gravel Pit	High
HC121	Minerals & Aggregate	Lime Kiln	High

1.4.3.5 Economic Geology

The economic geological features within the scheme study area have been subdivided into the following categories:

- Granular Aggregate Potential;
- Active pits, mines and quarries;
- Mineral resource locations; and
- Areas containing deep, well drained soils suitable for agriculture.

Granular Aggregate Potential

The GSI Granular Aggregate Potential Mapping categorises bedrock in terms of aggregate resource into five levels, from very high potential to very low potential. According to the NRA criteria in **Table 1.4.1**, the various granular aggregate potential categories are rated in this report as follows:

Table 1.4.19: Granular aggregate resource rating according to NRA guideline Box 4.1

Granular Aggregate Potential	Constraints Importance Ranking
Very high to high	High
Moderate	Medium
Low to very low	Low

The identified granular aggregate resources within the scheme study area are outlined in **Table 1.4.20**, **Table 1.4.21** and **Table 1.4.22** and shown on Volume 4C **Figures 1.4.22** to **1.4.24**.

Table 1.4.20: Granular aggregate resources within Study Area A

ID	Aggregate potential	Constraints Importance Ranking
AP01	Low potential	Low
AP02	Very Low potential	Low
AP03	Low potential	Low
AP04	Low potential	Low
AP05	Low potential	Low
AP06	Very Low potential	Low

ID	Aggregate potential	Constraints Importance Ranking
AP07	Low potential	Low
AP08	Low potential	Low
AP09	Very Low potential	Low
AP10	Very Low potential	Low
AP11	Very Low potential	Low
AP12	Very Low potential	Low
AP13	Very Low potential	Low
AP14	Low potential	Low
AP15	Very Low potential	Low
AP16	Moderate potential	Medium
AP17	Moderate potential	Medium
AP18	Low potential	Low
AP19	Moderate potential	Medium
AP20	High potential	High
AP21	High potential	High
AP22	Moderate potential	Medium
AP23	High potential	High
AP24	Moderate potential	Medium
AP25	Low potential	Low
AP26	Moderate potential	Medium
AP27	Moderate potential	Medium
AP28	Moderate potential	Medium
AP29	Very High potential	High
AP30	Moderate potential	Medium

Table 1.4.21: Granular aggregate resources within Study Area B

ID	Aggregate potential	Constraints Importance Ranking
AP29	Very High potential	High
AP30	Moderate potential	Medium
AP31	Very High potential	High
AP32	High potential	High
AP33	Low potential	Low
AP34	High potential	High
AP35	Very High potential	High
AP36	Moderate potential	Medium
AP37	High potential	High
AP38	Very Low potential	Low
AP39	Low potential	Low

ID	Aggregate potential	Constraints Importance Ranking
AP40	Moderate potential	Medium
AP41	Very Low potential	Low
AP42	Moderate potential	Medium
AP43	Moderate potential	Medium
AP44	Very Low potential	Low
AP45	Low potential	Low
AP46	Low potential	Low
AP47	Low potential	Low
AP48	High potential	High
AP49	Low potential	Low
AP50	Low potential	Low
AP51	Low potential	Low
AP52	Moderate potential	Medium
AP53	Low potential	Low
AP54	Moderate potential	Medium
AP55	Low potential	Low

Table 1.4.22: Granular aggregate resources within Study Area C

ID	Aggregate potential	Constraints Importance Ranking
AP56	Moderate potential	Medium
AP57	Low potential	Low
AP58	Very Low potential	Low
AP59	Moderate potential	Medium
AP60	Low potential	Low
AP61	Moderate potential	Medium
AP62	Very Low potential	Low
AP63	Moderate potential	Medium
AP64	Low potential	Low
AP65	Moderate potential	Medium
AP66	Low potential	Low
AP67	Moderate potential	Medium
AP68	Moderate potential	Medium
AP69	Low potential	Low
AP70	Low potential	Low
AP71	Low potential	Low
AP72	Very Low potential	Low
AP73	Low potential	Low
AP74	Low potential	Low

ID	Aggregate potential	Constraints Importance Ranking
AP75	Very Low potential	Low
AP76	Low potential	Low
AP77	Low potential	Low
AP78	Moderate potential	Medium
AP79	High potential	High
AP80	Very High potential	High
AP81	Very High potential	High
AP82	High potential	High
AP83	Low potential	Low
AP84	Moderate potential	Medium

Active pits, mines and quarries

The GSI 2014 Quarry Directory was consulted. There is no recorded active pit, mine or quarry located within the scheme study area.

Mineral resource locations

Mineral resources in Ireland mapped by the GSI were examined but there is no economical extractable mineral resource location identified within the scheme study area.

1.4.3.6 Geological Heritage

A database of geological heritage sites is maintained by the GSI. The county geological sites of Dublin and Fingal counties were also compiled for assessment. There are no geological sites that are on a regional or national scale (i.e. NHA or pNHA) within the scheme study area. There are **7** County Geological Sites within Study Area A and **1** site within Study Area B but none within Study Area C.

Locations of geological heritage are presented on Volume 4C **Figures 1.4.22 to 1.4.24** and summarised in **Table 1.4.23** and **Table 1.4.24**.

Table 1.4.23: Areas of Geological Heritage in Study Area A

ID	Site Name	Principle characteristic	Constraints Importance Ranking
GHA01	51 St. Stephens Green	The entrance lobby of the building is original (mid 1800s); A demonstration set of Irish marble. This is an excellent, accessible educational resource on Irish building stones.	High
GHA02	Oscar Wilde Statue	A life size statue of Oscar Wilde made of sculpted rocks placed on top of a large boulder of quartz. The statue is a remarkable example of different rock types used to extraordinary artistic effect.	High

ID	Site Name	Principle characteristic	Constraints Importance Ranking
GHA03	Museum Building, Trinity College	The museum building of trinity college Dublin, especially the original interior, completed in 1857. The building is a very fine demonstration of rocks in building construction and ornamentation.	High
GHA04	Dublin City Walls	Three remaining sections of the medieval city walls of Dublin City The walls are composed of local Calp limestone, built between 1100 and 1125.	High
GHA05	River Poddle	A river which flows northwards through Dublin City; most of its course is diverted underground. The site is important owing to the channelisation and in the lore associated with the Poddle.	High
GHA06	Temple Bar Street Well	An historic street well in the midst of temple bar. The site presents an interesting aspect of hydrogeology in a very accessible location.	High
GHA07	General Post Office	The general post office doorways and marble panelled interior area for customers are of interest. The sole use of three classic Irish marble types is a good example of building stone use.	High

Table 1.4.24: Areas of Geological Heritage in Study Area B

ID	Site Name	Principle characteristic	Constraints Importance Ranking
GHA08	Glasnevin Cemetery	This is a very large cemetery of 120 acres, dating from 1832. The variety of rock types here, and the variety of ways in which they have been worked, are unique.	High

1.4.4 Summary

The soils and geological features that will present constraints on the NMN development have been identified in this chapter. The constraints include the following aspects and are shown on Volume 4C **Figures 1.4.1 to 1.4.24**.

- Soils;
- Potential contamination: landfills, dumping site, burial ground, historic pits; and quarries, industrial facilities, and historic land use contamination;
- Economic geology: granular aggregate potential; and
- Geological heritage: county geological sites.

1.4.5 References

Farrell E. and Wall D. (1990) *The soils of Dublin*. Transactions of the Institution of Engineers of Ireland, Vol 115, 78–97.

Farrington A. (1929) *The pre-glacial topography of the Liffey Basin*. Proceedings of the Royal Irish Academy, 38B, 148-170.

McConnell B. and Philcox M.E. (1994) *Geology of Kildare-Wicklow: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 16, Kildare – Wicklow*.

McConnell B., Philcox M., & Geraghty M. (2001) *Geology of Meath: A Geological Description to Accompany the Bedrock Geology 1: 100,000 Map Series, Sheet 13, Meath*.

Nolan S.C. (1985) *The Carboniferous Geology of the Dublin Area*. Ph.D. thesis, Trinity College, Dublin.

1.5 Waste

1.5.1 Introduction

This section identifies the constraints regarding waste that have been identified within the scheme study area for the NMN Project.

The waste constraints are presented on Volume 4C **Figures 1.4.4 to 1.4.6** and Volume 4C **Figures 1.4.19 to 1.4.21**.

Section 1.5.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.5.3** describes the waste constraints identified within the scheme study area. A summary is presented in **Section 1.5.4** and references are listed in **Section 1.5.5**.

1.5.2 Methodology and Sources of Information

1.5.2.1 Methodology

The constraints study provides a qualitative assessment of the following within the scheme study area:

- Potential waste related constraints (e.g., contaminated sites); and
- Waste management facilities and infrastructure which could be impacted by the NMN Project.

In addition, further constraints, which may not be subject to statutory protection, but should none the less be considered as waste constraints, were also considered. These include topography, potentially contaminated sites and geomorphological features across the scheme study area. Those features are indicative of the potential locations within the scheme study area that may generate larger volumes of demolition and excavation waste during the construction of the NMN.

1.5.2.2 Sources of Information

Research for the constraints study was undertaken as a desktop exercise. The following sources were consulted in order to identify waste constraints:

- Aerial photography (1995, 2000, 2012 and 2005) of the scheme study area;
- Current and historical Ordnance Survey maps available for the scheme study area (1:2,500 and 1: 10,560 scales);
- Dublin City Council datasets on waste management facilities including civic amenity sites, community bring centres and bottle banks;
- Dublin City Development Plan 2011 - 2017. (Dublin City Council, 2011);
- Dataset from Environmental Protection Agency (EPA):
 - Licensed waste facilities; and
 - Licensed industrial and agricultural facilities.
- Eastern – Midlands Regional Waste Management Plan 2015 - 2021. (Eastern Midlands Waste Regional Authority, 2015);
- Fingal County Council datasets on waste management facilities including recycling centres and bring banks;
- Fingal Development Plan 2017 - 2023. (Fingal County Council, 2017);
- Ground investigation reports held by the Geological Survey of Ireland for the scheme study area;
- Ground investigation reports held by Arup for the scheme study area;
- Historical ground investigation records collated by the previous Metro North Scheme study;
- Preliminary and main ground investigations commissioned for the previous Metro North Scheme study.

1.5.3 Existing Environment

This section describes the waste management constraints identified within the scheme study area. Constraints associated with topography, geomorphology, waste management facilities and potentially contaminated sites within the scheme study area are described. Waste constraints are presented on Volume 4C **Figures 1.4.4 to 1.4.6 and 1.4.19 to 1.4.21**.

There are a mixture of land uses throughout the scheme study area of relevance to the waste management constraints. Study Area A comprises the highly urbanised area of Dublin city centre whilst Study Area B becomes more rural to the north around Dublin Airport. Study Area C is generally more rural to the south (in the vicinity of Dublin Airport) and becomes highly developed around Swords to the north. The extent of existing development can influence the quantity of demolition waste associated with the scheme, as it would be anticipated that in an urban environment there would be a greater level of demolition required in order to provide major transport infrastructure like the NMN Project.

1.5.3.1 Topography

Topography can be a constraint for waste management as the ground profile can influence the volume of excavation waste associated with the scheme. Generally, the scheme study area is relatively flat with gentle gradient throughout therefore this is not expected to be a major constraint for waste management.

In Study Area A, the topography rises slowly from sea level to about 30mOD at Milltown in the south and about 20mOD at Drumcondra in the north. The topography of Study Area B decreases gradually from about 70mOD in the west to about 50mOD in the east and to about 10mOD in the south. The topography of Study Area C generally descends steadily from about 70mOD at the Airport in the south to about 10m – 30mOD at Swords.

1.5.3.2 Geomorphology

Geomorphology can be a constraint for waste management as it can influence the quantity of construction waste arising, associated with the scheme. The geomorphology is discussed in detail in **Section 1.4 Soils and Geology**.

The most relevant information for this waste management constraints study is summarised below:

- Study Area A comprises the city centre of Dublin located at the western part of the deltaic region where the River Liffey enters into the Irish Sea at Dublin Bay. Study Area A is highly urbanised and geomorphological features have been modified by urban development. As such, there is limited information as to the subsurface ground conditions or geological features. Study Area A is generally a low-lying, very flat valley with the River Liffey running east-west through the area. See Volume 4C **Figure 1.4.4**.
- Study Area B stretches from Drumcondra in the south to Dublin Airport in the north. The majority of Study Area B is quite urban and mostly developed, with the exception of the rural land surrounding the airport boundary. The rural land around the airport includes recreational facilities (such as golf courses, equestrian centres and football pitches) and agricultural land. See Volume 4C **Figure 1.4.5**.
- Study Area C extends from Dublin Airport to the south to the suburban Study Area around Swords to the north. Study Area C includes the Ward River and associated valley which stretches from the western boundary eastwards towards the Swords Estuary. See Volume 4C **Figures 1.4.6** and
- The subsoils across the entire study area generally consist of material derived from the underlying bedrock. The majority of the scheme study area is therefore underlain by till derived from limestone. Unconsolidated, soft alluvial sediments are likely along the rivers and streams and may impose settlement problems for geotechnical earthworks as well as tunnelling works. Where tunnelling and associated excavation is required within these soft grounds, efforts would be made to reuse the materials within the scheme, but it is likely that some waste may need appropriate handling, transfer and disposal.

1.5.3.3 Waste Facilities

Waste facilities that are located within and service the scheme study area have been considered as part of this constraints study as they can influence waste management activities and impacts associated with the scheme.

Waste facilities licensed by the EPA include landfills, transfer stations, hazardous waste disposal and other significant waste disposal and recovery facilities. There are no licensed EPA waste facilities within the scheme study area. The nearest licensed facilities that service the scheme study area include the Greenstar Ltd waste transfer station at St Margaret's to the west of Dublin airport, the Site Environmental Ltd hazardous waste facility at North Wall and the Haytonvale Developments soil remediation facility at Sir John Rogerson's Quay in the city centre.

Additional waste management facilities of relevance include composting facilities, thermal treatment plant, recycling centres and bring banks. There are no composting or thermal treatment plants within the scheme study area, however there are a number of bring banks and civic amenity sites distributed throughout the scheme study area as it is urban or peri-urban in nature.

1.5.3.4 Potentially Contaminated Sites

Potentially contaminated sites have been considered as part of this constraints study because any subsurface pollutants encountered by the scheme would require appropriate handling, treatment, transfer and disposal. Potential sources of ground contamination within the scheme study area that have been considered include:

- Pits and quarries (active and historical);
- Licensed industrial and agricultural facilities (active and historical); and
- Legacy contamination (from historical land use contamination).

1.5.3.5 Pits and Quarries

Historical pits and quarries are identified as a potential source of ground contamination as the backfill materials can be highly variable in nature and unregulated. According to the GSI records, there are a number of historical pits and quarries within the scheme study area. The historic pits and quarries are identified below and detailed as part of **Section 1.4.3.4 Soils and Geology**.

- Study Area A: **1** historic pit
- Study Area B: **5** historic pits and **1** historic quarry
- Study Area C: **10** historic pits and **1** historic quarry

Volume 4C **Figures 1.4.19 to 1.4.21** illustrates the indicative locations of those historic pits and quarries.

1.5.3.6 Licensed Industrial Facilities

Industrial facilities may provide a local source of ground contamination; however, the risk of contamination is low, as such facilities are obligated to operate in accordance with the requirements of their license.

A number of licensed industrial facilities have been identified in Study Area B and Study Area C as outlined in **Table 1.5.1** and Volume 4C **Figures 1.4.19 to 1.4.21**. Additionally, **1** licensed wastewater treatment plant has been identified in Study Area C as illustrated in Volume 4C **Figure 1.4.21**.

Table 1.5.1: IPPC licensed industrial facilities in study areas B and C

ID	Licence Holder	Licence Status
Study Area B		
IP01	Lithographic Web Press Limited	Surrendered
IP02	Lithographic Web Press Limited	Licensed
IP03	Rentsch Dublin Limited	Licensed
IP04	Computer Plating Specialists Limited	Surrendered
Study Area C		
IP05	Eirtech Aviation Limited	Licensed
IP06	Arch Chemicals BV	Licensed
IP07	Swords Laboratories	Licensed
IP08	Evode Industries Limited	Surrendered

1.5.3.7 Legacy Contamination

Legacy contamination comprises historical landfills, poorly managed and/or unregulated industry and land use that may be a potential source for ground contamination.

Dublin City centre was historically industrial and a significant number of sites with the potential for historical contamination have been identified between the North and South Circular Roads. A number of sites with the potential for historical contamination have also been identified in the remainder of the scheme study area. The potentially historic land uses within the scheme study area are illustrated on Volume 4C **Figures 1.4.19 to 1.4.21**.

It is noted that there is **1** historic unregulated landfill site within the scheme study area located to the south of Dublin Airport in Study Area C. Fingal County Council has identified this as an unregulated historic landfill site (Ballymun IIRS).

1.5.4 Summary

The waste management aspects that have the potential to be constraints on the NMN are discussed below.

The scheme study area has undergone significant development and urbanisation, particularly towards the city centre to the south and Swords to the north. Construction waste arisings could be significantly influenced by the route alignment through these areas. Any demolition of structures including existing properties, utilities, services, infrastructure and hardstanding would increase the volume of construction waste arising from the NMN.

The site is generally flat with softer, compressible soils present in the vicinity of waterbodies including the River Liffey, Tolka and the Ward River. The route alignment would influence the extent of subsurface excavation and tunnelling required and therefore influence the volume of excavation waste arising from the NMN.

There are a number of bring banks and recycling centres, however there are no licensed waste facilities within the scheme study area. It is noted that there is generally limited capacity for construction and demolition waste within the Greater Dublin area which may impact on disposal options for the scheme.

There is a range of potentially contaminated sites and licensed industrial facilities throughout the scheme study area. The risk of contamination from these sites is low, however any unexpected subsurface contamination encountered during construction would require appropriate handling, treatment, transfer and disposal. Particular caution should be given to the historic pits and quarries and those sites noted for their potential for legacy contamination including the unregulated historic landfill site at Ballymun. The extent and nature of legacy contamination at those sites is unknown at this stage.

1.5.5 References

Dublin City Council. (2011) *Dublin City Development Plan 2011–2017*.

Eastern Midlands Waste Region. (2015) *Eastern Midlands Region Waste Management Plan 2015 - 2021*. Eastern Midlands Waste Regional Authority, Dublin, Ireland.

Fingal County Council. (2017). *Fingal Development Plan 2017–2023*.

1.6 Hydrogeology

1.6.1 Introduction

This section identifies the hydrogeological constraints identified within the scheme study area for the NMN Project.

The hydrogeological constraints are presented on Volume 4C **Figures 1.6.1 to 1.6.9**.

Section 1.6.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.6.3** describes the hydrogeological constraints identified within the scheme study area. A summary is presented in **Section 1.6.4** and references are listed in **Section 1.6.4**.

1.6.2 Methodology and Sources of Information

1.6.2.1 Methodology

This assessment was prepared taking cognisance of the requirements of the NRA *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009*.

The assessment is based on a review of the results of a desk study and ground investigation results. The desk study included a review of the information sources listed in **Section 1.6.2.2** to identify the constraints associated with hydrogeology within the scheme study area.

Once all hydrogeological features had been identified during the initial research, the sites were plotted onto a map of the scheme study area. In addition, further constraints, which may not be subject to statutory protection, but should none the less be considered as hydrogeological constraints, were also added. These include the list of private wells held by Dublin City Council and Fingal County Council.

In compiling the hydrogeology constraints consideration has been given to data acquired by other disciplines in particular the Soils and Geology, Ecology and Hydrology constraint studies.

The assessment considers the features identified under the following hydrogeological headings:

- Aquifer type and classification;
- Karst landforms;
- Groundwater vulnerability;
- Groundwater Resources; and
- Ecology.

Under each heading all the features highlighted are classified in terms of their importance in accordance with the NRA Guidelines. The criteria for ranking the importance of the identified hydrogeological constraints and these criteria are presented in **Table 1.6.1**

Table 1.6.1: Criteria for rating the importance of Hydrogeology Attributes (based on NRA Guidelines (2009) Box 4.3: Criteria for Rating Site Attributes)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale.	Groundwater supports river, wetland or surface water body ecosystem protected by EU legislation e.g. Special Areas of Conservation (SAC) or Special Protection area (SPA) status.
Very High	Attribute has a high quality or value on a regional or national scale	Regionally Important Aquifer with multiple well fields. Groundwater supports river, wetland or surface water body ecosystem protected by national legislation – e.g. Natural Heritage Area (NHA) status. Regionally important potable water source supplying >2500 homes. Inner source protection area for regionally important water source.
High	Attribute has a high quality or value on a <u>local scale</u>	Regionally Important Aquifer. Groundwater provides large proportion of baseflow to local rivers. Locally important potable water source supplying >1000 homes. Outer source protection area for regionally important water source. Inner source protection area for locally important water source.
Medium	Attribute has a medium quality or value on a local scale	Locally Important Aquifer Potable water source supplying >50 homes. Outer source protection area for locally important water source.
Low	Attribute has a low quality or value on a local scale	Poor Bedrock Aquifer. Potable water source supplying <50 homes.

1.6.2.2 Sources of Information

Research for the constraints study was undertaken as a desktop exercise. The following sources were consulted in order to identify hydrogeological constraints:

- Aerial photography (2013) of the scheme study area;
- Ordnance Survey topographical;
- Geological maps of the site area produced by the Geological Survey of Ireland (www.dcenr.gov.ie);
 - Groundwater Resources (Aquifers);
 - Karst;
 - Groundwater Vulnerability;
 - Groundwater Wells and Springs;
 - Drinking Water Protection Areas; and

- National Federation Group Water Scheme.
- Designated ecological area maps produced by the National Parks and Wildlife Service (www.npws.ie);
- A list of private wells held by Dublin City Council and Fingal County Council; and
- Preliminary and main ground investigations commissioned for the previous Metro North Scheme study.

1.6.3 Existing Environment

This section describes the hydrogeological constraints identified within the scheme study area. Constraints associated with aquifer type and classification, karst landforms, groundwater vulnerability, groundwater resources and ecology within the scheme study area are described. Hydrogeological constraints are presented on Volume 4C **Figures 1.6.7 to 1.6.9**.

1.6.3.1 Aquifer Classification and Groundwater Bodies

The Geological Survey of Ireland (GSI) has devised a system for classifying the aquifers in Ireland based on the hydrogeological characteristics, size and productivity of the groundwater resource. The three main classifications are Regionally Important Aquifers (RI), Locally Important Aquifers (LI) and Poor Aquifers (P). Each of these types of aquifer is further subdivided and has a specific range of criteria such as the transmissivity (m^2/day), productivity, yield and potential for springs associated with it. The GSI also provides a delineation of the extents for groundwater bodies within each aquifer.

Regionally Important Aquifers can be sub-divided into Karstified Bedrock with either diffuse (Rkd) or conduit (Rkc) flow, fissured bedrock (Rf) or extensive sand and gravel (Rg). By the very nature of Regionally Important Aquifers and their importance for groundwater resources, there may be significant impacts on the aquifer by any potential options in such an area. Examples of impacts which may occur are the disruption of groundwater flow paths during earthworks, derogation of water supplies if dewatering is necessary, disruption of base flow to groundwater fed rivers or fens, or contamination of the aquifer through accidental spillage and removal of the overburden which protects the aquifer.

Locally Important Aquifers are sub-divided into those that are generally moderately productive (Lm), those that are moderately productive only in local zones (Ll), and smaller sand and gravel aquifers (Lg). The term 'Locally Important Aquifers which are karstified (Lk)' is sometimes used; however, this is not an official classification. There is also potential to have an impact on the environment if any potential option is located on a Locally Important Aquifer, however the impacts may be limited to a localised area. In these aquifers there is the potential for contamination and the derogation of local water supplies and springs through changing groundwater flow paths during earthworks and dewatering.

Poor Aquifers are classed as either generally unproductive except for local zones (PI) or generally unproductive (Pu). Poor Aquifers generally provide little groundwater for water supply or for baseflow to surface water bodies, however they are sometimes used for local supply for individual houses/farms. While the impact on the environment of locating any potential option on a Poor Aquifer will be significantly less than that on a Regionally Important Aquifer, it still requires consideration and mitigation against impacts during the design and construction stages.

The aquifer classification within the scheme study area is shown on Volume 4C **Figures 1.6.1 to 1.6.3**. Carboniferous Limestone is the predominant rock type within the scheme study area. Two bedrock classifications are present in the scheme study area and these have been related to the geological formations named in **Section 1.4 Soils and Geology**.

The GSI has not identified any gravel aquifers within or in the vicinity of the scheme study area. The GSI only designates a sand and gravel aquifer as being locally important if the area of aerial extent is greater than 1 km² and the saturated thickness is greater than 5m (or if the saturated thickness is unknown a full thickness of <10m).

A pre-glacial Liffey Channel (referred to as the Liffey Channel) as noted in **Section 1.4.3** of the **Soils and Geology** constraints study, is identified to the north of the current River Liffey (Volume 4C **Figure 1.6.1**). It is not considered by the GSI as an aquifer as it does not meet the criteria for a locally important aquifer. However, it is likely to have a significant extent (Volume 4C **Figure 1.6.1**). The Liffey Channel is estimated to be nearly E-W oriented at the Parnell Square/Rotunda Hospital area extending to around Connolly Station and changing to a NW-SE trending direction through the Dublin Port area. The glacial gravel within the channel is likely to be water bearing, have a high hydraulic conductivity and storage. It is reported in **Section 1.4 Soils and Geology** to sit directly on the bedrock hence it is likely to be in continuity with the bedrock aquifer. Considering its properties and likely connection with the bedrock aquifer, it could comprise a good source of water for a supply. Notwithstanding that it has not been designated by the GSI it is conservatively assumed to have medium constraint importance ranking. The aquifer classifications and their constraint importance ranking are presented in **Table 1.6.2**.

Table 1.6.2: Aquifer Classification and Groundwater Bodies within the scheme study area

Rock Formation/Gravel aquifers	Groundwater Rock Unit	GSI Aquifer Classification	Constraint Importance Ranking
Calp/Lucan	Dinantian Upper Impure Limestones	LI	Medium
Tober Colleen		PI	Low
Waulsortian			
Malahide	Dinantian Lower Impure Limestones	LI	Medium

Rock Formation/Gravel aquifers	Groundwater Rock Unit	GSI Aquifer Classification	Constraint Importance Ranking
		GSI Aquifer Classification	Constraint Importance Ranking
Liffey Channel	-	None	Medium to High

The Locally Important Aquifers are located in the southern and northern parts of the scheme study area. The Poor Aquifer is located in the north west part of the scheme study area as well as a band through the middle of study area.

The scheme study area is underlain by both the PI and LI aquifers and in some areas by the Liffey Channel. Any route within the scheme study area will have to traverse both aquifers and the Liffey Channel. Consequently, there is no potential route within the scheme study area that avoids any of the identified aquifers for the proposed metro route.

1.6.3.2 Groundwater Vulnerability

Vulnerability of a groundwater body is the term used to describe the intrinsic geological and hydrogeological characteristics which determine the ease with which a groundwater body may be contaminated by human activities.

The vulnerability is determined by the permeability and thickness of the overlying deposits. For example, bedrock with a thick, low permeability overburden is less vulnerable than bedrock with a thin high permeability, gravel overburden.

The classification guidelines, as published by the GSI, are given in **Table 1.6.3**, which demonstrates that bedrock groundwater is most at risk in areas where subsoils are thin or absent and where karst features such as swallow holes are present. This is due to the ability of potential contaminants to reach the aquifer following a low travel time and with little or no contaminant attenuation due to the thin or absent overburden.

Table 1.6.3: GSI Vulnerability Rating Matrix

Vulnerability Rating	Hydrogeological Conditions				
	Subsoil Permeability (Type) and Thickness			Unsaturated Zone	Karst Features
	High permeability (sand/gravel)	Moderate permeability (e.g. Sandy subsoil)	Low permeability (e.g. Clayey subsoil, clay, peat)	Sand/gravel aquifers only	(<30m radius)
Extreme (E)	0 – 3.0m	0 – 3.0m	0 – 3.0m	0 – 3.0m	-
High (H)	>3.0m	3.0 – 10.0m	3.0 – 5.0m	>3.0m	N/A
Moderate (M)	N/A	>10.0m	5.0-10.0m	N/A	N/A
Low (L)	N/A	N/A	>10.0m	N/A	N/A

Notes: (1) N/A = not applicable

(2) Precise permeability values cannot be given at present.

(3) Release point of contaminants is assumed to be 1-2 meters below ground surface.

Groundwater vulnerability maps have been produced by the GSI. Volume 4C **Figures 1.6.4 to 1.6.6** show the groundwater vulnerability within the scheme study area. The vulnerability is classified as Low over much of study area. However, in the southern and northern part of the scheme study area, some areas of Moderate to Extreme vulnerability are present.

Localised areas of high to extreme vulnerability are present in the south of Study Area A, the south of Study Area B and the northern part of Study Area C. A route could be devised that avoids these areas. However, there is one area of high to extreme vulnerability, present in the north of Study Area B that cannot be avoided.

The information from the GSI on groundwater vulnerability is dependent on the elevation of the development relative to current ground level. Any excavation below ground level will reduce the thickness of the overlying deposits and increase the vulnerability rating of the scheme. The subsoil thickness is variable; the subsoils underlying the City Centre area of Study Area A are the thickest, up to 30m, but rock around Dublin Airport in Study Area B is very close to and even exposed at the surface. Consequently, the ratings presented on Volume 4C **Figures 1.6.4 to 1.6.6** only relate to developments at or above ground level.

1.6.3.3 Karst

Karst describes the origin of a number of features that form in areas where the rock present is readily dissolved by water. Distinctive karstic features examples include sink holes, turloughs, springs and voids with fast flowing water in them. Often these feature form along preferential groundwater flow paths such as fractures, fissures or joints. In these, groundwater flow is dominated by fissure flow, leading to potentially high yields and the aquifers can extend over large areas.

The limestone underlying the scheme study area is described as moderately permeable karstified (GSI, no date available (n.d.a)). However, it is reported in **Section 1.4.3 Soils and Geology** that in the published geological memoirs for the Dublin area, the limestone formations are not recognised to be susceptible to karstification.

Karst features were not detected during ground investigations carried out for the previous Metro North study (Arup 2008).

There are no karst features within the extent of the scheme study area as indicated on Volume 4C **Figures 1.6.1 to 1.6.3**. Although none are shown within the scheme study area a number of features are shown in north County Dublin in the strata which underlie the scheme study area. The closest feature is a karst spring called St Doolaghs Well approximately 3.7km to the east of the scheme study area.

Due to the geographical low frequency of karst features in the scheme study area as well as the overburden thickness across much of the scheme study area, significant karst features are unlikely to be present.

However, it is recognised that the effect on construction from intercepting a water filled karst feature could be significant.

There is no preference for routes in relation to karst features within the scheme study area as none were identified.

1.6.3.1 Groundwater Resources

Groundwater resources describe any large spring, well or borehole which is used as a groundwater abstraction source by domestic, agricultural, commercial, industrial, local authority, group water scheme users or private. Groundwater abstractions have the potential to be impacted by proposed route options. Lowering of the groundwater table during construction and operation, may reduce the supply available temporarily or permanently. Accidental spillages or releases of contaminants may impact the water quality.

Source Protection Zones (SPZ) reports have been produced by the GSI and the EPA. The reports aim to guide development planning and regulation to provide protection from pollution to groundwater sources. To date no SPZ reports have been produced for locations within the scheme study area.

Boreholes and springs (identified from GSI and Dublin City Council (DCC) records) used for supply within the scheme study area are summarised in **Table 1.6.4** and are identified on Volume 4C **Figures 1.6.7 to 1.6.9**. The 21 No. GSI abstractions are catalogued in terms of well accuracy which refers to the siting of the well from the location, within 50m, 100m etc. The remaining 2 No. abstractions are from Dublin City Council records and the accuracy is based on the site address.

Fingal County Council only holds records of abstractions greater than 25m³/day, of which, they have no recorded abstractions within the scheme study area.

There are a number of abstractions within and close to the scheme study area. In Study Area B and Study Area C, there tends to be clusters of abstractions which may be avoided by any proposed route. In Study Area A there are only 3 No. abstractions which can easily be avoided. It should be noted that the zone of contribution of abstractions may extend well beyond the abstraction location indicated on Volume 4C **Figures 1.6.7 to 1.6.9**.

Table 1.6.4: Boreholes and spring abstractions within the scheme study area

ID	Source	Abstraction Type	Townland	Yield (m ³ /day)	Abstraction Use	Constraints Importance Ranking
2923NEW015	GSI	Borehole	Santry	130	Industrial use	Low
2923NEW016	GSI	Borehole	Ballymun	109	Domestic use only	Low
2923NEW018	GSI	Borehole	Swords	110	Industrial use	Low
2923NEW019	GSI	Borehole	Swords	385	Unknown	Low

ID	Source	Abstraction Type	Townland	Yield (m ³ /day)	Abstraction Use	Constraints Importance Ranking
2923NEW020	GSI	Borehole	Swords	220	Unknown	Low
2923NEW021	GSI	Borehole	Nevinstown West	38.2	Agri & domestic use	Low
2923NEW034	GSI	Borehole	Corballis	300	Industrial use	Low
2923NEW036	GSI	Borehole	Ballymun	87	Industrial use	Low
2923NEW037	GSI	Borehole	Ballymun	Not reported	Industrial use	Low
2923NEW038	GSI	Spring	Forrestfields	Not reported	Unknown	Low
2923NEW039	GSI	Spring	Crowcastle	Not reported	Unknown	Low
2923NEW061	GSI	Borehole	Ballymun	87	Industrial use	Low
2923NEW062	GSI	Borehole	Ballymun	200	Industrial use	Low
2923NEW063	GSI	Spring	Lissenhall Little	Not reported	Unknown	Low
2923SEW010	GSI	Borehole	Rathmines	109.1	Domestic use only	Low
2923SEW012	GSI	Borehole	Parnell Street	163.6	Unknown	Low
2923SEW013	GSI	Borehole	Ormond Quay	114.5	Unknown	Low
2923SEW015	GSI	Borehole	North Brunswick Street	393	Industrial use	Low
2923SEW024	GSI	Borehole	Glasnevin	16.5	Unknown	Low
2923SEW027	GSI	Borehole	Glasnevin	300	Unknown	Low
2923SEW028	GSI	Borehole	Glasnevin	482	Unknown	Low
2923SEWO21	GSI	Borehole	Finglas	174.6	Industrial use	Low
Ballygall Road Service Station	DCC	Borehole	Ballygall	2.3 (average abstraction rate)	Commercial use	Low
DeCoursey Square Allotments Association	DCC	Borehole	Glasnevin	0.03 (estimated abstraction rate)	Irrigation	Low

1.6.3.2 Ecology

Groundwater dependant habitats may be impacted by any potential option through accidental contamination, localised flooding or the alteration of base-flow supplies to wetlands causing the area to dry out. A more comprehensive assessment of the impacts on ecology is presented in **Section 1.3 Biodiversity**. This section presents habitats that are present in scheme study area and assesses if they are reliant on groundwater.

Site of ecological importance recorded on the National Parks and Wildlife database (National Parks and Wildlife Service, n.d.a) within the scheme study area are listed in **Table 1.6.5** and presented on Volume 4C **Figures 1.6.7 to 1.6.9**.

Table 1.6.5: Ecological features within the scheme study area

Site Name	Site Code	Designation	Characteristics
Malahide Estuary and Broadmeadows / Swords Estuary	205 / 4025	pNHA, SAC, SPA	Estuary habitat which includes saltmarsh, sand dunes.
Royal Canal	2103	pNHA	Waterway comprised of canal and banks. Fed from Lough Owel (NHA)
Grand Canal	2104	pNHA	Waterway comprised of canal and banks. Fed from Pollardstown Fen (pNHA)

The Grand Canal and Royal Canal are designated by the National Parks and Wildlife Service as proposed Natural Heritage Areas (pNHA) and cross Study Area A.

Both canals are lined with puddle clay and as such are not hydraulically connected to the underlying groundwater body and therefore are not groundwater dependant (Headland Archaeology Ltd, 2007).

The Malahide Estuary SAC and pNHA and Broadmeadows/Swords Estuary SPA are located in the eastern part of Study Area C. These areas are reliant on sea water rather than river or groundwater. Consequently, water features in the area are not likely to be groundwater dependent.

1.6.4 Summary

The potential hydrogeological constraints on the NMN development within the scheme study area have been identified through the assessment of the aquifer classification, karst landforms, groundwater vulnerability and groundwater resources.

The hydrogeological constraints have been assessed in terms of importance so that they can be ranked for screening of potential options as per **Table 1.6.1**

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Recommendations have been made within the sections above where possible for areas that routes could pass through where the constraints are lower importance or less common.

The constraints are shown on Volume 4C **Figures 1.6.7 to 1.6.9**.

1.6.5 References

Arup. (2008) *Dublin Metro North Geotechnical Interpretive Report Issue 1*.

Geological Survey of Ireland. (GSI), no date available (n.d.a) *Dublin GWB: Summary of Initial Characterisation*. Available from: (www.gsi.ie).

Geological Survey of Ireland. (GSI), no date available (n.d.a) *Swords GWB: Summary of Initial Characterisation*. Available from: (www.gsi.ie).

National Parks and Wildlife Service. no date available (n.d.a) NPWS Site Synopsis for pNHAs (559 sites). Available from: (https://www.npws.ie/sites/default/files/general/pNHA_Site_Synopsis_Portfolio.pdf).

National Roads Authority. (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.

Ordnance Survey of Ireland. (2017) GeoHive. OSI Online Mapping. Available from: (<http://map.geohive.ie/mapviewer.html>).

Waterways Ireland. (2007) *The Grand Canal Architectural, Engineering and Industrial Heritage Assessment*. Headland Archaeology Ltd.

1.7 Hydrology

1.7.1 Introduction

This section identifies the hydrology constraints identified within the scheme study area for the NMN Project.

The hydrology constraints are presented on Volume 4C Figures **1.7.1 to 1.7.4**.

Section 1.7.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.7.3** describes the hydrology constraints identified within the scheme study area. A summary is presented in **Section 1.7.4** and references are listed in **Section 1.7.5**.

The hydrology constraints applicable to the scheme study area can be summarised under the following headings:

- Surface Waters
 - River and stream crossings (large and small);
 - Lakes (permanent and seasonal); and
 - Coastal Waters.
- Floodplains and Flood Risk

- Fluvial;
- Coastal and estuarine;
- Pluvial;
- Groundwater (seasonal lakes); and
- Arterial Drainage Schemes.
- Hydro ecology Sites
 - Natura 2000 sites;
 - Surface water related habitats; and
 - Salmonid Waters; Wetland Systems
- Surface Waters Abstractions

1.7.2 Methodology and Sources of Information

1.7.2.1 Methodology

This assessment was prepared taking cognisance of the requirements of the NRA *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009*.

The guidelines provide useful criteria for ranking the importance of the identified hydrological constraints and these criteria are presented in **Table 1.7.1**.

Table 1.7.1: Criteria for rating the Importance of Hydrology Attributes (based on NRA Guidelines (2009) Box 4.2: Criteria for Rating Site Attributes)

Importance	Criteria	Typical Example
Extremely High	Attribute has a high quality or value on an international scale	River, wetland or surface water body ecosystem protected by EU legislation e.g. 'European sites' designated under the Habitats Regulations or 'Salmonid waters' designated pursuant to the European Communities (Quality of Salmonid Waters) Regulations, 1988.
Very High	Attribute has a high quality or value on a regional or national scale	River, wetland or surface water body ecosystem protected by national legislation – NHA status Regionally important potable water source supplying >2500 homes Quality Class A (Biotic Index Q4, Q5) Flood plain protecting more than 50 residential or commercial properties from flooding Nationally important amenity site for wide range of leisure activities

Importance	Criteria	Typical Example
High	Attribute has a high quality or value on a local scale	Salmon fishery Locally important potable water source supplying >1000 homes Quality Class B (Biotic Index Q3-4) Flood plain protecting between 5 and 50 residential or commercial properties from flooding Locally important amenity site for wide range of leisure activities
Medium	Attribute has a medium quality or value on a local scale	Coarse fishery Local potable water source supplying >50 homes Quality Class C (Biotic Index Q3, Q2- 3) Flood plain protecting between 1 and 5 residential or commercial properties from flooding Locally important amenity site for small range of leisure activities
Low	Attribute has a low quality or value on a local scale	Local potable water source supplying < 50 homes Quality Class D (Biotic Index Q2, Q1) Floodplain protecting 1 residential or commercial property from flooding Amenity site used by small numbers of local people

1.7.2.2 Sources of Information

This desk study collated and reviewed the following sources of information to identify hydrological constraints within the scheme study area:

- Current and historical Ordnance Survey maps available for the study area (1:2,500 and 1:10,560 scales);
- Aerial photography of the scheme study area;
- OPW Flood Studies Update Web Portal;
- CFRAM Draft Mapping and CFRAM Hydrology and Hydraulics Reports for the scheme study area (<http://www.cfram.ie/fem-fram-pilot-study-website/>) and (<http://eastcfram.irish-surge-forecast.ie/>);
- Eastern River Basin Reports;
- Draft Flood Risk Management Plan for UoM 8: Nanny-Delvin;
- Draft Flood Risk Management Plan for UoM 9: Liffey and Dublin Bay;
- OPW CFRAM lidar and topographical data for scheme study area;
- OPW Hydrometric Data for River and Coastal Gauges;

- OPW Arterial Drainage Mapping for Broadmeadow & Ward Arterial Drainage scheme;
- EPA Water Quality Monitoring Data;
- Inland Fisheries Ireland;
- Dublin City Development Plan; and
- Fingal Development Plan.

1.7.3 Existing Environment

This section describes the hydrology constraints identified within the scheme study area. The overall hydrological river and stream catchment boundaries are shown on Volume 4C **Figure 1.7.1**. The hydrology constraints are presented on Volume 4C **Figure 1.7.2** to **Figure 1.7.4**.

The scheme study area is approximately 40km². The study area is broken down into 3 sub sections as follows.

- Study Area A = 8.19km²
- Study Area B = 17.67km²
- Study Area C = 14.19km²

Study Areas A and B lie wholly within Hydrometric Area 09, Liffey and Dublin Bay. Study Area C lies within both Hydrometric Area 09, Liffey and Dublin Bay and Hydrometric Area 08 Nanny-Delvin. Approximately 11.46km² of Study Area C lies within Hydrometric Area 08 and the remaining 2.73km² lies within Hydrometric Area 09.

In general, the topography of the scheme study area falls from west to east, with all rivers and streams ultimately outfalling to the Irish Sea. The majority of the study area is heavily urbanised especially around Dublin City Centre, Dublin Airport and Swords.

1.7.3.1 Watercourses

There are **8** main hydrological river catchments that intersect the scheme study area. Refer to Volume 4C **Figure 1.7.1** for details of the overall scheme catchment areas. From South to North these include;

- i. The River Liffey and its sub catchments
 - a. The River Poddle
 - b. The River Dodder
- ii. The River Tolka
- iii. The Santry River
- iv. The River Mayne and its sub catchment
 - a. The Cuckoo Stream

- v. The Sluice River
- vi. The Gaybrook Stream and its sub catchments
 - a. Seapoint Stream
 - b. Greenfields Stream
- vii. The Broadmeadow River and its sub catchment
 - a. The Ward River
- viii. The Turvey Stream and its sub catchment
 - a. The Staffordstown Stream

Two artificial water bodies (AWB) cross the scheme study area. These include both the Grand Canal and the Royal Canal.

The River Liffey flows through Study Area A and represents the largest watercourse in the Study Area. The catchment to Island Bridge is approximately 1,150km². There are a number of tributaries feeding into the Liffey downstream of Islandbridge including The Camac, Poddle and Dodder Rivers. The Camac River catchment is 53.5km² to its confluence with the Liffey, the River Poddle is 15.1km² to its confluence at Ushers Quay. The River Dodder is 112.8km² to its confluence with the River Liffey at Britain Quay. This gives a total catchment area to the sea at Ringsend of approximately 1,331km². Although the route of the Camac, Poddle and Dodder watercourses do not lie inside the study area, the study area makes up part of the contributing catchment of the Poddle and Dodder Rivers.

The River Tolka flows through Study Area's A and B and has a catchment area of 150.5km² to its outfall to the sea at East Wall. Its contributing catchment makes up a large portion of Study Area A and Study Area B.

The Santry River flows through Study Area B and has a catchment area of 15.6km² to its outfall to the sea at Raheny.

The Mayne River and its tributary the Cuckoo Stream flow through study Area B. It has combined catchment area of 19.6km² to its outfall at Baldoyle Estuary.

The Sluice River flows through Study Area C. Its catchment is split between Study Areas B and C and outfalls to the sea at Portmarnock. It has a contributing catchment of 17.7km² to its outfall.

The Gaybrook stream flows through Study Area C and has a catchment of 5.26km² and to its outfall at Malahide Estuary.

There are two smaller coastal streams that flow through the study areas to the East of the R132 in Swords. The Seapoint Stream and the Greenfields Stream both outfall to the Malahide Estuary at Seapoint.

The Broadmeadow River and its tributaries, including the Ward River, flows through Study Area C.

This river catchment makes up the majority of Study Area C. The Ward River which flows through Swords has a catchment area to Balheary of 61.6km². The combined catchment of the Broadmeadow and the Ward Rivers is 171.9km² to its outfall to the Malahide Estuary at Seatown.

The Staffordstown Stream flows through Study Area C and has a contributing catchment of 4.23km² to its outfall at Seapoint north of Swords to the Malahide Estuary.

1.7.3.2 Water Quality

The EPA classifies the water quality status of existing watercourses in Ireland based on information collated.

The collated information relating to water quality and macro-invertebrate community composition is condensed to a numerical scale of Q-values or Biotic Indices. The indices are grouped into four classes based on a river's suitability for beneficial uses such as water abstraction, fishery potential, amenity value, etc. (refer to **Table 1.7.2** below).

Table 1.7.2: Biological River Water Quality Classification System

Biotic Index (Q value)	Quality Status	Quality Class	Condition
Q5, Q4-5, Q4	Unpolluted	Class A	Satisfactory
Q3-4	Slightly Polluted / Eutrophic	Class B	Transitional
Q3, Q2-3	Moderately Polluted	Class C	Unsatisfactory
Q2, Q1-2, Q1	Seriously Polluted	Class D	Unsatisfactory

Table 1.7.3 below outlines the status for each watercourse within the scheme study area. This data is based on the latest EPA Water Quality in Ireland 2010-2015 document published in 2017. Some of the watercourses within the scheme study area have been tested and assigned a water quality status. There are also a number of unassigned reaches which have not been given a Q value.

Table 1.7.3: Water Quality Status

Watercourse	Water Quality Index Q-Value
Camac	Q2-3 (Moderately Polluted)
Tolka	Q2-3 (Moderately Polluted)
Santry	Q2-3 (Moderately Polluted)
Mayne	Q2-3 (Moderately Polluted)
Cuckoo	Q2-3 (Moderately Polluted)
Ward	Q2-3 (Moderately Polluted)
Broadmeadow	Q2-3 (Moderately Polluted)

Watercourse	Water Quality Index Q-Value
Poddle	No Q Value (not currently monitored by the EPA)
Sluice	No Q Value (not currently monitored by the EPA)
Gaybrook	No Q Value (not currently monitored by the EPA)

As can be seen in **Table 1.7.3**, the watercourses within the scheme study area are at risk of not achieving good status under the Water Framework Directive. Any proposed metro routes will need to take into consideration the status of the water quality and propose mitigation to maintain or improve water quality of these watercourses in accordance with the Water Framework Directive.

Canals are artificial water bodies and consequently are classified based on their ecological potential rather than ecological status. Both the Royal and Grand Canal achieved good ecological potential in the 2013-2015 period.

1.7.3.3 Coastal Waters

The eastern extent of Study Area A is located approximately 2.6km from the Irish Sea at Sandymount and 1km from the Irish Sea at Fairview. The Eastern side of Study Area B is located approximately 6km from Raheny and Portmarnock. Study Area C touches the Malahide Estuary at Swords.

All of the watercourses encountered in the overall study area eventually outfall to the sea on the east coast. These coastal waters, given their designated status are considered to have an extremely high attribute value and are potentially sensitive to water quality impacts. The designated sites are at risk of being impacted by potential route options during both the construction and operation phases.

Any potential route options should consider the impacts it may have on the hydrological functioning of coastal waters and European sites downstream. This should include impacts on flows, morphology, velocities, water depths, physico-chemical parameters such as salinity, pH, water hardness and temperature.

1.7.3.4 Lakes and Standing Waters

There are no major permanent or seasonal lakes identified within the scheme study area.

There are a number of small decorative ponds and standing waters located within the study areas, however, these are not of great significance in terms of catchment hydrology or river flows.

Within study area A, the following ponds and standing waters are notable; George's dock and the Inner Dock are located to the north of the River Liffey and at the eastern boundary of the study area. The Blessington Street Basin is also located to the west of the study area.

A number of smaller decorative ponds and waterbodies are located at Ranelagh Gardens and St. Stephens Green. There are also fountains located at the Iveagh Gardens and Garden of Remembrance.

Within study area B, there is a decorative pond located within Poppintree Park at Ballymun. There is also a small lake located on the Santry river, within the Santry Demesne, which is also identified in **Section 1.7.3.5** as a fluvial flood risk area.

There are no decorative ponds or standing water bodies of note located within study area C.

1.7.3.5 Flood Risk Areas

As an initial investigation, the OPW's flooding historical archive website www.floodmaps.ie was consulted to establish whether there are any historical records of previous flooding located within the scheme study area. A number of reports were generated and the results are compiled in Volume 4B **Annex 1.7.1**. There are numerous records of flood incidents located in the scheme study area.

The national preliminary flood risk assessment (PFRA) for the country was carried out on behalf of the OPW in 2011. This was a desk based national screening exercise to identify areas where there may be a significant risk associated with flooding. This assessment considered all types of flooding, including natural sources such as those which can occur from rivers, the sea and estuaries, heavy rain and groundwater and the failure of built infrastructure. The relevant maps for the study area are contained in Volume 4B **Annex 1.7.2**. Following the PFRA, areas for further assessment (AFA) were established and the national Catchment Flood Risk Assessment and Management (CFRAM) Plans were commissioned in 2011 to investigate further the AFAs.

As part of the CFRAM studies, detailed catchment flood risk and management plans (FRMP) have been undertaken to address flood risk. The assessment sets out the national policy for flood risk management and the strategy for implementation of it. Part of the scheme study area lies within the area assessed for flood risk under the Eastern CFRAM. Flood Maps for fluvial and coastal flooding have been developed and are available online. Areas relevant in the Eastern CFRAM are Dublin City Centre tidal and fluvial flooding, Clontarf and Sandymount coastal flood risk areas and fluvial and coastal risk in the Raheny area.

In addition, part of the scheme study area to the North has been assessed under the Fingal East Meath FRAM project. Fingal County Council along with its project partners Meath County Council and the OPW recognised the high level of flood risk in the area and have carried out studies to address the flood risk in this area. The resulting data is currently available online in respect to flood mapping and flood hydrology.

The relevant CFRAM output maps for the study area are contained in Volume 4B **Annex 1.7.3**. A summary of the findings in relation to flood risk in Study Areas A, B and C is provided, outlined in the sub-sections below.

Study Area A

Within Study Area A, the following areas have been identified under the CFRAM studies as being at risk of flooding.

- A fluvial flood risk extent is predicted at the Western side of Study Area A at St Patricks Cathedral from the River Poddle;
- In general, the fluvial flood risk is contained within the channel and quay sides of the River Liffey. However, there is a high coastal flood risk in the Docklands area and low lying lands at Ormond Quay alongside the River Liffey; and
- In the area of North Strand and East Wall alongside the River Tolka and its estuary an extensive coastal and fluvial flood risk exists.

The PFRA maps identify numerous localised areas of pluvial flood risk throughout the study area. Pluvial flooding typically occurs in localised topographical depressions when rainfall of high intensity and duration exceed the infiltration capacity of the underlying soil causing temporary build-up of flood waters. Similarly, the existing surface water sewer network within the city centre is subject to localised flood risk in high intensity and duration rainfall events. There are many anecdotal records of sewer flooding dispersed throughout the study area. Refer to Volume 4B **Annex 1.7.4** for anecdotal flooding information collated under the EU Interreg IVB Flood Resilient City project from the 24/25 October 2011 event.

There are no indications of any groundwater flood risk in Study Area A.

Study Area B

Within Study Area B, the following areas have been identified under the CFRAM studies as being at risk of flooding.

- A fluvial flood risk exists alongside the Tolka Valley, where the river extends out into its low-lying floodplains;
- To the north of Junction 4 Ballymun on the M50 an area of fluvial flood risk on the Santry River exists upstream of the culverts beneath the existing motorway. There is also a significant flood zone area located on the Santry River within the Santry Demesne to the south of Northwood Avenue and upstream of the crossing beneath the existing R132; and
- There are a number of localised fluvial flood risk areas located alongside the River Mayne in the vicinity of Turnapin townland to the North West of Junction 3 on the M50. Similarly, to the north, at Toberbunny, fluvial flooding is predicted in the green field floodplains alongside The Cuckoo Stream between the Dardistown Cemetery and Swords Rugby Club.

The PFRA maps identify numerous localised areas of pluvial flood risk throughout the study area. Pluvial flooding typically occurs in localised topographical depressions when rainfall of high intensity and duration exceed the infiltration capacity of the underlying soil causing temporary build-up of flood waters.

There are no indications of any groundwater flood risk in Study Area B.

Study Area C

Within the Study Area C, the following areas have been identified under the CFRAM studies as being at flood risk.

- The Sluice Stream is generally contained within its banks within the study area with the exception of some slight out of bank flooding upstream of the R132;
- There is extensive fluvial flood risk to the east of the study area associated with the Gaybrook Stream in the vicinity of the Airside Business Park and to the north at Crowcastle;
- Alongside the Ward River, there is substantial flood risk adjacent to its banks through the Ward Valley Park. The areas of flood risk extend along its banks right through the urbanised centre of Swords to the west of Swords Castle, northwards to where its flood plain extends widely to the Balheary Road to the west and to the Swords Wastewater Treatment Plant to the East, to its confluence with the Broadmeadow River; and
- Just outside the study area, to the north east, there is a low-lying area located in the townland of Part of Broadmeadow with extensive fluvial flood risk. The associated flood zone extends westwards to the townland of Saucerstown and eastwards into Study Area C through Oldtown, Newtown, Holybanks, to its confluence with the Ward River north of Swords, upstream of the R132. In general, the urbanised area of Swords lies to the south of the river, and is located outside of the flood risk zone. However, there are extensive areas of fluvial flood risk located on the northern bank of the Broadmeadow River.

Note that the Broadmeadow and Ward Rivers were subject to operations carried out under the Arterial Drainage Acts 1945 and 1995 whereby minor arterial drainage schemes were undertaken by the OPW from 1961 to 1964. These schemes typically were provided to allow protection of up to the three year return period event in channel, in addition to creating an outfall for drainage of adjoining lands.

At the Malahide estuary, there is some localised coastal flood risk at the low lying areas on the eastern side of the study area.

The PFRA maps identify a few localised areas of pluvial flood risk throughout the study area. Pluvial flooding typically occurs in localised topographical depressions when rainfall of high intensity and duration exceeds the infiltration capacity of the underlying soil causing temporary build-up of flood waters.

There are no indications of any groundwater flood risk in Study Area C.

1.7.3.6 Surface Water Abstraction

There are a number of surface water abstractions serving the population of Dublin City and its suburbs located upstream of the scheme study area. **Figure 1.7.1** outlines the water supply network in the Dublin Region.

Figure 1.7.1: Dublin Region Water Network

The Ballymore Eustace Water Treatment Plant is the largest in Ireland and supplies approximately 1 million customers. The intake is located upstream of the study area on the River Liffey. Similarly, the intake for the Leixlip Water Treatment works which serves some of the city centre and Fingal is located on the River Liffey, upstream of the study area. The Ballyboden Water Treatment extraction point is located on the River Dodder upstream of the study area. Any proposed works within the study area would have no effect on the water quality of the existing potable water treatment facilities for the greater Dublin region, therefore there are no surface water abstraction constraints within the study area.

1.7.3.7 Hydro Ecology

There are a number of European designated sites located to the east of the scheme study area. There is potential for interaction between these sites as they may be connected hydraulically to the scheme study area as previously discussed in **Section 1.3 Biodiversity**. The relevant Special Areas of Conservation (SAC) are outlined in **Table 1.7.4**.

Table 1.7.4: Special Areas of Conservation

Name	Site Code	Distance (km) from the scheme study area
South Dublin Bay SAC	000210	2.03
North Dublin Bay SAC	000206	4.04
Roackabill to Dalkey Island SAC	000300	8.7

Name	Site Code	Distance (km) from the scheme study area
Howth Head SAC	000202	9.64
Ireland's Eye SAC	002193	9.94
Baldoyle Bay SAC	000199	5.39
Malahide Estuary SAC (Site Code 205)	000205	Intersects scheme study area
Lambay Island SAC	000204	11.24

The designated Special Protection Areas (SPA) are outlined in **Table 1.7.5**.

Table 1.7.5: Special Protection Area

Name	Site Code	Distance (km) from the scheme study area
South Dublin Bay and River Tolka Estuary SPA	004024	0.91
North Bull Island SPA	004006	4.03
Howth Head SPA	004113	11.81
Ireland's Eye SPA	004117	9.69
Baldoyle Bay SPA	004016	5.38
Broadmeadow / Swords Estuary SPA (Partly inside Study Area)	004025	Intersects Study Area
Lambay Island SPA	004069	11.25

There are no Natural Heritage Areas within close proximity of the study areas. However, there are a number of nationally important Proposed Natural Heritage (pNHA) sites that are also located within or in proximity to watercourses and catchments located within the Study Area. Refer to **Table 1.7.6** for details.

Table 1.7.6: Proposed Natural Heritage Areas (pNHA)

Name	Site Code	Distance (km) from the scheme study area
South Dublin Bay pNHA	000210	2.03
North Dublin Bay pNHA	000206	0.65
Grand Canal pNHA	002104	Intersects Study Area
Royal Canal pNHA	002103	Intersects Study Area
Santry Demense pNHA	000178	Intersects Study Area
Howth Head pNHA	000202	9.18
Baldoyle Bay pNHA	000199	5.39
Ireland's Eye pNHA	000203	9.94
Sluice River Marsh pNHA	001763	4.32
Feltrim Hill pNHA	001208	1.05

Name	Site Code	Distance (km) from the scheme study area
Malahide Estuary pNHA	000205	Intersects Study Area
Portraine Shore pNHA	001215	5.85
Lambay Island pNHA	000204	11.24

The Convention on Wetlands, called the Ramsar Convention, is an intergovernmental treaty that provides the framework for national action and international cooperation for the conservation and wise use of wetlands and their resources. There are 4 internationally important Ramsar Sites located downstream of the study areas.

The Ramsar Sites located close to the scheme study area listed in **Table 1.7.7**.

Table 1.7.7: Ramsar Sites

Ramsar Sites	Ramsar Site Reference No.	Distance (km) from the scheme study area
Sandymount Strand/Tolka Estuary	832	0.91
North Bull Island	406	4.03
Baldoyle Bay	413	5.39
Broadmeadow Estuary (Malahide)	833	Intersects Study Area

None of the watercourses within the study area are designated under SI No. 293/1988 – European Communities (Quality of Salmonid Waters) Regulations, 1988.

As all of the rivers outfall to the Irish Sea on the eastern coast line, there is potential for hydrological influence from at-grade or elevated metro route options on designated European sites. Water dependant habitats may be impacted by an at-grade or elevated metro route option through accidental contamination during construction or operation, localised flooding through storm water drainage, or through the alteration of the natural base-flow water supplies to marshlands and watercourses triggering a change to the hydrological regime or causing the area to dry out. In areas where a potential route option passes close to or within an ecologically sensitive habitat, mitigation measures should be put in place to ensure the impact to the hydrological regime, in terms of water level fluctuation, water depth and water quality (pH, Nutrients, etc.) within the habitat is minimal.

1.7.4 Summary

The hydrological constraints to the New Metro North project are associated primarily with the potential watercourse crossings and their floodplains encountered in the scheme study area. Most of the watercourses are hydraulically connected to the designated sites located on the bays and estuaries along the western side of the Irish Sea and as such would be vulnerable to changes to the hydrological regime. There are a number of flood risk areas identified, associated with fluvial, coastal and pluvial flood risk throughout the study area.

As the study area is heavily urbanised, the streams provide protection from flooding to vast numbers of houses and commercial properties. These carry medium to very high attribute value in terms of their flood risk. In terms of the value to the community some of the streams and canals are locally important in terms of amenity. The existing rivers and streams within the scheme study area all have poor water quality status.

There are no hydrological drinking water abstraction constraints within the study area. **Table 1.7.8** summarises the hydrological constraints and gives their relative attribute importance. This is defined based on the NRA *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes, NRA 2009*.

Table 1.7.8: Hydrological Attributes and Attribute Importance

Hydrological Attribute	Attribute Importance
The River Liffey	Very High
The River Poddle	Very High
The River Dodder	Very High
The River Tolka	Very High
The Santry River	Very High
The River Mayne	Medium
The Cuckoo Stream	Medium
The Sluice River	Medium
The Gaybrook Stream	High
The Seapoint Stream	Medium
Greenfields Stream	Medium
The Broadmeadow River	Very High
The Ward River	Very High
The Turvey Stream	Medium
The Staffordstown Stream	Medium
The Royal Canal	Medium
The Grand Canal	Medium

1.7.5 References

CDM. (2010) *Eastern River Basin District, River Basin Management Plan 2009-2015*.

EPA. (2017) *Water Quality in Ireland 2010-2015*.

Jacobs (2012) EU Interreg IVB FloodResilienCity Project, Dublin City Report, Interim Review and recommendations following the Dublin flood even of 24th October 2011.

National Roads Authority. (2009) *Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes*.

OPW. *Eastern CFRAM Study 2011*.

OPW. *FEM FRAMS Study 2012*.

OPW. (2011) *Preliminary Flood Risk Assessment Mapping*.

OPW. (2017) *PFRA interactive viewer* (<http://www.cfram.ie/pfra/interactive-mapping/>).

OPW. (2017) *Flood Studies Update web portal* (<http://opw.hydronet.com/>)

OPW Floodmaps.ie *Historical archived flood events website* (<http://floodmaps.ie/>).

Water Matters Our Plan - *Mapping Information System to support River Basin Management Plans* (<http://www.wfdireland.ie/maps.html>).

1.8 Landscape and Visual

1.8.1 Introduction

This section describes the landscape and visual constraints identified within the scheme study area for the NMN Project.

The constraints study examined the existing landscape and highlights landscape and visual features of sensitivity that may influence the development of route options.

Section 1.8.2 describes the methodologies and sources of information that were used to carry out the constraints study. **Section 1.8.3** describes the landscape and visual constraints within the scheme study area. A summary is presented in **Section 1.8.4** and references are listed in **Section 1.8.5**.

1.8.2 Methodology and Sources of Information

1.8.2.1 Methodology

Landscape/urban landscape and visual constraints were identified by:

- Initial desk based review of statutory and non-statutory development plans, aerial photography and ordnance survey mapping; and
- Site based review to verify likely constraints.

1.8.2.2 Sources of Information

The Dublin City Development Plan 2016-2022 and associated Zoning Map E (Dublin City Centre) and Map B (Dublin North City) are key reference documents for Study Area A and the southern extent of Study Area B. Other documents of relevance within the Dublin City area include:

- Dublin City Council. Your City Your Space Dublin City Public Realm Strategy 2012;
- Dublin City Council. The Heart of Dublin; City Centre Public Realm Masterplan 2016; and
- Dublin City Council. Dublin City Parks Strategy 2016 (Consultation Draft).

Likewise, the Fingal Development Plan 2017-2023 and associated Sheet 11 (Fingal South) and Sheet 8 (Swords) are key reference documents for the northern extent of Study Area B and for Study Area C. Other documents of relevance within the Fingal County Council area include:

- Fingal Development Plan 2017-2023 - Sheet 1 County Strategy / Index;
- Fingal Development Plan 2017-2023 - Sheets 14, 15 & 16 (Green Infrastructure Sheets 1, 2 & 3);
- Fingal County Council. Dublin Airport Local Area Plan. 2006;
- Fingal County Council. Barrysparks Local Area Plan. 2011;
- Fingal County Council. Dardistown Local Area Plan. 2013;
- Fingal County Council. Fosterstown Local Area Plan. 2010;
- Fingal County Council. Oldtown Local Area Plan. 2012;
- Fingal County Council. Oldtown Mooretown Local Area Plan; and
- Fingal County Council. Rivermeade Local Area Plan. 2013.

Landscape/urban landscape and visual constraints are considered in accordance with the criteria set out in **Table 1.8.1**. These constraints include:

- Internationally and/or nationally protected landscapes and historic landscapes;
- City or County protected landscapes and historic landscapes;
- Urban Set pieces, Streetscapes, Squares, Plazas, Places;
- Protected views, vistas or scenic areas;
- Conservation Areas and Architectural Conservation Areas;
- Residential Conservation Areas, General Residential Areas;
- Landscape related National Monuments (refer also to **Section 1.10** Archaeology, Architectural and Cultural Heritage);
- Protected Structures and their Grounds (refer also to **Section 1.11** Archaeology, Architectural and Cultural Heritage);
- Historic Landscapes and Parks;
- Regional and District Parks, Neighbourhood and Local Parks, Public Open Spaces;
- Sports Grounds and Recreational Facilities; and
- Street Trees, Mature Trees, Tree Belts, Stands of Trees, and Trees covered by Tree Protection Orders and/or Objectives.

Table 1.8.1: Landscape/Urban Landscape and Visual Constraints Criteria¹

Landscape/Urban Landscape and Visual Constraints Criteria			
Minor	Moderate	High	Major
<p>Landscapes with broad capacity to accommodate change without significant impact.</p> <p>Landscape types include, but are not limited to:</p> <ul style="list-style-type: none"> • Undeveloped open lands • Agricultural lands • Industrial lands • Infrastructure corridors / landscapes • Typical background views without significant visual features 	<p>Landscapes with capacity to accommodate change with potential for some significant impact.</p> <p>Landscape types include, but are not limited to:</p> <ul style="list-style-type: none"> • Residential landscapes • Roadside open spaces, semi-private residential spaces • Local parks • Feature walls, structures, entrances, and boundaries • Typical background views with some significant visual features or views 	<p>Landscapes with some capacity to accommodate change without significant impact.</p> <p>Landscape types include, but are not limited to:</p> <ul style="list-style-type: none"> • Intact urban townscapes and core urban villages • Urban centre open spaces and plazas • District or regional parks • Landscape context to significant buildings / features • Residential conservation areas • Major amenities / sports grounds • Significant mature urban specimen trees • Views of recognised value with architectural or landscape merit 	<p>Landscapes with limited, or no capacity, to accommodate change without significant impact.</p> <p>Landscape types include, but are not limited to:</p> <ul style="list-style-type: none"> • Landscapes or townscape protected by international or national level designation • Historical city centre, townscape, urban set piece, streetscape, and historic institutional land • Nationally important open spaces and parkland • Trees protected with tree preservation orders • Special views of recognised high value due to nature or extent of architectural or landscape merit • Protected views / vistas as outlined in the relevant development plans

¹ **Table 7.1.1:** Landscape and Visual Baseline and Sensitivity Rating Criteria in TII Project Appraisal Guidelines for National Roads Unit 7.0 – Multi Criteria Analysis PE-PAG-02031 (October 2016) adapted by Brady Shipman Martin (2016)

1.8.3 Existing Environment

Landscape/urban landscape and visual constraints are discussed on a study area by study area basis in the following sections.

1.8.3.1 Study Area A (Dublin City Centre)

The description of the following landscape/urban landscape and visual constraints is made with particular regard to landscape and visual related policies and objectives of Dublin City Development Plan 2016 - 2022, to the land use zoning objectives indicated on Dublin City Development Plan Zoning Map E, and to:

- Dublin City Development Plan 2016-2022, Fig. 3. Making a Legible City - Key Spaces and Connections, as shown in **Figure 1.7.1** below;
- Dublin City Development Plan 2016-2022, Fig 4. Key Views and Prospects (Indicative), as shown in **Figure 1.8.2** below;
- Dublin City Development Plan 2016-2022, Fig 14. Strategic Green Network, as shown in **Figure 1.8.3** below;
- Dublin City Development Plan 2016-2022, Fig15. City Centre Green Routes, as shown in **Figure 1.8.4** and
- Dublin City Development Plan 2016-2022, Fig17. Dublin City: Historic Core, as shown in **Figure 1.8.5**.

Study Area A includes the core areas of Dublin City Centre, as shown in **Figure 1.8.6**, including:

- South Georgian City, including St. Stephen's Green and Merrion Square;
- Grafton Street Quarter;
- Trinity College and College Green;
- Old City, including Dublin Castle, St. Patrick's and Christchurch;
- Dame Street and Temple Bar;
- Liffey Corridor;
- O'Connell Street Spine, from Trinity north to Parnell Square;
- Henry Street Quarter; and
- North Georgian City from Custom House to Mountjoy Square.

Collectively these areas comprise some of the most significant and sensitive urban landmarks, spaces and streetscapes in Ireland and include the nationally and internationally recognisable urban set pieces of St. Stephen's Green and surrounding streets; the Shelbourne Hotel, Georgian streetscapes of the south city centre; Merrion Square and surroundings streets; Government Buildings (Leinster House), National Gallery, National Museum, Mansion House; Grafton Street and surrounding streets; Trinity College, College Green, Bank of Ireland; Dame Street, Central Bank; Dublin Castle, St. Patrick's Cathedral and Christchurch; Temple Bar; the Liffey Quays, Custom House, City Bridges; O'Connell Bridge, O'Connell Street, G.P.O., the Spire; Parnell Square, the Rotunda; and Mountjoy Square and the Georgian streetscapes of the north City centre.

Given the variety, quality and value of these urban landscapes, including the number of protected structures, national institutions and designated areas they are amongst the most notable landscape and visual constraints within this southern and central section of Study Area A.

The majority of these key urban landmarks are indicated within the historic core of the city on **Figure 1.8.5**. Urban character areas within the city centre are outlined on **Figure 1.8.6**, while the Key Views and Prospects are indicated on **Figure 1.8.2**. The Key Spaces and Connections, the Strategic Green Network and City Centre Green Routes are indicated on **Figure 1.8.1**, **Figure 1.8.3** and **Figure 1.8.4** respectively.

Study Area A also includes part of Dublin's North City Centre, including the Western Docklands, Connelly Station and North Strand; Dorset Street; and village areas of Phibsborough and Drumcondra.

The quality of the existing urban streetscape and general residential amenity are key landscape and visual constraints within this northern section of Study Area A. The area also includes notable urban landscape and visual features, including Croke Park, the Royal Canal Corridor; and Blessington Street Basin and Royal Canal Bank Park.

Figure 1.8.1: Dublin City - Key Spaces and Connections (Fig. 3: Dublin City Development Plan 2016-2022)

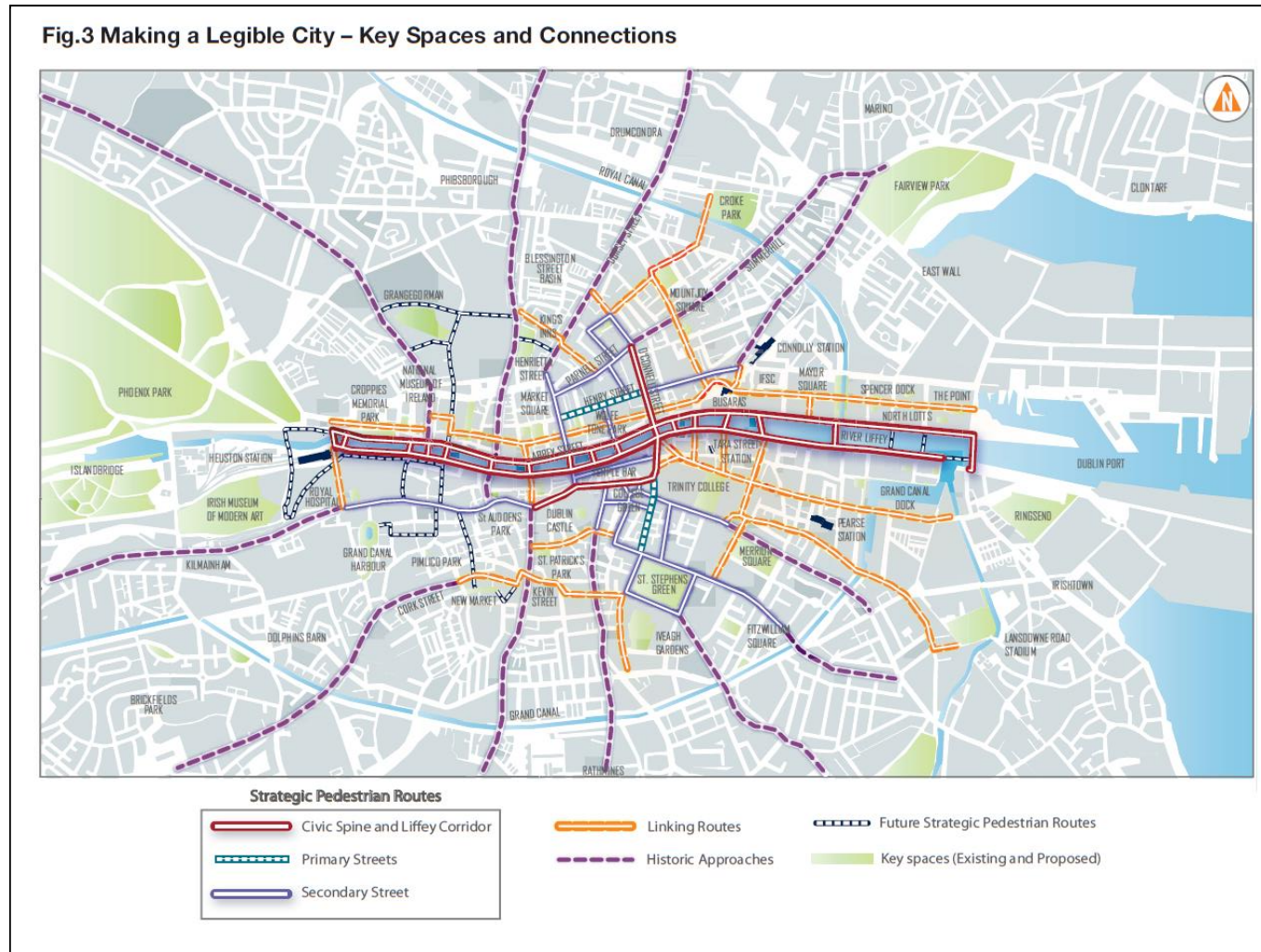


Figure 1.8.2: Dublin City – Key Views and Prospects (Fig.4: Dublin City Development Plan 2016 - 2022)

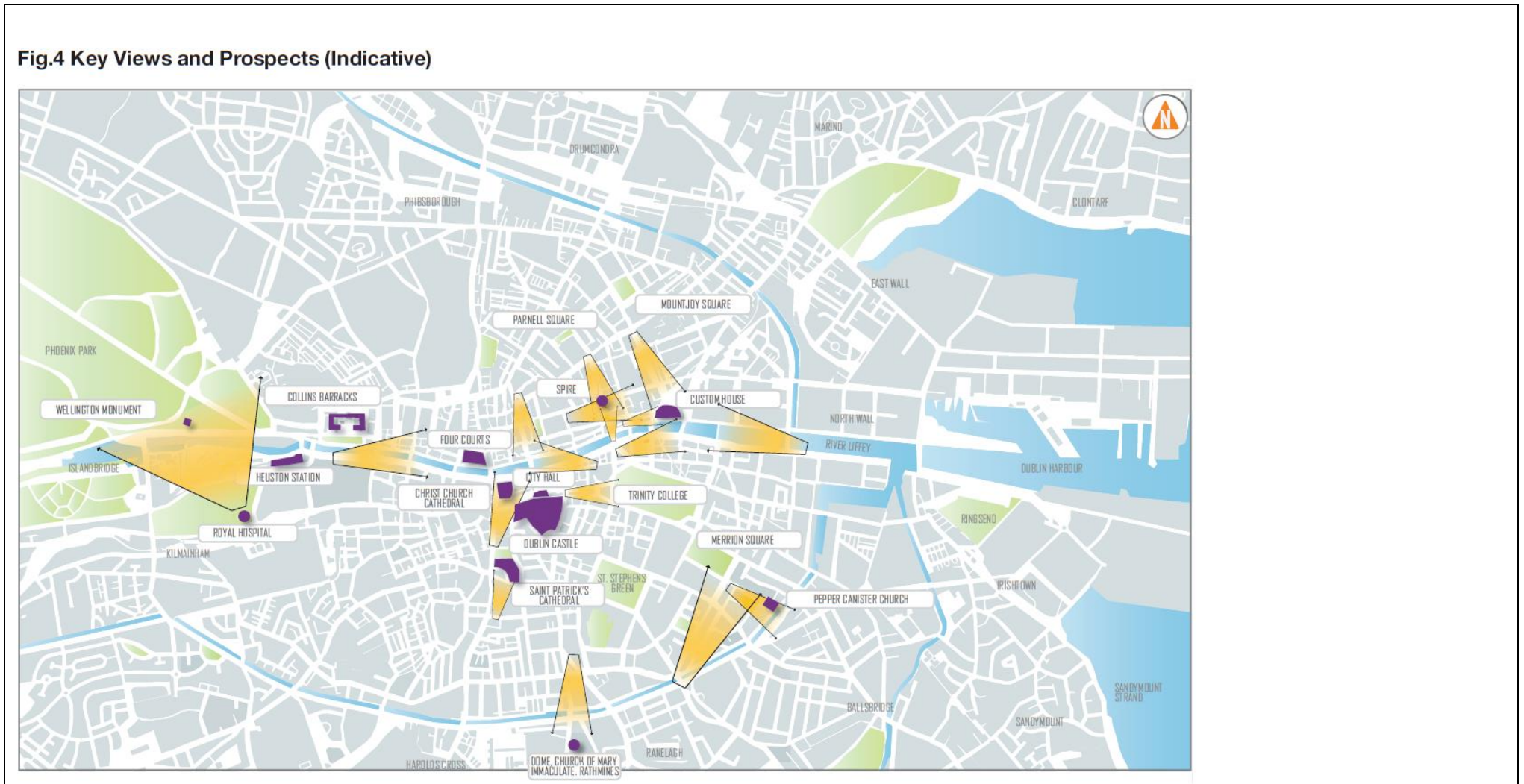


Figure 1.8.3: Strategic Green Network (Fig 14: Dublin City Development Plan 2016-2022)

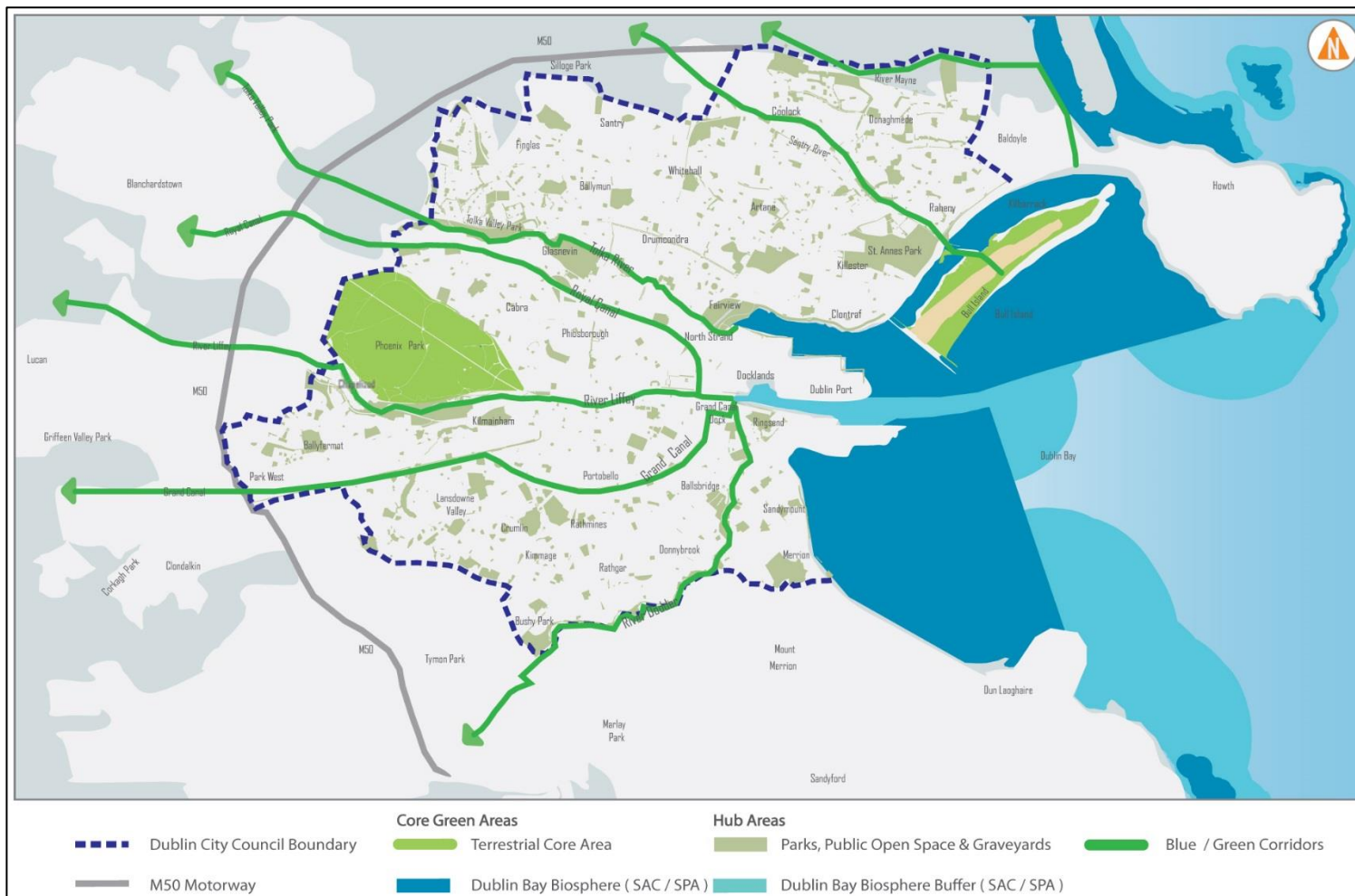


Figure 1.8.4: Dublin City Centre Green Routes (Fig. 15: Dublin City Development Plan 2016-2022)



Figure 1.8.5: Dublin City: Historic Core (Fig.17: Dublin City Development Plan 2016-2022)

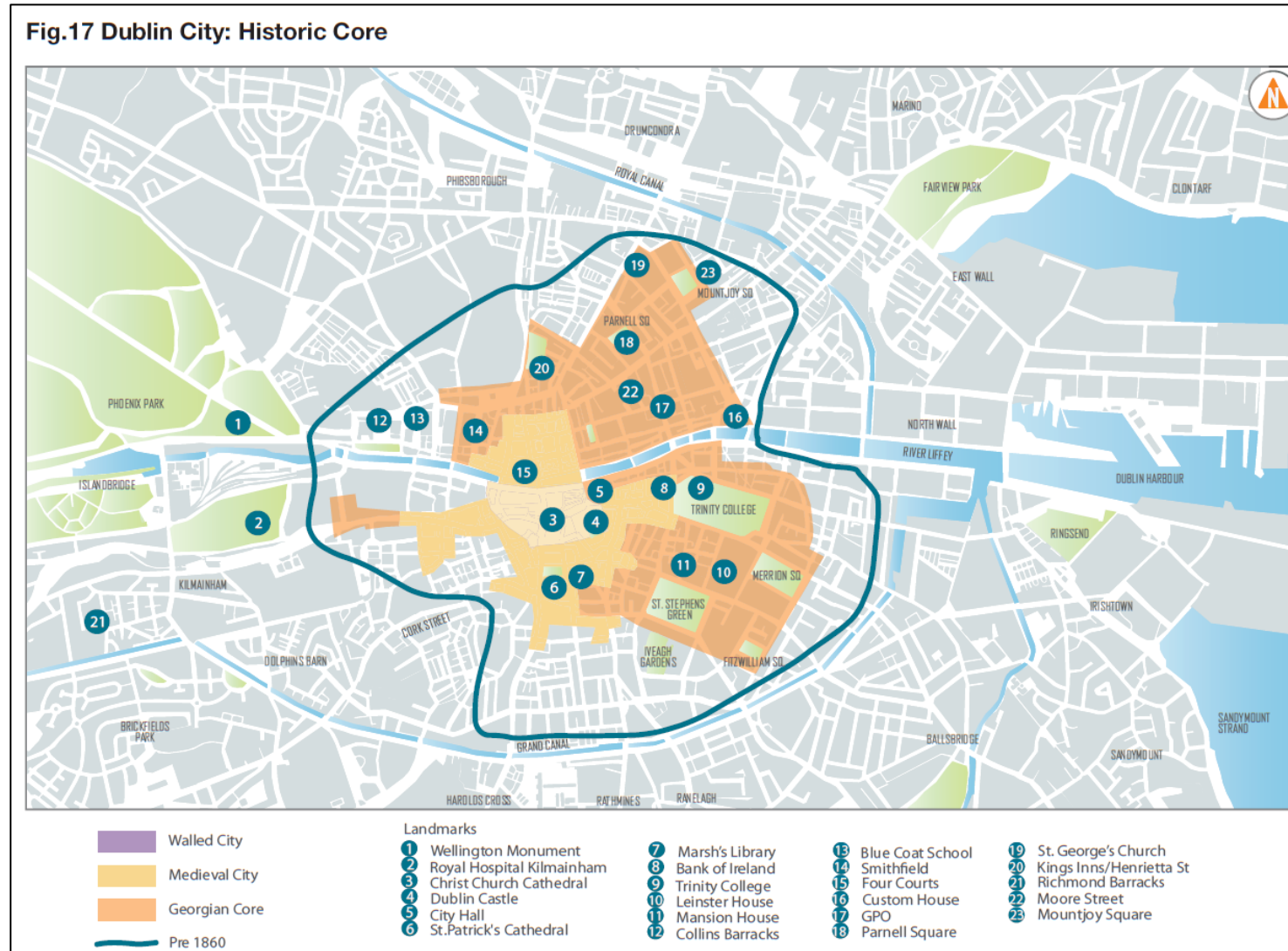


Figure 1.8.6: Dublin City Centre Character Areas (Fig 3: Dublin City Development Plan 2016-2022)



1.8.3.2 Study Area B (Ballymun/Airport)

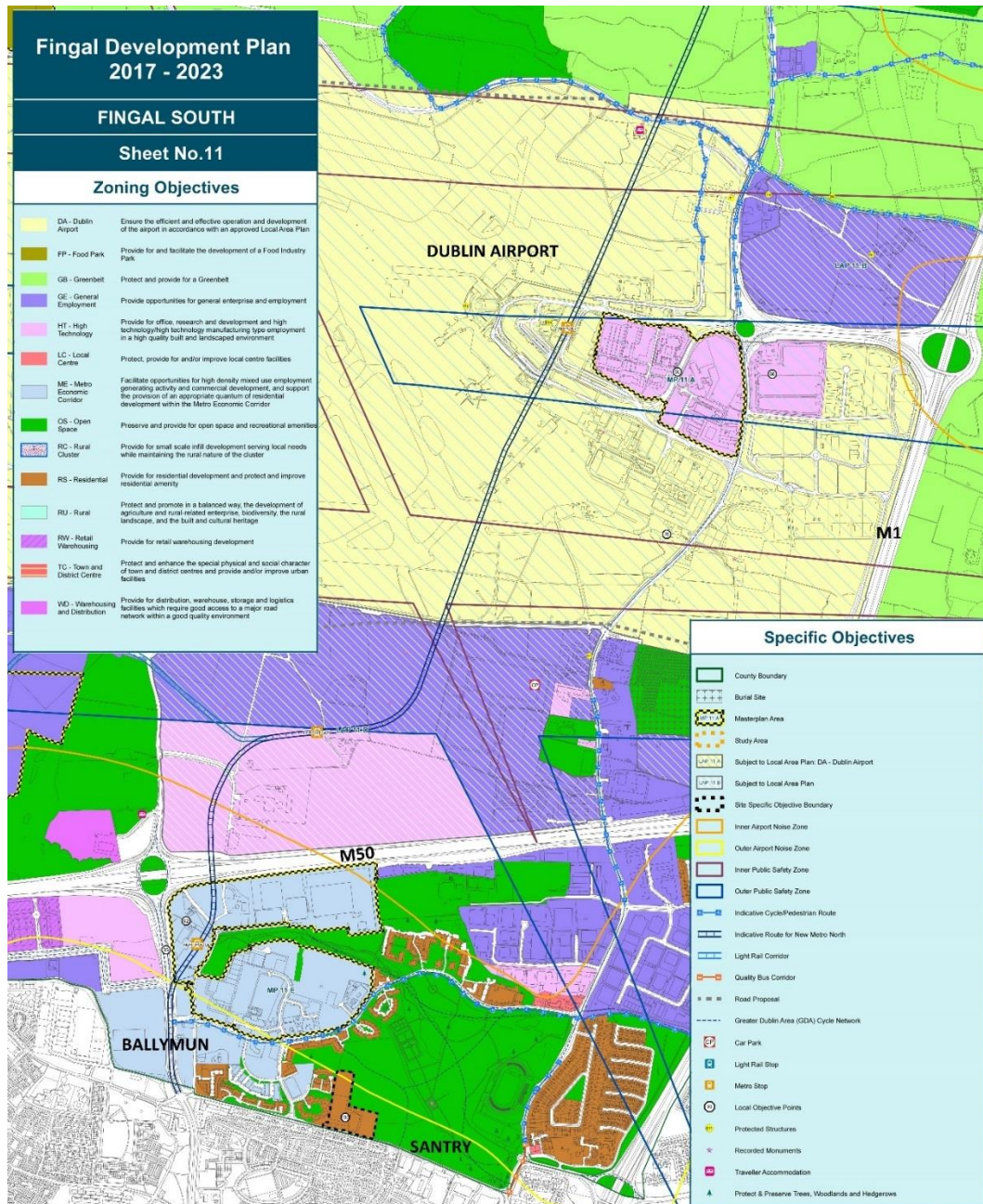
The description of the following landscape / urban landscape and visual constraints is made with particular regard to Dublin City Development Plan 2016 - 2022 and associated Zoning Map B (Dublin North City); and to the Fingal Development Plan 2017 - 2023 and associated Land Use Sheet 11 (Fingal South).

Study Area B includes part of Dublin's North City Suburbs and Dublin Airport, including the village areas and surrounds of Drumcondra, Glasnevin, Whitehall, Santry, and Ballymun. The area also includes the major north-south road arteries of the N1 Drumcondra – Whitehall Road and the R108 St. Mobi – Ballymun Road as well as the tree-lined east-west avenues of the R102 Griffith Avenue, R103 Collins Avenue, and R104 Santry Avenue.

Key landscape/urban landscape and visual constraints include:

- The core village areas of Drumcondra, Glasnevin and Santry;
- Residential land uses throughout, including some residential conservation areas;
- Tolka River Valley and associated parks, including Griffith Park and Tolka Park Sports Ground;
- Botanic Gardens;
- Glasnevin Cemetery and Dardistown Cemetery;
- Dublin City University and Sports Grounds;
- Santry Demesne, which includes an extensive Tree Preservation Order, Santry River Valley and Morton Stadium/Sports Grounds;
- Regional, District and Local Parks, including Hampstead Park, Balcurris Park, Poppintree Park;
- Institutional lands with open space, sports facilities, mature tree planting, including Holy Cross College, All Hallows College, St. Joseph's, St. Patrick's College, Colaiste Caoimhin, St. Clare's, and various school grounds etc.;
- Sillogue Park Golf Course, ALSAA Sports Grounds, Tolka Rovers Sports Grounds;
- Tree-line avenues of Griffith Avenue, Collins Avenue, and St. Mobi Road.

Part of Study Area B lies within Dublin City Council administrative area and as such, **Figure 1.8.1: Dublin City - Key Spaces and Connections (Fig. 3: Dublin City Development Plan 2016-2022)**, **Figure 1.8.3: Strategic Green Network (Fig 14: Dublin City Development Plan 2016-2022)**, and **Figure 1.8.4: Dublin City Centre Green Routes (Fig. 15: Dublin City Development Plan 2016-2022)** are also relevant. The remainder of the Study Area (north of Ballymun) is located within the administrative area of Fingal County Council – refer to **Figure 1.8.7** Fingal South (Extract from Sheet 11 of Fingal Development Plan) and **Figure 1.8.8** Green Infrastructure Sheet 1 (Extract from Sheet 14 of Fingal Development Plan).

Figure 1.8.7: Fingal South (Extract from Sheet 11 Fingal Development Plan 2017 - 2023)

1.8.3.3 Study Area C (Swords)

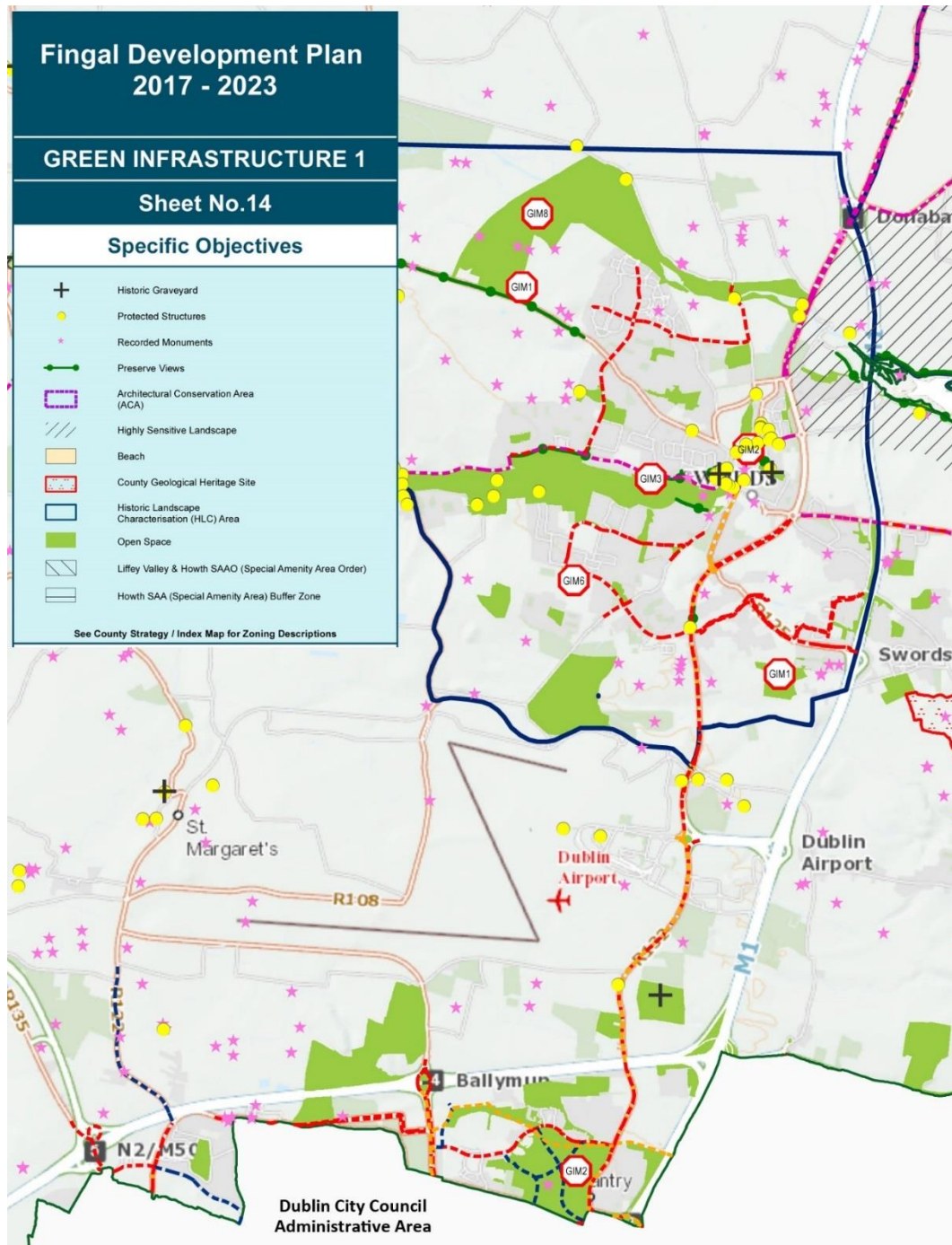
The description of the following landscape/urban landscape and visual constraints is made with particular regard to the Fingal Development Plan 2017-2023, Sheet 11 (Fingal South) and Sheet 8 (Swords).

Study Area C extends from **Dublin Airport to the north of Swords**, and includes greenbelt, undeveloped and agricultural lands between the airport and Swords as well as the core town centre of Swords and suburban estates. The area also includes the major north-south road artery of the R132 Swords Road.

Key landscape/urban landscape and visual constraints include:

- The core village/town centre and Main Street Swords, including Swords Castle;
- Residential land uses to the south, west and north of Swords;
- Ward River Valley & Park;
- Open space and sports grounds;
- Forrest Little Golf Course;
- Greenbelt and agricultural lands;
- Existing tree-line character of R132;
- Preserve views along a section of the R132 immediately north of Nevinstown Junction (Sheet 14);
- Preserve views along Highfield Road and Brackenstown Road south and north of Ward River Valley, Swords (Sheet 14);
- Preserve views along Rathbeale Road west of Cianlea/Bunbury Gate, Swords (Sheet 14); and
- Preserve views of Swords Castle, Church and Round Tower from within Swords and where feasible to open up new views (Objective ‘Swords 21’).

Figure 1.8.8: North City to Swords Green Infrastructure (Extract from Sheet 14 Fingal Development Plan 2017-2023)



1.8.4 Summary

Study Area A is located within the centre of Dublin City, an area which forms part of the historic core of the city and includes nationally and internationally recognisable landmarks. The area also includes some of the most significant and sensitive urban streetscapes and public spaces in Ireland.

The quality and significance of these existing urban streetscapes, open spaces and urban structure are key landscape, townscape and visual constraints.

Study Area B spans the northern city suburbs and south fringe area of Fingal, including Dublin Airport. The key landscape, townscape and visual constraints relate to established residential areas, institutional lands, open spaces and amenity and recreation facilities.

Study Area C runs north from Dublin Airport and takes in the town of Swords. The key landscape, townscape and visual constraints relate to established residential areas, open spaces, river valleys, townscape, heritage features, and amenity and recreation facilities.

1.8.5 References

Dublin City Council. *Dublin City Development Plan 2016 – 2022*.

Dublin City Council. *Your City Your Space: Dublin City Public Realm Strategy 2012*.

Dublin City Council. *The Heart of Dublin; City Centre Public Realm Masterplan 2016*.

Dublin City Council. *Dublin City Parks Strategy 2016*.

Fingal County Council. *Fingal Development Plan 2017 - 2023*.

Fingal County Council. (2006) *Dublin Airport Dublin Airport Local Area Plan*.

Fingal County Council. (2011) *Local Area Plans for Barrysparks Local Area Plan*.

Fingal County Council. (2013) *Dardistown Local Area Plan*.

Fingal County Council. (2010) *Fosterstown Local Area Plan*.

Fingal County Council. (2012) *Oldtown Local Area Plan*.

Fingal County Council. (2010) *Oldtown Mooretown Local Area Plan*.

Fingal County Council. (2013) *Rivermeade Local Area Plan*.

Ordinance Survey Mapping and Aerial Photography.

1.9 Artificial Constraints

Artificial Constraints are those which are forming part of the built environment, namely:

- Archaeology, Architecture and Cultural Heritage, which is detailed in **Section 1.10 Archaeology, Architectural and Cultural Heritage**;
- Material Assets, which is detailed in **Section 1.11 Material Assets**;
- Air Quality and Climate, which is detailed in **Section 1.12 Air Quality and 1.13 Climate**

- Noise, Groundborne Noise and Vibration, which is detailed in **Section 1.14 Noise, Groundborne Noise and Vibration**; and
- Population and Human Health, which is detailed in **Section 1.15 Population and Human Health**.

1.10 Archaeology, Architectural and Cultural Heritage

1.10.1 Introduction

This section describes the archaeological, architectural and cultural heritage constraints identified within the scheme study area for the NMN Project.

Publicly available datasets that could be used in a GIS environment were availed of for the purpose of understanding and investigating the heritage assets within the constraint study area. These datasets included National Monuments, the Record of Monument and Places (RMP), the Sites and Monuments Record, the Record of Protected Structures (RPS) and structures within the National Inventory for Architectural Heritage (NIAH). The results of archaeological investigations conducted for the Metro North project were also included in the assessment. Cultural heritage sites or sites of an industrial archaeological merit that are currently afforded protection as an RMP, RPS or listed in the NIAH were considered and assessed for the constraints report.

Archaeological, architectural and cultural heritage constraints are presented on Volume 4C **Figures 1.10.1 to 1.10.6**.

Section 1.10.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.10.3** describes the archaeological, architectural and cultural heritage constraints within the scheme study area. A description of the archaeological and architectural significance of the study areas is presented in **Section 1.10.4** and references are listed in **Section 1.10.5**.

1.10.2 Methodology and Sources of Information

1.10.2.1 Methodology

The study was informed by the following legislation, guidelines and advice notes:

- Environmental Protection Agency (EPA). Revised Guidelines on the information to be contained in Environmental Impact Statements, Draft August 2017;
- Environmental Protection Agency (EPA). Advice Notes for preparing Environmental Impact Statements Draft August 2017;
- Environmental Protection Agency (EPA). Advice Notes on Current Practice (in preparation of Environmental Impact Statements), 2003;

- Environmental Protection Agency (EPA). Guidelines on the information to be contained in Environmental Impact Statements, 2002;
- National Monuments Act, 1930 to 2014;
- Department of Arts Heritage and the Gaeltacht (DAHG). Architectural Heritage Protection Guidelines for Planning Authorities, 2011;
- Department of Arts, Heritage, Gaeltacht and Islands (now Department of Culture, Heritage and Gaeltacht). Framework and Principles for the Protection of the Archaeological Heritage, 1999a;
- Architectural Heritage (National Inventory) and Historic Monuments (Miscellaneous Provisions) Act, 1999;
- Planning and Development Act 2000 to 2017;
- Code of Practice for Archaeology agreed between the Minister for Arts, Heritage, Regional, Rural and Gaeltacht Affairs and Transport Infrastructure Ireland, 2017;
- NRA. Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes, 2006; and
- NRA. Guidelines for the Assessment of Architectural Heritage Impact of National Road Schemes, 2006.

1.10.2.2 Sources of Information

Research for this constraints study was undertaken as a desktop exercise. The following sources were consulted to identify archaeological, architectural heritage and cultural heritage constraints:

- Department of Culture, Heritage and the Gaeltacht (DCHG). National Monument Service: National Monuments in State Care: Ownership & Guardianship, 4th March 2009 Dublin;
- DCHG. Sites listed in the Record of Monuments and Places (RMP);
- DCHG. Archaeological Survey of Ireland. Sites and Monuments Records (SMR) database;
- Dublin City Council. Dublin City Development Plan 2016 - 2022 (regarding Architectural Conservation Areas (ACAs) and Record of Protected Structures (RPS));
- Fingal County Council. Fingal Development Plan 2017 - 2023 (regarding ACAs and RPS);
- DCHG. National Inventory of Architectural Heritage (NIAH) Garden Survey.
- DCHG. NIAH Building Survey took place as follows:
 - NIAH: Fingal County (2002); and
 - Dublin north city (2015) (D1, D8, D7 and north inner city to the canal).

- <http://www.buildingsofireland.ie/Surveys/Buildings/NIAHDataDownload/> accessed on 28/05/2017 and 30/10/2017.
- The Historic City of Dublin tentative list submission for future inscription as a UNESCO World Heritage Site (08/04/2010).
- Documentary sources as listed in the Reference **Section 1.10.5**.

The following tables are formed by extracting data from the above-mentioned datasets. Data is presented on mapping.

For each dataset, the data was clipped to match the extent of the Constraints Study area and the boundaries of Study Areas A, B and C. A unique ID for each record was assigned, for example, AH1, 2, 3 etc. is a unique reference code for National Monuments, SMR and Preservation Orders. On the mapping, National Monuments are differentiated from the sites and monuments within the SMR.

BH1, 2, 3 etc. refers to all built heritage features (structures on the Record of Protected Structures and features of architectural heritage merit contained within the NIAH). On the mapping, the features on the RPS and the NIAH are identified by different icons.

ACA's are identified individually by an ACA Code for example AA21 and AA22 and on the mapping the entire ACA is shaded so the full extent of the area is understood.

Additional fields were created to construct the required fields for the constraint tables and ITM co-ordinates were computed.

In order to provide a 'classification' column in the NIAH the dataset, data from the 'name' and 'street' columns were combined.

Each dataset was exported from ArcGIS to excel for formatting before being extracted into the table format shown in the report.

Once all sites had been identified, they were plotted onto a map of the scheme study area as shown on Volume 4C **Figures 1.10.1 to 1.10.6**.

1.10.3 Existing Environment

1.10.3.1 Archaeological Heritage

A total of **13** national monuments (**12** in Area A, **0** in Area B and **1** in Area C) have been identified within the scheme study area and are listed in

Table 1.10.1 and shown on Volume 4C **Figures 1.10.1 to 1.10.3**.

Table 1.10.1: National Monuments or sites with Preservation Orders

AH No	SMR No	Monument Type/Class	Townland/ Street Name	ITM Reference (E, N)	Statutory protection
Area A					
AH33	DU018-020710-	Castle - motte	Dame Street	715,323, 733,901	National Monument
AH35	DU018-020488-	Castle - Anglo-Norman masonry castle	Dame Street	715,362, 733,944	National Monument
AH593	DU018-020334-	Park	St Steven's Green	715,924, 733,406	National Monument
AH180	DU018-020048-	Religious house - Cistercian monks St Mary's Abbey	Meeting House Lane	715,232, 734,442	National Monument
AH285	DU018-020270-	Cathedral (Christ Church)	Christchurch Place	715,123, 733,975	National Monument
AH408	DU018-020269-	Cathedral (St Patrick's)	Patrick Street (N81)	715,119, 733,531	National Monument
AH542	DU018-390- ---	House - 18th/19th century	Moore Street	715,680, 734,770	National Monument
AH587	DU018-423- ---	Monumental structure (O'Connell)	O'Connell Street	715,895, 734,468	National Monument
AH589	DU018-425- ---	Monumental structure (Parnell)	O'Connell Street	715,742, 735,004	National Monument
AH595	DU01330	Church (St Audeon's)	High Street/ Cook Street	714919, 734000	National Monument
AH588	DU018-424	Monumental structure (O'Brien)	O'Connell Street	715879, 734527	National Monument
AH596	DU018-020169-172 DU018-020267-268. DU018-020573. DU18-020577, DU018-020582,	Town defences	Ship Street, Power's Square, Cook Street, Back Lane and High Street, St Augustine Street, Wood Quay and Wintavern Street, Lamb Alley, Francis Street,	Various see Volume 4C, Figure 1.10.1	National Monument

AH No	SMR No	Monument Type/Class	Townland/ Street Name	ITM Reference (E, N)	Statutory protection
	DU018-020595, DU018-020597-599. DU018-0200609-610. DU018-0200624, DU018-020632-633. DU018-020635-636		Bridge Street Upper, Essex Gate, Parliament Street, Christchurch Place and Werburgh Street. Patrick Street, St Nicholas Place, Winetavern Street		
See above	DU018-020169	Part of town defences – City Wall	Royal Exchange. Ship St Little	715259, 733848	Preservation Order
AH538	DU018-385	House	Royal Exchange B. 10/10a Aungier Street	715514, 733683	Temporary Preservation Order
AH590	DU018-426	House 17 th century	St Mary's Ward. 218-220 Parnell Street	715277, 734689	Temporary Preservation order
Area C					
AH208	DU011-034001-	Castle - Anglo-Norman masonry castle	TOWNPARKS (Nethercross By.) Swords	718,195, 747,010	National Monument

The defences/town of medieval Dublin are a national monument in accordance with national policy on town defences (Department of Environment, Heritage & Local Government 2008).

The National Monument Act defines a 'national monument' as 'a monument or the remains of a monument the preservation of which is a matter of national importance by reason of the historical, architectural, traditional, artistic or archaeological interest attaching thereto' (NMA 1930, Section 2).

The National Monuments legislation legally protects access and the visual amenity associated with National Monuments and requires consent from the Minister for invasive works within their vicinity.

The primary source of information for archaeology is the Record of Monuments and Places (RMP) maintained by the Department of Culture, Heritage and the Gaeltacht (DCHG). The RMP documents known upstanding archaeological monuments, their original location (in cases of destroyed monuments) and the position of possible sites in rural areas identified as cropmarks on vertical aerial photographs dating to before 1700 AD (with some later ones also being included). It is based on a comprehensive range of published and publicly available documentary and cartographic sources.

For the purpose of this study, the Sites and Monument Record (SMR) data and mapping as updated by the Archaeological Survey of Ireland (www.archaeology.ie) was examined so it could be used within an interactive identification and mapping system developed for this project.

A total of **722** Recorded Monuments have been identified within the scheme study area as presented in:

- (i) Volume 4B **Annex 1.10.1** for Study Area A (**635** Recorded Monuments) and shown on Volume 4C **Figure 1.10.1**,
- (ii) Volume 4B **Annex 1.10.2** for Study Area B (**43** Recorded Monuments) and shown on Volume 4C **Figure 1.10.2** and
- (iii) Volume 4B **Annex 1.10.3** for Study Area C (**44** Recorded Monuments) and shown on Volume 4C **Figure 1.10.3**.

1.10.3.2 Areas of Archaeological Potential

Areas of Archaeological Potential can be defined as parts of the urban and rural landscape that possess the potential to contain archaeological remains due to the settlement history of a place, such as the historic town of Dublin, which is classified as a zone of archaeological potential (DU018-020---) and/or the presence of topographic features such as rivers, lakes and high defensible ground.

For the purpose of this study, only areas of archaeological potential with statutory protection and archaeological constraints identified through the assessment of Metro North have been considered (see **Section 1.10.4** and **Section 1.10.5**).

1.10.3.3 Architectural Heritage

A total of **3299** RPS have been identified in the scheme study area as presented in:

- Volume 4B **Annex 1.10.4** for Study Area A (**3226** RPS) and shown on Volume 4C **Figure 1.10.4**,
- (ii) Volume 4B **Annex 1.10.5** for Study Area B (**47** RPS) and shown on Volume 4C **Figure 1.10.5** and
- (iii) Volume 4B **Annex 1.10.6** for Study Area C (**26** RPS) and shown on Volume 4C **Figure 1.10.6**.

A total of **1383** NIAH have been identified in the scheme study area as presented in:

- Volume 4B **Annex 1.10.7** for Study Area A (**1343** NIAH) and shown on Volume 4C **Figure 1.10.4**,
- (ii) Volume 4B **Annex 1.10.8** for Study Area B (**4** NIAH) and shown on Volume 4C **Figure 1.10.5** and
- (iii) Volume 4B **Annex 1.10.9** for Study Area C (**36** NIAH) and shown on Volume 4C **Figure 1.10.6**.

A number of NIAH structures are also listed as protected structures, this means that an individual structure or building may have two entries and have been considered as an NIAH and a RPS (leading to double counting). As these are two separate datasets, it was decided to present all information for consideration within the Constraints study. In the reporting narrative structures were differentiated by prefixing the built heritage number with either RPS or NIAH.

Structures of architectural, cultural, scientific, historical or archaeological interest are protected under the Planning and Development Act, 2000, where the conditions relating to the protection of the architectural heritage are set out in Part IV of this Act. The Act defines a protected structure as ‘(a) a structure, or (b) a specified part of a structure which is included in a Record of Protected Structures (RPS), and, where that record so indicates, includes any specified feature which is in the attendant grounds of the structure and which would not otherwise be included in this definition. ‘Protection of the structure or part thereof, includes conservation, preservation, and improvement compatible with maintaining its character and interest’.

Buildings recorded in the RPS can include Recorded Monuments and structures listed in the NIAH deemed to be of architectural, archaeological or artistic importance by the Minister of Arts, Heritage and Gaeltacht. It is noted that inclusion within the NIAH survey does not afford statutory protection. As such, features considered to be of architectural heritage merit as identified in the NIAH have been considered within the constraints report.

The NIAH rating values are: International, National, Regional, Local and Record Only (I, N, R, L, O). Structures which are considered of International, National, and Regional significance are recommended by the Minister to the relevant Local Authority for inclusion in their RPS (NIAH handbook 2011).

International: Structures or sites of sufficient architectural heritage importance to be considered in an international context. These are exceptional structures that can be compared to and contrasted with the finest architectural heritage in other countries.

National: Structures or sites that make a significant contribution to the architectural heritage of Ireland. These are structures and sites that are considered to be of great architectural heritage significance in an Irish context.

Regional: Structures or sites that make a significant contribution to the architectural heritage within their region or area. They also stand in comparison with similar structures or sites in other regions or areas within Ireland. Increasingly, structures that need to be protected include structures or sites that make a significant contribution to the architectural heritage within their own locality. Examples of these would include modest terraces and timber shop fronts.

Local: These are structures or sites of some vintage that make a contribution to the architectural heritage but may not merit being placed in the RPS separately. Such structures may have lost much of their original fabric.

Record Only: These are structures or sites that are not deemed to have sufficient presence or inherent architectural or other importance at the time of recording to warrant a higher rating. It is acknowledged, however, that they might be considered further at a future time.

1.10.3.4 Architectural Conservation Areas (ACAs)

An Architectural Conservation Area is defined as ‘*A place, area, group of structures or townscape, taking account of buildings lines and heights, that is of special architectural, historical, archaeological, artistic, cultural, scientific, social or technical interest or that contributes to the appreciation of a protected structure, and whose character it is an objective of a development plan to preserve.*’ (DoAHG 2011, 40). Chapter II of Part IV of the Planning and Development Act 2000 states that all development plans must now include objectives for preserving the character of ACAs. As such ACAs are subject to statutory protection and are a key constraint.

There are **14** ACAs within the scheme study area as shown in **Table 1.10.2. 13** are located in Study Area A (as shown on Volume 4C **Figure 1.10.4**) and **1** is located in Study Area B (as shown on Volume 4C **Figure 1.10.5**).

Table 1.10.2: ACA’s within the scheme study area

Study Area	ACA No.	ACA Code	ACA Location
Study Area A	ACA2	AA22	Phibsborough Centre
Study Area A	ACA3	AA21	Ranelagh Avenue
Study Area A	ACA4	AA18	Elmpark Avenue and Elmwood Avenue
Study Area A	ACA5	AA17	Collier's Avenue
Study Area A	ACA6	AA16	Temple Place
Study Area A	ACA7	AA14	Westmoreland Park
Study Area A	ACA8	AA13	Mountjoy Square
Study Area A	ACA9	AA11	O'Connell Street
Study Area A	ACA12	AA07	Grafton Street & Environs
Study Area A	ACA13	AA06 and AA08	South City Retail Quarter
Study Area A	ACA14	AA05	Fitzwilliam Square and Environs
Study Area A	ACA15	AA03	Dartmouth Square and Environs
Study Area A	ACA16	AA01	Capel Street and Environs
Study Area B	ACA1	AA04	Prospect Square-DeCourcy Square and Environs

1.10.3.5 Designed Landscapes

Not all demesne landscapes are subject to statutory protection. For the purpose of this study designed landscapes that have been identified in the RMP and the RPS or NIAH have been considered.

Historic designed landscapes relate to gardens, parkland, woodland, estates and public parks that were deliberately laid out for artistic effect. A number of formal parks are recorded in Dublin's City centre, for example St Stephen's Green (National Monument AH593 and RMP AH174 and multiple RPS listings), Merrion Square (the Rutland Fountain is protected RPS BH2226), Fitzwilliam Square (AA05), North Rutland Square (now Parnell Square and the Garden of Remembrance) (NIAH BH4398, NIAH BH3887, it is also the site of a Viking burial ground) and Mountjoy Square (AA13 and NIAH BH4367).

Fingal, unlike Dublin City, does not have a tradition of urban public parks or cemetery gardens and so the designed landscapes of the county consists primarily of former demesnes and estate lands.

Many designed landscapes within Fingal County Council's jurisdiction, have not survived to the present day; Corballis House and lands used to stand within the airport grounds and Swords House and gardens formerly occupied the lands where Fingal County Council offices now stand, while Mount Gamble used to be on the lands now occupied by the Pavilion Shopping Centre in Swords.

In other areas, the lands have experienced a change of use from a privately-owned demesne to a public or educational institution, for example in Drumcondra, where a number of former demesnes such as Belvidere House, Drumcondra House, Clonturk House and Drumcondra Castle were located, are now recognisable in the modern day landscape as Saint Patricks National School (NIAH BH971), All Hallows College (NIAH BH1583) and St Joseph's Asylum for the Blind (NIAH BH2537). Many demesnes have older origins and are recorded in the archaeological record as castles and/or medieval foundations.

1.10.3.6 Cultural Heritage

Cultural heritage is a broad term that includes a wide range of tangible and intangible cultural considerations valued for their age, beauty, history or tradition. It encompasses aspects of archaeology and architecture and is expressed in the physical landscape as well as in non-physical ways. Cultural heritage can relate to settlements, former designed landscapes, building and structures, as well as folklore, townland and place names, historical events and traditions.

Cultural heritage sites are often afforded protection either as a Recorded Monument or as Protected Structure or a structure within the National Inventory of Architectural Heritage. For the purpose of this study, the identification of sites of cultural heritage interest were considered in the context of statutory architectural and/or archaeological sites.

Each recorded monument and protected structure provides a unique cultural record and acts as a carrier of memory, meaning and cultural value.

When considered in its wider context, each can form an essential component in the mechanism for analysing the broader cultural character and context of an area. Together, these can assist in mapping the changes that have led to the development of the modern environment. Such analysis provides insight into the communication, trade, transport, growth and associations of past human societies. Cultural assets are valued for the important contribution they make to our understanding of the history of a place an event or a people.

1.10.4 Summary

1.10.4.1 Identification and Discussion of Significant Archaeological, Architectural and Cultural Heritage Constraints

This summary is an overview of the archaeological, architectural and cultural heritage background of the constraints study area. It is a desk based assessment, outlining the chronological development of the historic city of Dublin and its suburbs from the prehistoric period to the modern period.

Sites of cultural heritage interest and industrial heritage interest are considered under the headings of archaeology and architecture for Study Areas A, B and C within the constraints area, where:

- Area A – Dublin City Centre - this study area extends from Ranelagh in the south to Drumcondra in the north and includes both the Grand Canal and the Royal Canal,
- Area B – Ballymun/Airport – this study area extends from Drumcondra in the south to Dublin Airport in the north,
- Area C – Swords – this study area extends from Dublin Airport in the south to Lissenhall north of Swords.

The archaeological, architectural and cultural heritage features that will present significant constraints on the NMN development are discussed in **Sections 1.10.4.1.1 to 1.10.4.1.5 (Study Areas A-C)** within the context of the development of Dublin.

1.10.4.1.1 Archaeology and Cultural Heritage: Study Area A

The highest concentration of both Recorded Monuments and Protected Structures are present within the boundaries of the historic City of Dublin, which extends from the Royal Canal in the north to St. Stephen's Green in the south and largely covers Area A. A large portion of the city centre is a designated Recorded Monument and reflects the continuous intense occupation of a relatively confined area from the Mesolithic period onwards to modern times. Upstanding monuments survive in the form of the city walls, several castles, churches, graveyards, historic parks and the quay walls. The city also has deeply buried archaeological deposits which provide a rich and complex record of human activity and while not readily legible in the street scape today, have been revealed through archaeological investigation and excavation.

In total, there are **12** National Monuments, **3** monuments with preservation orders and **635** Recorded Monuments within Area A. All these monuments are listed in the accompanying constraints tables (

Table 1.10.1 and Volume 4B Annex 1.10.2).Prehistoric Period (c. 8000BC-AD400)

The evidence for prehistoric settlement and activity within the study area is relatively limited and predominantly subsurface in nature, having been primarily identified through archaeological excavations. The earliest prehistoric occupation of Dublin dates to the Mesolithic period where a wooden fish trap, stake rows and worked wood was identified at North Wall quay at Spencer Dock located outside and to the east of the study area (McQuade 2008). Evidence for Bronze Age activity includes a burial described as a cist-tomb in Suffolk Street and stray finds such as a flat bronze axe head and bronze palstave located within the grounds of Trinity College Dublin (RPA 2010).

During the prehistoric and medieval period, the historic town of Dublin was located on the confluence of the Rivers Liffey, Stein, Bradogue, Poddle and Dodder. A key consequence of which, throughout the ages, has been the attempt by the occupants of the city to not only reclaim land for settlement, but to prevent developed lands from flooding through the construction of riverine revetments. The earliest riverine revetment (AH197) identified, dates to the Iron Age (c. 160–60 BC), and was identified on Ormond Quay at the confluence of the River Liffey and River Bradogue (Bolger 2010).

Early Medieval and Viking Period (AD400-1100)

The settlement of ‘Black Pool’ refers to a tidal pool associated with the River Poddle, in the environs of which a late 6th or early 7th century ecclesiastical foundation was established. This site is now marked by the garden of Dublin Castle (AH220) (Clarke 2002).

Dubhlinn would have attracted further settlers leading to the establishment of a small town, which eventually, and on foot of Viking and Anglo-Norman invasions, was to develop and expand into Ireland’s capital city. In addition to this extended lay population, there is archaeological evidence to suggest that a number of churches were scattered outside as well as inside the ecclesiastical enclosure. The original ecclesiastical enclosure was a substantial oval complex which is estimated to have measured 335m north-south by 260m east-west. Evidence for this early medieval ecclesiastical site is still evident in the current street pattern, extending from Stephen Street Lower to Aungier Street (Simpson 2000).

Archaeological excavations on Great George’s Street South have led to the identification of the possible site of this harbour, in lands backing onto Dublin Castle and associated with the traditional site of ‘Dubhlinn’ (Simpson 2003). Four Viking warrior burials were also excavated and have been dated from AD670–AD882 (King 2014) (AH143). The scientific date of these Viking burials indicates that the arrival of the Vikings was somewhat earlier to the date traditionally ascribed, derived from the Annals of Ulster (Simpson 2003, 2005). At Wood Quay, an exceptionally well-preserved Viking Town was uncovered and partially excavated in 1974 - 1981.

During the 18th century, a possible Viking cemetery was disturbed during the construction of the Rotunda Hospital and associated pleasure grounds on Parnell

Street/Parnell Street East. Numerous finds of spears, swords and rivets associated with vast numbers of human bones were found. An article by Patrick Traynor in the *Irish Builder* points to remains encountered around North Great Georges Street, Summerhill, Gardiner's Row, Mountjoy Square and the surrounding area (Traynor 1897). These finds have been linked with the Battle of Clontarf fought in AD1014 between the High King Brian Boiromhe (Brian Boru) and the Dublin Vikings under Sigtrygg Silkenbeard (RPA 2010). The Battle of Clontarf is known to have been fought on the north side of the River Liffey, opposite the Viking town, and resulted in the defeat of the Vikings.

A Viking boundary stone (AH363), erected in the 9th/10th century and known as the "Long Stone", is located on the intersection of Hawkins Street and College Street/Pearse Street. This boundary stone is traditionally believed to have been used as a mooring post by the Vikings, marking the limit of the River Liffey floodplains. It was subsequently used in medieval times as a marker between the jurisdictions of the city and St. Mary's Abbey (DCHG 2017). The boundary stone was removed sometime between 1679 and 1700. The postulated site of the boundary stone is marked by the "Steyne" sculpture, erected in 1986 (RPA 2010).

Additional evidence for Viking activity within the Area A relates to the site of the former "Thingmote" which was located on the intersection of College Green/Suffolk Street and Church Lane. The "Thingmote" was where the Dublin Vikings conducted their political assemblies. College Green, was formerly known as 'Hoggen Green', the word Hoggen derives from a Scandinavian word 'Haugr' meaning burial mound. This green, which was extensive in size, did originally contain earthen mounds thought to represent part of a Viking cemetery, the last one of which, in Suffolk Street was only removed in the late 17th century (Simpson 2000). The "Thingmote" was levelled in 1685 and no evidence existed to indicate the precise location of the associated burial mounds.

Anglo-Norman and Late Medieval Period (c.1171-1550)

The majority of evidence for the late medieval occupation of the Area A is found within the historic walled town of Dublin (AH 596). Although the population of Dublin expanded considerably during the late medieval period, the populace were reluctant to build outside the confines and protection of the town walls; a factor greatly influenced by the devastation of the Bruce invasion of 1317 and subsequently by the significant decrease in population as a consequence of the Black Death in 1348. Consequently, lands, particularly those to the north of the River Liffey, remained effectively undeveloped and were generally exploited for agricultural purposes only.

The continuous occupation of historic Dublin City was greatly influenced by the presence of medieval trade centres and the protection afforded to the citizens of Dublin by the town walls on the south banks of the River Liffey. The latter, in association with the Rivers Poddle, Bradogue and Stein, were a focus of concentrated industry throughout the history of Dublin (NTA 2015).

Exceptions to the development outside the protection of the town walls could be made, for example the important medieval suburb of Oxmanstown that developed on the north side of the River Liffey.

The Priory of All Hallows on College Green was established in 1166 (AH177) (Simpson 2013). The priory was a substantial foundation in Dublin with the site at College Green known to have incorporated a stone house with vault, a steeple, cloister, vestry, bawn and tower along with gardens and orchards (ibid.) The site of the priory church is believed to have stood on the site of the present Campanile in Library Square in the grounds of TCD (DCHG 2017).

During the Medieval period, College Green would have been part of the eastern suburbs of Dublin, lying just outside of the city walls. This area was the focal point for the Hiberno-Norse of Dublin. The place-name College Green is first used in the documentary sources in c. 1666.

The hospital of St James (AH184) was founded by Archbishop Henry of London at the shoreline of the Stein River (Steyn), in 1216 when Pope Innocent III appropriated certain revenues to it. This was the embarking point for pilgrims to Compostella and was dedicated to the patron saint of lepers. The hospital became known as 'A hospital for incurables' (DCHG 2017) and the area as 'Lazers' or 'Lazy Hill' (Mc'Cready 1892).

Post Medieval Period (1550-present)

In 1534, the city was placed under siege by Thomas FitzGerald (Silken Thomas), who caused some damage to the walled town through the burning of streets, and various assaults on the city's walls and gates. Though FitzGerald was unsuccessful in his attempt to revolt, the city's subsequent petition to the King for finance to repair the ensuing damage, highlighted how the town defences had remained virtually unchanged since the 13th century (Clarke 2002). The city's petition led to the property of the All Saints Priory (now TCD) being handed to the Dublin Corporation on 3rd February 1539 to fund the town's necessary repairs. This action was followed on 7th April 1539 by the appointment of the Lord Chancellor and Archbishop of Dublin by Henry VIII to act as commissioners to accept the surrender of all religious houses under the dissolution of the monasteries (ibid.).

As for Dublin County, the dissolution of the monastery released substantial tracts of land for development and facilitated the outwards expansion of the city which is well documented on various cartographic sources.

The reclamation programme of the 17th century in Dublin saw the beginning of a period of rapid expansion, as riverside mud-flats were in-filled and reclaimed along the south bank of the Liffey. Prior to reclamation the shoreline, covering the area occupied by the Steine, still consisted of pasture and marsh.

An archaeological site excavated at the corner of Luke Street and Townsend Street (Walshe 1997) revealed a timber shore revetment and wharf, constructed almost entirely of oak and dated by dendrochronology to sometime after AD1655. The timber revetments extended across the site parallel with the Liffey and stood in places to a height of 1.50m.

They were well constructed, and many of the boards had carpenter's assembly marks in Roman numerals. A range of mid-to late-seventeenth century artefacts, including pottery, clay pipes and leather shoes, were recovered from around the

timbers. The foundations of the Westmorland, or Lock Hospital, constructed on the site in 1753, were also uncovered. Further evidence of the reclamation of land has been identified on D'Olier Street (Simpson 2002) (AH141), Pearse Street (Myles 2008 and Shine 2007), Westland Row (Cryerhall 2004 and Byrne 2004), Tara Street (Kehoe 2002) and O'Connell Street Lower (Baker 2005).

Access to deep water along the southern shoreline of the Liffey was also problematic due to the progressive silting up of the mouth of the Liffey and the creation of extensive mud-flats, which had pushed the southern line of the river northwards (Simpson 2002). The solution was a rapid programme of reclamation that began in c. 1600 along the south bank of the Liffey. The process had begun to the east of the walled town and continued as far as the mouth of the River Steine.

In the vicinity of Tara Street Station, the site of the church and graveyard (AH139) was excavated by John Channing in 1992. This site was located on the south side of Poolbeg Street, at its junction with Luke Street, in an area reclaimed from the Liffey estuary. The main interest on the site was provided by a series of burials, some of which had been disturbed prior to the arrival of the archaeologists. These interments appeared to be associated with a Lutheran church of early eighteenth century date shown on the first edition O.S. map. Laureen Buckley has highlighted the presence of wear patterns consistent with clay-pipe smoking on the teeth of some individuals (DCHG 2017).

St. Stephen's Green is a national monument (AH593), a recorded monument (DU018-020334, AH174) and a collection of protected structures (BH2855, BH2860, BH2859, BH2856, BH2857, BH2854, BH2858, BH2861, BH2852 and BH2851). The boundary treatment (BH2851), fountains, bandstand, water troughs and statuary, a statue of Lord Ardilaun and memorials to Robert Emmet, James Clarence Mangan and Countess Markeivicz are all individual elements listed in the RPS. Cartographic evidence supported by historical writings suggest that St Stephen's Green was an open commonage, enclosed c.1610 by a wall and ditch, with a road constructed around the four sides and plots allocated for development outside this road.

St Stephen's Green is named after the medieval leper hospital (AH185) and church of St Stephen's, which was founded in 1230AD outside the medieval city wall to the west of the present Green and on the site of St Peter's, an earlier ecclesiastical foundation (AH250). The modern streets of Mercer Street, Stephen's Street and Peter Row respect the line of the enclosure.

In 1664 the Corporation of Dublin assigned 27 acres as public open space and the area surrounding it was divided up and sold as plots for development. The boundaries of the park at that time are as seen today and its creation demonstrates the trend, in the late seventeenth century, to provide open space for the citizens of Dublin (CRDS 2008).

The Earl of Meath assumed responsibility for the park between 1702 and 1709, after which it was taken back by the civic authorities as a public space.

The development around the Green was carried out in stages, with the north and west sides the first to be built upon as shown on Pratt's map (1708). By 1756, as

Rocque's map depicts, the four sides had been developed. All traces of any seventeenth-century buildings have now disappeared.

The green was transformed once again in the 1870s at the instigation of Arthur E. Guinness who engaged the architect J.E. Fuller and the landscape designer William Shepard and the firm of Pulham & Sons to produce the current picturesque landscaping, including the pond, around a central parterre and gateways at each of the corners (NTA 2015).

In 1907 The Royal Dublin Fusilier's Arch at the northwest corner of the Green was erected on the site of the 19th century gateway to commemorate the casualties of the Boer War. It was designed by J. Howard Pentland of the OPW and consultant Sir Thomas Drew. It is a granite arch flanked by four rusticated piers creating a shallow, curved forecourt at the northwestern entrance to the Green where it is approached from Grafton Street. It has inscribed panels in Sheepphouse limestone (ibid.)

During the 1916 Rising, St. Stephen's Green was the location for a fiercely contested, if short lived, engagement.

The quays (AH60, AH140, AH283, AH69, AH51, AH47, AH612, AH623, BH4509) became the focus of industrial activity, industries included iron works, windmills (AH68), glassworks (AH373 and AH371), brickworks and shipyards. The development of bridges both pedestrian and vehicular (BH431, BH430, BH429, AH48) allowed greater and easier access across the city.

The construction of both the Royal and Grand canals in Ireland took place on foot of a 1715 Act of Parliament to make the inland rivers of Ireland navigable. In 1751, a further Act was passed in order to establish a Navigational Board and in 1755, £20,000 was made available to promote a system of inland navigation from Dublin to the Shannon, commencing with the construction of the Grand Canal (Clarke 1993). In 1788, Parliament devised a grant system to promote the private construction of canals. The Royal Canal Company was established in order to fund and manage the construction of the Royal Canal, which commenced in 1790.

Along with the canals the development of the railway improved transport links to and from the capital. In the 1830s and 1840s the Dublin and Kingstown (from Westland Row to Dún Laoghaire), Midland and Great Western (now Dublin-Maynooth) and Dublin and South Eastern (now Dublin-Wexford) railway lines were established. A railway line from Harcourt Street was opened in 1854 (BH1651). When the line was opened there was no stop at Ranelagh and a station at Ranelagh/Rathmines was not opened until 1896. The line was closed in 1958 (Kelly 1995). In the 1870s, Dublin's tramways were constructed and in 1879 a tram line from Ranelagh to Clonskeagh was opened by the Dublin Central Tramways Company. This tram line ran along Ranelagh Road. In 1896 the company, then called the Dublin United Tramways company, commenced electrifying their complete network. The trams were withdrawn from Dublin in 1949 (Bennet 1991). The Luas light rail tram system began services in 2004 along the same route used by the railway line.

The somewhat unregulated development and growth of the city during this era, coupled with a narrow medieval street pattern, left the city difficult to navigate,

having a serious impact on commerce and trade (Lennon 2008). A 1757 Act of Parliament was therefore passed for the establishment of the Commissioners for the Making of Wide and Convenient Streets and Passages, otherwise known as the Wide Street Commissioners (WSC) (Goodbody 2014). This organisation was responsible for the planning and construction of new streets on behalf of the city, or for overseeing the planning and construction of all new streets by private developers.

Many statues and sculptures adorn the streets of Dublin and are considered from a monument as well as from a built heritage perspective. For example, located on the south side of O'Connell Street, the O'Connell Monument (AH587 and BH2443), was created by John Henry Foley in 1882 and was commissioned by Dublin Corporation. The monument commemorates Daniel O'Connell (1775-1847). The project to construct the monument started in 1847 with the formation of the O'Connell Monument Committee. On the 8th August 1864 Lord Mayor Peter Paul Mc Swiney laid the foundation stone on Sackville Street. The completed sculpture comprises of three sections, a statue of O'Connell at the top, a frieze in the middle depicting the 'Maid of Erin' holding the 1929 Act of Catholic Emancipation and at the lower section of the monument are the four winged victories.

1.10.4.1.2 Archaeology and Cultural Heritage: Study Area B

There are no National Monuments, no monuments with preservation orders and 43 Recorded Monuments within Area B (Volume 4B, **Annex 1.10.2**).

Prehistoric Period (c. 8000BC-AD400)

Mesolithic evidence was identified within the study area in the northern section of Area B from a number of stray finds in Santry, comprising a flint scraper, a flint flake, a flint Bann flake and a stone axe (NMI 1947:43; 1969:58-60).

At Drumcondra, a Bronze Age ring ditch was revealed during test excavation of the parkland south of Drumcondra Castle, suggesting prehistoric activity in the area, which is not surprising given that the River Tolka runs to the south and would have attracted human activity since the earliest of times (Moriarty 2009). There is also a ringditch recorded in Claremont townland (AH568) in ploughed fields to the south of the Dublin City University Campus (DCU). A mound (AH29) is also recorded in Claremont townland in the grounds of the former Claremont House located to the west of Ballymun Road.

Early Medieval Period (c. AD400-800)

An ecclesiastical enclosure in Santry (AH252), which comprised a roughly oval enclosure measuring c. 55m in length by c. 46m in width, has been continuously occupied since the early medieval period and is believed to have been rebuilt in the 12th, 16th and again in the 18th centuries and is now occupied by St. Pappin's Church (AH268) and Graveyard (AH27) which was constructed in 1709 (DCHG 2017)

While at Drumcondra, the church (AH158) and lands belonged to the Priory of All Hallows (BH1583) in medieval times, some historic sources suggest that the site has an early medieval origin:

‘In 655, the year of the great pestilence in Ireland, St Malaga (Molua) had church and religious establishment at a place called Laorn-beachaire, in Fingall, near Dublin. It is conjectured the site was in the now townland of Clonturk, and within the demesne of Drumcondra-house, the residence of William Stewart Hamilton’ (Dublin Penny Journal 1834).

The site of an enclosure (AH218) is recorded in Claremont townland and it is possible that this was a ringfort, the site is now built over.

Viking Period (c. AD800-1100)

The northern portion of the study area lies within Fingal, which derives from Fine Gall or ‘territory of the strangers’, indicating it was in the possession of the Vikings (Bolton 2008).

Anglo Norman and late Medieval Period (c. AD1100-1550)

Santry and Drumcondra are examples of Anglo-Norman towns where large ecclesiastical houses were established.

The lands of Santry were granted by Hugh de Lacey, Lord of Meath, to his Baron Adam de Fiepo, who in the late 12th century erected a church on the early ecclesiastical site of St. Pappin’s; the only surviving element of which is a medieval stone font (AH270) (DCHG 2017). The church and its associated lands were granted to the Abbey of St. Mary’s in Dublin and remained in their ownership until the dissolution of the monasteries in the 16th century (Dennehy 2006).

The 12th century Augustinian ‘Priory of All Saints’ was established in Drumcondra on lands presently occupied by All Hallows College (AH158 and AH159). This priory was associated with the Augustinian Priory of All Hallows on College Green (now TCD), for which it was the chief supplier of grain. Drumcondra church is referred to in a 12th century letter sent to Rome in 1179, which lists the religious establishments at Drumcondra, Glasnevin and Killester amongst others (Bradley 1988).

Subsequent archaeological investigations on this site have identified fragments of medieval pottery (Reed 1997 and O’Connor 2001).

A late medieval castle, Corballis Castle (AH12) was located on the grounds of Corballis House (BH3222), (now removed and excavated) (Frazer 2007) on lands that are now occupied by Dublin Airport. It was annotated on the 1st edition Ordnance Survey map of 1837 as ‘Corballis Castle in ruins’. The castle site is located within Dublin Airport and there are no surviving remains for this site.

Post-Medieval and Modern Period (1550-present)

In 1641, the village of Santry was burnt by a detachment from the Dublin parliamentarian forces. It was at this time that the lands of Santry came into the possession of Sir James Barry.

In 1654, the village of Santry is described as comprising ‘a small slated house and six thatched cottages’, while Barry’s house is described as being ‘a dwelling house of stone with a barne and an old stable. Thatcht, ye walls of a house & garden & 2 orchards’ (Simington 1945).

Santry Court (AH267) was reputedly built on the site of this earlier house in 1703. Santry demesne was presided over by the Domville family at this time, who widened the main street running up to the demesne gates and added a formal square. According to Lewis, the demesne comprised more than 140 acres of tasteful gardens ‘richly embellished with timber, and commanding some beautiful scenery and some extensive mountain and sea views’ (Lewis 1837). Santry was remodelled into a Swiss village in 1840 by Lady Domville. A number of smaller former estates were located within the environs at Santry and include Furry Park and Woodford (Dennehy 2006). Other former estates shown on the 1st edition OS six-inch mapping but that longer exist above ground in the Ballymun area include Balcurreis House, Clonmel Cottage and Stormanstown House (AH91 and AH272).

East and off the Ballymun Road there are a number of protected structures, these include Elmhurst (BH1648), Hampstead House (BH1649), Hillside Farm (BH1650), Cuilin House (BH1647), An Grianan which is part of Dublin City University (BH278) and the former agricultural college (Albert College) (BH277).

Drumcondra Castle, built in 1560 is attributed to John Bathe, son of James Bathe, who held the office of solicitor-general. The Bathe family had merchant, military and legal associations. The Civil Survey (1654-6) describes a ‘castle, with a slated stone roof, a barn and gate-house also slated and three cottages’ valued at five hundred pounds.

In the 17th century, Belvidere House (as shown on the 1st edition OS six-inch map) was constructed on Drumcondra Road Upper in lands now occupied by St. Patrick’s College (AH 157 and BH971). The Civil Survey (1654-6) describes the house, which was once the seat of the Coughill family, as a ‘faire brick house’. Elements of the house’s original 17th century fabric are incorporated into the present structure (DCHG 2017). The house was sold to the Archbishop of Dublin in 1883 for use as St. Patrick’s College.

A church dedicated to St Margaret was erected (Ball 1920) in the grounds of the former Priory of All Saints, and now All Hallows College. It is recorded that the corporation lease for the lands at Clonturk to Mr John Bathe of Drumcondra Castle in 1597 contained a clause obliging him to ‘keappe upp and reapaire the Chourche and mainteyne a priest to serve there during the tearme’. (AH158 and AH159). It was subsequently replaced in 1734 with the Church of St. John the Baptist (BH606) and All Hallows College (BH1583) was founded on the site in 1842 by Reverend John Hand.

The village of Drumcondra itself was relatively well occupied during the 17th, 18th and early 19th centuries, with the 1st edition OS six-inch map of 1843 showing both Georgian houses and large estate houses fronting onto Swords Road and Drumcondra Road Upper. The latter included White Hall and Wellpark House. The River Tolka attracted activity in the form over a flour mill which was located at the intersection of Drumcondra Road and Millmount Avenue.

Lewis also records the presence of a woollen mill on the river which was washed away in 1834 and a brass foundry (Lewis 1837). None of these industrial heritage features survive today.

1.10.4.1.3 Archaeology and Cultural Heritage: Study Area C

In total, there is **1** National Monument (AH208, Swords Castle), no monuments with preservation orders and **44** recorded monuments within Area C (Volume 4B **Annex 1.10.3**).

Prehistoric Period (c. 8000BC – AD400)

Following monitoring of works associated with the M1 motorway in the late 1990s (Northern Motorway/Airport-Balbriggan Bypass), an Early Neolithic habitation site was uncovered in Lissenhall Little townland (Lynch, 2000) DU012-079001 & -079002). Three areas of activity, which included pits, a hearth and stake-holes, were revealed (Reilly 2001).

Later prehistoric activity dating to the Early Bronze Age is indicated by the presence of several ring-ditches in Area C. At Fosterstown South, Nevinstown West and Crowscastle ringditches are recorded (AH563, AH26 and AH579) in agricultural fields. At Holybanks (AH253), Lissenhall Little townland (RMP DU012-003 and DU011-130) and Balheary Demesne (DU011-123), ring-ditches have been identified as crop marks from an aerial photography. The term ring-ditch refers to a regularly-shaped circular or pennanular ditch cut. The term is most often used as a generic description in cases where there is no clear evidence for the function of the site; for instance, where it has been ploughed flat and is known only as a cropmark or a geophysical anomaly. The two commonest monument types represented by ring-ditches are roundhouses (where the 'ditch' is actually a foundation slot or eaves drip gully) and round barrows – a funerary monument. The site in Lissenhall Little was subject to geophysical survey and archaeological testing, which confirmed the presence of a cremation pit (Licence Nos 08R117 & 09E0463).

At Lissenhall Great two waste flints were recovered (NMI Ref. 1978:77-78) and a flanged axe was found in Newtown (NMI Ref. 1962:259). Prehistoric artefacts recovered from Swords town include two flat axes (NMI Ref. 1939:16; E92:335), the earliest type of bronze axe, and a palstave (NMI Ref. 1939: 17), a type of middle Bronze Age axe. Archaeological monitoring on the south side of Church Road has also yielded a shale stone axe rough-out, which, while not found in its original context, corroborates some activity in the environs of the town from the prehistoric period (O'Carroll 2000).

Excavation in advance of development in the former grounds of Mount Gamble House in the town of Swords identified an assemblage of artefacts which include 31 flints, one chert and one quartz piece, which has been dated from the Neolithic or Early Bronze Age and relates its presence on the site to possible sporadic occupation over time (O'Donovan 2005). Excavations at this site also revealed a multi-phased cemetery with the earliest phase of burial dating to the Late Iron Age indicating the pre-Christian population of the area (AH287).

An Iron Age ring-barrow (DU012-068) was identified during monitoring associated with the M1 motorway (Airport–Balbriggan Bypass). The site consisted of a circular ring-barrow, with an entrance at the northern and western part of the ring. A deer antler was found directly opposite the western causeway/entrance. A small deposit of cremated human bone was found within the ditch, also on the eastern side of the feature. The north-eastern side of the ring-ditch was cut through by five inhumations oriented east–west. Beside these inhumations were four others, oriented north-east/south-west (Lynch 2001).

Early Medieval Period (c. AD400-800)

Swords town (AH 284) is at the heart of an area that was of particular importance in the early medieval period, it is said to have owed its origins to the establishment of the church site founded by St Colmcille (AH209). The local folk tradition records that when St. Colmcille established his church, he took possession of a pre-Christian well, blessed it, and devoted it, after his usual custom to the service of religion.

Swords derives its name from the Irish word, sord, meaning ‘pure’. Sord was also the name of a pagan spring or well (Joyce 1995). Therefore, it is likely that the town’s name originally applied to St Colmcille’s well or Sord Colmcille. The well (AH23) site was one of the principal sources of water supply in the town and is located and named on 1st edition OS six-inch mapping located to the south of Well Road.

The association of the early foundation of Swords with St Colmcille, who appointed St Finan Lobhar (the Leper) abbot, could suggest a 6th century date for the sites foundation (Gwynn and Hadcock, 1988), however, there are no contemporary documentary sources to confirm this. The site was established on a ridge of high ground overlooking the Ward River.

Three churches have been recorded at Swords, dedicated to St Fintan, St Brigid and St Catherine and it is probable that these churches were all located within the present Church of Ireland site with its standing round tower (AH212) (D’Alton, 1838). The round tower, is the only surviving portion of the original monastic establishment, the medieval church, belongs to a structure which was erected in the later Middle Ages.

There are several ringfort sites in proximity to the Area C. These include DU011-078 (in Newtown townland), DU012-015 (in Lissenhall Great townland), DU012-00101, DU011-00702, DU008-056, (in Belinstown townland) and DU012-002 (in Lissenhall Little townland). The majority of these sites have been identified on aerial photographs and are interpreted as levelled ringforts with associated field systems.

A number of enclosure sites have also been identified these include a now built over site in the townland of Broadmeadow (AH255) and three enclosures that were identified as a result of archaeological investigation undertaken for the original Metro North project in Fostertown South (AH567, AH565 and AH562) in agricultural fields. Owing to morphological indistinctiveness, enclosure sites cannot be attributed to specific periods of antiquity.

However, it is believed that the majority of these sites are examples of damaged barrows (prehistoric ritual sites) of the Late Bronze Age / Early Iron Age or indeed ringforts (settlement sites) of the early medieval period.

The Vikings at Swords (c. AD800-1100)

The monastery at Swords was attacked by Maelsechlainn in 994 AD. In 1014, the bodies of Brian Boru and his son, Murchad, were taken through Swords on route for burial in Armagh. The monastery was also plundered on several further occasions from 1020 to 1166 during which it and village of Swords had become part of the Scandinavian kingdom of Dublin. Swords had first become a target of the Vikings, or Ostmen, from the close of the 10th century, and according to the Annals of the Four Masters was attacked and burned by them in 1012 and again in 1016. By 1035 the village had been conquered by the Vikings, under Sitric, King of Dublin, and in retaliation for a raid conducted by the settlers Ardraccan was attacked and burned in that year by the then King of Meath, Conor O'Melaghlin (Bradley 1998).

Anglo Norman and Late Medieval Period (c. AD1100-1550)

Prior to the Anglo-Norman invasion of 1169, the monastery at Swords and its possessions had been transferred to the Archbishop of Dublin (Laurence O'Toole) and Swords subsequently became one of the main archiepiscopal manors (Killanin and Duignan 1995). The ruins of the archbishop's palace (a National Monument) (AH208) (Harbison 1992) are situated at the north end of the town. The building of the castle is thought to have commenced c. 1200 and is more manorial in character than defensive, though it is walled on all sides (Leask 1973).

In a charter, Archbishop O' Toole's successor, John Comyn, confirmed the burgesses of Swords in their burgages, 1181-1212 AD (Bradley 1998). The borough was one of the largest and most enduring of those established by the archbishops of Dublin. There are many references which show that it functioned continuously into the 16th century. The settlement was granted a new charter by Elizabeth I in 1578, establishing the town as a parliamentary borough.

The manor at Swords appears to have flourished in the 13th century with many references to the court and other legal proceedings. However, by the early 14th century it was coming under increasing pressure from the Gaelic Irish of the Dublin/Wicklow Mountains who were in a state of rebellion, maintaining a guerrilla-type war in the area surrounding Dublin. In 1326 an account of the manor of Swords describes it as semi-derelict with the lands, including lands at Lusk, lying in waste owing to the conflict with the Gaelic Irish. A town wall was recorded by D'Alton in 1838 when he refers to a manuscript, now lost, that describes the walls as enclosing 'an area of great extent, and several parts indicate that they were founded as much for strength and protection as for any other purpose. They were strongly fortified with towers, and their exterior presents an embattled front, of an imposing appearance' (D'Alton 1838). No evidence for the town wall survives today.

Post-Medieval and Modern Period (c. AD1550-present)

At Lissenhall Great/ Balheary Demesne a bridge, crossing the Broadmeadow River, is depicted on the Down Survey map of Nethercross, c. 1655. A five-arched bridge which appears to be part of a much larger structure containing at least eight arches, exists in the same location as that shown on the Down Survey map. The existing bridge is a recorded archaeological monument (AH254) (RPS BH29) (NIAH BH3201) and it has been dated to the period 1450-1550 with later additions (O' Keeffe & Simington 1991).

1.10.4.1.4 Architectural Heritage and Cultural Heritage: Study Area A

Within Study Area A, there are:

- **3226** Protected Structures (Volume 4B **Annex 1.10.4**),
- **1383** NIAH structures (Volume 4B **Annex 1.10.7**) and
- **13** ACA's.

3 buildings have been assigned an international rating by the NIAH, the Custom House (NIAH BH3404) (RPS BH758), Busáras (NIAH 3397) (RPS BH2930) and the Four Courts (NIAH BH4637) (RPS BH4550). **45** structures have been assigned a national rating and the remaining **1335** NIAH structures are of regional value.

A large number of protected structures are also listed in the NIAH. Structures have been included from both datasets so the total information presented in this report has led to a significant amount of double counting. The datasets are differentiated by prefixing the built heritage number with either RPS or NIAH. It was deemed preferable to have all information available at this stage of the scheme, within the reporting process and on the interactive mapping portal for review.

Study Area A has a rich and varied cultural landscape of historic buildings and structures. These structures range from nationally important parks and designed landscapes such as St Stephen's Green, where individual elements form part of the protected structure listing and Mountjoy Square (NIAH BH4367 and ACA AA13). Typical Georgian and Victorian residential terraces, for example Eccles Street and Parnell Square West and public buildings, the General Post Office (GPO) (NIAH BH2463 and RPS BH2463) and the National Concert Hall (RPS BH1010) add to the historic character of the city and form part of the modern-day streetscape. Examples of vernacular architecture and historic street furniture as well as statues are also to be found. For example, the statue of Archbishop Plunket at Kildare Place (RPS BH1908) and Oliver Goldsmith and Edmund Burke (RPS BH717) at College Green, Trinity College as well as the fountain and horse trough at St Stephen's Green (RPS BH2853) and a pillar box on O'Connell Street Upper (NIAH BH 3802).

Essentially the evolution of Dublin City commences with the development of the medieval walled city (AH 596).

The city is then expanded along reclaimed land on both sides of the River Liffey, affording new land for both industrial and residential development, this is followed by the development of the Georgian core in the 18th century and the radial development of the adjoining lands and 19th century development of the suburbs.

The historic city of Dublin is on the UNESCO World Heritage tentative list which is an inventory of properties each State party intends to consider for nomination. The Georgian city plan under consideration still survives largely intact and is bounded to the north and south by the canals, to the west by the Phoenix Park and the east by the sea (Permanent Delegation of Ireland to the OECD and UNESCO 2010). The city is considered under the headings of authenticity, integrity and justification of outstanding universal value is provided as following the Restoration (1660) Dublin became the second city, after London, of the British Empire, with major development and expansion in the Georgian period (1714-1830). This has given Dublin the institutional buildings, terraces and infrastructure, and set out the city plan as it substantially survives today.

Dublin has an outstanding range of buildings and structures that are linked to this development. This includes 18th and 19th century terrace housing for example Seville Place, mews and worker's housing, industrial complexes (CHQ building/ Stack A NIAH BH3319/ RPS BH756) and streets and architectural conservation areas dominated by governmental, institutional and educational uses, for example O'Connell Street ACA (AA11) and Grafton Street and environs ACA (AA07).

The Wide Street Commission (WSC), established through a 1757 Act of Parliament, was tasked with reducing the city-centre congestion, arising from the existing narrow medieval streets, and consequently worked to widen and develop the thoroughfares of Dublin city centre. The WSC had extensive powers, including the authority to acquire property by compulsory purchase, to demolish structures and lay down new streets and set lots along the new streets to lease to builders for development. The work of the WSC resulted in the eradication of distinct house styles that once lined the city's streets, namely the Dutch Billy. These were a late 17th century house style, the arrival of which is generally attributed to the influx of both the French Huguenots into Dublin c. 1685 and of Dutch and Flemish Protestants fleeing persecution c. 1690. The buildings were gable fronted brick houses with corner fireplaces.

Dutch Billys were once the dominant form of Dublin architecture but now only isolated examples survive. Two examples of Dutch Billys are located on St. Stephen's Green East (RPS BH2882 and RPS BH2881), though these are masked by Georgian façades (Moriarty 2012). The subsurface remains of this house type have been identified at numerous locations throughout the city during the course of archaeological investigations. Within the study area, their structural remains have been archaeologically identified on Parnell Street, O'Connell Street, College Green and on D'Olier Street/Fleet Street (Baker 2005, Gilligan and McGlade 2015 and Bolger 2008)

In 1777, the Wide Streets Commission was given a grant to extend Sackville (now O'Connell) Street to the quays, and, in 1782, it was given Parliamentary approval to build a bridge (to be called the Carlisle Bridge, now O'Connell Bridge RPS BH431) over the Liffey. The bridge, designed by James Gandon, was opened in 1795, the extension of Sackville Street took until 1800 to complete. While the bridge and Sackville Street were under construction, plans for Eden Quay were being drawn, and the quay, involving the proper embankment of the river with stone walls, was laid after 1806.

Many notable buildings and monuments align O'Connell Street including the GPO (RPS BH2463 and NIAH BH3775) and statues of national significance including O'Connell (RPS BH2443), O'Brien (RPS BH2450) and Parnell (RPS BH2473). The former site of Nelson's Pillar and the Spire all contribute to the cultural heritage significance and character of the street and are integral to its ACA status (AA11). Further to the north, Parnell Square was the first Georgian square constructed in Dublin (c. 1753–1785). The construction of Parnell Square (formerly Rutland Square) was instigated by the construction of the 'New Gardens' which were established as pleasure gardens by Dr. Bartholomew Mosse between 1748 and 1750 to the immediate north of Parnell Street. The New Gardens were opened to raise money for the construction of first 'Lying-in Hospital' or maternity hospital; the construction of which commenced in 1751 on the south side of the square. The Lying-in Hospital now known as the Rotunda Hospital (NIAH BH3848-BH3851, RPS BH2614) was not opened until 1757 but it is shown on Rocque's Map of the preceding year.

Cavendish Street (now Parnell Square East) was the first street to be developed on Parnell Square. Named after the Lord Lieutenant, William Cavendish, 3rd Duke of Devonshire, the street was developed by Luke Gardiner. The first property plots fronting onto Cavendish Street were leased in 1753, marking the commencement of formal street construction. The street is first illustrated on Rocque's map of 1756 (Duggan 2006). In 1766, Cavendish Street was renamed Cavendish Row. Development works implemented by the WSC from 1786–1789 led to the completion of the frontage of Cavendish Row. This was achieved through the demolition of the existing early 18th century houses on the south end of the street which fronted onto Parnell Street. Four houses and two shops fronting onto Cavendish Row were constructed in their stead (Duggan 2006). The square was renamed Parnell Square in 1933. The Garden of Remembrance (NIAH BH3887) and the Rotunda Gardens (NIAH BH4398) are located within the square. Buildings include the Gate Theatre (a former assembly building for the Rotunda Hospital (NIAH BH4235 and RPS BH573) and the former ambassador cinema (RPS BH2631, NIAH BH3847). From a cultural heritage view point Parnell Square and the Garden of Remembrance have acted as a gathering point for marches, rallies and parades over the years.

Political power and commerce were centred on College Green, and during the 18th century, large civic buildings were constructed including the Houses of Parliament (RPS BH703), a new façade for Trinity College (RPS BH716), Dublin and the Central Bank (RPS BH1341 and BH1342) at Foster Place. In 1727 the construction of the new parliament building at College Green began.

This building was designed by Edward Lovett Pearce and it was the first purpose built two chamber parliament building in the world. James Gandon, who had designed the Custom House, the Four Courts and the King's Inns buildings, later extended the building. Statues erected at College Green include: Thomas Moore (RPS BH724), Henry Grattan (RPS BH704), Thomas Davis (x 2) and Molly Malone (now located outside the tourist office on Suffolk Street). College Green has long been associated as a place of assembly and many civic events, concerts and rallies have and continue to be held at this site.

Ireland's industrial heritage is also well represented within the study area, significantly by the Royal and Grand Canals (as discussed in **Section 1.10.4.1.1**) and the Dublin-Maynooth/Dublin-Wexford railway lines. Industrial buildings within the study area include Pearse Street Station on Westland Row and its associated railway bridge (RPS BH3107 and BH427), Connolly Station (RPS BH108, NIAH BH3390 and BH3394), Tara Street Station and the former Harcourt Street Station (RPS BH1651) (Dublin City Development Plan (DCDP) 2016). The quay walls which relate to the period of the reclamation of the River Liffey, though not protected, are also considered to be of architectural heritage merit.

A number of streets within the study area contain historic street furniture such as limestone and granite kerb stones, cobblestones, cast-iron postboxes, waterpumps, milestones, coal hole covers, street lighting, water troughs and protective bollards. Under the DCDP these are to be retained or restored at their original location (DCDP 2016). Examples of historic street paving and furniture can be found on Parnell Square for example on Cavendish Row there is a fountain and water trough (RPS BH574, NIAH BH4236), O'Connell Street, Abbey Street, O'Connell Bridge, College Green - the entrance gates, railings and walls associated with Trinity College (RPS BH718), Pearse Street, Merrion Square and Earlsfort Terrace.

The potential to reveal cellars/basements that extend out beneath the road surface and are associated with the Georgian and Victorian terraces throughout the city should also be borne in mind. These cellars may be in use or may be severed from their original associated houses, a number of which are protected structures. Extensive surveys were carried out by the RPA for the Luas Cross City Project and this led to the identification and recording of subterranean structures along Dawson Street, Marlborough Street, Parnell Street, Westmoreland Street and Dominick Street.

The city has made an extraordinary contribution to world literature. Including Swift, Sheridan, Goldsmith, Burke and Moore in the 18th and early 19th centuries; Wilde, Stoker in the later 19th century; the Irish Literary Revival of the early 20th centuries with Yeats, Gregory and the Abbey Theatre, Synge, O'Casey and Joyce; continuing with Shaw, Beckett and Flann O'Brien to the present.

Three of the four Irish Nobel laureates for Literature - Yeats (1923), Shaw (1925) and Beckett (1969), were from Dublin.

The street plan, local architectural features, the form of buildings and spaces, civic buildings within set pieces of urban design, the unique Georgian squares and streets, together with the larger area of Victorian and Edwardian architecture north and south of the canals and the industrial buildings all contribute to the city's character, identify and authenticity.

1.10.4.1.5 Architectural and Cultural Heritage: Study Areas B and C

Within Study Areas B and C, there are:

- **47** protected structures in Area B and 26 in Area C (Volume 4B **Annexes 1.10.5 and 1.10.6**),
- **4** NIAH structures in Area B and 36 in Area C (Volume 4B **Annex 1.10.8 and 1.10.9**).
- **1** ACA in Area B and no ACAs in Area C.

The architectural heritage of the north section of Study Areas B and C has a dispersed distribution. Consequently, the architectural heritage resource in north Dublin primarily comprises 17th –19th century demesne houses, designated Historic Gardens and Designed Landscapes, in addition to industrial heritage items.

Examples of former estate houses within or bordering the northern section of the study area include Newtown House and Balheary House in Swords, Santry Court and Belvidere House in Drumcondra. The latter now functions as St. Patrick's College (NIAH BH971 and RPS BH991).

Protected structures within Area B comprise many forms and include Whitehall Garda Station (RPS BH1645), the Clonliffe College (RPS BH697 and BH963) and a number of Georgian buildings along the R132 (Drumcondra-Whitehall Road).

Along the R108 structures such as the Botanic House (a licenced premises) (RPS BH416) and the former player's factory (RPS BH417) and features such as the railings and gates associated with the former St Vincent's orphanage (RPS BH4606) are located. While 19th century college buildings (RPS BH2847) are located on St Mobhi Road. Further north, there are a number of structures such as a dwelling (RPS BH276), Hampstead House (RPS BH1649) and Cuilin House (RPS BH1647) located off the Ballymun Road.

Binn's Bridge (RPS BH432), Clarke's Bridge (RPS BH433), Newcomen Bridge (RPS BH434 and NIAH BH3334) are all located on the Royal Canal (DCDP 2016).

A number of institutions are also recorded in the form of Dublin City University (RPS BH277) and St Alphonsus Monastery (RPS BH2837) and amenity areas such as the Botanic Gardens which contains a number of protected structures (RPS BH 412-415). Church sites such as St Mobhi Church (RPS BH607), St Pappin's Church (RPS BH280) and the Church of Our Lady Queen of Heaven (NIAH BH3221) are also located in Area B.

Scattered throughout the Fingal area is an extensive stock of historic buildings dating to mainly from the 18th to 20th century. These include, for example, cottages, for example a thatched cottage in Collinstown townland (RPS BH27 and NIAH BH3223) houses, shops, farm complexes, outbuildings, mills, forges and inns. These structures built by local people for local people with local material are known as ‘vernacular’ buildings and contribute positively to the landscape and help to establish a distinctive character for a particular area.

The architectural heritage of Area C (north of the airport) has a dispersed settlement pattern apart from the town of Swords where a number of protected structures contribute to the historic streetscape of the town. The rural nature of the wider area is predominantly reflected in the architectural heritage resources by 17th - 19th century demesne houses, historic gardens and designed landscapes, in addition to simple vernacular buildings such as thatched cottages and structures of industrial heritage.

Lissenhall Bridge is a protected structure (RPS BH28 and NIAH BH3201). It is also a recorded archaeological monument (see previous section). The Down Survey map of Nethercross, c. 1655 depicts a bridge in this location. The bridge incorporates medieval material, possibly dating to the period 1450-1550, with later 18th century additions (O’Keeffe and Simington 1991 & Channing 2009). This five-arched bridge is located west of the present R132 road north of Swords village where it crosses the Broadmeadow River. It is built of mortared limestone masonry. The bridge has three abutting sections, the middle section has slightly pointed arches with wattle marks. The upriver cutwaters are triangular with semi-pyramidal cutwater cappings.

Three other bridges span the Broadmeadow river and its tributaries, the adjoining two Lissenhall Bridges (NIAH BH3194, BH3195), built in 1895 and 1903 respectively, and Balheary Bridge, a mid-19th century stone bridge (RPS BH29, NIAH BH3200). All of these structures have been given a regional rating by the NIAH.

Ground penetrating radar and test-excavation undertaken in advance of the original Metro North identified that much of the medieval fabric has survived within the Lissenhall Bridge structure (Licence No. 09E0464). A wall extends on the eastern side between Lissenhall and Balheary Bridges and an arch/culvert pre-dating the existing visible culvert on the western side of the bridge exists beneath the road. This is suggestive of a precursor or early phase of building, possibly indicating an early road prior to the re-development or widening of the road in the late 17th /early 18th century (Channing 2009).

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1.11 Material Assets

1.11.1 Introduction

This section describes the material assets constraints identified within the scheme study area for the NMN Project.

Section 1.11.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.11.3** describes the existing environment within the scheme study area. A summary is presented in **Section 1.11.4** and references are listed in **Section 1.11.5**.

In this constraints study, material assets include both agricultural and non-agriculture assets.

The material assets constraints identified are shown on Volume 4C **Figures 1.11.1 to 1.11.9** and **1.11.3** and **1.11.4**.

1.11.2 Methodology and Sources of Information

1.11.2.1 Methodology

The aim of this assessment is to identify the material assets, both agricultural and non-agricultural, within the scheme study area and assess the level of significance of these as constraints.

As the scheme study area is generally urban in nature, the vast majority of the assets within the area are non-agricultural assets such as property, utilities, industry and built infrastructure. The urban area is dominated by residential areas, which access employment and industry, which in turn are serviced by utilities throughout its entirety and which are accessed by major infrastructure. Construction activities in such urban areas require the diversion and relocation of utilities and reconfiguration of properties on a regular basis, and whether such are considered constraints is dependent on their importance relative to the importance of the construction of the metro in such a location.

Study Area A comprises the highly urbanised area of Dublin City Centre. Study Area B stretches from Drumcondra in the south to Dublin Airport in the north. The majority of Study Area B is also urbanised and mostly developed, with the exception of the rural land surrounding the airport boundary. The rural land around the airport includes recreational facilities (such as golf courses, equestrian centres and football pitches) and agricultural land. Study Area C is generally more rural, with agricultural land to the south (in the vicinity of Dublin Airport) and becomes highly developed around Swords to the north.

The assessment is based on a desk study and on information gathered during windshield surveys.

1.11.2.2 Sources of Information

The desk study included review of the data sources as shown in **Table 1.11.1**.

Table 1.11.1: Data Source for Information Gathered

Data Source	Review of
ESB and ESBI	ESB and ESBI records of High Voltage lines
Gas Networks Ireland (Bord Gais)	Gas Networks Ireland records for transmission gas lines

Data Source	Review of
Irish Water	Review records for location of water and sewer truck mains greater than 300 mm diameters
Fingal County Council and Dublin City Council	Review of surface water sewers greater than 300 mm diameter
Heavy Rail and Light Rail network	Irish Rail data sets
Locations of properties	Orthophotography Windshield surveys throughout study area to identify non-agricultural properties.
Planning applications	Fingal County Council and Dublin City Council planning database
Landuse and planning policy	Dublin City Development Plan 2016-2022. (Dublin City Council, 2016) and Fingal Development Plan 2017-2023. (Fingal County Council, 2017)
2010 Census of Agriculture Report, Central Statistics Office	Aerial photography
Environmental Protection Agency (EPA) Soil Mapping Data (2013 data set)	Land quality mapping. Available from (http://gis.epa.ie/GetData/Download)

1.11.3 Existing Environment

1.11.3.1 Utilities and Services

Existing utility records were obtained from the relevant utility service providers.

There are considerable numbers of low and medium voltage ESB lines in the scheme study area, these services were not assessed as part of the constraints study, as they are not considered to be constraints and will be diverted where necessary for the final design. The ESB services that have been assessed, see bullet list below are considered to be the major utilities for this service provider and pose more significant constraints for the scheme.

Similarly, there are numerous small diameter foul, combined and surface water sewers and watermains throughout the scheme study area that have not been assessed, as they are not considered constraints and will be readily diverted where necessary for the final design. The assessment has been carried out based on the larger diameter, more critical services, as detailed in the bulleted list below, as these pose more significant constraints for the scheme.

The following utilities and services were considered for the constraints study:

- ESB High Voltage (38 kV) Overhead Lines (HV OH) and High Voltage Underground Lines (HV UG)
- ESBI High Voltage (110 kV) Overhead Lines (HV OH) and High Voltage Underground Lines (HV UG)

- Irish Water potable trunk mains greater than or equal to 300 mm diameter.
- Irish Water trunk sewers (foul and combined sewers) of greater than or equal to 300 mm diameter
- Dublin City Council and Fingal County Council surface water sewers of greater than or equal to 300 mm diameter.
- Gas Network Ireland (also referred to as Bord Gáis) underground services

The utilities and services are discussed below in more detail.

1.11.3.1.1 ESB and ESBI High Voltage Underground and Overground Lines

Study Area A

The ESB High Voltage Underground Lines (38 kV) and ESBI High Voltage Underground Lines (110 kV and 220kV) within Study Area A are shown on Volume 4C **Figure 1.11.1**.

There are no High Voltage Overground Lines in Study Area A.

Study Area B

The ESB High Voltage Underground Lines (38 kV) and ESBI High Voltage Underground Lines (110 kV and 220 kV) within Study Area B are shown on Volume 4C **Figure 1.11.2**.

There are no High Voltage Overground Lines in Study Area B.

Study Area C

The ESB High Voltage Overground and Underground Lines (38 kV) and ESBI High Voltage Overground and Underground Lines (110 kV) within Study Area C are shown on Volume 4C **Figure 1.11.3**.

1.11.3.1.2 Irish Water Potable Mains, Foul and Combined Sewers and DCC and FCC Surface Water Sewers

Study Area A

The IW Potable Supply trunk mains, Foul and Combined Sewers and DCC Surface water sewers greater than or equal to 300 mm diameter within Study Area A are shown on Volume 4C **Figure 1.11.4**.

Study Area B

The IW Potable Supply trunk mains, Foul and Combined Sewers and DCC and FCC Surface water sewers greater than or equal to 300 mm diameter within Study Area B are shown on Volume 4C **Figure 1.11.5**.

Study Area C

The IW Potable Supply trunk mains, Foul and Combined Sewers and FCC Surface water sewers greater than or equal to 300 mm diameter within Study Area C are shown on Volume 4C **Figure 1.11.6**.

1.11.3.1.3 Gas Networks Ireland Gas Supply

Study Area A

The GNI transmission lines for Study Area A are shown on Volume 4C **Figure 1.11.7**.

Study Area B

The GNI transmission lines for Study Area B are shown on Volume 4C **Figure 1.11.8**

Study Area C

There are no GNI transmission lines within Study Area C as shown on Volume 4C **Figure 1.11.9**.

1.11.3.1.4 Telecommunication Services

Various telecommunications companies have utilities, which are widespread throughout the study area, These utilities are not considered to be a constraint or of significance across the study area, within which to install infrastructure such as the NMN.

1.11.3.2 Heavy Rail and Light Rail Network

Dublin has an extensive heavy and light rail network. **Figure 1.11.10** shows the existing heavy rail and light rail network within the scheme study area.

1.11.3.3 Land Use and Planning Policy

Certain areas within Study Areas A, B and C are zoned Z9 in the Dublin City Council (DCC) and as Heritage Areas (HA) in the Fingal County Council (FCC) zoning plans for “*Natural Heritage, Recreation and Amenity*”. Specific objectives have been set out both for DCC and FCC in relation to these Natural Heritage, Recreation and Amenity zones. These main objectives are outlined below.

Dublin County Council (DCC)

The objective of the development plan is to develop Dublin as a compact, vibrant and connected city with a dynamic public transport network integrated into the city. Dublin is to be the retail hub of the country and the performance of this is believed, will have a strong correlation to the performance of the local and national economy with Dublin City becoming one of the most sustainable, dynamic and resourceful cities in Europe.

There are clusters of educational, cultural and residential zones throughout the city. The DCC development plan recognises that Dublin's built and natural heritage is a major contributor to the city's character and plays an important role in attracting tourism.

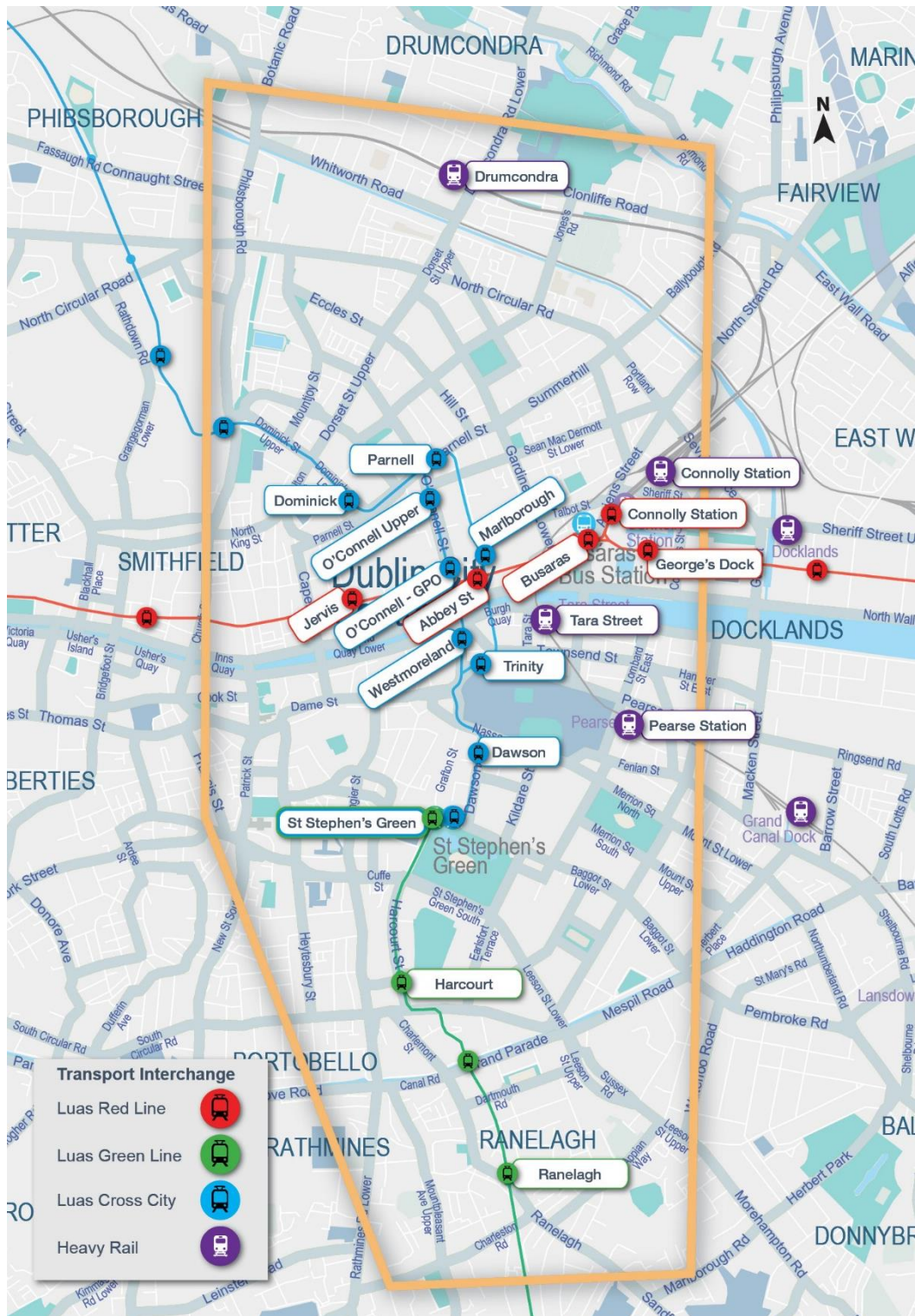
The retail core in Dublin City centre is the prime retail area of the state and is connected to the suburbs via critical public transport infrastructure such as the Luas and DART.

Fingal County Council (FCC)

Fingal County Council acknowledges in its development plan that Fingal is one of the most populous, fastest growing and youngest populated locations in the country. The county has a diverse character including both urban and rural areas with the town of Swords located in close proximity to Dublin City and Dublin Airport, which gives it access to national and international markets and also makes it an attractive location for foreign investment. Dublin Airport is a key constraint and key opportunity in the Fingal area.

Swords is identified as being capable of accommodating an expanding population and local area plans have been developed in consultation with the elected members and the public to facilitate this increased population whilst retaining the cultural quarter of Swords.

Figure 1.11.10: Existing Rail Network in Dublin City within Study Area A

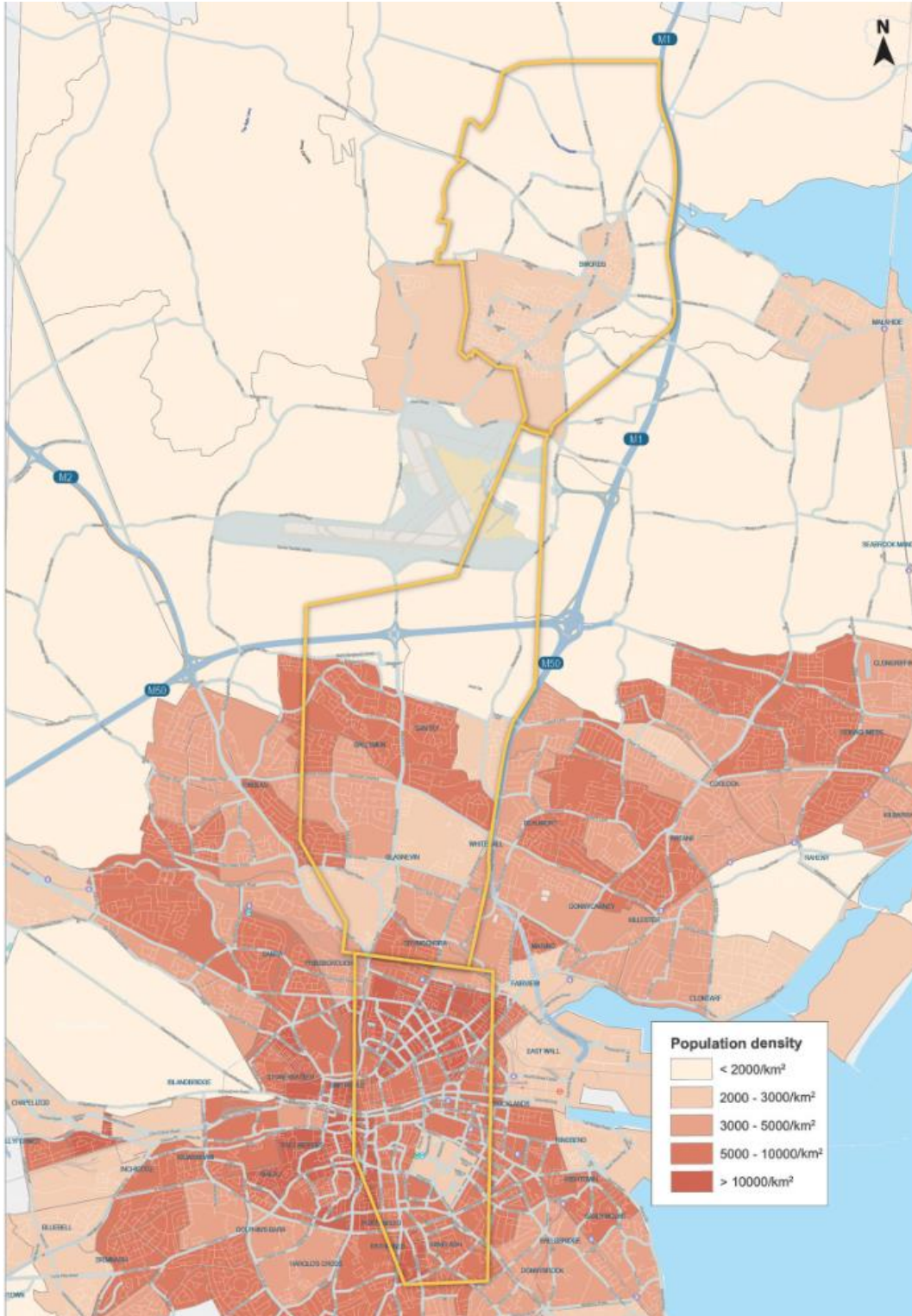


1.11.3.4 Residential Properties

Residential properties are prevalent throughout the majority of the study area, with some areas more densely populated than others. Population mapping shown

in **Figure 1.11.11** correlates with the distribution of residential properties throughout the study area.

Figure 1.11.11: Population Density for the scheme study area (Census 2016)



1.11.3.5 Educational Facilities

Primary and secondary schools are found throughout the scheme study area, with the exception of the area between the M50 and Swords near Dublin Airport.

The predominant third level institutions within the study area are Trinity College Dublin, whose main campus is located in Study Area A in the city centre, and Dublin City University, whose main campus is located in Study Area B, in the north of the city near Ballymun. A considerable number of smaller third level institutions are also based within the scheme study area, concentrated in Study Area A. The primary, post primary, and third level educational facilities located within the scheme study Area are listed in **Table 1.11.2**, **Table 1.11.3** and **Table 1.11.4**.

Table 1.11.2: Primary Schools within the scheme study area

Primary Schools		
Central Model Senior School	Ranelagh Multi Denom. NS	Virgin Mary Girls' NS
Central Model Infants' School	Rutland National School	St. Ciaran's Spec Sch
City Quay Boys' NS	Henrietta Street School	Scoil Mobhí
St Laurence O Toole Junior Boys	St. Mary's Primary School Dorset Street	Scoil an tSeachtar Laoch
Gardiner St Convent	Scoil an Croí Naofa	St. Joseph's Junior
St. Enda's Whitefriar St	St. Patrick's NS	St. Joseph's Senior NS
Nth William St Girls	Glasnevin NS	North Dublin NS Project
Nth William Infants Boys	Drumcondra NS	Gaelscoil Bhaile Munna
Lindsay Road NS Glasnevin	St Brigid's Convent	Glasnevin Educate Together NS
Laurence O'Toole Senior Boys	St Columba's Con G & I	Holy Child National School
Scoil Uí Chonaill	Corpus Christi NS	The Old Borough N S
Temple St Hosp. NS	St. Vincent's Primary School	St. Colmeille's Boys
Synge St CBS	Larkhill Boys NS	St. Colmeille's Girls
Mater School	Ballymun Rd St. Michael's House	St. Cronan's NS
An t-Aonad Réamhscoil	Bantiarna na mBuanna BNS	St. Cronan's Senior NS
Catherine McAuley NS	Bantiarna na mBuanna GNS	Holy Family Junior NS
St L O'Tooles 2 Spec	Holy Spirit BNS	Holy Family Senior NS
Scoil Chaoimhín	Holy Spirit GNS	Gaelscoil Brian Bóroimhe
Scoil Chaitríona Baggot Street	Our Lady of Victories Infant NS	Swords Educate Together NS
Gaelscoil Choláiste Mhuire	SN na Maighdine Muire B	Thornleigh Educate Together National School

Table 1.11.3: Post-Primary Schools within the scheme study area

Post Primary Schools		
O'Connell School	Larkin Community College	Plunket College
Christian Brothers, Syngé St.	St. Vincent's CBS Glasnevin	Clonturk College
CBS Westland Row	St. Aidan's CBS	Trinity Comprehensive School
Belvedere College SJ	St. Kevin's College	Coláiste Choilm
Catholic University School	Dominican College	Loreto College
Loreto College	Scoil Chaitríona	St. Finian's Community College
Mount Carmel Secondary School	St Mary's Secondary School	Fingal Community College

Table 1.11.4: Third Level Institutions within the scheme study area

Third Level Institutions		
DIT, Kevin Street Campus	Trinity College Dublin	ICD Business School
DIT, Bolton Street Campus	American College	Portobello Institute
Royal Irish Academy of Music	College of Computing Technology	Church of Ireland College of Education
Dublin Institute for Advanced Studies	Dublin Business School	St. Patrick's College
Mater Dei Institute	Dorset College	Dublin City University
Royal College of Surgeons Ireland		

1.11.3.6 Healthcare Facilities

A large number of healthcare facilities are located within the scheme study area, including **12** hospitals, **8** health centres, **19** nursing homes, and **138** general practices. The hospitals are mainly located in Study Area A, nursing homes are mainly in Study Area B, whilst the other facilities are fairly evenly spread. The hospitals, health centres, and nursing homes within the study are presented in **Table 1.11.5**, **Table 1.11.6** and **Table 1.11.7**.

Table 1.11.5: Hospitals within the scheme study area

Hospitals		
The Highfield Hospital Group	National Maternity Hospital	Royal Victoria Eye and Ear Hospital
Dublin Dental School and Hospital	Rotunda Hospital	Temple Street Children's University Hospital
Royal Victoria Eye and Ear Hospital	The Royal Hospital Donnybrook	Bon Secours Hospital
Mater Private Hospital	Mater Misericordiae Hospital	

Table 1.11.6: Health Centres within the scheme study area

Health Centres		
Ballymun Health Centre	Larkhill Health Centre	North Strand Health Centre
Summerhill Health Centre	Swords Health Centre	Baggot Street Health Centre
Millmount Health Centre	Ranelagh Primary Care Centre	

Table 1.11.7: Nursing Homes within the scheme study area

Nursing Homes		
Alzheimer Care Centre	Fold Ireland Anam Cara Housing with Care	Shrewsbury House Nursing Home
Beneavin House	Leeson Park House Nursing Home	St. Clare's Home
Beneavin Lodge	Marian House	St. Monica's Nursing Home
Cara Care Centre	Northbrook Nursing Home	St. Pappin's Nursing Home
Clarehaven Home	Queen of Peace Centre	TLC Centre Santry
Elmhurst Nursing Home	Seanchara Community Unit	Tara Winthrop Private Clinic
Fingal House Nursing Home		

1.11.3.7 Community and Related Centres

A considerable number of community centres, recreational centres, and parish halls are located within Study Area A and are especially prevalent in the North Inner City area, although some are also located to the south of Study Area A, such as Rathmines Parish Hall and Charlemont Community Centre. The community centres in Study Area B are concentrated in the Ballymun and Santry area, with Fr. Maloney Hall on Drapier Road in Ballygall, an outlying facility. Three community centres are located in Study Area C, all within the environs of Swords, namely Applewood Community Centre to the northwest, Holywell Community Centre to the southeast, and Rivervalley Community Centre to the southwest.

1.11.3.8 Retail Properties

The major retail area in the scheme study Area is the Central Shopping Area in central Dublin, which is focused on Grafton Street to the south of the River Liffey, and Henry Street to the north. This area takes up a large proportion of Study Area A. Study Area B has a more suburban character, with small-scale retail centred on a number of neighbourhood centres. There are a number of larger retail outlets within this zone, including Omni Park Shopping Centre and IKEA. Study Area C is dominated by the Swords core retail area, which consists of Main Street in Swords together with the Pavilions Shopping Centre adjacent to the R132 Swords Bypass.

1.11.3.9 Business and Industrial Parks/Areas

Owing to the urban characteristics of Study Areas A and B within the Dublin City local authority area, there are few business parks or industrial areas within this study area. The Dublin City Development Plan 2016-2022 states that due to the potential negative impacts of such areas on residential areas, developments are to be largely confined to the Dublin Port area.

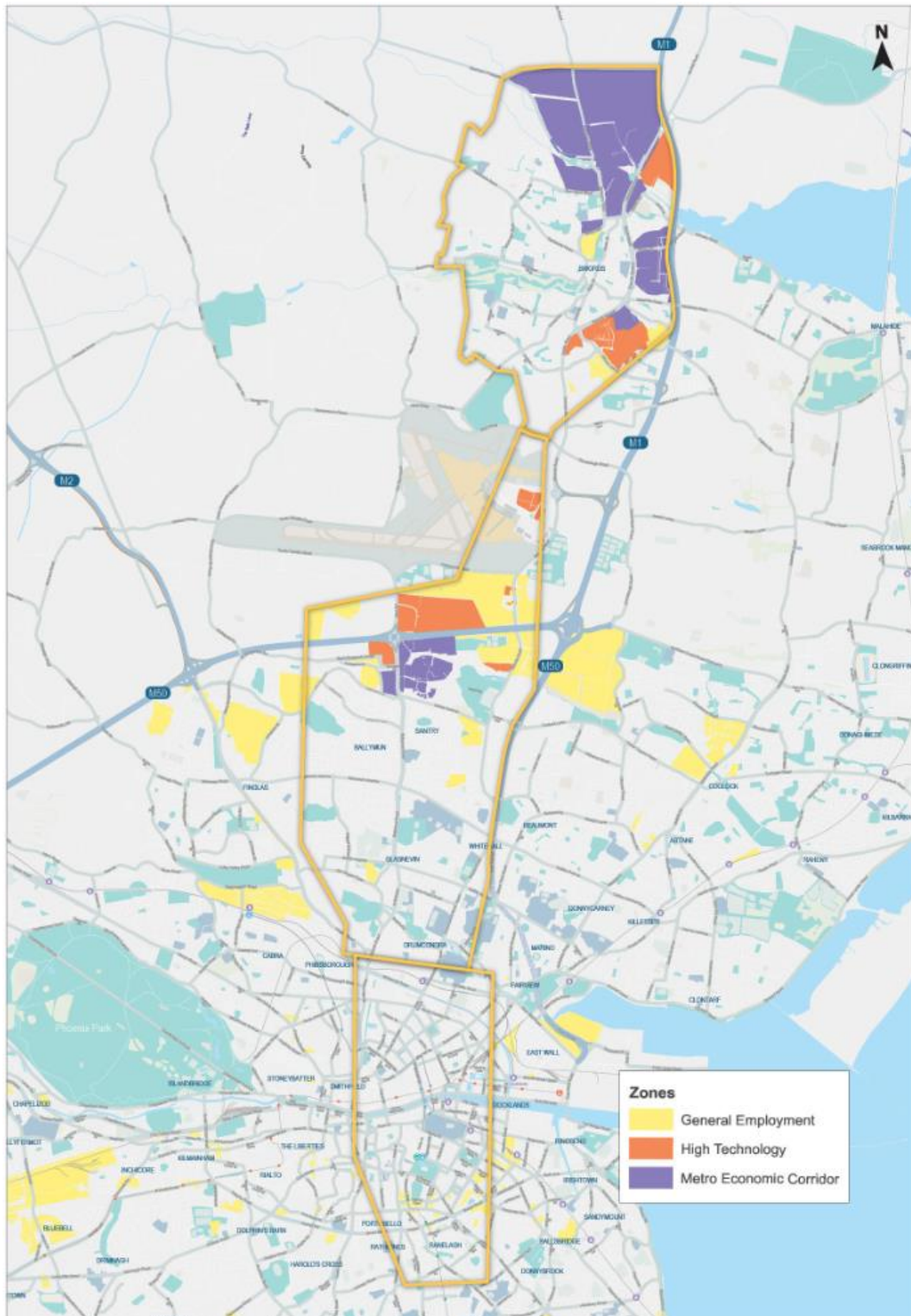
Within the Fingal local authority section of Study Areas B and C, there are a number of major business parks and industrial estates. One cluster is located at Turnapin between Santry Park and the M50, and includes Airways Industrial Estate, Furry Park Industrial Estate, and Dublin Airport Business Park. There are further clusters in the vicinity of Swords, particularly along the R132 Swords Bypass, including Airside Business Park, Swords Business Park, and Swords Business Campus, located from south to north respectively.

A number of areas within the scheme study area have been zoned for the creation of enterprise and the facilitation of employment opportunities. The majority of these areas are within the Fingal section of the scheme study area, but some smaller areas are also located within the Dublin City area. Within the Fingal area, certain areas have also been zoned for high technology manufacturing, and other areas have been designated as part of the Metro Economic Corridor. The latter aims to provide high density mixed-use development, which will provide employment generation and facilitate commercial activity. A map of these zones is presented in **Figure 1.11.12**.

1.11.3.10 Dublin Airport

Dublin Airport is included within the scheme study area. It is located in Collinstown approximately 10km north of Dublin City centre and catered for nearly 28 million passengers in 2016. The airport incorporates many commercial properties belonging to numerous airline companies, hangars and general operation buildings on site. The proposed Ground Transportation at Dublin Airport is to be considered a fixed point on the alignment and NMN will run underground at Dublin Airport.

Figure 1.11.12: Lands zoned for employment and enterprise (Dublin City Development Plan 2016-2022 and Fingal Development Plan 2017-2023)



1.11.3.10.1 Agriculture

Agricultural Land

Approximately 14% of the scheme study area comprises agricultural land.

In Study Area A, there is no agricultural land. Study Area B comprises 7.5% agricultural land, east of the R108 and immediately south of the airport. Study Area C comprises 31% agricultural land, north of Dublin Airport. Volume 4C **Figures 1.11.13** and **1.11.14** shows agricultural lands within the scheme study area.

1.11.4 Summary

The constraints study for material assets (non-agriculture) within the scheme study area reviews the following:

- Major utilities and services;
- Existing heavy rail and light rail;
- Cultural heritage areas;
- Residential, educational and healthcare properties;
- Community and related centres;
- Retail properties;
- Business and Industrial Parks; and
- Dublin Airport.

The constraints study for material assets (agriculture) within the scheme study area is summarised as follows:

- The vast majority of the scheme study area is urban/suburban in nature, with small areas of agricultural land in Study Areas B and C.

1.11.5 References

Central Statistics Office. (2010) *Census of Agriculture 2010*.

Dublin City Council. *Dublin City Development Plan 2016-2022*.

Environmental Protection Agency. (EPA) Soil Mapping Data (Data set 2013). Available from: (<http://gis.epa.ie/GetData/Download>)

Fingal County Council. *Fingal Development Plan 2017 - 2023*.

1.12 Air Quality

1.12.1 Introduction

This section describes the air quality constraints identified within the scheme study area for the NMN Project.

Section 1.12.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.12.3** describes the existing environment within the scheme study area. A summary is presented in **Section 1.12.4** and references are listed in **Section 1.12.5**.

The main constraints associated with air quality are the number of sensitive locations in the scheme study area and the baseline air quality relative to limit values.

It is expected that the main air quality impacts due to the proposed NMN Project will occur during the construction phase. The NMN Project is expected to have a positive impact on air quality during the operational phase by encouraging a modal shift away from private car. It is proposed that the NMN trains will be powered by electricity.

1.12.2 Methodology and Sources of Information

1.12.2.1 Methodology

The air quality assessment has been prepared in accordance with the Transport Infrastructure Ireland *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes, NRA, 2011*.

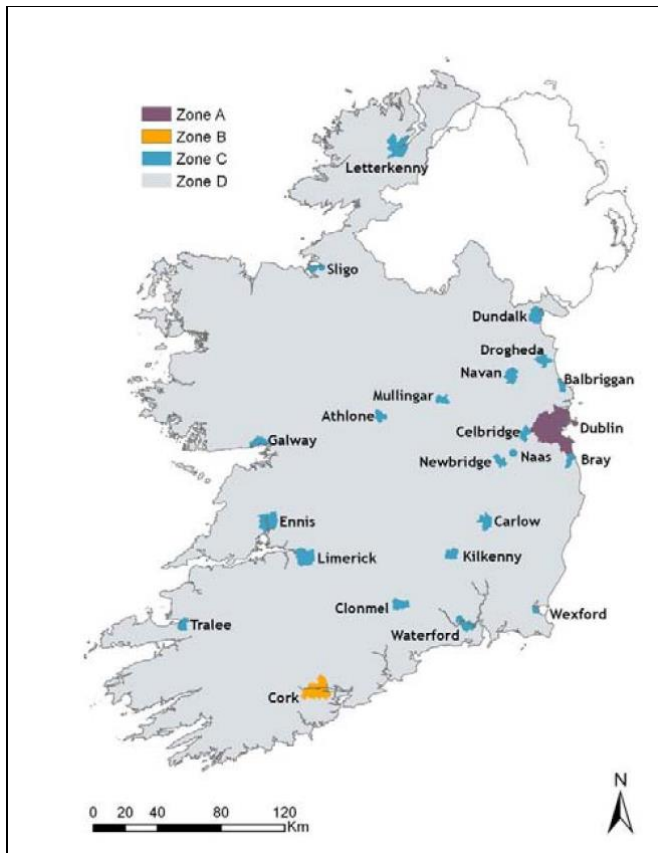
The following three stages are followed for this assessment:

- Identify sensitive receptor locations within the scheme study area;
- Describe existing local air quality conditions within the study corridor and identify any areas where the standards are exceeded; and
- Describe any non-road sources that may significantly affect air quality within the study corridor, for example, industry, ports, areas of domestic solid fuel combustion, or power stations.

Sensitive receptor locations are defined in the guidelines as residential housing, schools, hospitals, places of worship, sport centres and shopping areas, i.e. locations where members of the public are likely to be regularly present. Designated habitats are also potentially sensitive receptors. Such sites include, Natural Heritage Areas (NHA), Special Areas of Conservation (SAC), Special Protection Areas (SPA), National Parks, Nature Reserves, Refuges for Fauna, Refuges for Flora, Wildfowl Sanctuaries, Ramsar Sites, Biogenetic Reserves and UNESCO Biosphere Reserves.

1.12.2.2 Sources of Information

The existing air quality is determined from air quality data recorded by the EPA in Zone A. Zone A is defined under the Air Quality Standards Regulations (S.I. No. 180 of 2011) as Agglomeration A — Dublin Conurbation, as shown in **Figure 1.12.1**. The NMN scheme study area is located within Zone A.

Figure 1.12.1: Location of Zone A

Air Quality Standards

The ambient air quality is compared to limits provided in the Air Quality Standards Regulations 2011 (S.I. No. 180 of 2011), refer to **Table 1.12.1**.

Table 1.12.1: Air Quality Standards (AQS) from Regulations 2011 (S.I No. 180 of 2011)

Pollutant	Limit value for the protection of:	Averaging period	Limit value ($\mu\text{g}/\text{m}^3$)	Basis of application of limit value	Limit value attainment date
NO ₂	Human Health	1-hour	200	≤18 exceedances p.a. (99.79%ile)	1 January 2010
		Calendar year	40	Annual mean	1 January 2010
NO _x	Vegetation	Calendar year	30	Annual mean	1 January 2010
PM ₁₀	Human Health	24-hours	50	≤35 exceedances p.a. (98.1%ile)	1 January 2005
		Calendar year	40	Annual mean	1 January 2005
PM _{2.5}	Human Health	Calendar year	20	Annual mean	1 January 2020
CO	Human Health	8-hour annual average	10,000	8-hour Average	1 January 2005
Benzene	Human Health	Calendar year	5	Annual mean	1 January 2010

The Environmental Protection Agency (EPA) is responsible for compiling Ireland's annual greenhouse gas emission inventories and projections. This allows the Government to assess progress in terms of meeting key targets and to inform policy development in terms of developing appropriate mitigation measures. Published data from the EPA is used in this study to determine the baseline climate.

1.12.3 Existing Environment

1.12.3.1 Sensitive Areas

The land use of the scheme study area of the NMN Project varies significantly. Study Area A, located in the city centre consists of high density urban commercial and residential zones in addition to a significant number of schools and churches and some, universities and hospitals. Outside the city centre and in the suburbs, the land uses are less dense with residential and associated support facilities.

1.12.3.2 Baseline Air Quality

The existing air quality is determined through the review of EPA air quality monitoring data in Zone A. Station locations include Winetavern Street, Coleraine Street, Rathmines, Dun Laoghaire, Ballyfermot, Blanchardstown, St. Ann's Park and Swords.

Monitoring data for the pollutants NO₂, NO_x, PM₁₀, PM_{2.5}, benzene and carbon monoxide is presented in **Table 1.12.2**.

Concentrations of each pollutant recorded in Zone A are averaged to represent typical background levels for the most recent available years, 2015, 2014 and 2013. Average concentrations were obtained from all stations where 90% data capture was achieved. This is in accordance with the air quality standards which specifies that any site used for assessment purposes must comply with 90% data capture.

Table 1.12.2: Annual Average Pollutant Concentration 2013 - 2015 for Zone A

Pollutant / Year	NO ₂ (µg/m ³)	NO _x (µg/m ³)	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	CO (mg/m ³)	Benzene (µg/m ³)
2013	19.6	34.3	10.3	17.6	0.33	0.94
2014	20.4	35.9	8.3	14.2	0.30	0.94
2015	19.8	33.6	8.8	14.3	0.20	0.92
Average	19.9	34.6	9.1	15.4	0.28	0.93

Pollutant / Year	NO ₂ (µg/m ³)	NO _x (µg/m ³)	PM _{2.5} (µg/m ³)	PM ₁₀ (µg/m ³)	CO (mg/m ³)	Benzene (µg/m ³)
Air Quality Standard	40	30	20	40	10	5

The air quality recorded in Zone A by the EPA is shown to be well within air quality standards for related pollutants NO₂, PM₁₀, PM_{2.5}, benzene and carbon monoxide. Levels of NO_x are found to exceed the Air Quality Standard (AQS) of 30 µg/m³. However, this limit for the protection of vegetation and natural ecosystems only applies more than 20km away from agglomerations and is therefore not applicable in this case for the NMN Project.

1.12.3.3 Licensed Facilities within the Scheme Study Area

Table 1.12.3 provides details of the facilities licensed by the EPA in the scheme study area. Emissions to air from these facilities are regulated by EPA licence.

Table 1.12.3: Licensed facilities in the scheme study area

Licence Number	Licensee Name	License Type ¹
P0301-04	Diageo Ireland	IE
P0468-01	Everlac Paints Limited	IPC
P0345-01	Brooks Thomas Limited	IPC
P0537-01	Rentsch Dublin Limited	IPC
P0212-01	Lithographic Universal Limited	IPC
P0306-03	Forest Laboratories Ireland Limited	IPC
P0480-02	Dublin Aerospace Limited	IE
P0921-01	Eirtech aviation Limited	IPC
P0189-01	AIBP Limited t/a AIBP Dublin	IPC
P0014-04	Swords Laboratories	IE
P0060-01	Arch Chemicals BV	IE
P0075-03	Burgess Galvin and Company Limited	IPC
W0083-01	Dempsey Drums Limited	Waste
W0035-01	Pipe and Drain Services Limited	Waste
W0042-01	Dean Waste Company Limited	Waste
W0097-01	Swalcliffe Limited	Waste

¹ IE - Industrial Emissions License

IPC - Integrated Pollution Control Licence

1.12.4 Summary and Conclusions

The air quality in Zone A, which encompasses the entirety of the study area for NMN, is monitored by the EPA and shows that pollutant concentrations are well within air quality standards, where applicable. The scheme study area comprises of high density commercial and residential uses, particularly in the city centre area. Applicable air quality standards are compiled within the Dublin Agglomeration.

The proposed NMN Project is expected to have a positive impact on air quality by encouraging a modal shift away from private car. It is proposed that the NMN trains will be powered by electricity.

During the construction phase, there is the potential for significant impacts due to the generation of dust and particulate matter. Air quality monitoring will be carried out to ensure compliance with relevant limit values. Measures will be implemented in accordance with the Procedure for the Control of Aspergillosis during Construction/Renovation Activities, HSE 2004 to minimise the increased incidence of invasive aspergillosis among immunosuppressed patients.

1.12.5 References

National Roads Authority. (2011) *Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes*.

Environmental Protection Agency. (2016) *Air Quality in Ireland 2015*.

Environmental Protection Agency. (2015) *Air Quality in Ireland 2014*.

Environmental Protection Agency. (2014) *Air Quality in Ireland 2013*.

SI No. 180 of 2011. *Air Quality Standards Regulations 2011*.

1.13 Climate

1.13.1 Introduction

This section describes the climate constraints identified within the scheme study area for the NMN Project.

Section 1.13.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.13.3** describes the existing environment within the scheme study area. A summary is presented in **Section 1.13.4** and references are listed in **Section 1.13.5**.

There is the potential for climate impacts due to the proposed NMN Project to occur during the construction phase due to carbon emissions from the transportation of materials, use of plant and equipment and the manufacture of construction materials. During the operational phase, the NMN Project is expected to have a positive impact on climate by encouraging a modal shift away from private car. It is proposed that the NMN trains will be powered by electricity. The generation of this electricity will result in carbon emissions.

1.13.2 Methodology and Sources of Information

1.13.2.1 Methodology

The Environmental Protection Agency (EPA) is responsible for compiling Ireland's annual greenhouse gas emission inventories and projections. This allows the Government to assess progress in terms of meeting key targets and to inform policy development in terms of developing appropriate mitigation measures. Published data from the EPA provided in '*Ireland's Greenhouse Gas Emission Projections 2016 - 2035*' is used in this study to determine the baseline climate.

1.13.2.2 Sources of Information

- Ireland's Greenhouse Gas Emission Projections 2016 – 2035 (Environmental Protection Agency, 2016)

1.13.3 Existing Environment

In April 2017, the EPA reported in '*Ireland's Greenhouse Gas Emission Projections 2016 - 2035*' that Ireland will not meet its 2020 EU greenhouse gas emission reduction targets with the current range of policy measures. Ireland's EU target for 2020 is to reduce greenhouse gas emissions from the non-Emissions Trading Scheme (non-ETS) sector by 20% on 2005 levels. The non-ETS sector covers emissions from agriculture, transport, residential, commercial, non-energy intensive industry and waste sectors.

Transport emissions are projected to show strong growth over the period to 2020 with a 10 – 12% increase on 2015 levels.

1.13.4 Summary and Conclusions

As reported by the EPA, Ireland will not meet its 2020 EU greenhouse gas emission targets. More stringent targets will be set at EU level for 2030.

The National Mitigation Plan published by the Department of Communications, Climate Action and Environment in July 2017 contains a suite of measures to reduce emissions in transport with a particular focus on smarter travel and modal shift.

The proposed NMN Project is expected to have a positive impact on climate by encouraging a modal shift away from private car.

1.13.5 References

Environmental Protection Agency. (2017). *Ireland's Greenhouse Gas Emission Projections 2016 - 2035*.

1.14 Noise, Groundborne Noise and Vibration

1.14.1 Introduction

This section identifies the noise, groundborne noise and vibration constraints within the scheme study area for the NMN Project.

Section 1.14.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.14.3** describes the existing environment within the scheme study area. A summary is presented in **Section 1.14.4** and references are listed in **Section 1.14.5**.

The main constraints associated with noise, groundborne noise and vibration are the number of sensitive locations in the scheme study area and the baseline noise, groundborne noise and vibration environment relative to limit values.

It is expected that the main noise, groundborne noise and vibration impacts due to the proposed NMN Project will occur during the construction phase. Regionally, the NMN Project is expected to have a positive impact on noise during the operational phase by encouraging a modal shift away from private car. However, at a local level, there is the potential for noise and vibration impacts to occur when the proposed rail line is overground and for groundborne noise and vibration effects when the rail line is underground, during the operational phase.

1.14.2 Methodology and Sources of Information

1.14.2.1 Methodology

The constraints study has been prepared in accordance with the following guidelines:

- National Roads Authority Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes – 2014; and
- National Roads Authority Guidelines for the Treatment of Noise during the Planning of National Road Schemes – 2004.
- The Association of Noise Consultants Guidelines 'Measurement & Assessment of Groundborne Noise & Vibration – 2012'

The study consisted of a desk-top study using published data.

The specific objective of the noise constraints study is to identify any receptors that may be deemed to be particularly sensitive to noise, groundborne noise and/or vibration. Examples of sensitive receptors include housing, schools, colleges, hospitals, places of worship, heritage buildings, special habitats, amenity areas in common use and designated quiet areas.

Some commercial or industrial uses can also be noise, groundborne noise and vibration sensitive, for example noise recording studios and research or manufacturing facilities using noise or vibration-sensitive equipment.

1.14.2.2 Sources of Information

The Dublin Agglomeration Environmental Noise Action Plan 2013-2018 (Dublin City Council, Dún Laoghaire Rathdown County Council, Fingal County Council, and South Dublin County Council) introduces the thresholds for desirable low and undesirable high sound levels as outlined in **Table 1.14.1**.

Table 1.14.1: Desirable low and undesirable high sound levels

	Lday	Lnight
Desirable Low Sound levels	< 55 dB(A)	< 50 dB(A)
Undesirable High Sound levels	> 70 dB(A)	> 55 dB(A)

1.14.3 Existing Environment

1.14.3.1 Identification of Noise, Groundborne Noise and/or Vibration Sensitive Receptors

The scheme study area was examined to identify the distribution of noise, groundborne noise and/or vibration sensitive receptors and to determine the presence, if any, of significant constraints relating to noise or vibration.

Noise sensitive areas were grouped into the following categories:

- Education establishments (crèches, primary schools, secondary schools, colleges and university buildings);
- Hospitals (including nursing homes);
- Amenity areas (racecourses, golf clubs, sports grounds, etc.);
- Theatres and recording studios;
- Monuments and historic buildings;
- Religious buildings; and
- Residential areas.

It is important to note that the presence of the noise, groundborne noise and vibration sensitive receptors listed above is not necessarily considered to be a strict constraint, which would prevent the development of a route option in close proximity to them. The intention of the development of NMN is to provide a transport link in proximity to residential areas and locations where people may wish to visit.

1.14.3.2 Existing Noise Environment

The Dublin Agglomeration Environmental Noise Action Plan 2013-2018 provides exposure levels for Dublin City and Fingal areas, the jurisdictions that cover the scheme study area.

Table 1.14.2 sets out the population exposure levels from traffic sources on all roads in the Dublin City Council area. 54% of the population in this area fall within the daytime desirable low sound level bands with 5% falling within the undesirable high sound level bands. 69% of the population in this area fall within the night-time desirable low sound level bands with 23% falling within the undesirable high sound level bands at night.

Table 1.14.2: Noise exposure levels from all roads in the Dublin City Council area

Decibels dB(A)	L _{day} People exposed (%)	L _{night} People exposed (%)
< 50	5	69
50-54	49	7
55-59	19	13
60-64	9	9
65-69	14	1
70-74	5	0
> 75	0	0

Table 1.14.3 sets out the population exposure to sound from traffic sources on all roads in the Fingal County Council Area. 82% of the population in this area falls within the daytime desirable low sound level bands with 0% falling within the undesirable high sound level bands. 84% of the population in this area fall within the night-time desirable low sound level bands with 7% falling within the undesirable high sound level bands at night.

Table 1.14.3: Noise exposure levels from all roads in the Fingal County Council area

Decibels dB(A)	L _{day} People exposed (%)	L _{night} People exposed (%)
< 50	36	84
50-54	46	9
55-59	10	5
60-64	7	1
65-69	2	1
70-74	0	0
> 75	0	0

In addition, the Noise Plan provides noise exposure levels from all rail sources in Dublin. These results are provided in **Table 1.14.4**. 98% of the population in this area fall within the daytime desirable low sound level bands with 0% falling within the undesirable high sound level bands. 99% of the population in this area fall within the night-time desirable low sound level bands with 0% falling within the undesirable high sound level bands at night

Table 1.14.4: Noise exposure levels from all rail sources in Dublin

Decibels dB(A)	L _{day} People exposed (%)	L _{night} People exposed (%)
< 50	97	99
50-54	1	1
55-59	1	0
60-64	0	0
65-69	0	0
70-74	0	0
> 75	0	0

The Noise Plan also provides noise exposure levels from aircraft at Dublin Airport which is located within the scheme study area. These levels are provided in **Table 1.14.5**.

Table 1.14.5: Noise exposure levels from aircraft – Dublin Agglomeration 2012

Decibels dB(A)	L _{day} Households exposed (%)	L _{night} Households exposed (%)
< 50	99	100
50-54	1	0
55-59	0	0
60-64	0	0
65-69	0	0
70-74	0	0
> 75	0	0

The noise levels outlined in the Noise Plan are as would be expected in a busy city centre environment.

1.14.4 Summary and Conclusions

The scheme study area consists of high-density urban commercial and residential zones in addition to a significant number of schools and churches and some, universities and hospitals. The existing noise baseline is as expected in a city centre environment.

Regionally, the proposed NMN Project is expected to have a positive impact on noise by encouraging a modal shift away from private car and reducing traffic road noise. However, at a local level, there is the potential for noise, groundborne noise and vibration impacts to occur during the operational phase, when the proposed rail line is overground and for groundborne noise and vibration effects when the rail line is underground.

1.14.5 References

Dublin City Council, Dun Laoghaire Rathdown County Council, Fingal County Council, and South Dublin County Council. (2013) *The Dublin Agglomeration Environmental Noise Action Plan 2013-2018*.

National Roads Authority. (2013) *Good Practice Guidance for the Treatment of Noise during the Planning of National Road Schemes*.

National Roads Authority. (2004). *Guidelines for the Treatment of Noise and Vibration in National Road Schemes*.

The Association of Noise Consultants Guidelines (2012) *Measurement & Assessment of Groundborne Noise & Vibration*.

1.15 Population and Human Health

1.15.1 Introduction

This section identifies the constraints relating to Population and Human Health identified within the scheme study area for the NMN Project.

This section can be read in conjunction with **Section 1.11 Material Assets**, **Section 1.12 Air Quality**, **Section 1.13 Climate** and **Section 1.14 Noise, Groundborne Noise and Vibration** that also address constraints in terms of Population and Human Health.

Section 1.15.2 describes the methodologies and sources of information that were used to carry out the study. **Section 1.15.3** describes the existing environment within the scheme study area. A summary is presented in **Section 1.15.5** and references are listed in **Section 1.15.6**.

The purpose of the Population and Human Health constraints study is to identify baseline conditions in terms of population and human health which may be impacted by the introduction of NMN.

Metro routes can have positive impacts by reducing existing levels of severance or environmental impact. Through enhancing accessibility and connectivity, they can supply benefits for social interaction, economic growth, and employment opportunities. A new rail line can provide additional capacity to both the public transport and road networks within a city, improved connections between homes and places of employment, improved interaction with other transport modes, and improved connections to other parts of the country. This would have the effect of reducing journey times, thereby improving quality of life and/or economic competitiveness.

Metro routes could also have potential negative impacts on local communities. For example, if the route is travelling at-grade and segregated through an area, there could be potential obstruction/disturbance to the residents along the route to access local services.

1.15.2 Methodology and Sources of Information

1.15.2.1 Methodology

The Population and Human Health constraints study has been prepared in accordance with the following guidelines:

- EPA Draft Advice Notes for Preparing Environmental Impact Statements (2015); and
- EPA Draft Guidelines on the Information to be contained in Environmental Impact Statements Draft (2017).

The emphasis of this study is understand baseline conditions in the study area in terms of Population and Human Health. In line with the above guidelines, the following characteristics are considered:

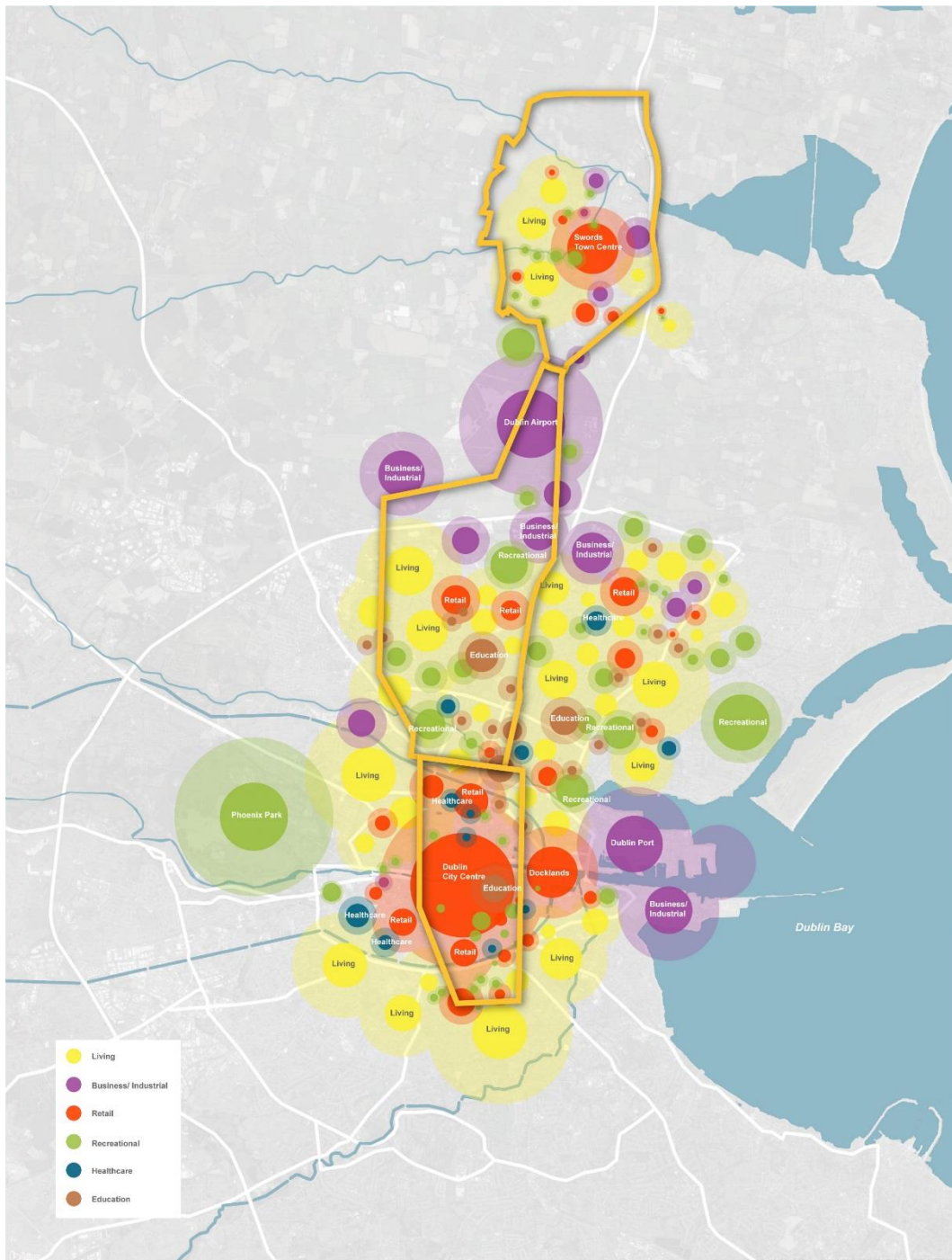
- Population: Numbers, location and density;
- Employment: Location of existing and zoned employment centres;
- Community Facilities: Location of education, healthcare, retail, tourism and amenity;
- Future Land Use: Planned development in the study area;
- Community Severance: Existing severance within the study area; and
- Health and Well Being: Existing health of the population within the study area.

1.15.2.2 Sources of Information

Documents consulted for the development of the constraints include the Dublin City Development Plan 2016-2022, the Fingal Development Plan 2017-2023, statistical data from the Central Statistics Office and various websites relating to economic developments, tourism, amenity and recreation.

1.15.3 Existing Environment

The following section describes the existing environment as regards Population and Human Health, specifically the demographic character of the city, its economy, its amenities and community facilities as shown below in **Figure 1.15.1**.

Figure 1.15.1: Existing Built Environment in Scheme Study Area

1.15.3.1 Population

The populations of Dublin City and Fingal local authority areas were recorded as 554,554 and 296,020 persons respectively in the Census of 2016. The population of both areas has been growing considerably in recent years, with the population of Dublin City increasing by 5.1% from the 2011 Census, and that of Fingal by 8.0%.

Table 1.15.1, Table 1.15.2, and Table 1.15.3 indicate the population of each Electoral Division (ED) in Study Areas A, B, and C respectively as recorded at the time of the most recent Census in 2016. As might be expected, the central areas within Study Area A have especially high population densities. Districts with population densities in excess of 2,000 - 3,000 persons per km² can be regarded as especially urban in character. Almost all areas within Study Area A exceed this threshold, with especially high densities in the area between the River Liffey and the River Tolka. The areas of Dublin City Council within Study Area B are likewise within the urban threshold, with the Ballymun area being particularly densely populated. The areas of Fingal within Study Areas B and C are less densely populated, although Swords is also considered urban. In many, but not all cases, these higher densities coincide with areas of less affluent socio-economic groups or social housing.

Table 1.15.1: Population and population density of Electoral Divisions, Study Area A (2016 Census)

Electoral Division	Local Authority	% Land Area within Study Area	Population (2016)	Population Density (per km ²)
Ballybough A	Dublin City	77.4%	3,718	10,628
Ballybough B	Dublin City	100%	3,698	10,438
Botanic B	Dublin City	8.4%	3,481	7,012
Botanic C	Dublin City	92.5%	2,222	7,331
Drumcondra South A	Dublin City	3.4%	5,064	4,927
Drumcondra South B	Dublin City	67.9%	1,697	4,968
Inns Quay A	Dublin City	98.7%	3,919	12,725
Inns Quay B	Dublin City	76%	3,666	13,258
Inns Quay C	Dublin City	22.5%	2,757	9,710
Mansion House A	Dublin City	99.8%	4,665	7,031
Mansion House B	Dublin City	100%	1,311	2,035
Mountjoy A	Dublin City	100%	5,389	18,186
Mountjoy B	Dublin City	100%	3,963	17,941
North City	Dublin City	100%	5,654	9,919
North Dock A	Dublin City	4.8%	1,365	9,320
North Dock C	Dublin City	71%	4,214	7,020
Pembroke West C	Dublin City	36.1%	4,852	7,234
Rathmines East A	Dublin City	88.9%	4,836	6,946
Rathmines East D	Dublin City	52.3%	2,757	7,779
Rathmines West A	Dublin City	5.7%	5,461	8,285
Rathmines West B	Dublin City	87.5%	3,713	11,222
Rathmines West C	Dublin City	4.2%	2,681	6,302

Electoral Division	Local Authority	% Land Area within Study Area	Population (2016)	Population Density (per km ²)
Rotunda A	Dublin City	100%	5,965	24,057
Rotunda B	Dublin City	100%	2,458	11,783
Royal Exchange A	Dublin City	100%	4,329	9,834
Royal Exchange B	Dublin City	100%	2,082	9,267
Saint Kevin's	Dublin City	97.7%	5,122	8,199
South Dock	Dublin City	28.1%	7,004	6,592
Wood Quay A	Dublin City	63.3%	2,606	14,587
Wood Quay B	Dublin City	10.1%	3,414	11,902

Table 1.15.2: Population and population density of Electoral Divisions, Study Area B (Census 2016)

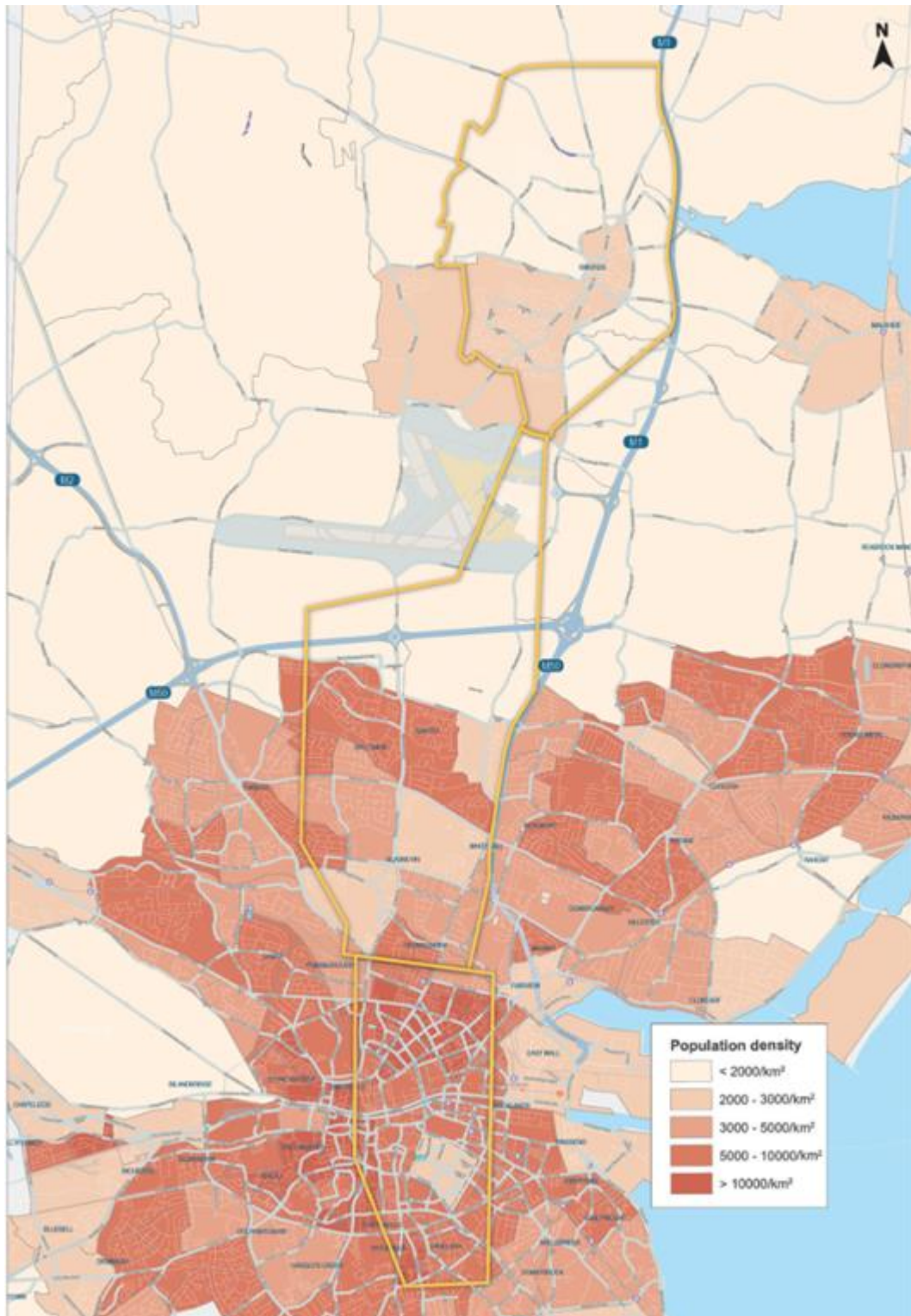
Electoral Division	Local Authority	% Land Area within Study Area	Population (2016)	Population Density (per km ²)
Airport	Fingal	55.1%	5,018	576
Balgriffin	Fingal	2.9%	3,113	300
Ballygall A	Dublin City	1.5%	3,606	7,254
Ballygall B	Dublin City	66.9%	1,887	3,446
Ballygall C	Dublin City	100%	3,521	3,514
Ballygall D	Dublin City	90.9%	2,531	5,942
Ballymun A	Dublin City	61.7%	4,765	5,023
Ballymun B	Dublin City	100%	4,379	6,687
Ballymun C	Dublin City	100%	6,112	7,786
Ballymun D	Dublin City	100%	2,458	5,282
Ballymun E	Dublin City	100%	1,562	4,371
Ballymun F	Dublin City	70.4%	2,350	5,330
Botanic A	Dublin City	77.9%	3,174	2,425
Botanic B	Dublin City	89.9%	3,481	7,012
Cabra East A	Dublin City	3.7%	5,650	3,962
Drumcondra South A	Dublin City	35.9%	5,064	4,927
Drumcondra South B	Dublin City	28.9%	1,697	4,968
Drumcondra South C	Dublin City	100%	3,517	4,723
Dubber	Fingal	8.1%	7,372	409
Turnapin	Fingal	58.6%	1,700	1,803
Whitehall A	Dublin City	100%	3,286	2,491

Electoral Division	Local Authority	% Land Area within Study Area	Population (2016)	Population Density (per km ²)
Whitehall B	Dublin City	99.2%	4,128	5,529
Whitehall C	Dublin City	96.2%	2,153	2,930
Whitehall D	Dublin City	21%	3,456	4,945

Table 1.15.3: Population and population density of Electoral Divisions, Study Area C (Census 2016)

Electoral Division	Local Authority	% Land Area within Study Area	Population (2016)	Population Density (per km ²)
Kinsaley	Fingal	8.3%	9,621	853
Swords-Lissenhall	Fingal	28.5%	10,447	556
Swords-Forrest	Fingal	46.2%	15,153	2,266
Swords-Glasmore	Fingal	40.8%	7,711	1,713
Donabate	Fingal	1.6%	9,399	385
Swords-Seatown	Fingal	41.5%	7,003	1,737
Swords Village	Fingal	100%	2,674	2,923

A map indicating the population densities of Electoral Divisions within the Study Area is presented in **Figure 1.15.2**.

Figure 1.15.2: Population Density for the scheme study area (Census 2016)

1.15.3.2 Enterprise and Employment Centres

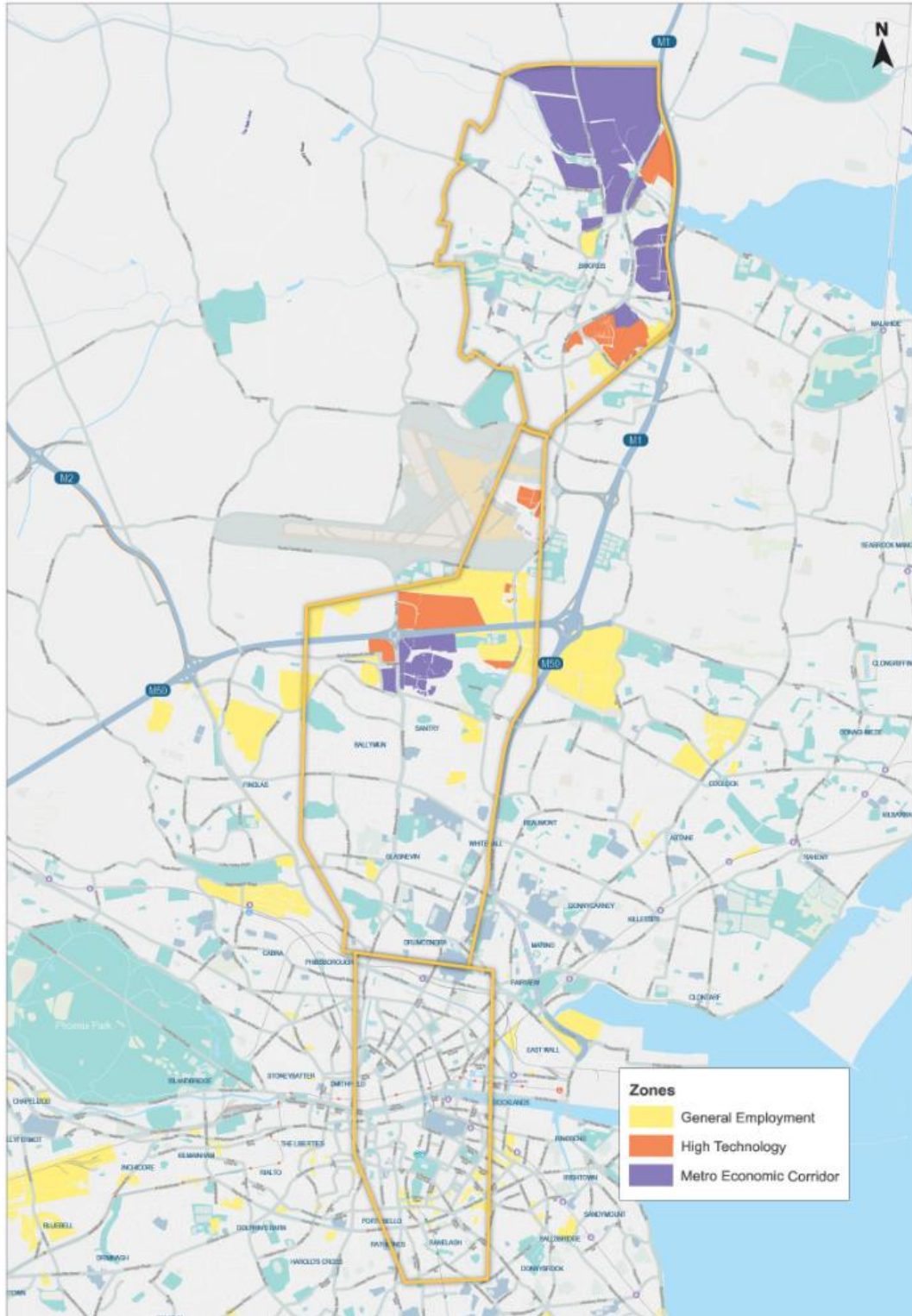
Generally, within Study Areas A and B, there are large numbers of enterprise and employment centres owing to the urban characteristics of these areas.

There are very few business parks or industrial areas within these study areas and the Dublin City Development Plan 2016-2022 states that due to the potential negative impacts of such areas on residential areas, developments are to be largely confined to the Dublin Port area.

Within the Fingal local authority section of Study Areas B and C, there are a number of major business parks and industrial estates. One cluster is located at Turnapin between Santry Park and the M50, and includes Airways Industrial Estate, Furry Park Industrial Estate, and Dublin Airport Business Park. There are further clusters in the vicinity of Swords, particularly along the R132 Swords Bypass, including Airside Business Park, Swords Business Park, and Swords Business Campus, located from south to north respectively.

A number of areas within the scheme study area have been zoned for the creation of enterprise and the facilitation of employment opportunities. The majority of these areas are within the Fingal section of the scheme study area, but some smaller areas are also located within the Dublin City area. Within the Fingal area, certain areas have also been zoned for high technology manufacturing, and other areas have been designated as part of the Metro Economic Corridor. The latter aims to provide high density mixed-use development, which will provide employment generation and facilitate commercial activity. A map illustrating zones of future enterprise and employment opportunities is presented in **Figure 1.15.3**.

Figure 1.15.3: Lands zoned for employment and enterprise (Dublin City Development Plan 2016-2022 and Fingal Development Plan 2017-2023)



1.15.3.3 Community Facilities

Education

Primary and secondary schools are found throughout the scheme study area, with the exception of the area between the M50 and Swords in the vicinity of Dublin Airport. The predominant third level institutions within the study area are Trinity College Dublin, whose main campus is located in Study Area A in the city centre, and Dublin City University, whose main campus is located Study Area B, in the north of the city near Ballymun. A considerable number of smaller third level institutions are also based within the scheme study area, concentrated in Study Area A. The primary, post primary, and third level educational facilities located within the Study Area are listed in **Table 1.15.4**, **Table 1.15.5** and **Table 1.15.6** respectively.

Table 1.15.4: Primary Schools within the scheme study area

Primary Schools		
Central Model Senior School	Ranelagh Multi Denom. NS	Virgin Mary Girls' NS
Central Model Infants' School	Rutland National School	St. Ciaran's Spec Sch
City Quay Boys' NS	Henrietta Street School	Scoil Mobhí
St. Laurence O Toole Junior Boys	St. Mary's Primary School Dorset Street	Scoil an tSeachtar Laoch
Gardiner St Convent	Scoil an Croí Naofa	St. Joseph's Junior
St. Enda's Whitefriar St	St. Patrick's NS	St. Joseph's Senior NS
Nth William St Girls	Glasnevin NS	North Dublin NS Project
Nth William Infants Boys	Drumcondra NS	Gaelscoil Bhaile Munna
Lindsay Road NS Glasnevin	St. Brigid's Convent	Glasnevin Educate Together NS
Laurence O'Toole Senior Boys	St. Columba's Con G & I	Holy Child National School
Scoil Uí Chonaill	Corpus Christi NS	The Old Borough N S
Temple Street Hosp. NS	St. Vincent's Primary School	St. Colmcille's Boys
Synge St CBS	Larkhill Boys NS	St. Colmcille's Girls
Mater School	Ballymun Rd St Michael's House	St. Cronan's NS
An t-Aonad Réamhscoil	Bantiarna na mBuanna BNS	St. Cronan's Senior NS
Catherine McAuley NS	Bantiarna na mBuanna GNS	Holy Family Junior NS
St. L O'Tooles 2 Spec	Holy Spirit BNS	Holy Family Senior NS
Scoil Chaoimhín	Holy Spirit GNS	Gaelscoil Brian Bóroimhe
Scoil Chaitríona Baggot Street	Our Lady of Victories Infant NS	Swords Educate Together NS
Gaelscoil Choláiste Mhuire	SN na Maighdine Muire B	Thornleigh Educate Together National School

Table 1.15.5: Post-Primary Schools within the scheme study area

Post Primary Schools		
O'Connell School	Larkin Community College	Plunket College
Christian Brothers, Syngé St.	St. Vincent's CBS Glasnevin	Clonturk College
CBS Westland Row	St. Aidan's CBS	Trinity Comprehensive School
Belvedere College SJ	St. Kevin's College	Coláiste Choilm
Catholic University School	Dominican College	Loreto College
Loreto College	Scoil Chaitríona	St. Finian's Community College
Mount Carmel Secondary School	St. Mary's Secondary School	Fingal Community College

Table 1.15.6: Third Level Institutions within the scheme study area

Third Level Institutions		
DIT, Kevin Street Campus	Trinity College Dublin	ICD Business School
DIT, Bolton Street Campus	American College	Portobello Institute
Royal Irish Academy of Music	College of Computing Technology	Church of Ireland College of Education
Dublin Institute for Advanced Studies	Dublin Business School	St. Patrick's College
Mater Dei Institute	Dorset College	Dublin City University
Royal College of Surgeons Ireland		

Healthcare

A large number of healthcare facilities are located within the scheme study area, including **12** hospitals, **8** health centres, **19** nursing homes, and **138** general practices. The hospitals are mainly located in Study Area A, nursing homes are mainly in Study Area B, whilst the other facilities are fairly evenly spread. The hospitals, health centres, and nursing homes within the study are presented in **Table 1.15.7**, **Table 1.15.8** and **Table 1.15.9** respectively.

Table 1.15.7: Hospitals within the scheme study area

Hospitals		
The Highfield Hospital Group	National Maternity Hospital	Royal Victoria Eye and Ear Hospital
Dublin Dental School and Hospital	Rotunda Hospital	Temple Street Children's University Hospital
Royal Victoria Eye and Ear Hospital	The Royal Hospital Donnybrook	Bon Secours Hospital
Mater Private Hospital	Mater Misericordiae Hospital	

Table 1.15.8: Health Centres within the scheme study area

Health Centres		
Ballymun Health Centre	Larkhill Health Centre	North Strand Health Centre
Summerhill Health Centre	Swords Health Centre	Baggot Street Health Centre
Millmount Health Centre	Ranelagh Primary Care Centre	

Table 1.15.9: Nursing Homes within the scheme study area

Nursing Homes		
Alzheimer Care Centre	Fold Ireland Anam Cara Housing with Care	Shrewsbury House Nursing Home
Beneavin House	Leeson Park House Nursing Home	St. Clare's Home
Beneavin Lodge	Marian House	St. Monica's Nursing Home
Cara Care Centre	Northbrook Nursing Home	St. Pappin's Nursing Home
Clarehaven Home	Queen of Peace Centre	TLC Centre Santry
Elmhurst Nursing Home	Seanchara Community Unit	Tara Winthrop Private Clinic
Fingal House Nursing Home		

Community and Related Centres

A considerable number of community centres, recreational centres, and parish halls are located within Study Area A and are especially prevalent in the North Inner City area, although some are also located to the south of Study Area A, such as Rathmines Parish Hall and Charlemont Community Centre. The community centres in Study Area B are concentrated in the Ballymun and Santry area, with Fr. Maloney Hall on Drapier Road in Ballygall, an outlying facility. Three community centres are located in Study Area C, all within the environs of Swords, namely Applewood Community Centre to the northwest, Holywell Community Centre to the southeast, and Rivervalley Community Centre to the southwest.

Retail

The major retail area in the scheme study Area is the Central Shopping Area in central Dublin, which is focused on Grafton Street to the south of the River Liffey, and Henry Street to the north. This area takes up a large proportion of Study Area A. Study Area B has a more suburban character, with small-scale retail centred on a number of neighbourhood centres. There are a number of larger retail outlets within this zone, including Omni Park Shopping Centre and IKEA. Study Area C is dominated by the Swords core retail area, which consists of Main Street in Swords together with the Pavilions Shopping Centre adjacent to the R132 Swords Bypass.

Tourism

Most tourist activity is focused on central areas of Dublin City within Study Area A.

In addition, Dublin Airport, within Study Area B, is the major international gateway for visitors to Ireland, with 27.9 million passengers travelling through the airport in 2016. Dublin is Ireland's primary tourist destination, with 5.7 million overseas visitors in 2016, and the city also serves as a gateway to the rest of the country through its nationwide rail and bus connections. The city is home to numerous attractions, including art galleries, museums, historic locations, visitor centres, major sporting events, parks, and a vibrant nightlife. In Study Area C, Swords contains the historic attractions of a castle and round tower. Within the city annually numerous festivals are held which attract large numbers of visitors, examples of which include the St. Patrick's Day parade, the Dublin Horse Show, and the Dublin Writer's Festival.

Amenities

Numerous areas within the scheme study area facilitate amenity and recreation. Despite being a dense urban area, Study Area A has a significant amount of green space, including a number of parks such as St. Stephen's Green, Merrion Square, and Iveagh Gardens. Three major watercourses pass through the area, namely the Grand Canal, the River Liffey, and the Royal Canal, with significant stretches of greenway along both canals making these attractive for pedestrians and cyclists. Croke Park, which is the largest stadium in the country and the venue for numerous GAA games and concerts throughout the year, is also located in the northern part of Study Area A adjacent to the Royal Canal.

Within Study Area B, there are also considerable spaces for amenity. These include Griffith Park and Botanic Gardens along the River Tolka to the south, with Johnstown Park, Albert College Park, Poppintree Park, and Santry Demesne further north. A number of significant sporting facilities are located within this area, including the Morton Stadium athletics facilities, the DCU Sports Campus, Sportslink, and ALSAA, the latter of which is located to the north of the M50 next to Dublin Airport.

The major area of amenity within Study Area C is Ward River Valley Park, located just southwest of the centre of Swords. It is envisioned in the Fingal Development Plan 2017-2023 that a similarly large park will be developed along the Broadmeadow River Valley to the north, which will in turn, link to the circa 65 hectares of Swords Regional Park to the west of the town.

1.15.4 Future Land Use

Both Dublin City Council and Fingal Development Plans emphasise the promotion and facilitation of NMN through planning policy. Although little of the section of the scheme study area within the Dublin City local authority area is undeveloped, two Local Area Plans (LAPs) are within the study area, namely the George's Quay LAP 2012 and the Ballymun Draft LAP 2017. The former seeks to deliver a mixed-use office and residential area, in particular creating a regenerated street block at Hawkins Street to provide an interesting and attractive setting for College Green. The Ballymun Draft LAP seeks to coordinate development on key sites with improvements to infrastructure among other aspects and NMN is an essential tool in achieving the aims of the draft LAP.

While the draft LAP fully supports the metro route, it seeks to have any metro routed underground to avoid segregation of east and west Ballymun.

Study Areas B and C, within the Fingal local authority area contains more considerable areas of undeveloped lands, and there are thus a higher number of LAPs within this part of the scheme study Area. The Fingal Development Plan 2017-2023 has zoned 390 hectares of land as part of a dedicated Metro Economic Corridor (ME), which aims to provide high density commercial and residential development focused on the Metro corridor to maximise the potential of the infrastructure. Within the lifetime of the Development Plan, it is intended to prepare a LAP at Lissenhall and a number of Masterplans for ME zoned lands located at Estuary West, Estuary Central and Estuary East, Northwood, Seatown North and Seatown South, and Watery Lane. A number of LAPs and masterplans have already been adopted along this corridor, namely:

- Barrysparks LAP (2011), consisting of 10 hectares of lands to the southeast of Swords adjacent to the R132, which is to become a high-density mixed use development including retail, office, and residential uses;
- Fosterstown LAP (2010), consisting of 13 hectares of lands to the south of Swords adjacent to the R132, which is to become a high-density residential area with an average net density of 80 - 90 units per hectare;
- Dublin Airport Central Masterplan (2016), consisting of 300,000m² of high quality office development on existing non-operational lands adjacent to the Ground Transport Centre; and
- Dardistown LAP (2013), consisting of 154 hectares between the M50 and Dublin Airport, with a capacity of 733,050m² to 1,201,069m² of mixed use development focused on research and development and high technology manufacturing.

These LAPs have been developed around the provision of NMN, and the majority of development in these areas is directly linked to its implementation.

1.15.4.1 Community Severance

The urban character of Study Areas A and B in particular mean that severance is not an issue of concern for the majority of areas. There is a high degree of permeability for pedestrians and cyclists throughout these areas, although some examples of severance can be seen to the north due to the M50 and the R132 Swords Bypass. The absence of residential areas to the immediate north of the M50 means that its impact is not particularly acute, whereas the R132 Swords Bypass divides a number of residential areas and employment centres on one side from the centre of Swords on the other. The lack of footpaths along the route, the wide road layout punctuated with large roundabouts, and the absence of crossing points with the exception of a number of footbridges combine to cause considerable difficulty for pedestrians and cyclists seeking to cross from one side to the other.

Ballymun previously suffered from severance as a result of the R108 dual carriageway dividing the area east and west, with the only connection point provided by pedestrian underpasses beneath a large roundabout in the centre of the area. A major redevelopment scheme in the early 2000s helped to redress this severance by eliminating the roundabout, converting the dual carriageway to a traffic calmed main street with numerous pedestrian crossings, flanked by residential apartments over retail units. An at-grade route option for NMN through the centre of Ballymun would require restrictions to movement of pedestrians and traffic between the east and west sides of Ballymun, and would thus have potential to reintroduce the issues with severance that were addressed in the redevelopment of the area.

1.15.4.2 Health and Wellbeing

The 2016 Census asked respondents to indicate their general health, allowing the level of health and wellbeing of the population within the scheme study area to be assessed. The levels were on a five-point scale, ranging from ‘Very Good’ at one end to ‘Very Bad’ at the other. The general health characteristics of each Study Area are presented in **Table 1.15.10**.

Table 1.15.10: General Health of Population by Study Area (Census 2016)

Study Area	Very Good	Good	Fair	Bad	Very Bad
A	58.5%	31.1%	8.3%	1.7%	0.4%
B	58.5%	29.5%	9.7%	1.9%	0.4%
C	63.3%	29.0%	6.5%	1.1%	0.2%

Around 90% of the population within the scheme study area are in ‘Very Good’ or ‘Good’ health, with the remainder being mostly in ‘Fair’ health. Those living in Study Area C tend to be in slightly better health than the other Study Areas, although the variation is small. The Electoral Divisions with the best general health levels included Rathmines and Pembroke, whereas lower levels of general health were reported in Electoral Divisions such as Ballymun and Ballygall.

1.15.5 Summary

As the scheme study area encompasses a large section of Dublin, which is the principal urban area in Ireland, there are inevitably a large number of community facilities, areas of employment, and residential areas located within. Some of these are concentrated in dense urban areas, especially within Study Area A. Others are focused on distinct neighbourhood centres or as individual premises within suburban areas, as is largely the case in Study Areas B and C. In addition, there are considerable areas of open space used for amenity and sports.

In terms of future land use, there are several land banks within the study area which are zoned for development and when developed would introduce additional population, employment opportunities and community facilities. It is worth noting that a number of the local area plans are directly linked to the development of the metro.

In terms of human health, the existing health of residents within the study area is seen to be consistent throughout the study area.

This Population and Human Health constraints study can be read in conjunction with **Section 1.11 Material Assets**, **Section 1.12 Air Quality**, **Section 1.13 Climate** and **Section 1.14 Noise, Groundborne Noise and Vibration** that also address constraints in terms of Population and Human Health.

1.15.6 References

Central Statistics Office, Census 2016.

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