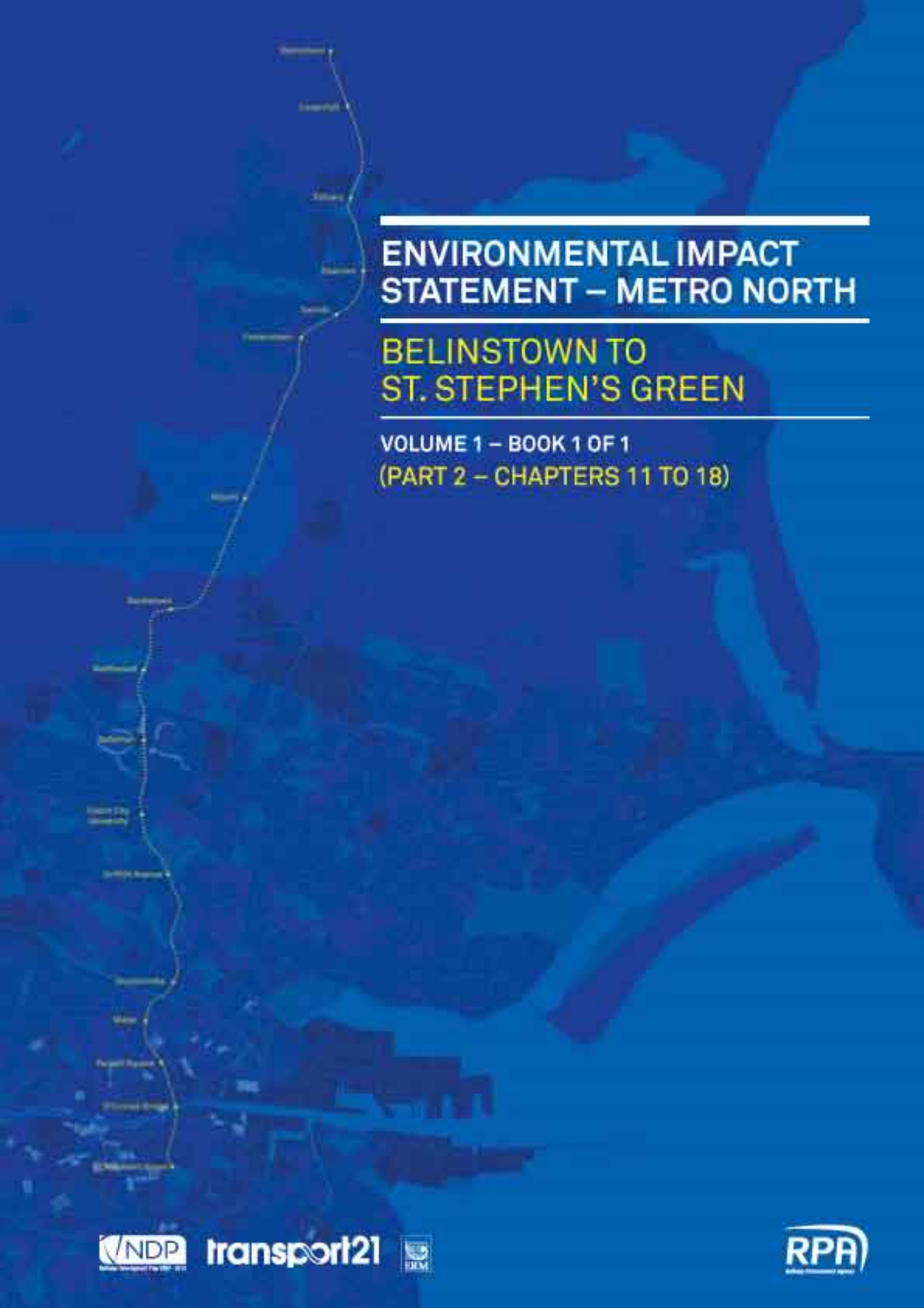
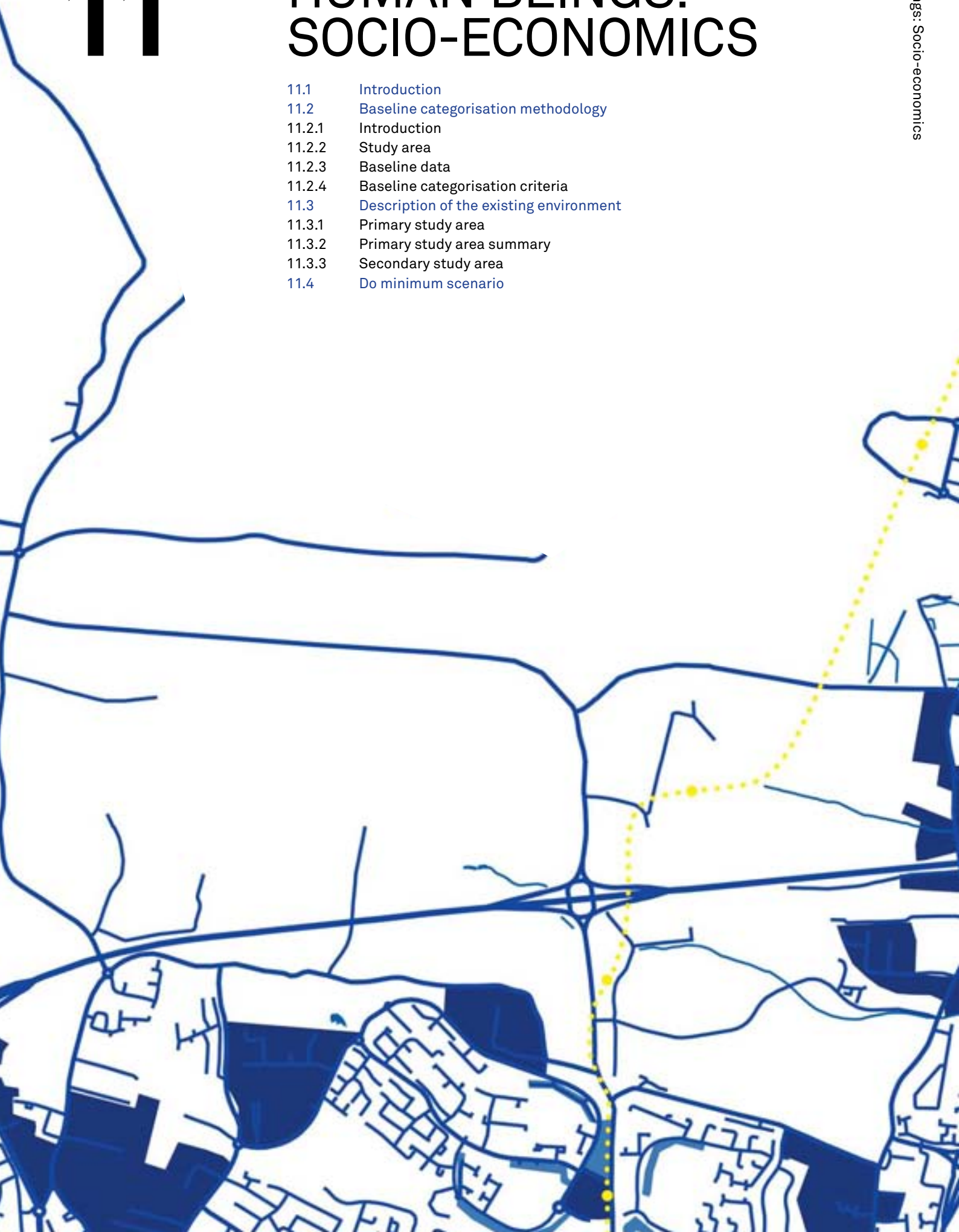


ENVIRONMENTAL IMPACT STATEMENT – METRO NORTH

BELINSTOWN TO ST. STEPHEN'S GREEN

VOLUME 1 – BOOK 1 OF 1
(PART 2 – CHAPTERS 11 TO 18)

11 HUMAN BEINGS: SOCIO-ECONOMICS



Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter of the EIS has been prepared in order to fulfil this requirement with respect to socio-economic factors affecting human beings.

11.1 INTRODUCTION

This chapter describes and evaluates the existing socio-economic environment in the area of the proposed scheme.

Prior to preparing this chapter, a review of relevant planning and policy documents was undertaken in order to identify relevant objectives relating to the socio-economic environment affecting human beings in the area of the proposed scheme. This task included a review of the following policy documents:

- National Development Plan 2007 – 2013;
- National Action Plan for Social Inclusion 2007-2016: Building an Inclusive Society (NAP);
- Regional Planning Guidelines for the Greater Dublin Area, 2004 (RPGGDA);
- Dublin City Council Development Plan (2005 – 2011);
- Fingal County Council Development Plan (2005 - 2011).

The findings of this review are detailed in Planning and Policy Context chapter of this EIS (Volume 1, Chapter 4).

11.2 BASELINE CATEGORISATION METHODOLOGY

11.2.1 Introduction

According to the EPA's Guidelines on the Information to be contained in Environmental Impact Statements (2002), economic activity, social patterns and employment should be assessed in the Environmental Impact Assessment (EIA) under the heading of 'Human Beings': This chapter addresses all of these issues.

11.2.2 Study area

The impacts of the proposed scheme will be felt over a wide area. The proposed scheme will have impacts on a local and regional scale. In order to examine the micro and macro impacts it is necessary to consider two separate study areas.

The primary study area for this chapter is defined by the Electoral Divisions (EDs) that are crossed by or contained within a 500m corridor either side of the proposed alignment. An ED is the smallest administrative area for which population statistics are published by the Central Statistics Office (CSO).

The secondary study area comprises the lands belonging to the two local authorities in which the proposed scheme is located i.e. Fingal County Council and Dublin City Council. The socio-economic characteristics of the primary and secondary study areas are compared to statistics for the Greater Dublin Area (comprising of the local authorities of Dublin and also County Kildare, Meath and Wicklow) and the State.

11.2.3 Baseline data

The baseline data used to compile this chapter is taken from the 'Census of Population of Ireland' (CSO, 2006). This census includes the following data:

- Demographic data;
- Age profile data;
- Economic status (employment) data;
- Industry employment data;
- Social classification data;
- Mode of transport data;
- Car ownership data;
- Education data.

11.2.4 Baseline categorisation criteria

Baseline socio-economic data is provided in this chapter in order to describe a socio-economic context and background with respect to the study area. Categorisation of the baseline environment involves the allocation of overall 'functional values' to areas within the study area. The baseline categorisation is not based on the census data but is based on current policy-based designations and other schemes. Due to the nature of the existing socio-economic environment, all areas are attributed a functional value of Very high.

11.2.4.1 RAPID areas

RAPID (Revitalising Areas by Planning, Investment and Development) is an initiative that is led by the Department of Community, Rural and Gaeltacht Affairs to focus investment into the most concentrated areas of disadvantage in the country. Its purpose is to improve the quality of life and the opportunities available to residents of the most disadvantaged communities. The aims of RAPID include:

- Increasing the investment made by Government departments;
- Integrating and coordinating the delivery of public services;
- Facilitating opportunities for communities to contribute towards strategic improvements.

For each RAPID area a plan is prepared outlining the implementation of the programme. Resources are provided through targeted investment via the Social Inclusion Measures of the National Development Plan

In Ireland there are a total of 46 RAPID areas. All RAPID areas crossed by or contained within the 500m study area are noted in this chapter.

11.2.4.2 Urban Renewal Scheme

In 1998, Integrated Area Plans (IAPs) were prepared by local authorities in accordance with the Urban Renewal Act 1998. These plans detailed objectives for specific areas and concentrated on communities' cultural, employment and educational needs. In 1999 the Government launched a new Urban Renewal Scheme based on the IAPs. While phase one focused on residential tax incentives, phase two applied to commercial and industrial incentives. The scheme used a targeted approach to urban renewal to encourage physical development and to tackle socio-economic issues. The incentives provided applied to specific sites and were granted only if the development was deemed to contribute to some element of community gain within the IAP area. Within the study area the following areas were covered by IAPs and designated as areas of urban renewal:

- Ballymun;
- O'Connell Street;
- North East Inner City;
- Historic Area Rejuvenation Project (HARP).

11.2.4.3 DEIS

The Department of Education and Science's social inclusion programme, 'Delivering Equality of Opportunity in Schools' (DEIS), aims to provide support to the most disadvantaged schools in the country. The purpose of the DEIS programme is to develop an integrated, strategic approach to addressing the educational needs of children and young people from disadvantaged communities. Overall, 16 primary and 3 post-primary schools, included in the DEIS programme, are located within 500m of the alignment.

11.3 DESCRIPTION OF THE EXISTING ENVIRONMENT

11.3.1 Primary study area

40 EDs are identified as being partially or wholly within the primary study area (as described in Section 11.2.2). The evaluation of the socio-economic environment includes an assessment of demographics (population changes and age profiles), economic and employment status, statistics relating to transport, and information regarding levels of schooling and education. Relevant data for each of these parameters is set out in the following areas.

11.3.1.1 Area MN101: Belinstown to Swords Stop

Area MN101 contains the following EDs:

- Lusk;
- Swords Lissenhall;
- Donabate;
- Swords Seatown;
- Swords Village.

Parts of Swords Seatown and Swords Village EDs are located within Area MN102 but they are described in this area because the majority of the area of these EDs is in Area MN101. There are no RAPID areas, no Urban Renewal Schemes and no DEIS schools located within Area MN101.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.1 Area MN101 EDs

Table 11.1 Demographic Data for Area MN101

Area MN101	Lusk	Swords Lissenhall	Donabate	Swords Seatown	Swords Village	Fingal	Greater Dublin Area	State
Demographics								
Population 2002	4,131	6,081	6,141	4,919	2,572	196,413	1,535,446	3,917,203
Population 2006	7,048	9,072	7,600	5,934	2,514	239,992	1,662,536	4,239,848
Percentage Change '02-'06	70.6	49.2	23.8	20.6	-2.3	22.2	8.3	8.2
Age Profile								
Percentage of population aged 0-14	22.1	22.2	26.5	25.7	14.2	22.1	19.6	20.4
Percentage of population aged 15-24	13.1	15.0	9.8	14.4	17.7	14.9	15.6	14.9
Percentage of population aged 25-44	43.1	47.5	39.7	37.9	34.4	37.7	34.4	31.7
Percentage of population aged 45-64	16.5	12.5	17.6	18.4	23.5	19.4	20.7	21.9
Percentage of population aged 65+	5.2	2.8	6.4	3.7	10.3	6.0	9.7	11.0

There have been substantial changes in the population of Area MN101 over the period 2002-2006. While the population of Lusk has grown by 70.6%, Swords Village saw a population decline of 2.3%. In total the population of the EDs of Area MN101 has grown from 23,844 in 2002 to 32,168 in 2006. In Area MN101 the two most populated age categories are the 25-44 age category and the 0-14 age category. The least populated category is the 65 or older age category. Donabate has the lowest proportion of population aged 15-24 of all EDs in the study area (9.8%).

Over the inter-census period the population of EDs within Area MN101 increased significantly, average of 34.9% increase over the entire area. The populations of the Greater Dublin Area increased by 8.3% and 8.2% respectively over the same period. This illustrates the expanding population of the GDA, into areas further and further from Dublin

Most EDs in Area MN101 have quite a young age structure. However, Swords Village has relatively higher proportion of people aged 45-64 and 65+. This ED therefore has a much older age structure than the other EDs in Area MN101.

Table 11.2 Economic and Employment Data for Area MN101

Area MN101	Lusk	Swords Lissenhall	Donabate	Swords Seatown	Swords Village	Fingal	Greater Dublin Area	State
Economic status								
Total working population (persons aged 15 years and over)	5,493	7,059	5,585	4,408	2,158	187,018	1,336,588	3,375,399
Percentage at work	70.1	72.3	64.4	68.4	61.4	64.6	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	4.6	5.9	4.0	3.0	5.3	5.4	5.4	5.3
Labour Force	4,103	5,521	3,823	3,148	1,440	130,816	873,009	2,109,498
Labour Force Participation Rate	74.7	78.2	68.5	71.4	66.7	69.9	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	5.0	5.9	4.8	3.3	6.6	6.1	7.0	7.1
Percentage of persons at work by industry								
Agriculture, forestry and fishing	2.9	1.2	0.9	0.5	1.7	1.2	1.5	4.6
Building and construction	9.2	7.6	6.9	6.1	6.8	8.1	8.8	11.1
Manufacturing industries	9.9	9.4	8.5	9.8	9.9	10.5	10.7	13.6
Commerce and trade	31.4	37.4	31.0	37.6	34.9	33.9	33.1	27.1
Transport and communications	11.7	11.5	10.7	11.2	11.5	9.4	6.7	5.5
Public administration	7.0	5.0	6.3	5.7	4.8	6.3	5.9	5.2
Professional services	13.0	11.3	20.2	12.8	11.0	14.9	15.7	16.5
Other	14.9	16.6	15.5	16.3	19.4	15.8	17.6	16.3
Social classification								
Percentage professional and technical	37.1	33.1	44.2	46.7	26.5	38.2	35.8	32.9
Percentage non-manual, skilled and semi-skilled	44.4	46.0	36.5	39.7	51.1	42.2	42.3	45.2
Percentage unskilled and other occupations	18.6	20.8	19.3	13.7	22.5	19.6	22.0	21.9

Area MN101 has a relatively high proportion of population at work (61.4% to 72.3%) with a relatively low percentage of people looking for their first job or unemployed (3.0% to 5.9%). Swords Village has the lowest percentage of population aged 15 years and over at work. It thus has the highest rate of unemployment in Area MN101. Swords Lissenhall has the highest proportion of population at work in Area MN101. Compared with the Greater Dublin Area and the State averages, Area MN101 has a relatively high rate of employment.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services and transport and communications industries. Compared with the GDA and State averages, this area has above average proportion working in commerce and trade and transport and communications with lower than average percentages working in the professional services.

The majority of the population of Area MN101 belong to either the professional and technical employment classification or the non-manual, skilled and semi-skilled employment classification. Swords Seatown has the highest percentage of population of professional and technical employment classification in Area MN101. Donabate also has a high proportion of its population classified as professional and technical. Together these two EDs show that there is a large professional and technical population in the EDs of Swords Seatown and Donabate. Swords Village has the highest percentage of population of non-manual, skilled and semi-skilled employment classification in this area (51.1%) and the highest percentage population of unskilled and other employment classification (22.5%).

Table 11.3 Transport Data for Area MN101

Area MN101	Lusk	Swords Lissenhall	Donabate	Swords Seatown	Swords Village	Fingal	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college								
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	32.8	31.9	41.6	34.8	53.9	38.5	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	57.9	59.7	51.1	59.8	38.8	53.9	50.3	57.0
Car Ownership								
Percentage of households with no car	8.9	14.8	12.6	9.3	28.6	13.9	22.0	19.7
Percentage of households with one car	38.9	39.7	39.0	37.3	44.0	40.7	39.1	38.6
Percentage of households with two cars	44.2	35.4	42.2	46.9	22.9	37.5	31.4	32.9
Percentage of households with three or more cars	8.0	10.0	6.2	6.5	4.5	7.9	7.6	8.7

Area MN101 has one of the lowest percentages of non-car modes of transport to work, school or college, ranging from 31.9% in Swords Lissenhall to 53.9% in Swords Village. It therefore has a relatively high percentage of private motorised transport to work, school and college (38.8% to 59.8%). The population of Swords Village are heavily reliant on non private-motorised transport. It has the highest proportion of households with no car in Area MN101. Compared with GDA and State averages, the EDs of Area MN101 generally have considerably higher than average percentage of households with two cars.

Table 11.4 Education Data for Area MN101

Area MN101	Lusk	Swords Lissenhall	Donabate	Swords Seatown	Swords Village	Fingal	Greater Dublin Area	State
Education levels								
Percentage of population aged 15 years and over at school or university	6.0	6.1	5.8	8.3	6.5	7.8	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	5.1	7.4	3.3	3.7	7.3	5.4	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	11.1	13.4	9.1	12.1	13.8	13.2	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained								
No formal education	0.4	0.3	3.5	0.2	0.6	0.4	0.5	0.6
Primary education	11.6	6.2	9.8	6.1	13.4	9.8	14.9	17.5
Lower secondary	16.7	15.2	15.0	14.1	20.8	16.2	17.5	20.1
Upper secondary	21.6	23.1	20.3	26.0	20.3	22.1	19.3	19.6
Technical or vocational qualification	6.3	5.8	5.3	5.2	6.2	5.3	5.3	5.6
Upper secondary and technical or vocational	2.7	4.4	3.1	3.3	2.7	3.3	2.9	3.0
Non-degree	14.8	15.4	14.8	13.4	10.4	12.8	10.7	10.6
Primary degree	8.2	8.8	8.1	8.7	7.1	8.1	7.5	5.8
Professional qualification (degree status)	2.6	3.0	3.4	4.1	3.0	3.4	3.1	2.6
Both degree and professional qualification	3.5	4.0	4.2	4.9	3.3	4.5	4.4	3.4
Post-graduate certificate or diploma	4.2	4.3	3.8	4.5	3.0	4.1	3.7	3.2
Post-graduate degree (masters)	2.8	3.6	4.3	5.2	2.4	4.3	4.4	3.0
Doctorate (PhD)	0.3	0.4	0.7	0.5	0.5	0.6	0.7	0.5
Not stated	4.0	5.4	3.8	3.8	6.4	4.8	5.1	4.6

Within Area MN101 the percentage of population aged 15 years and over whose education has not ceased is below GDA and State averages. The only ED that has a percentage of population aged 15 years and over whose education has not ceased higher than the GDA and State averages is Swords Village. This shows that within Area MN101, Swords Village has the highest number of students aged 15 years or older. The proportion of people who attained a level of non-degree or primary degree is higher than the GDA and State averages. Swords Village has a relatively higher proportion of its population that only have a lower secondary education.

11.3.1.2 Area MN102: Swords Stop to Dublin Airport north portal

Area MN102 contains the following EDs:

- Kinsaley;
- Swords Forest.

Parts of both of these EDs are also located in Area MN103 but they are described in this area because the majority of the area of these EDs is in Area MN102. There are no RAPID areas, no Urban Renewal Schemes and no DEIS schools located within Area MN102.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.2
Area MN102 EDs

Table 11.5 Demographic Data for Area MN102

Area MN102	Kinsaley	Swords Forest	Fingal	Greater Dublin Area	State
Demographics					
Population 2002	3,528	9,797	196,413	1,535,446	3,917,203
Population 2006	5,526	12,443	239,992	1,662,536	4,239,848
Percentage Change '02-'06	56.6	27.0	22.2	8.3	8.2
Age Profile					
Percentage of population aged 0-14	18.8	21.6	22.1	19.6	20.4
Percentage of population aged 15-24	12.9	17.0	14.9	15.6	14.9
Percentage of population aged 25-44	47.2	41.6	37.7	34.4	31.7
Percentage of population aged 45-64	15.1	17.6	19.4	20.7	21.9
Percentage of population aged 65+	5.9	2.2	6.0	9.7	11.0

There has been a substantial change in the population of Area MN102 over the period 2002-2006. Kinsaley's population has grown by 56.6% and Swords Forest's population grew by 27.0%. In total, the population of the EDs of Area MN102 has grown from 13,325 in 2002 to 17,969 in 2006. In Area MN102 the two most populated age categories are 25-44 age category and 0-14 age category. The least populated age category is the 65 or older age category. Swords Forest has the lowest percentage of 65 or older age category of all EDs in the study area.

These two EDs are significant for their extremely high proportions of population aged 25-44. While the population aged 0-14 is comparable with GDA and State averages, it is very likely that it will increase significantly over the coming years, as those in the 25-44 age bracket raise families. Over the inter-census period the population of EDs within Area MN102 increased significantly, average of 34.9% increase over the entire area. A vast amount of housing has been built in the area over the past few years. The populations of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively over the same period.

Table 11.6 Economic and Employment Data for Area MN102

Area MN102	Kinsaley	Swords Forest	Fingal	Greater Dublin Area	State
Economic status					
Total working population (persons aged 15 years and over)	4,487	9,753	187,018	1,336,588	3,375,399
Percentage at work	71.6	72.9	64.6	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	3.2	5.0	5.4	5.4	5.3
Labour Force	3,357	7,596	130,816	873,009	2,109,498
Labour Force Participation Rate	74.8	77.9	69.9	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	3.6	4.7	6.1	7.0	7.1
Percentage of persons at work by industry					
Agriculture, forestry and fishing	0.8	0.5	1.2	1.5	4.6
Building and construction	7.5	7.6	8.1	8.8	11.1
Manufacturing industries	8.9	10.1	10.5	10.7	13.6
Commerce and trade	37.4	33.6	33.9	33.1	27.1
Transport and communications	10.4	14.7	9.4	6.7	5.5
Public administration	5.5	6.3	6.3	5.9	5.2
Professional services	14.4	12.4	14.9	15.7	16.5
Other	15.2	14.8	15.8	17.6	16.3
Social classification					
Percentage professional and technical	42.9	33.7	38.2	35.8	32.9
Percentage non-manual, skilled and semi-skilled	40.2	51.4	42.2	42.3	45.2
Percentage unskilled and other occupations	16.9	14.9	19.6	22.0	21.9

Area MN102 has a relatively high proportion of population at work (71.6% in Kinsaley and 72.9% in Swords Forest). Consequently, it has low percentages of people looking for their first jobs or unemployed (3.2% in Kinsaley and 5.0% in Swords Forest). Compared with the Greater Dublin Area and the State averages, Area MN102 has a considerably lower rate of unemployment.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services and transport and communications industries. Compared with the GDA and State averages, this area has above average proportion working in commerce and trade, and transport and communications with lower than average percentages working in the professional services.

The majority of the working population of Area MN102 belong to the non-manual, skilled and semi-skilled employment classification. Kinsaley ED has a higher proportion of professional and technical employment classification (42.9%) and a higher proportion of unskilled and other employment classification (16.9%). Swords Forest the highest proportion of population classified as non-manual, skilled and semi-skilled of all the EDs in the study area (51.4%).

Table 11.7 Transport Data for Area MN102

Area MN102	Kinsaley	Swords Forest	Fingal	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college					
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	29.5	37.9	38.5	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	63.8	56.1	53.9	50.3	57.0
Car Ownership					
Percentage of households with no car	8.6	11.7	13.9	22.0	19.7
Percentage of households with one car	43.6	41.5	40.7	39.1	38.6
Percentage of households with two cars	41.2	38.8	37.5	31.4	32.9
Percentage of households with three or more cars	6.6	8.0	7.9	7.6	8.7

In Kinsaley ED 63.8% of the population are reliant on private motorised transport to work, school or college. The population of Swords Forest is less reliant on private motorised transport (56.1%). Area MN102 has a relatively low percentage use of non-car modes of transport to work, school or college (29.5% in Kinsaley and 37.9% in Swords Forest). The majority of population of EDs in Area MN102 live in households with one or two cars. Compared with GDA and State averages, the EDs of Area MN102 generally have considerably higher than average percentage of households with two cars.

Table 11.8 Education Data for Area MN102

Area MN102	Kinsaley	Swords Forest	Fingal	Greater Dublin Area	State
Education levels					
Percentage of population aged 15 years and over at school or university	6.5	7.7	7.8	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	4.7	7.1	5.4	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	11.2	14.9	13.2	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained					
No formal education	0.2	0.3	0.4	0.5	0.6
Primary education	8.1	7.2	9.8	14.9	17.5
Lower secondary	13.4	17.6	16.2	17.5	20.1
Upper secondary	21.7	26.1	22.1	19.3	19.6
Technical or vocational qualification	5.7	6.2	5.3	5.3	5.6
Upper secondary and technical or vocational	3.3	4.1	3.3	2.9	3.0
Non-degree	13.7	13.6	12.8	10.7	10.6
Primary degree	9.8	7.7	8.1	7.5	5.8
Professional qualification (degree status)	2.9	3.2	3.4	3.1	2.6
Both degree and professional qualification	5.4	3.3	4.5	4.4	3.4
Post-graduate certificate or diploma	4.4	3.9	4.1	3.7	3.2
Post-graduate degree (masters)	5.2	3.4	4.3	4.4	3.0
Doctorate (PhD)	0.8	0.3	0.6	0.7	0.5
Not stated	5.4	3.3	4.8	5.1	4.6

Within Area MN102 the percentage of population aged 15 years and over whose education has not ceased is relatively equal to the GDA and State averages. The proportion of people in both EDs who attained a level of non-degree or primary degree is higher than the GDA and State averages.

11.3.1.3 Area MN103: Dublin Airport

Area MN103 contains the following EDs:

- Balgriffin;
- Airport.

Parts of both of these EDs are located within Area MN104 but they are described in this area because the majority of the area of these EDs is in Area MN103. There are no RAPID areas, no designated Urban Renewal Schemes and no DEIS schools are located within Area MN103.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.3
Area MN103 EDs

Table 11.9 Demographic Data for Area MN103

Area MN103	Balgriffin	Airport	Fingal	Greater Dublin Area	State
Demographics					
Population 2002	590	441	196,413	1,535,446	3,917,203
Population 2006	911	1,611	239,992	1,662,536	4,239,848
Percentage Change '02-'06	54.4	265.3	22.2	8.3	8.2
Age Profile					
Percentage of population aged 0-14	21.1	10.0	22.1	19.6	20.4
Percentage of population aged 15-24	12.1	12.9	14.9	15.6	14.9
Percentage of population aged 25-44	34.7	54.8	37.7	34.4	31.7
Percentage of population aged 45-64	16.0	13.3	19.4	20.7	21.9
Percentage of population aged 65+	16.1	8.9	6.0	9.7	11.0

The EDs of Area MN103 have seen some of the largest percentage growths of population in the country over the period 2002-2006. Ballgriffin's population grew by 54.4% while Airport's population grew by 265.3%. In total the population of the EDs of Area MN103 has grown from 1,031 in 2002 to 2,522 in 2006. In Area MN103 the two most populated age categories are the 25-44 age category and the 45-64 age category. In fact, Airport has the highest proportion of population aged 25-44 of all EDs in the study area.

Over the inter-census period the population of EDs within Area MN103 increased considerably, average of 144.6% increase over the entire area. The populations of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively, over the same period. The significant growth in the populations of these two EDs is attributable to the growth in residential development in the area over the past few years. Numerous suburban housing developments have been built, catering for relatively large, populations compared to what previously existed.

Table 11.10 Economic and Employment Data for Area MN103

Area MN103	Balgriffin	Airport	Fingal	Greater Dublin Area	State
Economic status					
Total working population (persons aged 15 years and over)	719	1,450	187,018	1,336,588	3,375,399
Percentage at work	59.2	74.3	64.6	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	3.2	5.2	5.4	5.4	5.3
Labour Force	449	1,154	130,816	873,009	2,109,498
Labour Force Participation Rate	62.4	79.6	69.9	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	4.0	5.7	6.1	7.0	7.1
Percentage of persons at work by industry					
Agriculture, forestry and fishing	3.1	0.6	1.2	1.5	4.6
Building and construction	7.3	7.3	8.1	8.8	11.1
Manufacturing industries	8.9	10.5	10.5	10.7	13.6
Commerce and trade	30.8	31.8	33.9	33.1	27.1
Transport and communications	7.5	12.9	9.4	6.7	5.5
Public administration	2.6	3.8	6.3	5.9	5.2
Professional services	11.3	12.2	14.9	15.7	16.5
Other	28.6	20.9	15.8	17.6	16.3
Social classification					
Percentage professional and technical	43.7	36.7	38.2	35.8	32.9
Percentage non-manual, skilled and semi-skilled	32.9	32.6	42.2	42.3	45.2
Percentage unskilled and other occupations	23.4	30.7	19.6	22.0	21.9

The proportion of population at work in the EDs of Area MN103 varies from a relatively medium proportion in Balgriffin (59.2%) to a relatively high proportion in Airport (74.3%). The population of people looking for their first job or unemployed in Balgriffin and Airport is relatively low (3.2% and 5.2%). Compared with the Greater Dublin Area and the State averages, Area MN103 has a relatively lower rate of unemployment.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services and transport and communications industries. Compared with the GDA and State averages, this area has relatively average proportion working in commerce and trade, relatively higher proportion working in transport and communications, and lower than average proportion working in the professional services.

The employment classifications of the population of Airport and Balgriffin are relatively balanced. The majority of the population are classified as professional and technical (36.7% and 43.7%) and the minority of the population are classified as unskilled and other occupations (30.7% and 23.4%). A high proportion of those employed are employed in the transport and communications industry. Large numbers of respondents from Area MN103 classed their industry of employment as 'other'. Airport also has comparatively high proportion of its population classified as 'unskilled and other occupations'. It is probable that a large proportion of these populations are employed directly or indirectly by the airport and its services.

Table 11.11 Transport Data for Area MN103

Area MN103	Balgriffin	Airport	Fingal	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college					
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	20.3	38.5	38.5	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	65.6	53.6	53.9	50.3	57.0
Car Ownership					
Percentage of households with no car	10.3	28.2	13.9	22.0	19.7
Percentage of households with one car	29.3	51.4	40.7	39.1	38.6
Percentage of households with two cars	45.1	19.3	37.5	31.4	32.9
Percentage of households with three or more cars	15.4	1.1	7.9	7.6	8.7

Both EDs have relatively low percentages of people travelling to work, school or college by non-car modes of transport (20.3% in Balgriffin and 38.5% in Airport). Balgriffin has the highest proportion of population travelling to work, school or college by private motorised modes of all EDs in the study area (65.6%) and thus the lowest proportion of people travelling to work, school or college by non-car modes of transport (20.3%). There is a very high reliance in Area MN103 on private motorised transport.

Compared with GDA and State averages, Area MN103 generally has a relatively average number of cars per household. However, here are large differences between the two EDs of Area MN103, i.e. Balgriffin having a higher proportion of households with multiple cars while the majority of households within Airport have 0 or 1 car per household. With regards to the number of cars per household, the two EDs are very different.

Table 11.12 Education Data for Area MN103

Area MN103	Balgriffin	Airport	Fingal	Greater Dublin Area	State
Education levels					
Percentage of population aged 15 years and over at school or university	7.1	3.5	7.8	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	2.7	7.9	5.4	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	9.9	11.4	13.2	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained					
No formal education	0.2	0.2	0.4	0.5	0.6
Primary education	9.1	3.3	9.8	14.9	17.5
Lower secondary	16.7	9.5	16.2	17.5	20.1
Upper secondary	20.0	16.6	22.1	19.3	19.6
Technical or vocational qualification	5.6	3.2	5.3	5.3	5.6
Upper secondary and technical or vocational	2.7	3.6	3.3	2.9	3.0
Non-degree	10.8	12.5	12.8	10.7	10.6
Primary degree	7.2	12.2	8.1	7.5	5.8
Professional qualification (degree status)	3.2	4.3	3.4	3.1	2.6
Both degree and professional qualification	3.3	7.3	4.5	4.4	3.4
Post-graduate certificate or diploma	3.0	4.7	4.1	3.7	3.2
Post-graduate degree (masters)	3.3	8.2	4.3	4.4	3.0
Doctorate (PhD)	0.6	1.4	0.6	0.7	0.5
Not stated	14.3	13.1	4.8	5.1	4.6

Within Area MN103 the percentage of population aged 15 years and over whose education has not ceased is below GDA and State averages. The proportion of people who attained a level of non-degree or primary degree is higher than the GDA and State averages.

The figures for Airport are notable in that it has approximately twice the State average for the percentage of population with a primary degree. The percentages of the population of Airport for all educational levels above primary degree are all higher than both the GDA and State averages. This shows that the population of the area is a relatively well educated population.

11.3.1.4 Area MN104: Dublin Airport south portal to Santry Avenue

Area MN104 contains only one ED:

- Dubber.

There are no RAPID areas, no Urban Renewal Schemes and no DEIS schools located within Area MN104. Relevant socio-economic data is shown in the following tables.

Relevant socio-economic data available for the ED in this area is shown in the following tables.

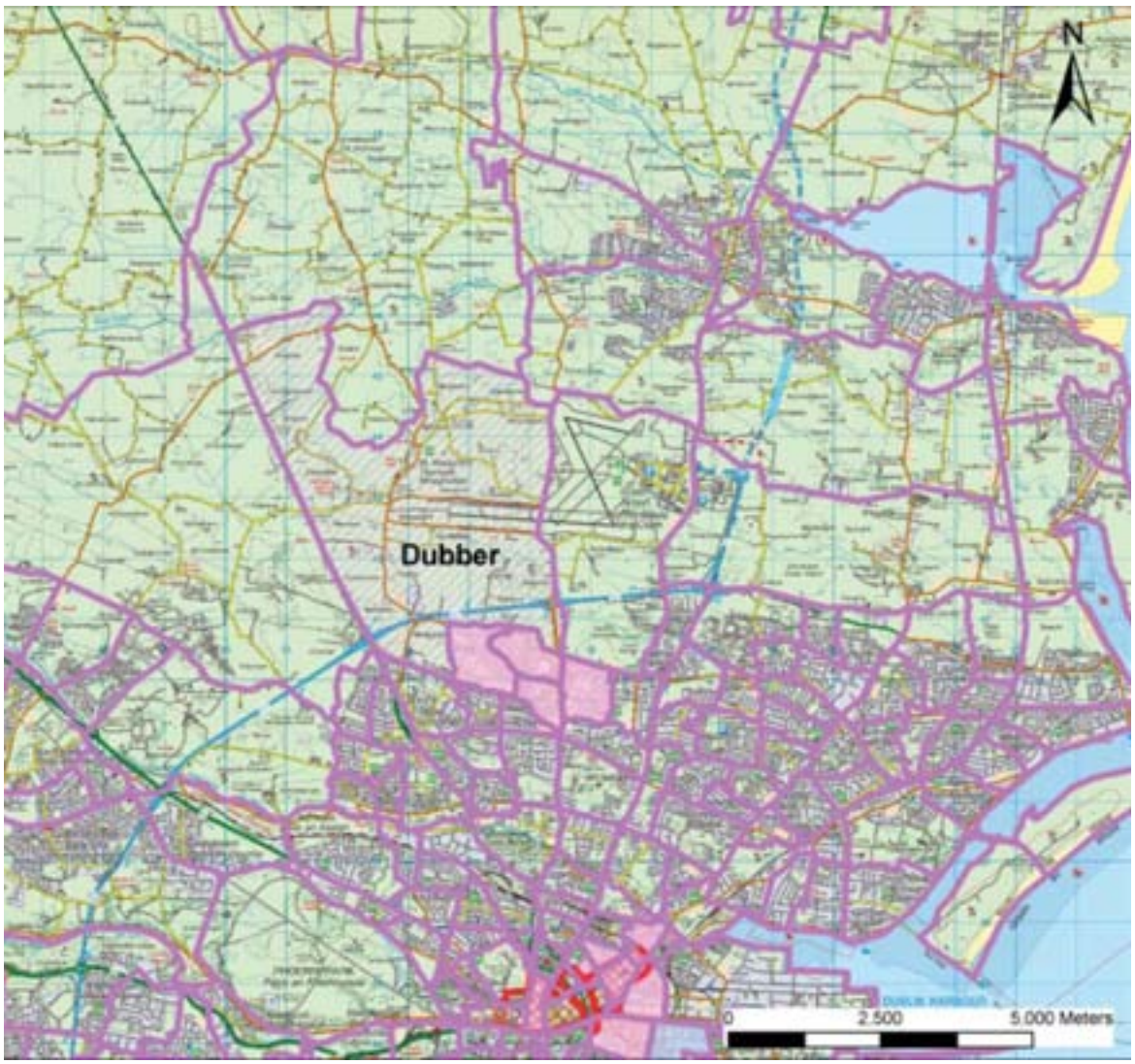


Figure 11.4
Area MN104 EDs

Table 11.13 Demographic Data for Area MN104

Area MN104	Dubber	Fingal	Greater Dublin Area	State
Demographics				
Population 2002	838	196,413	1,535,446	3,917,203
Population 2006	3,747	239,992	1,662,536	4,239,848
Percentage Change '02-'06	347.1	22.2	8.3	8.2
Age Profile				
Percentage of population aged 0-14	19.1	22.1	19.6	20.4
Percentage of population aged 15-24	14.2	14.9	15.6	14.9
Percentage of population aged 25-44	53.6	37.7	34.4	31.7
Percentage of population aged 45-64	9.2	19.4	20.7	21.9
Percentage of population aged 65+	3.9	6.0	9.7	11.0

Dubber exhibits one of the largest percentage increases in population in the country. The population in 2002 (838) increased by 347.1% between 2002 and 2006 to reach a total population of 3,747. This is the largest population growth of all EDs in the study area. The populations of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively over the same period.

This large population increase in Dubber is attributable to large residential developments built in the area. In Area MN104, the two most populated age categories are the 25-44 age category and the 0-14 age category. The least populated age category is the 65 or older age category. This shows that this area consists of a large number of relatively young families.

Table 11.14 Economic and Employment Data for Area MN104

Area MN104	Dubber	Fingal	Greater Dublin Area	State
Economic status				
Total working population (persons aged 15 years and over)	3,031	187,018	1,336,588	3,375,399
Percentage at work	76.2	64.6	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	5.2	5.4	5.4	5.3
Labour Force	2,467	130,816	873,009	2,109,498
Labour Force Participation Rate	81.4	69.9	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	5.6	6.1	7.0	7.1
Percentage of persons at work by industry				
Agriculture, forestry and fishing	0.6	1.2	1.5	4.6
Building and construction	9.3	8.1	8.8	11.1
Manufacturing industries	11.0	10.5	10.7	13.6.
Commerce and trade	31.0	33.9	33.1	27.1
Transport and communications	9.6	9.4	6.7	5.5
Public administration	5.1	6.3	5.9	5.2
Professional services	12.5	14.9	15.7	16.5
Other	21.0	15.8	17.6	16.3
Social classification				
Percentage professional and technical	25.3	38.2	35.8	32.9
Percentage non-manual, skilled and semi-skilled	47.0	42.2	42.3	45.2
Percentage unskilled and other occupations	27.7	19.6	22.0	21.9

In Dubber ED, 76.2% of the population are working. This is the highest percentage of all EDs in the study area. The percentage of people looking for their first job or unemployed in Area MN104 is 5.2% and this is relatively average figure compared to other areas. Compared with the Greater Dublin Area and the State averages, Area MN104 has a relatively lower rate of unemployment.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services and manufacturing industries. Compared with the GDA and State averages, this area has relatively average proportions working in commerce and trade and manufacturing with lower than average percentages working in the professional services. The majority of people are classified as non-manual, skilled and semi-skilled (47.0%). This is followed by the unskilled and other occupations employment classification (27.7%).

Table 11.15 Transport Data for Area MN104

Area MN104	Dubber	Fingal	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college				
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	31.3	38.5	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	55.5	53.9	50.3	57.0
Car Ownership				
Percentage of households with no car	19.1	13.9	22.0	19.7
Percentage of households with one car	46.7	40.7	39.1	38.6
Percentage of households with two cars	28.3	37.5	31.4	32.9
Percentage of households with three or more cars	5.9	7.9	7.6	8.7

The majority of people travelling to work, school or college do so by private motorised means (55.5%). Dubber has a relatively low percentage of non-car mode of transport to work, school or college (31.3%). Compared with GDA and State averages, the ED of Area MN104 generally has slightly below average proportion of households with no car, considerably above average for households with one car, below average for households with two cars and below average for households with three or more cars.

Table 11.16 Education Data for Area MN104

Area MN104	Dubber	Fingal	Greater Dublin Area	State
Education levels				
Percentage of population aged 15 years and over at school or university	4.2	7.8	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	6.6	5.4	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	10.8	13.2	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained				
No formal education	0.1	0.4	0.5	0.6
Primary education	9.2	9.8	14.9	17.5
Lower secondary	15.4	16.2	17.5	20.1
Upper secondary	21.7	22.1	19.3	19.6
Technical or vocational qualification	5.7	5.3	5.3	5.6
Upper secondary and technical or vocational	4.7	3.3	2.9	3.0
Non-degree	11.8	12.8	10.7	10.6
Primary degree	7.7	8.1	7.5	5.8
Professional qualification (degree status)	2.4	3.4	3.1	2.6
Both degree and professional qualification	4.0	4.5	4.4	3.4
Post-graduate certificate or diploma	4.1	4.1	3.7	3.2
Post-graduate degree (masters)	3.6	4.3	4.4	3.0
Doctorate (PhD)	0.2	0.6	0.7	0.5
Not stated	9.4	4.8	5.1	4.6

Within Area MN104 the percentage of population aged 15 years and over whose education has not ceased (10.8%) is below GDA and State averages. The proportion of people who attained a level of non-degree (11.8%) or primary degree (7.7%) is higher than the GDA and State averages.

11.3.1.5 Area MN105: Santry Avenue to Albert College Park

Area MN105 contains the following EDs:

- Ballymun B;
- Ballymun C;
- Ballymun D;
- Ballymun E;
- Whitehall B;
- Whitehall A;
- Ballygall C.

Parts of Whitehall A and Ballygall C are located within Area MN106 but they are described in this area because the majority of the area of these EDs is in Area MN105. Ballymun B, Ballymun C and Ballymun D are included in the Dublin City Ballymun RAPID Area. Area MN105 also contains the Ballymun IAP area under the Urban Renewal Scheme. Located within Area MN105, within 500m of the alignment, are 9 primary schools and 1 post-primary school included in the DEIS programme.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.5
Area MN105 EDs

Table 11.17 Demographic Data for Area MN105

Area MN105	Ballymun B	Ballymun C	Ballymun D	Ballymun E	Whitehall B	Whitehall A	Ballygall C	Dublin City	Greater Dublin Area	State
Demographics										
Population 2002	4,050	5,896	3,712	1,602	3,902	3,542	3,787	495,781	1,535,446	3,917,203
Population 2006	3,949	5,921	3,522	1,550	4,120	3,959	3,575	506,211	1,662,536	4,239,848
Percentage Change '02-'06	-2.5	0.4	-5.1	-3.2	5.6	11.8	-5.6	2.1	8.3	8.2
Age Profile										
Percentage of population aged 0-14	25.4	27.0	31.1	15.5	11.5	11.3	12.9	15.0	19.6	20.4
Percentage of population aged 15-24	20.0	18.1	17.3	13.2	24.6	26.4	13.5	16.9	15.6	14.9
Percentage of population aged 25-44	30.3	30.2	33.8	24.9	24.9	22.2	25.3	35.7	34.4	31.7
Percentage of population aged 45-64	17.6	15.7	12.3	19.9	19.6	20.8	25.5	19.7	20.7	21.9
Percentage of population aged 65+	6.7	9.0	5.5	26.5	19.4	19.2	22.7	12.7	9.7	11.0

The populations of each of the EDs in this area remained relatively constant between 2002 and 2006 (<12% increases/decreases over this period). Overall, the population has grown from 26,491 in 2002 to 26,596 in 2006. There were population declines in particular EDs. Over the inter-census period the population of EDs within Area MN105 increased only slightly, average of 0.4% increase over the entire area.

The population of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively over the same period. In terms of age categories, Ballymun D has the highest percentage of 0-14 age category of all EDs in the study area. Whitehall A has the lowest percentage of 25-44 age category of all EDs in the study area. Ballymun E has the highest percentage of all 65 or older age category of all EDs in the study area.

Table 11.18 Economic and Employment Data for Area MN105

Area MN105	Ballymun B	Ballymun C	Ballymun D	Ballymun E	Whitehall B	Whitehall A	Ballygall C	Dublin City	Greater Dublin Area	State
Economic status										
Total working population (persons aged 15 years and over)	2,947	4,324	2,426	1,310	3,648	3,511	3,113	430,357	1,336,588	3,375,399
Percentage at work	46.1	45.7	47.6	47.6	44.9	42.1	48.7	56.9	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	18.4	14.3	17.4	1.8	4.1	2.2	3.2	6.8	5.4	5.3
Labour Force	1,902	2,596	1,575	647	1,786	1,555	1,616	274,310	873,009	2,109,498
Labour Force Participation Rate	64.5	60.0	64.9	49.4	49.0	44.3	51.9	63.7	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	25.8	21.1	23.7	2.9	6.7	3.9	5.3	9.0	7.0	7.1
Percentage of persons at work by industry										
Agriculture, forestry and fishing	0.1	0.1	0.2	0.0	0.4	0.2	0.2	0.3	1.5	4.6
Building and construction	6.8	7.9	9.1	5.1	6.2	5.0	6.9	6.5	8.8	11.1
Manufacturing industries	8.2	8.3	8.6	10.6	9.5	6.0	8.8	8.2	10.7	13.6.
Commerce and trade	28.3	30.1	28.5	31.1	30.4	30.6	27.9	34.1	33.1	27.1
Transport and communications	7.4	8.8	7.2	8.5	12.8	7.4	9.2	6.9	6.7	5.5
Public administration	3.5	4.5	3.7	12.8	7.9	8.8	10.7	6.0	5.9	5.2
Professional services	13.2	15.8	14.6	15.4	16.7	18.7	18.1	16.2	15.7	16.5
Other	32.4	24.4	28.2	16.4	16.1	23.3	18.1	21.7	17.6	16.3
Social classification										
Percentage professional and technical	9.3	13.0	7.8	38.6	24.6	35.0	32.2	30.4	35.8	32.9
Percentage non-manual, skilled and semi-skilled	44.8	48.9	42.0	45.1	44.1	27.0	42.1	41.3	42.3	45.2
Percentage unskilled and other occupations	45.9	38.1	50.1	16.3	31.4	37.9	25.7	28.3	22.0	21.9

Area MN105 has a relatively low proportion of population at work, ranging from 42.1% in Whitehall A (lowest for all EDs in the study area) to 48.7% in Ballygall C. The percentage of people looking for their first job or unemployed ranges from 1.8% in Ballymun E (lowest for all EDs in the study area) to 18.4% in Ballymun B (highest for all EDs in the study area). There is a large variance in the rates of unemployment across Area MN105. Ballymun B, Ballymun C and Ballymun D have considerably higher rates of unemployment when compared with Greater Dublin Area and State averages. The remaining EDs have comparatively lower rates of unemployment. Ballymun B has the highest rate of unemployment of all EDs considered along the alignment (25.8%), while Ballymun E has the lowest rate (2.9%). The populations of Ballymun B, Ballymun C and Ballymun D have high proportions looking for their first job or unemployed, having lost or given up their previous job.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services and transport and communications industries.

Compared with the GDA and State averages, this area has above average proportion working in transport and communications with lower than average percentages working in the professional services and commerce and trade. The majority of the population of Area MN105 belong to either the non-manual, skilled and semi-skilled employment classification or the unskilled and other occupations classification. Ballymun E has the highest percentage of population of professional and technical employment classification in this area (38.6%). Ballymun C has the highest proportion of non-manual, skilled and semi-skilled employment classification in this area (48.9%). Ballymun D has the highest proportion of unskilled and other employment classification in this area (50.1%). Ballymun D has the lowest proportion in the professional and technical employment classification of all EDs in the study area (7.8%). Overall, there are large differences in Area MN105. Ballymun B, Ballymun C and Ballymun D can be considered together. They have high rates of unemployment and low levels of population classified as professional and technical. On the other side there are the EDS of Ballymun E, Whitehall A, Whitehall B and Ballygall C, where there are relatively low rates of unemployment and high proportions of the population classified as professional and technical.

Table 11.19 Transport Data for Area MN105

Area MN105	Ballymun B	Ballymun C	Ballymun D	Ballymun E	Whitehall B	Whitehall A	Ballygall C	Dublin City	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college										
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	60.0	59.5	67.0	35.3	58.8	59.0	47.9	57.7	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	28.1	32.2	24.3	55.1	35.5	32.7	44.9	34.1	50.3	57.0
Car Ownership										
Percentage of households with no car	51.8	46.3	59.5	14.6	33.3	30.5	23.6	40.5	22.0	19.7
Percentage of households with one car	36.6	38.3	33.9	45.1	43.2	37.1	42.8	39.0	39.1	38.6
Percentage of households with two cars	10.0	12.6	6.1	32.3	19.0	26.6	28.6	16.9	31.4	32.9
Percentage of households with three or more cars	1.6	2.8	0.6	8.0	4.6	5.8	5.0	3.6	7.6	8.7

Area MN105 has relatively high proportions of people travelling to work, school or college by non-car modes, ranging from 35.3% in Ballymun E to 67.0% in Ballymun D. The percentage of population travelling to work, school or college using private motorised transport ranges from 24.3% in Ballymun D to 55.1% in Ballymun E. Compared with GDA and State averages, the EDs of Area MN105 generally have considerably higher than average percentage of households with no cars and a relatively average percentage of households with one car.

Subsequently, the percentages of households with two or three cares are significantly lower than the GDA and State averages. The differences between EDs within Area MN105 continue through to transport considerations. It can be seen that Ballymun B, Ballymun C and Ballymun D rely heavily on non private-motorised transport and have high proportions of households with no car.

Table 11.20 Education Data for Area MN105

Area MN105	Ballymun B	Ballymun C	Ballymun D	Ballymun E	Whitehall B	Whitehall A	Ballygall C	Dublin City	Greater Dublin Area	State
Education levels										
Percentage of population aged 15 years and over at school or university	6.0	9.2	6.2	9.5	18.4	23.6	8.3	9.2	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	7.6	6.0	8.3	2.5	4.6	3.5	4.0	6.1	4.9	4.1
Total percentage of population aged 15 and over whose education has not ceased	13.6	15.1	14.4	12.0	23.0	27.1	12.3	15.3	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained										
No formal education	1.2	1.5	1.0	1.7	0.6	0.2	1.6	0.7	0.5	0.6
Primary education	35.0	29.3	25.1	15.1	27.1	11.7	19.0	19.8	14.9	17.5
Lower secondary	23.8	28.2	27.9	16.5	19.3	12.6	16.7	16.4	17.5	20.1
Upper secondary	14.6	17.7	19.0	24.9	17.6	18.7	21.1	15.9	19.3	19.6
Technical or vocational qualification	3.3	4.2	4.2	6.9	6.5	4.7	6.5	4.6	5.3	5.6
Upper secondary and technical or vocational	1.8	2.1	2.5	3.3	2.1	2.1	2.5	2.5	2.9	3.0
Non-degree	3.5	4.6	4.1	10.1	8.5	9.0	8.0	7.9	10.7	10.6
Primary degree	1.4	2.3	1.4	5.0	5.9	8.1	5.7	8.1	7.5	5.8
Professional qualification (degree status)	0.5	0.7	0.6	4.2	1.5	3.6	2.1	2.7	3.1	2.6
Both degree and professional qualification	0.6	0.7	1.0	2.5	2.5	3.7	2.3	4.8	4.4	3.4
Post-graduate certificate or diploma	0.6	0.8	1.2	2.1	2.4	3.2	1.8	3.5	3.7	3.2
Post-graduate degree (masters)	1.4	1.0	1.5	2.5	2.8	4.8	2.8	5.4	4.4	3.0
Doctorate (PhD)	0.1	0.2	0.1	0.4	0.5	1.6	0.8	0.8	0.7	0.5
Not stated	12.2	6.6	10.6	4.6	2.7	16.1	8.9	6.8	5.1	4.6

Within Area MN105 the percentage of population aged 15 years and over whose education has not ceased is above GDA and State averages. The proportion of people who attained a level of non-degree or primary degree is below the GDA and State averages. Whitehall B and Whitehall A are notable due to their high proportions of population aged 15 and over whose education has not ceased. The vast majority of population aged 15 years and over whose education has ceased reached only primary or lower secondary levels, especially in Ballymun B, Ballymun C, Ballymun D and Whitehall B.

11.3.1.6 Area MN106: Albert College Park to Mater Stop

Area MN106 contains the following EDs:

- Drumcondra South C;
- Botanic A;
- Drumcondra South A;
- Botanic B;
- Drumcondra South B;
- Botanic C;
- Ballybough B;
- Inns Quay A;
- Cabra East A;
- Mountjoy B;
- Inns Quay B.

Parts of Mountjoy B and Inns Quay B are located within Area MN107 but they are described in this area because the majority of the area of these EDs is in Area MN106. Mountjoy B is included in Dublin City North East Inner City RAPID Area. There are no Urban Renewal Schemes located within Area MN106. Located within Area MN106, within 500m of the alignment, is one primary school included in the DEIS programme.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.6
Area MN106 EDs

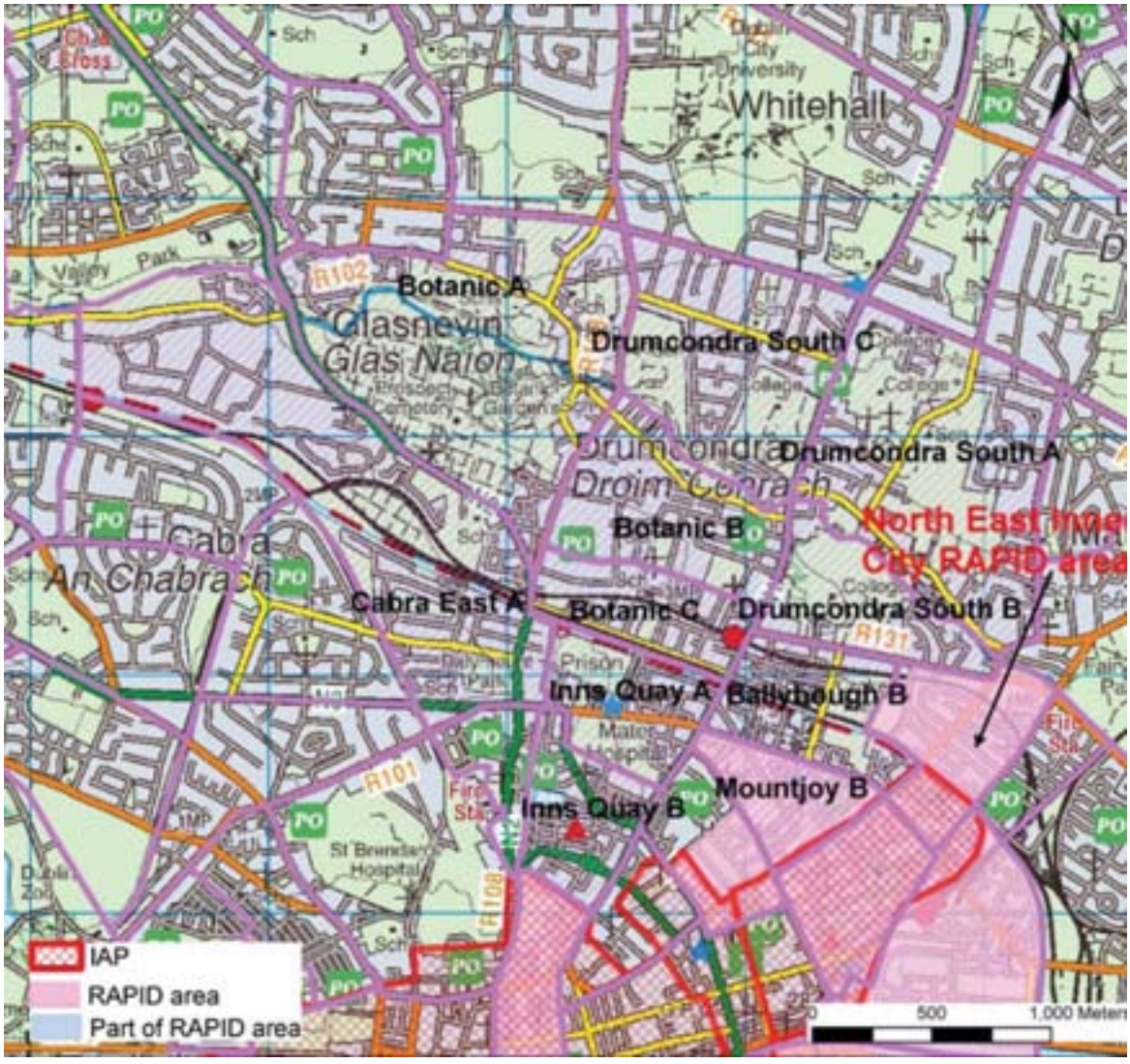


Table 11.21 Demographic Data for Area MN106

Area MN106	Drumcondra South C	Botanic A	Drumcondra South A	Botanic B	Drumcondra South B	Botanic C	Ballybough B	Inns Quay A	Cabra East A	Mountjoy B	Inns Quay B	Dublin City	Greater Dublin Area	State
Demographics														
Population 2002	3,504	2,914	3,857	3,449	1,377	2,195	309	3,373	5,396	2,725	2,953	495,781	1,535,446	3,917,203
Population 2006	3,323	3,091	3,945	3,214	1,369	2,098	3,215	3,715	5,366	3,446	3,113	506,211	1,662,536	4,239,848
Percentage Change '02-'06	-5.2	6.1	2.3	-6.8	-0.6	-4.4	6.8	10.1	-0.6	26.5	5.4	2.1	8.3	8.2
Age Profile														
Percentage of population aged 0-14	13.2	12.4	13.0	13.1	10.7	11.7	7.5	5.0	11.0	12.1	11.8	15.0	19.6	20.4
Percentage of population aged 15-24	19.6	13.1	18.4	16.6	18.4	19.4	23.0	24.4	18.5	23.8	18.7	16.9	15.6	14.9
Percentage of population aged 25-44	27.5	35.9	35.0	35.3	38.0	40.4	42.6	40.5	39.7	47.0	44.4	35.7	34.4	31.7
Percentage of population aged 45-64	22.4	22.8	21.3	20.7	16.5	18.0	18.4	13.8	20.9	11.5	14.9	19.7	20.7	21.9
Percentage of population aged 65+	17.3	15.9	12.3	14.3	16.4	10.6	8.6	16.4	9.9	5.6	10.2	12.7	9.7	11.0

There has been a slight change in the population of Area MN106 over the period 2002-2006 (approximately 3.3% increase over the entire area). In total the population has grown from 34,752 in 2002 to 35,895 in 2006. There was significant growth in the population of Mountjoy B over the inter-census years (26.5%). The populations of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively over the same period.

In Area MN106 the two most populated age categories are the 15-24 age category and the 25-44 age category. The least populated age category is the 0-14 age category, closely followed by the 65 or older age category. In the EDs of Drumcondra South A, Drumcondra South B, Drumcondra South C, Botanic A and Botanic B the populations are slightly older than the remaining EDs, i.e. there are larger proportions of the population in the 45-64 and 65+ age categories.

Table 11.22 Economic and Employment Data for Area MN106

Area MN106	Drumcondra South C	Botanic A	Drumcondra South A	Botanic B	Drumcondra South B	Botanic C	Ballybough B	Inns Quay A	Cabra East A	Mountjoy B	Inns Quay B	Dublin City	Greater Dublin Area	State
Economic status														
Total working population (persons aged 15 years and over)	2,884	2,709	3,433	2,792	1,222	1,853	2,973	3,531	4,776	3,029	2,746	430,357	1,336,588	3,375,399
Percentage at work	53.4	60.3	59.2	60.2	57.9	64.5	58.9	54.7	64.0	58.5	59.6	56.9	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	2.6	3.0	5.0	14.7	6.1	5.1	10.0	7.5	5.6	13.6	11.2	6.8	5.4	5.3
Labour Force	1,614	1,715	2,204	1,798	783	1,289	2,048	2,195	3,344	2,183	1,944	274,310	873,009	2,109,498
Labour Force Participation Rate	56.0	63.3	64.2	64.4	64.1	69.6	68.9	62.2	70.0	72.1	70.8	63.7	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	3.5	3.8	6.6	4.9	6.8	6.0	10.5	10.3	6.5	15.0	12.2	9.0	7.0	7.1
Percentage of persons at work by industry														
Agriculture, forestry and fishing	0.3	0.6	0.1	0.3	0.1	0.2	0.3	0.3	0.2	0.4	0.4	0.3	1.5	4.6
Building and construction	5.3	6.2	6.7	7.9	8.9	6.9	11.2	4.0	7.6	9.3	7.1	6.5	8.8	11.1
Manufacturing industries	7.1	8.3	6.1	6.1	6.4	4.9	7.9	4.5	7.5	8.4	6.5	8.2	10.7	13.6
Commerce and trade	31.3	34.7	33.9	34.0	31.4	32.7	30.0	23.9	30.9	29.6	27.6	34.1	33.1	27.1
Transport and communications	7.6	5.8	7.0	5.5	5.4	7.2	5.7	3.3	5.3	5.1	4.3	6.9	6.7	5.5
Public administration	11.0	7.8	7.3	8.6	7.6	6.4	4.7	3.1	8.7	1.6	4.0	6.0	5.9	5.2
Professional services	22.6	23.3	19.4	22.0	19.4	19.2	15.5	21.8	20.8	10.4	17.1	16.2	15.7	16.5
Other	14.7	13.4	19.4	15.5	20.9	22.4	24.7	39.2	19.0	35.2	32.9	21.7	17.6	16.3
Social classification														
Percentage professional and technical	43.2	50.7	44.7	48.4	31.5	42.1	24.6	24.9	37.6	13.5	24.4	30.4	35.8	32.9
Percentage non-manual, skilled and semi-skilled	35.4	35.7	31.9	33.6	37.5	36.7	42.2	24.1	39.9	38.6	34.2	41.3	42.3	45.2
Percentage unskilled and other occupations	21.4	13.6	23.3	18.0	31.0	21.1	33.2	51.0	22.5	47.9	41.3	28.3	22.0	21.9

Area MN106 exhibits average proportions of people at work, ranging from 53.4% in Drumcondra South C to 64.5% in Botanic C. It also exhibits a large range with respect to the percentages of people looking for their first job or unemployed, 2.6% in Drumcondra South C (the lowest percentage of all EDs in the study area) to 14.7% in Botanic B). Compared with the Greater Dublin Area and the State averages, Area MN106 has a relatively average rate of unemployment. It must be noted that while the rates of unemployment in the northern part of this area are lower than the Greater Dublin Area and State averages, the rates of unemployment increase further south along the alignment, towards the city centre. The EDs of Ballybough B, Mountjoy B and Inns Quay B have the highest proportions of population looking for first job or unemployed, and the highest rates of unemployment in this area.

The industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services. Compared with the GDA and State averages, this area has above average proportion working professional services with a relatively average percentage of population working in the professional services. The EDs within the area also exhibit a wide range with respect to the employment classifications of the population. Botanic A has the highest percentage of population of professional and technical employment classification of all EDs in the study area (50.7%). It also has the lowest proportion of population of unskilled and other employment classification of all EDs in the study area (13.6%). Overall, the highest proportions of professional and technical are recorded in the EDs of Drumcondra South C, Drumcondra South A, Botanic A, Botanic B and Botanic C. Ballybough B has the highest percentage of non-manual, skilled and semi-skilled employment classification in this area (42.2%). Inns Quay A has the highest percentage of unskilled and other employment classifications in this area (51.0%).

Table 11.23 Transport Data for Area MN106

Area MN106	Drumcondra South C	Botanic A	Drumcondra South A	Botanic B	Drumcondra South B	Botanic C	Ballybough B	Inns Quay A	Cabra East A	Mountjoy B	Inns Quay B	Dublin City	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college														
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	60.0	51.7	57.9	56.5	61.5	64.8	73.4	56.8	61.6	78.2	70.5	57.7	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	34.1	42.9	34.6	37.4	29.3	28.6	19.6	12.6	30.5	8.6	14.2	34.1	50.3	57.0
Car Ownership														
Percentage of households with no car	31.9	25.1	33.9	32.3	47.6	41.2	63.2	59.8	47.4	76.2	70.3	40.5	22.0	19.7
Percentage of households with one car	44.7	46.8	39.6	43.7	39.5	38.4	27.4	33.6	35.4	20.4	24.2	39.0	39.1	38.6
Percentage of households with two cars	19.3	24.4	22.2	20.5	10.8	16.9	7.7	5.0	14.0	2.4	4.7	16.9	31.4	32.9
Percentage of households with three or more cars	4.1	3.7	4.3	3.5	2.1	3.5	1.6	1.7	3.2	0.9	0.7	3.6	7.6	8.7

Area MN106 has extremely high proportions of people travelling to work, school and college by non-car modes, ranging from 51.7% in Botanic A to 78.2% in Mountjoy B. Therefore, there are low percentages using private motorised transport to travel to work, school or college, ranging from 8.6% to 37.4%. Similar to the employment statistics, the EDs with the highest reliance on non private-motorised transport and the highest proportions of households with no cars include Ballybough B, Mountjoy B and Inns Quay B.

Compared with GDA and State averages, the EDs of Area MN106 generally have considerably higher than average percentage of households with no cars and a relatively average percentage of households with one car. Subsequently, the percentages of households with two or three cares are significantly lower than the GDA and State averages.

Table 11.24 Education Data for Area MN106

Area MN106	Drumcondra South C	Botanic A	Drumcondra South A	Botanic B	Drumcondra South B	Botanic C	Ballybough B	Inns Quay A	Cabra East A	Mountjoy B	Inns Quay B	Dublin City	Greater Dublin Area	State
Education levels														
Percentage of population aged 15 years and over at school or university	14.0	8.1	11.2	10.0	8.8	11.2	11.1	10.6	9.5	10.3	8.5	9.2	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	3.9	5.2	6.3	5.8	7.6	7.2	8.5	6.5	8.0	14.9	10.6	6.1	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	17.9	13.3	17.5	15.8	16.4	18.4	19.6	17.1	17.5	25.3	19.1	15.3	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained														
No formal education	0.5	0.3	0.7	0.4	1.5	0.1	4.1	0.4	0.3	1.3	0.7	0.7	0.5	0.6
Primary education	15.9	10.9	11.6	8.7	19.9	8.0	17.5	11.7	11.3	13.7	18.6	19.8	14.9	17.5
Lower secondary	13.5	12.4	12.4	11.2	11.8	12.3	14.6	9.7	12.3	11.6	11.5	16.4	17.5	20.1
Upper secondary	17.4	18.7	17.2	19.6	13.6	17.4	14.2	8.3	18.5	12.1	12.5	15.9	19.3	19.6
Technical or vocational qualification	4.4	5.0	5.0	4.6	4.0	4.6	6.1	3.5	5.4	7.1	4.2	4.6	5.3	5.6
Upper secondary and technical or vocational	2.3	2.5	2.4	2.7	2.5	3.6	4.1	3.1	3.1	5.3	3.3	2.5	2.9	3.0
Non-degree	10.3	9.7	9.1	10.2	9.8	11.7	8.3	6.4	9.4	6.2	7.3	7.9	10.7	10.6
Primary degree	10.2	11.3	11.6	11.9	10.7	12.6	8.9	7.7	11.5	8.1	8.0	8.1	7.5	5.8
Professional qualification (degree status)	3.1	3.7	3.8	4.5	2.2	4.4	2.9	3.8	3.4	2.2	2.6	2.7	3.1	2.6
Both degree and professional qualification	6.7	7.7	6.6	7.4	5.2	7.1	3.6	5.4	5.9	3.3	5.4	4.8	4.4	3.4
Post-graduate certificate or diploma	5.0	4.9	4.9	5.7	4.0	5.5	4.1	2.4	4.6	3.6	4.3	3.5	3.7	3.2
Post-graduate degree (masters)	6.2	7.8	7.5	8.1	5.6	8.0	6.4	4.1	7.1	6.3	6.4	5.4	4.4	3.0
Doctorate (PhD)	1.4	1.7	1.1	1.4	0.9	1.4	0.6	0.7	1.3	0.6	0.8	0.8	0.7	0.5
Not stated	3.2	3.3	6.1	3.9	8.1	3.3	4.7	32.7	5.8	18.4	14.4	6.8	5.1	4.6

Within Area MN106 the percentage of population aged 15 years and over whose education has not ceased is above GDA and State averages. Mountjoy B is exceptional in that 25.3% of its population aged 15 has not ceased education. This is interesting in the light that approximately 70% of its population are aged 15-44. The proportion of people who attained a level of non-degree is below the GDA and State averages while the proportion attaining primary degree is higher than the GDA and State averages. Within Area MN106 the EDs of Drumcondra South C, Drumcondra South A, Cabra East A, Botanic A, Botanic B and Botanic C have higher proportions of population attaining educational levels higher than primary degree than the remaining EDs.

11.3.1.7 Area MN107: Mater Stop to St. Stephen's Green

Area MN107 contains the following EDs:

- Rotunda A;
- Arran Quay A;
- Mountjoy A;
- Rotunda B;
- Inns Quay C;
- North City;
- North Dock C;
- Mansion House A;
- Royal Exchange A;
- Mansion House B;
- Royal Exchange B;
- St. Kevin's.

Parts of Mountjoy A, Rotunda A and Arran Quay A are located within Area MN106 but they are described in this area because the majority of the area of these EDs is in Area MN107. Rotunda A, Mountjoy A and North Dock C are included in Dublin City North East Inner City RAPID Area. Inns Quay C is included in Dublin City North West Inner City RAPID Area. Mansion House A, Mansion House B, St. Kevin's, Royal Exchange A and Royal Exchange B are included in Dublin City South East Inner City RAPID Area. Area MN107 also contains the North East Inner City IAP, O'Connell Street IAP and the HARP IAP areas under the Urban Renewal Scheme. Located within Area MN107, within 500m of the alignment, are 4 primary schools and 2 post-primary schools included in the DEIS programme.

Relevant socio-economic data available for the EDs in this area is shown in the following tables.

Figure 11.7
Area MN107 EDs

Table 11.25 Demographic Data for Area MN107

Area MN107	Rotunda A	Arran Quay A	Mountjoy A	Rotunda B	Inns Quay C	North City	North Dock C	Mansion House A	Royal Exchange A	Mansion House B	Royal Exchange B	St. Kevins	Dublin City	Greater Dublin Area	State Total
Demographics															
Population 2002	4,199	1,390	3,242	1,752	2,359	3,942	3,568	4,269	3,569	990	1,936	4,601	495,781	1,535,446	3,917,203
Population 2006	4,672	1,502	3,760	2,137	2,672	3,867	4,179	4,462	3,602	869	2,020	5,206	506,211	1,662,536	4,239,848
Percentage Change '02-'06	11.3	8.1	16.0	22.0	13.3	-1.9	17.1	4.5	0.9	-12.2	4.3	13.1	2.1	8.3	8.2
Age Profile															
Percentage of population aged 0-14	12.8	9.3	15.0	10.9	13.6	5.2	11.8	10.6	4.0	2.3	7.5	6.4	15.0	19.6	20.4
Percentage of population aged 15-24	21.1	23.0	22.4	25.0	19.8	23.1	25.4	28.3	23.6	20.3	19.5	18.8	16.9	15.6	14.9
Percentage of population aged 25-44	45.1	43.1	40.9	51.7	41.0	50.9	43.5	37.2	47.4	38.5	40.1	49.3	35.7	34.4	31.7
Percentage of population aged 45-64	16.4	13.1	15.2	9.1	16.3	16.2	15.1	16.8	19.5	26.9	24.2	17.5	19.7	20.7	21.9
Percentage of population aged 65+	4.6	11.5	6.5	3.3	9.3	4.6	4.3	7.0	5.6	11.0	8.7	8.1	12.7	9.7	11.0

There has been a small change in the population of Area MN107 over the period 2002-2006 (approximately 9%). In total the population of Area MN107 has grown from 35,817 in 2002 to 38,948 in 2006. Mansion House B ED has the greatest percentage decrease of population of all the EDs in the study area over the period 2002-2007 (12.2%). Rotund B and North Dock C saw the greatest population increase over the period. Over the inter-census period the population of EDs within Area MN107 increased moderately, average of 8.7% increase over the entire area. The populations of the Greater Dublin Area and the State increased by 8.3% and 8.2% respectively over the same period.

In Area MN107 the two most populated categories are the 15-24 age category and the 25-44 age category. The least populated age category is the 65 or older age category. Rotunda B has the lowest percentage of 45-64 age category of all EDs in the study area (9.1%). Mansion House A has the highest percentage of 15-24 age category of all EDs in the study area (28.3%). Mansion House B has the lowest percentage of 0-14 age category of all EDs in the study area (2.3%) and the highest percentage of 45-64 age category of all EDs in the study area (26.9%). Mansion House B and Royal Exchange B have higher proportions of population aged 45-64 than the remaining EDs. The majority of the remaining EDs population are within the 15-24 and 25-44 age categories.

Table 11.26 Economic and Employment Data for Area MN107

Area MN107	Rotunda A	Arran Quay A	Mountjoy A	Rotunda B	Inns Quay C	North City	North Dock C	Mansion House A	Royal Exchange A	Mansion House B	Royal Exchange B	St. Kevin's	Dublin City	Greater Dublin Area	State
Economic status															
Total working population (persons aged 15 years and over)	4,074	1,362	3,196	1,904	2,309	3,666	3,686	3,987	3,459	849	1,868	4,875	430,357	1,336,588	3,375,399
Percentage at work	59.1	60.4	55.1	61.1	52.3	64.7	57.6	53.6	62.2	65.6	59.0	61.3	56.9	59.9	57.2
Percentage looking for first job or unemployed (having lost or given up previous job)	10.9	6.5	14.0	9.6	13.2	8.8	9.2	5.9	6.4	2.9	6.5	8.1	6.8	5.4	5.3
Labour Force	2,852	910	2,210	1,346	1,513	2,694	2,461	2,373	2,374	582	1,224	3,381	274,310	873,009	2,109,498
Labour Force Participation Rate	70.0	66.8	69.1	70.7	65.5	73.5	66.8	59.5	68.6	68.6	65.5	69.4	63.7	65.3	62.5
Unemployment Rates (unemployed as percentage of labour force)	12.1	8.2	16.0	10.8	16.2	9.3	11.8	8.6	7.5	3.4	8.8	9.1	9.0	7.0	7.1
Percentage of persons at work by industry															
Agriculture, forestry and fishing	0.3	0.1	0.4	0.0	0.2	0.3	0.1	0.2	0.3	0.7	0.1	0.4	0.3	1.5	4.6
Building and construction	8.1	7.1	8.6	6.3	7.5	4.8	5.7	3.9	3.2	1.3	3.8	3.6	6.5	8.8	11.1
Manufacturing industries	6.7	6.8	6.4	7.0	6.5	7.5	5.2	6.7	6.4	7.4	5.3	5.8	8.2	10.7	13.6
Commerce and trade	28.0	32.7	28.9	32.2	33.4	34.7	35.8	36.4	33.7	35.0	34.0	37.1	34.1	33.1	27.1
Transport and communications	4.4	4.3	4.5	3.5	5.0	5.0	5.2	5.2	2.7	4.1	4.6	3.6	6.9	6.7	5.5
Public administration	2.9	4.5	3.2	1.5	3.6	3.5	2.4	3.0	3.9	3.4	4.2	4.5	6.0	5.9	5.2
Professional services	11.3	19.8	12.0	11.0	12.2	11.4	10.1	14.6	10.5	10.6	10.3	11.2	16.2	15.7	16.5
Other	38.1	24.7	36.0	38.4	31.6	32.7	35.5	30.0	39.2	37.5	37.6	33.7	21.7	17.6	16.3
Social classification															
Percentage professional and technical	16.3	31.4	15.3	17.8	15.9	28.0	20.8	21.4	28.2	41.1	24.2	32.1	30.4	35.8	32.9
Percentage non-manual, skilled and semi-skilled	34.8	38.0	32.3	30.4	39.7	34.0	29.0	31.1	27.5	16.7	29.7	28.8	41.3	42.3	45.2
Percentage unskilled and other occupations	48.9	30.6	52.4	51.8	44.3	38.1	50.2	47.5	44.3	42.2	46.1	39.1	28.3	22.0	21.9

The percentage of people at work varies over a wide range in this area (52.3% in Inns Quay to 65.6% in Mansion House B) and is quite high on average (53.4%). This area also has a large percentage of people looking for their first job or unemployed, ranging from 2.9% in Mansion House B to 14.0% in Mountjoy A. Compared with the Greater Dublin Area and the State averages, Area MN107 has a relatively higher rate of unemployment. The EDs with the highest rates of unemployment include Inns Quay C (16.2%), Mountjoy A (16.0%), Rotunda A (12.1%) and North Dock C (11.8%).

Overwhelmingly the majority of respondents to the 2006 Census from EDs within Area MN107 indicated their employment industry as 'other'. Of the remaining working population the industry of commerce and trade employs the highest percentage of the working population in this area. High percentages of the working population are also employed in the professional services. Compared with the GDA and State averages, this area has slightly higher than average proportion working in commerce and a reasonably lower than average proportion working in the professional services. The majority of people at work from Area MN107 are employed in unskilled and other occupations. Mansion House B has the highest proportion of professional and technical classification (41.1%) in this area. Inns Quay C has the highest proportion of non-manual, skilled and semi-skilled (39.7%). Mountjoy A has the highest proportion of unskilled and other employment classification (52.4%) of all EDs in the study area.

Table 11.27 Transport Data for Area MN107

Area MN107	Rotunda A	Arran Quay A	Mountjoy A	Rotunda B	Inns Quay C	North City	North Dock C	Mansion House A	Royal Exchange A	Mansion House B	Royal Exchange B	St. Kevin's	Dublin City	Greater Dublin Area	State
Mode of transport for persons aged 5 or over to work, school or college															
Percentage non private-motorised transport (by foot, bicycle, tram, train, bus)	77.7	74.0	77.3	81.2	77.5	84.0	75.7	79.2	74.7	65.9	64.2	70.4	57.7	41.0	31.7
Percentage private-motorised transport (car, motorcycle)	9.5	18.7	7.2	8.3	12.0	7.4	10.7	10.4	8.3	13.6	11.6	13.3	34.1	50.3	57.0
Car Ownership															
Percentage of households with no car	78.5	56.1	77.0	82.7	71.4	82.6	69.5	70.7	78.6	63.9	80.1	67.4	40.5	22.0	19.7
Percentage of households with one car	18.9	31.3	21.0	13.4	24.5	16.3	25.5	26.1	18.5	26.7	17.5	25.9	39.0	39.1	38.6
Percentage of households with two cars	1.9	11.3	1.2	2.6	3.4	0.9	4.3	2.6	2.4	7.9	2.0	5.5	16.9	31.4	32.9
Percentage of households with three or more cars	0.6	1.3	0.8	1.3	0.7	0.2	0.7	0.6	0.5	1.6	0.4	1.1	3.6	7.6	8.7

Area MN107 also has relatively high proportions of people travelling to work, school or college by non-car modes, ranging from 64.2% in Royal Exchange B to 84.0% in North City (highest proportion of all EDs in the study area). Compared with GDA and State averages, the EDs of Area MN107 generally have considerably higher than average percentage of households with no cars. An overwhelming majority of the households have no cars. Subsequently, the percentages of households with one, two or three cars are significantly lower than the GDA and State averages. Notable are the relatively high proportions in Arran Quay A, Mansion House B and St. Kevin's for the percentage of private-motorised mode of transport and the percentage of households with three or more cars.

Table 11.28 Education Data for Area MN107

Area MN107	Rotunda A	Arran Quay A	Mountjoy A	Rotunda B	Inns Quay C	North City	North Dock C	Mansion House A	Royal Exchange A	Mansion House B	Royal Exchange B	St. Kevin's	Dublin City	Greater Dublin Area	State
Education levels															
Percentage of population aged 15 years and over at school or university	12.5	13.2	9.7	14.3	10.7	13.7	15.7	21.2	15.9	14.7	14.2	12.3	9.2	8.6	8.2
Percentage of population aged 15 years and over at other educational institution	12.2	8.7	12.9	14.9	10.9	13.7	10.9	8.7	10.2	8.5	6.7	9.3	6.1	4.9	4.1
Total percentage of population aged 15 years and over whose education has not ceased	24.7	21.9	22.6	29.2	21.5	27.4	26.6	29.9	26.1	23.2	20.9	21.6	15.3	13.5	12.4
Percentage of persons aged 15 years and over whose full-time education has ceased and level attained															
No formal education	0.5	0.6	1.1	0.9	0.4	0.9	1.4	0.9	2.3	0.2	0.3	1.2	0.7	0.5	0.6
Primary education	13.1	17.7	20.5	8.7	25.3	7.4	15.0	19.2	11.5	1.5	12.5	10.1	19.8	14.9	17.5
Lower secondary	12.4	11.3	14.3	10.0	15.6	10.3	11.9	13.8	9.1	2.6	13.6	8.9	16.4	17.5	20.1
Upper secondary	15.1	14.6	11.6	11.1	12.6	14.2	10.4	10.3	10.2	8.0	10.9	10.7	15.9	19.3	19.6
Technical or vocational qualification	5.6	4.6	5.6	4.9	5.0	4.0	3.1	2.6	3.1	2.9	3.0	2.9	4.6	5.3	5.6
Upper secondary and technical or vocational	3.0	3.5	3.5	3.8	3.4	3.3	2.9	2.4	2.5	3.2	1.3	2.7	2.5	2.9	3.0
Non-degree	6.0	8.0	5.6	9.5	5.2	8.1	6.1	5.9	6.1	6.0	4.8	7.9	7.9	10.7	10.6
Primary degree	7.5	10.2	6.3	10.7	7.8	11.4	9.1	10.5	11.5	11.6	10.7	12.1	8.1	7.5	5.8
Professional qualification (degree status)	3.1	4.5	3.0	3.3	2.3	4.7	3.6	2.5	3.9	4.6	4.4	4.2	2.7	3.1	2.6
Both degree and professional qualification	4.5	7.1	3.7	5.8	2.8	6.7	6.2	4.4	6.4	12.1	5.9	6.9	4.8	4.4	3.4
Post-graduate certificate or diploma	3.7	4.5	3.4	4.8	3.1	5.5	4.4	3.5	5.5	5.1	2.7	4.6	3.5	3.7	3.2
Post-graduate degree (masters)	5.3	6.8	5.1	7.3	5.9	9.0	6.7	6.5	7.2	13.0	5.4	9.6	5.4	4.4	3.0
Doctorate (PhD)	0.9	0.4	0.9	0.7	0.5	1.3	1.4	1.8	1.3	4.6	1.8	1.2	0.8	0.7	0.5
Not stated	19.3	6.3	15.3	18.5	10.1	13.2	17.8	15.7	19.4	24.4	22.7	17.1	6.8	5.1	4.6

Within Area MN107 the percentage of population aged 15 years and over whose education has not ceased is considerably higher than GDA and State averages, the lowest percentage being 20.9% in Royal Exchange B. The EDs of North City and Mansion House B, and Royal Exchange A and St. Kevin's to some extent have the highest levels of education. The EDs with the highest proportions of population attaining only lower secondary level of education include Inns Quay C, Mountjoy A and Mansion House A. Overall, the proportion of people who attained a level of non-degree is below the GDA and State averages while the proportion attaining primary degree is higher than the GDA and State averages.

11.3.2 Primary study area summary

The primary study area consists of EDs within areas:

- MN101;
- MN102;
- MN103;
- MN104;
- MN105;
- MN106;
- MN107.

Headline data for each area is shown in the following table:

Table 11.29 Area Totals

Area MN107	MN101	MN102	MN103	MN104	MN105	MN106	MN107	Fingal	Dublin City	Greater Dublin Area	State
Key Statistics											
Population 2002	23,844	13,325	1,031	838	26,491	34,752	35,817	196,413	495,781	1,535,446	3,917,203
Population 2006	32,168	17,969	2,522	3,747	26,596	35,895	38,948	239,992	506,211	1,662,536	4,239,848
Percentage population change	34.9	34.9	144.6	347.1	0.4	3.3	8.7	22.2	2.1	8.3	8.2
Percentage of total working population (persons aged 15 years and over) at work	68.4	72.5	69.3	76.2	45.8	59.3	59.0	64.6	56.9	59.9	57.2
Percentage of population aged 5 years and over using non private-motorised transport (foot, bicycle, tram, train, bus) to travel to work, school or college	36.4	35.4	31.9	31.3	57.5	62.7	76.2	38.5	57.7	41.0	31.7
Percentage of population who are aged 15 or older and whose education has not ceased	11.7	13.7	10.8	10.8	17.2	18.1	25.0	13.2	15.3	13.5	12.4

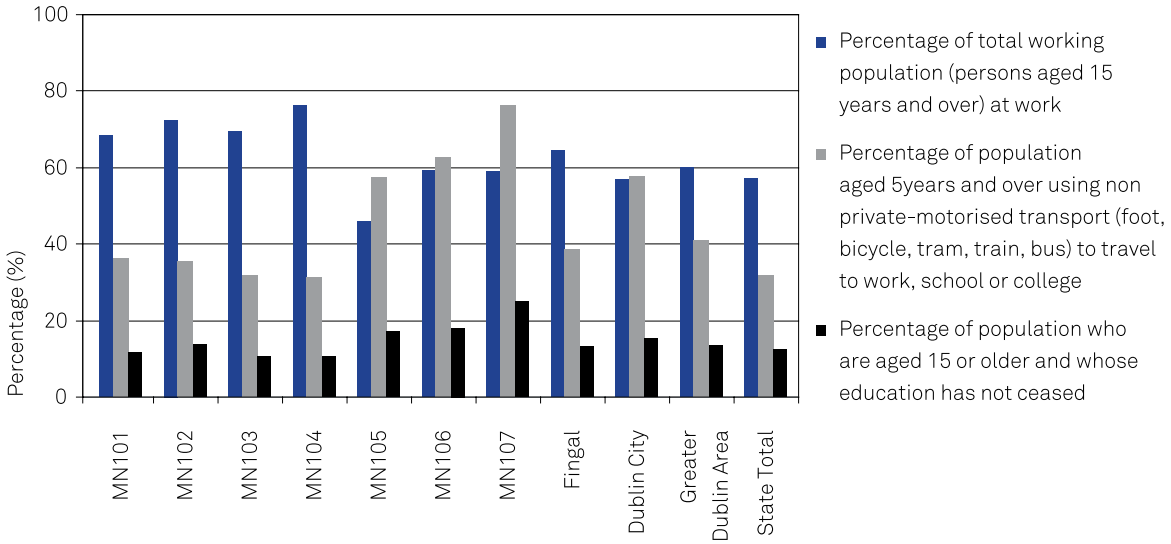


Figure 11.8
Headline data

All areas along the alignment have seen increases in population, as have had Dublin City (2.1%) and Fingal (22.2%). Areas MN101, MN102, MN103 and MN104 all saw large increases in population over the inter-census period. While there were population declines in EDs such as Ballymun B, Ballymun D, Ballymun E, Ballygall C, Cabra East A, Drumcondra South C, Drumcondra South B, Botanic B, Botanic C, North City and Mansion House B, the population increases of the remaining EDs of MN105, MN106 and MN107 result in net population increases for all areas.

Areas MN101, MN102 and MN104 have the youngest populations, the majority of their populations being balanced between the 0-14 age category and the 25-44 age category. Area MN103 has the highest proportion of 15-24 age category. Area MN106 also has a relatively young population, with the majority of its population belonging to the 15-24 and the 25-44 age categories. The population of Area MN107 is older than the other areas; the majority of its population are in the 25-44 and 45-64 age categories. The northern areas have higher levels of young people due to the large amount of recent suburban development in these areas. Further to the south the ages of the resident families are older, with a higher proportion of teenagers and young adults. The highest levels of population aged 65 years or older occur in the EDs of Ballymun, Whitehall, Drumcondra, Botanic and Inns Quay. The City Centre EDs of areas MN106 and MN107 are overwhelmingly populated by persons of the age category 25-44 years.

The highest percentages of working population (persons aged 15 years or older) at work occur in the EDs of Areas MN101, MN102, MN103 and MN104. Areas MN106 and MN107 have lower percentages of working population (persons aged 15 years or older) at work. Area Mn105 has the lowest percentages of working population (persons aged 15 years or older) at work. Similarly all EDs of areas MN101, MN102, MN103 and MN104 have rates of unemployment lower than the GDA and State averages. While the rates of unemployment vary across the areas of MN106 and MN107 it can be seen that their rates of unemployment are slightly higher than the GDA and State averages. Area MN105 has both the EDs with the highest and lowest rates of unemployment of all EDs along the alignment. The EDs of Ballymun show unemployment rates considerably higher than the GDA and State averages.

Overall, the majority of people are employed in the commerce and trade industry, across all EDs in all areas. The second most important industry is professional services. The proportion of the population employed in each industry is relatively uniform across all EDs in all areas. However, these figures are hampered by the proportion of respondents who indicated their industry as 'other'. The highest percentages of respondents choosing 'other' are from areas MN105, MN106 and the highest in MN107.

The proportion of population of each social classification changes slightly from area to area. In Areas MN101, 102, 103 and 104 the proportion of non-manual, skilled and semi-skilled is comparatively high, with a slightly lower proportion classified as professional and technical. The smallest proportion of the population is classified as unskilled and of other occupations. Within the Areas MN105, MN106 and MN107 the proportion of population classified as unskilled or of other occupation are elevated, especially in MN105 and MN107. Only in Area MN106 is there a relatively high proportion of the population classified as non-manual, skilled and semi-skilled.

The percentage of persons aged 5 or older using private motorised transport to work school or college is relatively high in Areas MN101, MN102, MN103 and MN104. As we move closer to the city centre, the proportion of persons aged 5 or older using private motorised transport to work school or college declines, with the lowest rate of use of private motorised transport being in MN107.

In all of the seven MN areas, there is a high proportion of households that have one car per household, except for Area MN107, which is mostly composed of no-car households. Within Areas MN101, MN102, and MN103, there are significantly higher numbers of households with two cars per household.

The percentage of population aged 15 years or older at school, college or other educational institution varies across the different areas. By far the highest proportion is to be found in Area MN107, closely followed by Area MN106. The proportion within Area MN105 is still relatively high compared with GDA and State averages. Areas MN101, MN102, MN103 and MN104 have proportions lower than GDA and State averages.

Areas MN101, MN102, MN103 and MN104 show higher levels of the population who have ceased education attaining the levels of non degree and primary degree than the remaining areas. Within all areas there are high proportions of the population only having attained a primary or lower secondary education, especially in MN105, MN106 and MN107. The lowest levels of population attaining qualifications higher than secondary, technical or vocational occurs in Area MN105, Within areas MN106 and MN107 are the highest proportions of people attaining levels of qualification higher than secondary, technical or vocational. Within areas MN101, MN102, MN103 and MN104 the proportion of population attaining qualifications higher than secondary, technical or vocational is comparable to the GDA and State averages.

11.3.3 Secondary study area

The population increase of Fingal (22.2%) was significantly higher than the GDA and State averages (8.3% and 8.2% respectively). There has been considerable growth in the Fingal region over the inter-census years. This has been due to the expansion and development of suburban and commuter towns. The population of Dublin City only increased by 2.1% over the same period. It seems that while the city population remains relatively static the population of Fingal is increasing rapidly.

Compared to GDA and State averages, Fingal has a younger population while Dublin City has a greater proportion of older persons. Both Fingal and Dublin City show proportions of population aged 25-44 higher than the GDA and State averages.

The percentage of the population (aged 15 years or older) at work in Fingal is higher than the GDA and State averages, while the percentage in Dublin City is lower. The unemployment rate in Fingal considerably lower than the GDA and State average, while the unemployment rate in Dublin City is considerably higher than the GDA and State average.

Fingal has higher proportions of its working population employed in agriculture, forestry and fishing; building and construction; manufacturing industries; transport and communication; and public administration than Dublin City. Dublin City has higher proportion of its working population employed in commerce and trade, and professional services than Fingal. Both Fingal and Dublin City, when compared with GDA and State averages, have lower proportions of working population employed in agriculture, forestry and fishing; building and construction; manufacturing industries. Again when compared with GDA and State averages they have higher proportions of the working population employed in transport and communications, and public administration. Their figures on professional services are comparable with GDA and State averages.

Fingal has higher proportions of population classified as professional and technical and non-manual, skilled and semi-skilled than Dublin City, and a lower proportion of population classified as unskilled and of other occupations. With regards to the proportions of population classified as professional and technical, Fingal has higher and Dublin City has lower than the GDA and State averages. The figures for non-manual, skilled and semi-skilled are relatively comparable for both Fingal and Dublin City and the GDA and State averages. Fingal has a lower proportion and Dublin City has a higher proportion of population classified as unskilled and of other occupations than the GDA and State averages.

With regards to the mode of transport for persons aged 5 or older to work, school or college Fingal and Dublin City are quite opposite to each other. In Fingal the majority of the population use private motorised transport, while in Dublin City the majority use non private-motorised transport, such as by foot, bicycle, train, tram or bus. Fingal's figures for private-motorised are higher than the GDA average but lower than the State average. Dublin City's figures for private-motorised are considerably lower than both the GDA and State averages.

Fingal and Dublin City also differ from each number when considering the number of cars per household. The percentage of households with no car in Fingal is lower than both the GDA and State averages. Whereas, in Dublin City the percentage of households with no car is significantly higher than the GDA and State averages. Both Fingal and Dublin City have a similar percentage of households with one car, comparable to the GDA and State averages. When considering two, three or more cars per household, Dublin City has considerably lower percentages than the GDA and State averages, while Fingal's percentages are relatively higher or slightly higher than the GDA and State averages.

With regards to education Dublin City has higher proportions of its population aged 15 years or older, whose education has not ceased, at school, university or other educational institution than both the GDA and State averages. Fingal's figures for the proportion of population aged 15 years or older (whose education has not ceased) at school or university are lower than the GDA and State averages. Fingal's figures for the proportion of population aged 15 years or older (whose education has not ceased) at other educational institution is lower than the GDA average, but higher than the State average.

Fingal exceeds both the GDA and State averages in the proportion of its population having attained non-degree, primary degree, professional qualification (degree status), both degree and professional qualification and post graduate certificate or diploma level. Dublin City exceeds the GDA and State averages in the proportion of its population having attained primary degree, both degree and professional qualification, post-graduate degree (masters) and Doctorate (PhD). The proportion of population (whose education has ceased) with no formal education or only a primary education is higher in Dublin City than both the GDA and State averages.

11.4 DO MINIMUM SCENARIO

In order to understand the impact of the proposed scheme in the future, it is necessary to have knowledge of how the existing baseline environment will change in the future if the proposed scheme is not implemented. The do minimum socio-economic scenario is based on population projections estimated by the Department of the Environment, Heritage and Local Government (DoEHLG) and the CSO. The DoEHLG projections are based on past trends and the envisaged impact associated with the implementation of Government policy. These projections are detailed in the National Spatial Strategy (2002) and have been adopted into the Regional Planning Guidelines (2004). The Central Statistics Office does not include consideration of policy implementation into their population projections. The CSO's projections date from 2004 and 2005. The following table indicates the projections made by the DoEHLG and CSO.

Table 11.30 Population projections for 2020

Region	National Spatial Strategy low estimates	DoEHLG guidelines estimates	Estimates adopted into RPGs	Central Statistics Office M1f2 (Medium) estimates
Greater Dublin Area	1,900,000	1,800,000	1,832,000	2,039,000
State	4,345,000	4,700,000	4,737,000	5,017,022

The national population numbers are the result of two factors, natural increases (births minus deaths) and net migration. There are various assumptions that have been made in the projection of population data. In the calculation of their figures, the CSO have assumed that the fertility rate will decline up until 2011 and subsequently remain stable for the period up to and beyond 2020. Mortality was considered to decrease for both males and females until and beyond 2020.

It is assumed that for the State, natural increase will be at the following rates:

- 2006-2011: 34,000 per annum
- 2011-2016: 35,000 per annum
- 2016-2020: 32,000 per annum.

Over recent years Ireland has experienced increased levels of net migration. The CSO projections assume that net migration will be at the following rates:

- 2006-2011: 50,000 per annum
- 2011-2016: 45,000 per annum
- 2016-2020: 37,500 per annum.

By including these assumptions in their population projections, the CSO calculate population projections as:

Table 11.31 National Population Projections to 2020

Year	2006	2011	2016	2020
Population	4,234,925	4,655,000	5,055,000	5,333,000

In the case of the GDA, the CSO has suggested that the population in the GDA as a percentage of the national population would increase from 39.2% in 2002 to 40.7% by 2021.

The RPG uses the following assumptions in the calculation of their population projections:

- regions adjacent to the GDA will grow at a relatively slower rate,;
- within the GDA, the pace of growth will balance out among the counties;
- growth in the south-west and mid-west will be supported;
- Government will continue to support regions such as the West and Border, which have been performing as according to the NSS.

With these assumptions considered the following population projections have been calculated:

Table 11.32 Regional Target Projections to 2020

Region	2006	2011	2016	2020	% Share 2006	% Share 2020	RPG 2020
Dublin	1,186,159	1,287,525	1,390,579	1,464,387	28.01	27.46	-
GDA	1,661,185	1,824,566	1,966,184	2,066,317	39.23	38.75	1,832,000
State	4,234,925	4,655,000	5,055,000	5,333,000	100	100	4,737,000

These projections are relevant to the study area in that they highlight the amount of population growth that is likely to occur. According to Table 11.32 the population of Dublin will grow by 8.5% between 2006 and 2011, by 8.0% between 2011 and 2016 and by 5.3% between 2016 and 2020. The population of the study area is likely to grow at these rates or higher. It will more than likely grow at a higher rate due to policies concentrating future development around transport hubs.

The population age structure will also change. It is likely that in areas currently with high proportions of young population there will be relatively higher levels of population of older age categories. Similarly in areas of high middle-aged populations there will be high numbers of older populations.

It is impossible at this stage to calculate how the economic status, employment industries and social classifications will change over time. It can be taken that these statistics will remain relatively uniform over the future years, except in areas of high redevelopment.

With regards to transport, in the absence of the proposed scheme, the proportion of the population using private motorised transport is likely to increase. The number of cars per households will also increase, especially in areas where there are currently young populations.

Education levels will also remain relatively uniform in future years in the absence of the proposed scheme. It is likely that the percentages of the population with minimal formal education will decline and there will be an increase in the proportions of the population with secondary or higher educations.

12 HUMAN BEINGS: NOISE

Section 39(2) (b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter has been prepared in order to fulfil this requirement with respect to noise affecting human beings.

12.1 INTRODUCTION

This chapter describes and evaluates the existing noise environment in the area of the proposed scheme.

Prior to preparing this chapter, a review of relevant planning and policy documents was undertaken in order to identify relevant objectives relating to noise. The following documents have been reviewed:

- Fingal County Development Plan 2005-2011;
- Airport Local Area Plan (2006);
- Dublin City Development Plan 2005-2011;
- Masteplan for the new Ballymun, (1998 (as amended)).

The results of this review are detailed in the Planning and Policy Context chapter of this EIS (Volume 1, Chapter 4).

12.2 BASELINE CATEGORISATION METHODOLOGY

12.2.1 Introduction

Noise has been defined as any sound which has the potential to cause disturbance, discomfort or psychological stress to a subject exposed to it, or any sound which has the potential to cause actual physiological harm to a subject exposed to it or physical damage to any structure exposed to it (EPA, 2006).

Noise, as a result of human activity, is almost ubiquitous in the modern world. Noise sources in urban environments such as Dublin city centre are typically dominated by transport and industrial sources. Quiet areas do however exist, where noise levels can be influenced by domestic sources (e.g. music, lawnmowers and children playing) and the environment itself (e.g. birds and dogs).

12.2.2 Study area

The following points have been considered when defining the study area:

- A preliminary corridor of 500m either side of the proposed alignment is initially examined to identify sensitive receptors. This corridor allows for short distance traffic diversions to be taken into account should they occur.
- Monitoring has generally been carried out at locations that represent the 'worst affected receptor scenario' i.e. sensitive receptors along the row of buildings closest to the alignment.
- In more rural areas (e.g. Metropark and Lissenhall), a 'first row of buildings' does not always exist. In these cases, noise levels are taken at the nearest noise sensitive receptors to represent the 'worst affected receptor scenario'.

Consideration of the above points has led to the study area being defined as shown in Table 12.1.

Table 12.1 Study area

Aspect	Width of study area (on both sides of the alignment)
Initial identification of sensitive receptors	500m either side of the alignment
Noise monitoring in urban areas	Sensitive receptors along the nearest row of buildings
Noise monitoring in rural areas	At the closest noise sensitive receptors

12.2.3 Baseline data

The data used to compile the baseline for this chapter is shown in Table 12.2.

Table 12.2 Baseline data

Information required	Data source
Suitable Noise monitoring locations (NMLs) and noise sensitive areas	- Baseline Landuse Maps (Volume 3, Book 1 of 2); - Business directory maps of Dublin; - Ordnance Survey Ireland (OSI) Discovery series maps of Dublin; - Landuse zonings detailed in Dublin City and Fingal County Development Plans (2005 – 2011); - Landuse zonings detailed in Dublin Airport Authority Local Area Plan (2005 – 2011).
Existing noise levels within the study area	- Dublin City Council 'Noise Maps' 2007*, which indicate modelled noise levels, within the DCC area, as a result of modelled traffic flow on the city's roads. Note: equivalent maps are not available for the Fingal County Council area.
Noise readings in specific areas	- Noise survey involving in-the-field monitoring (report included as Annex B (Volume 3, Book 2 of 2).

*The Noise maps produced by Dublin City Council model road traffic noise as LA10, 18-hour dB noise levels. The LA10, 18-hour was the accepted parameter used to measure traffic noise prior to the Environmental Noise Regulations 2006.

The noise values shown in the Dublin City Council 'Noise Maps' have been used to obtain an initial view of the range of noise levels that occur within the Dublin City Council parts of the study area. This information has been considered when selecting appropriate Noise Monitoring Locations (NMLs).

12.2.4 Baseline categorisation criteria

Categorisation of the baseline environment involves the allocation of overall 'functional values' to discreet areas within the study area. The functional value of the area is determined with reference to the 'importance' and 'sensitivity' of the area and any 'existing adverse effects' that impact on the area. Each of these three terms is explained in detail in this section.

12.2.4.1 Importance

There are not any designated areas within the baseline study area where defined or statutory noise limits must be conserved. Neither are there any areas that are currently protected by any specific policy objectives relating to noise.

Residential areas, public and private health facilities, places of worship, recreational areas and educational facilities are considered to be important areas within the noise baseline environment. The activities carried out in these areas perform an important function for local communities.

The purpose of the EU Noise Directive (EU, 2002), is 'to control and manage environmental noise in built-up areas, in public parks or other acoustically valued soundscapes…in an agglomeration and in Quiet Areas in open country' (Weiss et al., 2003). In the absence of specific noise limits for any area of the baseline, efforts have been made to identify these types of areas through the landuse mapping. The criteria chosen for the assessment has taken into consideration these landuses.

12.2.4.2 Sensitivity

Receptors that are considered to be highly sensitive to noise include residential areas and public and private health facilities. These areas are considered to be highly sensitive noise receptors because the activities that are carried out at these locations are dependent on low noise levels being maintained e.g. sleeping and recuperation.

Places of worship and educational facilities are also considered to be sensitive to noise because the activities that are carried out in these areas are also dependent on low noise levels. Religious activities are only typically carried out during daytime. These landuses are therefore only considered to be sensitive during the day.

Areas where recreational activities are carried out and offices are not considered to be as sensitive as residential areas, hospitals or places of worship. In comparison to residential areas and hospitals, these areas are typically only sensitive during the day, and not necessarily continually. The performance of individuals involved in activities that are carried out at these areas may be diminished if significant noise levels occur. However, the threshold of disturbance is higher than is the case with the activities that are practiced in places of worship or educational facilities. For these reasons, recreational facilities and offices are considered to be of medium sensitivity.

Receptors that are considered to be of low sensitivity include: industrial/warehouse premises; purpose-built, indoor retail areas including shopping complexes; indoor recreational areas; brownfield/vacant/derelict sites; and Dublin Airport. These areas are considered to be of low sensitivity because the activities that are carried out at these locations are typically carried out indoors in areas that are already protected from noise disturbance. Furthermore, the activities that are carried out are not typically dependent on low noise levels. Agricultural areas and greenbelt areas that are not typically used for recreation are also considered to be of low sensitivity because these areas are typically only occupied by limited numbers of humans/animals for short periods of time. The activities that are carried out in these areas are also not considered to be noise sensitive. Areas of existing transport infrastructure are considered areas of low sensitivity as they are designed to take modes of transport.

12.2.4.3 Existing adverse effects

In some parts of the study area, existing noise levels are already quite high prior to the introduction of the proposed scheme. These existing high noise levels need to be taken into account. For this reason, baseline monitoring was carried out at a number of locations within the study area and the results obtained are taken into account in the impact assessment.

12.2.4.4 Functional value

The functional value of the baseline environment is evaluated by means of a number of specific criteria to take into account the importance and sensitivity of different features of the environment. The criteria that have been defined are described in Table 12.3.

Table 12.3 Criteria for baseline categorisation

Criteria	Functional value
Locations that are highly sensitive during both night and day: - All residential areas including permanent halting sites and residential landuses with a commercial/retail component (e.g. an apartment located on the first floor over a pharmacy); - Hospitals, nursing homes etc.	Very high (V)
Locations that are only sensitive during the day, where the activities that are carried out require an acceptable noise environment: - Educational/Institutional uses including schools; - Theatres; - Places of worship i.e. religious buildings.	High (IV)
Locations that are only sensitive during the day and where the activities that are carried out can be carried out in the presence of some noise, but not high levels of noise: - Outdoor recreational areas; - Cinemas; - Offices.	Medium (III)
Locations that are only sensitive during the day and where the activities that are carried out are carried out indoors and/or not sensitive to noise: - Industrial/Warehouse uses; - Indoor recreation areas; - Dublin Airport Zone; - Agricultural areas; - Brownfield/Vacant/ Derelict sites; - Carparks and other infrastructure including roads; - Purpose-built shopping complexes.	Low (II)
Not Applicable.	Very low (I)

The results of the baseline categorisation in terms of functional value are shown in Table 12.4 and illustrated on maps (Baseline Noise) included in Volume 3, Book 1 of 2.

12.3. DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

12.3.1 Description of the baseline environment

12.3.1.1 Belinstown to Lissenhall Bridge

This area comprises the area that extends from the most northerly part of the study area (500m north of the depot location) to Lissenhall Bridge. The majority of this area is currently zoned as a greenbelt under the development plan and the dominant landuse within this area is agricultural. Residential areas are limited to a small number of scattered farmhouses and standalone houses.

As set out in the criteria the residential areas within this area are considered to have a Very high functional value. The agricultural lands have a Low functional value.

There are a number of residential properties in this area as well as a farm produce processing facility. Noise levels in the area are dominated by the traffic on the M1 and local roads. Noise measurements at locations NML 1, 2 and 3 gave similar readings for both day and night with all daytime noise levels ranging between 51-55dB(A) $L_{Aeq,\ 15\ minute}$ and night-time levels ranging between 42-48dB(A) $L_{Aeq,\ 15\ minute.}$

To the west of the R132 is the Emmaus Retreat and Conference Centre. This centre includes dormitories and is highly sensitive during both day and night. It therefore has a Very high functional value. The grounds of this Centre include a river walk along the Broad Meadow River which is regularly used for recreational purposes. Baseline noise samples have been taken at the Emmaus Retreat and Conference Centre (NML 7). The monitoring results indicate that daytime noise levels at the centre are relatively low and constant (53-56dB(A) $L_{Aeq,\ 15\ minute}$). Nighttime noise levels in this area are also quite low (48dB(A) $L_{Aeq,\ 15\ minute}$).

Baseline daytime and nighttime noise samples have also been taken at two residential houses in this area (NML 5, 6). Daytime noise levels at NML 4 and NML 5 are similar to that of the Emmaus Retreat Centre in that they are relatively low and relatively constant. Daytime noise levels at NML 6 were slightly higher (56-60dB(A) $L_{Aeq,\ 15\ minute}$), which may be due to the closer proximity of the M1 motorway.

Noise measurements have been taken from NML 8, NML 9, and NML 10. All of these locations are positioned along the R132, which is the dominant source of noise at these locations. The results from these locations indicate that daytime noise levels along the road can vary between 54 and 63dB(A) $L_{Aeq,\ 15\ minutes}$. It is likely that increases in traffic flow by the year of operation in 2014 will increase baseline noise levels here by 1dB(A).

12.3.1.2 Lissenhall Bridge to the north of the airport

This area consists of a number of different distinct landuses.

As set out in the criteria, the commercial and industrial landuses of Low functional value include premises to the south of Lissenhall Bridge (including Swords Wastewater Treatment plant, the Swords Business Park, the Pavilions Shopping Centre, the Airside Retail Park, the Scotchstone Business area and areas within Swords town centre). All of the commercial and industrial landuses within this area have been allocated a Low functional value. A number of landuses within this area have been allocated a Medium functional value because of their recreational value. These areas include the open green areas and parklands that surround the Ward River, Swords Castle and the playing fields in this area (including Fingallians GAA sports grounds).

Residential areas in this area include Swords town, the Lissenhall and Seatown residential areas, Kilronan House, two halting sites and also a number of smaller residential areas and stand-alone houses. All of the residential areas in this area have been allocated a Very high functional value. The Tara Winthrop Private Clinic (nursing home) located on Nevinstown Lane has also been allocated a Very high functional value.

A number of educational facilities and buildings used as places of worship are also located in this area. These landuses have been allocated a High functional value. Examples include Colaiste Choilm, St. Colmcille's Boys National School and Girl's National School as well as a church and graveyard located on Chapel Lane.

The open spaces around the Ward River, Forrest Little Golf Club, and the playing fields in this area have been allocated a Medium functional value because of their potential recreational use and the fact that these areas are typically only sensitive during the day. Open green spaces with Medium functional value area also located around the Airside Retail Park and extensive areas exist to the north of the airport.

From the Seatown Roundabout to the Airside Retail Park, the alignment runs along the R132. Traffic noise dominates in this area. Noise monitoring has been carried out at three monitoring locations (NML 11, NML 12 and NML 13) which are all located along the busy R132. The monitoring results from these locations indicate that high existing noise levels are experienced at these locations during both night and day (Day: $L_{Aeq\ 15\ minute}$: 63 - 66dB(A), Night: $L_{Aeq\ 15\ minute}$: 52 - 60dB(A)) and that this existing noise is primarily due to traffic noise. The receptors at NML 11 and NML 12 experience lower noise levels than that of NML 13 because of a wall that exists between the road and the receptors, which effectively acts as a noise barrier. It is likely that increases in traffic flow by the year of operation in 2014 will increase baseline noise levels at NML 11 by 1dB(A).

12.3.1.3 Dublin Airport

The area within and around the airport has been assigned a Low functional value because the activities that take place are not sensitive to noise. The houses and halting sites have been assigned a Very high functional value. These receptors are already experiencing very high levels of noise. A number of offices located within the Dublin Airport Zone have been allocated a Medium functional value.

12.3.1.4 South of the airport to Northwood

In this area the dominant landuse is agricultural. Some small areas are also used for light industrial and commercial landuses e.g. the Ballymun NCT test centre, Tesco's Distribution Centre and warehousing areas. These areas have been allocated a Low functional value. To the north of the M50 some of the open fields are used for recreation e.g. Cumann Parnell, Ciceam Baile Munna, Sillogue Golf Course and the sports grounds that are used by the Royal College of Surgeons. These areas can all be used for recreation and therefore have been allocated a Medium functional value. Some small areas are also used for light industrial and commercial landuses e.g. the Ballymun NCT test centre, warehousing areas. A small number of residential landuses such as Santry Demense are allocated a Very high functional value.

Existing noise levels have been measured at two locations (NML 14 and NML 15). The results obtained indicate that existing noise levels during the day and night are high (Day: 60-69dB(A) $L_{Aeq\ 15\ minute}$; Night: 57-63dB(A) $L_{Aeq\ 15\ minute}$). The dominant source of noise is traffic noise.

12.3.1.5 Northwood to Albert College Park

This area consists primarily of the residential areas of Ballymun (e.g. Poppintree, Ballcurris gardens, Sillogue, Coultry Park and Shangan). This area includes Ballymun town centre and Main Street, and also a number of prefabricated, (and sometimes vacant) tower blocks, which are all in the process of undergoing major redevelopment and regeneration. All of the residential areas are considered to be of Very high functional value.

A number of educational facilities also exist. These include Holy Spirit National School, St. Joseph's National School, Scoil an Tseachtar Laoch, Ballymun Senior Comprehensive School, The Virgin Mary School, Our Lady of Victories Schools and Ballymun Junior Comprehensive School. All of these facilities are of High functional value.

A number of green areas also exist including Poppintree Park, Coultry Park and other smaller parks and greens within residential areas. The Ballymun Civic Plaza is another recognised area for potential recreation. All of these areas have been allocated a Medium functional value to represent the sensitivity and importance of the recreational activities that are carried out.

The area around Albert College Park is primarily residential in nature with small green areas largely restricted to areas within residential estates or associated with schools. The residential areas are all of Very high functional value.

Noise monitoring was carried out at three locations along busy roads within this section of the alignment (NML 16, NML 17 and NML 18). The monitoring results indicate that existing noise levels are very high during both day and night and vary between 63dB(A) and 68dB(A) $L_{Aeq\ 15\ minute}$ during the day and 54dB(A) and 62dB(A) $L_{Aeq\ 15\ minute}$ at night. The dominant source of noise in this area is traffic. It is likely that increases in traffic flow by the year of operation in 2014 will increase baseline noise levels at NML 16 and NML 18 by 2dB(A).

12.3.1.6 The northern boundary of Albert College Park to St. Stephen's Green

This area is dominated by residential uses and residential with mixed uses (commercial/retail/office): Griffith Avenue, Drumcondra, Phibsborough and Mountjoy residential areas; areas around Mater Hospital and Parnell Square. Other areas of very high sensitivity include Elmhurst Convalescent Home, Mater Private, Mater Misericordiae and Children's University Hospital, Rotunda Hospital and Mountjoy prison. All of these areas have been allocated a Very high functional value.

A number of educational facilities also exist in this section including: Dublin City University (DCU); Corpus Christi Girls' National School; St. Patrick's College and Boys' National School; Clonliffe College Estate/Holy Cross College; St. Vincent's Centre for the Deaf; Dublin Institute of Technology (DIT); Trinity College Dublin (TCD); and The Royal College of Surgeons. All educational facilities are of High functional value.

Baseline noise monitoring was carried out at four locations around Albert College Park (NML 21, NML 22, NML 23 and NML 24). The noise monitoring indicates that existing noise levels at the houses around the park during the day varies widely between 48dB(A) and 66dB(A) $L_{Aeq\ 15\ minute}$. Noise monitoring undertaken during the night at NML 21 indicated a noise level of 57dB(A)$L_{Aeq\ 15\ minute}$.

Noise monitoring was also carried out at the south-western corner of St. Patrick's College (NML 26) where the existing daytime noise levels were less than 46dB(A) $L_{Aeq\ 15\ minute}$, which is very low for an urban location. Existing noise levels monitored at St. Vincent's Centre for the Deaf in Drumcondra (NML 27) and daytime noise levels recorded as being less than 58dB(A) $L_{Aeq\ 15\ minute}$. Noise monitoring was also carried out at the south-western corner of St. Patrick's College (NML 26) where the existing daytime noise levels were less than 46dB(A) $L_{Aeq\ 15\ minute}$, which is very low for an urban location. Nighttime measurements at this location within St. Patrick's College were also found to be low (37-38dB(A) $L_{Aeq\ 15\ minute}$).

Recreational areas within this area include: Albert College Park; Na Fianna GAA sports grounds; Griffith Park; areas around the Tolka River valley; Wolfe Tone Memorial Park; the River Liffey and the quays; St. Stephen's Green; the Iveagh Gardens and numerous smaller parks, green areas and sports grounds. These recreational areas have been allocated a Medium functional value.

Mixed commercial retail and business uses within this section of the alignment include areas: around Henry and O'Connell Street; to the south of the Liffey including around the Customs House, Temple Bar and Dublin Castle; around Gardiner Street; Grafton Street and surrounding retail/commercial uses; Leinster House; and around St. Stephen's Green. All of these areas have been allocated a Low functional value. However, mixed residential uses also exist where residential areas exist above commercial premises. These areas have been allocated a Very high functional value.

The noise maps that have been produced by Dublin City Council indicate that noise levels in this section of the alignment are highest along the streets and the existing exposure of houses facing busy streets is already quite high. Baseline monitoring was carried out at a number of receptors that are located next to busy roads including: NML 25: Griffith Avenue; NML 20: Albert College Grove; and NML 19: Church of Our Lady of Victories. The daytime noise levels at all of these locations were found to be high (60–73dB(A) $L_{Aeq\ 15\ minute}$) and the night-time levels, although slightly lower, were also high (56–64dB(A) $L_{Aeq\ 15\ minute}$. The noise at these locations is confirmed to be primarily associated with traffic noise. It is likely that increases in traffic flow by the year of operation in 2014 will increase baseline noise levels here by 1dB(A).

Existing noise levels at St. Stephen's Green have been measured at four locations (NML 28 to 31). The results indicate that noise levels at the boundary of the park during the day are significantly influenced by traffic and are very variable depending on local traffic (Day: 63 – 76dB(A) $L_{Aeq\ 15\ minute}$). Within the park, noise levels are significantly lower during the day (56dB(A) $L_{Aeq\ 15\ minute}$). At night, the noise levels are slightly less variable than during the day but are obviously still strongly influenced by local traffic (Night: 54 – 65dB(A) $L_{Aeq\ 15\ minute}$).

12.3.2 Categorisation of the baseline environment

The results of the baseline categorisation are summarised in Table 12.4.

Table 12.4 Baseline categorisation

Area	Summary Description	Functional value
MN101	- Dominated by areas of Low functional value e.g. agricultural areas;	(II)
	- Some areas of Very high functional value (residential areas);	(III)
	- Some areas of Medium functional value (e.g. recreational areas);	(V)
	- Isolated areas of High functional value (e.g. school).	(IV)
MN102	- Dominated by areas of open agricultural land (Low functional value);	(II)
	- Large residential areas of Very high functional value;	(V)
	- Some areas of Medium functional value (office areas of employment);	(III)
	- Isolated areas of High functional value (e.g. school)	(IV)
MN103	- Dublin Airport Zone;	(II)
	- Isolated areas of Medium functional value (e.g. offices);	(III)
	- Isolated residential areas (e.g. the halting sites).	(V)
MN104	- Area dominated by open Greenfield areas of Low functional value;	(II)
	- Some recreational areas;	(III)
	- Some residential areas to the south.	(V)
MN105	- Area dominated by residential areas of Very high functional value;	(V)
	- A number of educational/religious facilities of High functional value;	(IV)
	- Some limited recreational areas of Medium functional value.	(III)
MN106	- Area dominated by residential areas of Very high functional value;	(V)
	- A number of educational/religious facilities of High functional value;	(IV)
	- Some limited recreational areas of Medium functional value.	(III)
MN107	- Northern part of this area is dominated by residential areas of Very high functional value;	(V)
	- Moving south, areas of Medium functional value become more common (e.g. offices etc.);	(III)
	- Some commercial/retail areas of Low functional value;	(II)
	- A number of educational/religious facilities are also located in this area.	(IV)

13 HUMAN BEINGS: VIBRATION

Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter of the EIS has been prepared in order to fulfil this requirement in respect of vibration.

13.1 INTRODUCTION

This chapter describes and evaluates the existing environment in the area of the proposed scheme in terms of the sensitive receptors to vibration. Sensitive receptors to vibration include human beings, equipment and features of archaeological, architectural and cultural heritage. Vibration impacts on features of archaeological, architectural and cultural heritage are described in the Archaeology, Architectural Heritage and Cultural Heritage chapter of this EIS (Volume 2, Chapter 15). Sensitive human receptors and sensitive equipment are described in detail in this chapter.

Prior to compiling this chapter, a number of planning and policy documents were reviewed to ascertain if the documents contain any plans, policies or objectives relating to vibration. The following documents have been reviewed:

- Fingal County Development Plan 2005-2011;
- Airport Local Area Plan (2006);
- Dublin City Development Plan 2005-2011;
- Masterplan for the new Ballymun, (1998 (as amended)).

None of these documents specify any relevant policies, plans or objectives in relation to vibration.

13.2 BASELINE CATEGORISATION METHODOLOGY

13.2.1 Introduction

Vibration is considered in two forms:

- Motion of surfaces or structures: This movement can be perceived by the human sense of touch and/or is capable of having direct physical effects on structures and sensitive equipment. In this chapter this form of vibration is referred to as 'vibration'.
- Structure-radiated noise: occurs when surfaces vibrate and radiate noise as a result. This noise can be perceived by the human sense of hearing and/or can be detected by sound recording or broadcasting equipment. In this chapter this form of vibration is referred to as 'structure-radiated noise'.

Vibration is normally imperceptible to humans. The exceptions to this are locations where human beings are:

- close to construction sites;
- within 25m of railways;
- adjacent to instances of defective paving of highways;
- adjacent to traffic calming devices that affect road paving;
- near heavy industrial processes where vibrating equipment/processes may be used.

Vibration may affect sensitive equipment at levels that are imperceptible to humans. Equipment of this kind includes electron microscopes, for example, which may be installed in some hospital laboratories.

Perceptible vibration, where it occurs, is not necessarily considered to be unacceptable by the people who experience it. However it is important that it does not exceed thresholds whereby it becomes an annoyance or cause for complaint. Vibration at levels well above annoyance thresholds for humans may damage buildings and structures.

When people perceive vibration for the first time, they tend to fear that building damage will occur, even if the levels of vibration are well below the established thresholds at which building damage is known to potentially occur. Such concerns may cause people to notice pre-existing building damage such as hairline cracks for the first time. This damage may not in fact have been caused by vibration and may have been caused by other factors such as ground heave or settlement for example due to variation in soil moisture content.

Vibration that is perceived as structure-radiated noise is similar to that of normal airborne noise except for the fact that unlike normal airborne noise:

- it may be transmitted directly to the ears of people in bed (through the bed and pillow);
- it cannot be reduced by closing windows;
- in the case of structure-radiated noise from underground rail vehicles, it is not possible to reduce the level of noise heard by moving to another room as is the case with, for example airborne noise from a highway.

This chapter includes an assessment of both vibration and structure radiated noise and was informed by the results of the following activities:

- A desktop study;
- Consultation with relevant stakeholders;
- Vibration monitoring at specific sensitive locations.

13.2.2 Study area

The study area comprises a 100m – 1,000m corridor on either side of the proposed alignment as shown in Table 13.1. An area of 100m either side of the alignment is used in the majority of locations because it encompasses the likely limit of perceptible vibration or groundborne structure-radiated noise. Imperceptible vibration will not cause disturbance of sensitive equipment outside of this area. A wider study area is used in areas where drill and blast construction techniques are to be used, in recognition of the fact that such techniques can have an effect over a much wider area.

From Belinstown to Ballymun Stop the alignment is at grade or elevated except for the tunnel under the airport. Structure-radiated noise would not normally require consideration along the at grade sections of the track except in cases where buildings are located very close to the track.

Table 13.1 Study area

Criteria	Width of study area (on both sides of the alignment)
Landuse field survey to identify areas that are sensitive to vibration	100m
Vibration monitoring of specific sensitive areas	Specific sample locations within 100m – 1,000m depending on the construction methodology to be used in the area

13.2.3 Baseline data

The data used to compile the baseline for this chapter is shown in the Table 13.2.

Table 13.2 Baseline data

Information required	Data source
- Policies and objectives specifically relating to vibration	- Dublin City Council Development Plan 2005 – 2011; - Fingal County Council Development Plan 2005 – 2011; - North Ballymun Local Action Plan; - Dublin Airport Masterplan.
- Vibration sensitive receptors	- Baseline Landuse maps (Volume 3, Book 1 of 2).
- Vibration sensitive equipment	- Consultation with key stakeholders to identify premises where sensitive equipment is located.
- Existing levels of vibration in sensitive areas	- Baseline vibration monitoring survey.

13.2.4 Baseline categorisation criteria

Categorisation of the baseline environment involves the allocation of overall 'functional values' to discreet areas within the study area. The functional value of the area is determined with reference to the 'importance' and 'sensitivity' of the area and also any 'existing adverse effects' that impact on the area. Each of these three terms is explained in detail in this section.

13.2.4.1 Importance

Any equipment that performs an important function and/or is sensitive to vibration is considered to be important. The areas in which this equipment is located are therefore allocated a Very high functional value. Examples of such equipment include: optical equipment such as telescopes, electron microscopes; equipment operated or controlled by laser, particle or optical beams; high sensitivity weighing machines; equipment for the manufacture of data storage devices and major computer installations; and broadcasting or sound recording equipment. Premises that may have such equipment include: industrial premises; private and public health facilities; educational research facilities; and telecommunications installations. Consultation initiatives have been undertaken by RPA to identify sensitive receptors in this regard. Historic, archaeological, architectural or cultural features are considered to be important and features of this type are described in detail in the Archaeology, Architectural Heritage and Cultural Heritage chapter of this EIS (Volume 1, Chapter 23).

Human beings are not as sensitive to vibration as equipment but they are recognised as being very important. The importance of residential areas, health care facilities and any other areas where individuals sleep or carry out other sensitive activities is recognised to be important in this regard. For this reason, these landuses have been allocated a Very high functional value.

13.2.4.2 Sensitivity

Sites that may hold equipment that is 'super-sensitive' to vibration have been identified by means of professional judgement, experience and consultation. The specific sensitivity of each any equipment has been determined through consultation with the equipment manufacturers and equipment owners.

Landuses that are associated with sensitive activities that are carried out during both day and night (e.g. residential areas and hospital facilities where people are sleeping at night) are judged to be of high sensitivity. These landuses are considered to be very important. They have been assigned a Very high functional value as a result.

The majority of the equipment that is used in Dublin Airport is of medium sensitivity. Considerable vibration already occurs at the airport due to air turbulence and low frequency aircraft noise. The equipment that is used at this facility is therefore known to be sufficiently robust to withstand the considerable vibration.

Some features of archaeological, architectural and cultural heritage importance have been reviewed and are sensitive to vibration impacts. Vibration impacts on these features are described on a case by case basis in Volume 2, Chapter 15 of this EIS. Concert halls and theatres are considered to be of medium sensitivity because these facilities may be sensitive to structure-radiated noise.

Areas that are used for recreation, agriculture or employment during daytime hours are considered to be of very low sensitivity.

13.2.4.3 Existing adverse effects

Adverse effects may potentially exist in the vicinity of traffic calming devices (e.g. speed bumps). These devices may result in vibration due to the passage of vehicles and this vibration may occur at levels that are perceptible and possibly annoying in nearby dwellings. There are a small number of locations where existing railways are close enough to the proposed alignment to potentially cause measurable background vibration including at Drumcondra, Royal Canal, O'Connell Street and St. Stephen's Green. Baseline monitoring of existing vibration levels has been carried out in sample 'worst-case scenario' locations within the study area. The results of this monitoring have been taken into consideration and are presented in Section 13.3.

Short-term adverse effects may also occur from time to time in proximity to any major construction sites due to the use of vibrating equipment on-site. It is not possible to predict where third party construction sites may be located when the proposed scheme is being constructed so this factor cannot be taken into account in this baseline categorisation.

High levels of vibration may occur in buildings, particularly dwellings, due to human activity such as footfalls and door slams. In many cases this vibration is under the control of the occupier and this reduces the level of annoyance experienced and extent of adverse effect. In some cases, building damage such as cracks in plaster may be caused by existing vibration from these sources. This type of baseline vibration is unpredictable and typically occurs for very short durations. It cannot therefore be taken into account in the baseline evaluation.

13.2.4.4 Functional value

The functional value of the baseline environment is evaluated by means of a number of specific criteria to take into account the importance and sensitivity of different features of the environment. The criteria that have been defined are described in Table 13.3.

Categories (IV) High and (I) Low are not used in the categorisation of baseline vibration because the level and precision of data available with respect to vibration sensitivity and existing vibration levels in Dublin does not facilitate that categorisation of the baseline into five categories. The use of three categories is deemed to be sufficient to allow for appropriate assessment of this baseline.

Table 13.3 Criteria for baseline categorisation

Criteria	Functional value
- Museums (only if they have extremely sensitive artefacts/manuscripts/materials that are not protected against vibration); - Any facility which has vibration-sensitive equipment on the premises; - Any area where people are sleeping e.g. residential areas including halting sites, private/public health facilities, Mountjoy prison etc; - Concert halls and theatres.	Very high (V)
- Not applicable.	High (IV)
- Art galleries, schools, colleges, lecture halls (other than those that have vibration sensitive equipment); - Museums (other than those that have extremely fragile artefacts/manuscripts/ materials that are not protected against vibration); - Churches religious landuses; - Residential landuses with commercial /retail and/or office uses (i.e. mixed uses with a residential component); - Areas of Dublin Airport where equipment of medium sensitivity to vibration is used; - Water bodies/features containing fish.	Medium (III)
- Not applicable.	Low (II)
- Recreational areas; - Agricultural landuses and open green areas; - Areas of employment; - Purpose built facilities such as large retail outlets; - Water bodies/features that do not contain fish.	Very low (I)

The results of the baseline categorisation in terms of functional value are shown in Table 13.4 and illustrated on maps (Baseline Vibration) included in Volume 3, Book 1 of 2.

13.3 DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

13.3.1 Description of the baseline environment

13.3.1.1 Belinstown to Estuary Roundabout

In general this area is considered to be of Very low functional value because it largely consists of open green spaces and agricultural landuses. The residential dwellings are all allocated a Very high functional value. The Emmaus Retreat and Conference Centre is considered to be highly sensitive to vibration due to the nature of the activities taking place on the grounds. Existing vibration in this area is believed to be very low and is not likely to be perceptible to human beings.

13.3.1.2 Estuary Roundabout to the northern boundary of the Dublin Airport Zone

Large, established residential areas include Lissenhall, Seatown, Swords, Fosterstown and Nevinstown. Two halting sites also exist. These landuses are considered to be of Very high functional value and are very sensitive to vibration. A number of schools and other educational facilities are present. These are considered to be sensitive to vibration because of the nature of the activities carried out.

Other highly sensitive receptors include the Tara Winthrop Private Clinic (Nursing home), and the Kilronan House and Equestrian Centre.

Industrial and business premises are also present. These have a Very low functional value because human beings are only present for relatively short periods of time. The activities that are being carried out are often not highly sensitive to vibration. Swords Business Park and the Airside Business and Retail Parks are not considered to be very sensitive to vibration. Some low-level, localised vibration may exist due activities that are carried out in individual business units. However, existing vibration is believed to be very low and is not likely to be perceptible to human beings.

13.3.1.3 Dublin Airport Zone

The residential areas and the hotels included within this section are sensitive to structure-radiated noise and vibration. Existing baseline vibration occurs as induced vibration of lightweight structures due to aircraft noise.

13.3.1.4 Southern boundary of Dublin Airport Zone to M50

This area primarily comprises open spaces that are used for agriculture. These are considered to be of Very low functional value. Existing levels of vibration are believed to be below the level of human perceptibility.

13.3.1.5 M50 to the Royal Canal

All of the residential landuses within this part of the study area are considered to be of Very high functional value with high sensitivity to vibration. These include residential landuses around Ballymun, Drumcondra and Mountjoy, Educational and community landuses are considered to be sensitive to vibration. The area around St. Patrick's College is considered to be of Very high functional value because it is used for educational purposes and for student residents. Hampstead Private Hospital and Elmhurst Convelescent Home are considered to be highly sensitive.

Low levels of existing vibration are likely to exist in many locations within this part of the study area. Examples include areas where traffic calming devices have been installed and the railway at Drumcondra. Vibration from these sources is unlikely to be perceptible to human beings.

Around Clonliffe College Estate/Holy Cross College is considered to be of Very high functional value because landuse in the area is dominated by educational, religious and amenity uses.

13.3.1.6 The Royal Canal to St. Stephen's Green

Mater Misericordiae University Hospital, the Mater Private Hospital and the Rotunda Hospital are located in this area. These facilities are considered to be of Very high functional value because of the highly sensitive equipment that is used on-site. All of this equipment is designed so as to be capable of withstanding specific thresholds of low-level vibration. If this threshold is exceeded, vibration can be expected to have a detrimental effect on the functionality of the equipment. Areas surrounding the hospital are considered to be of Very high functional value because of the fact that a significant proportion of the landuse consists of residential landuses.

All educational, institutional and community facilities are considered to be of Very high functional value. An example of this is Trinity College, which is an important educational facility.

To the south of the Ambassador Theatre, the functional value tends to decrease to low and very low because of the dominance of commercial premises that are not considered to be very sensitive to vibration. Accommodation above retail and commercial premises is common and these landuses are considered to be very sensitive to vibration. The hotels and hostels in the vicinity of O'Connell Street and Grafton Street are considered to be very sensitive to vibration and structure-radiated noise. The Gaiety Theatre and Gate Theatre are also located within 100m of the central line of the proposed alignment. These theatres are considered of very high sensitivity and have been allocated a Very high functional value.

Existing baseline vibration is limited to effects of road traffic, which is normally only significant when there are deformities in the paving. Some existing, baseline vibration may exist in the vicinity of the Luas Red and Green Lines.

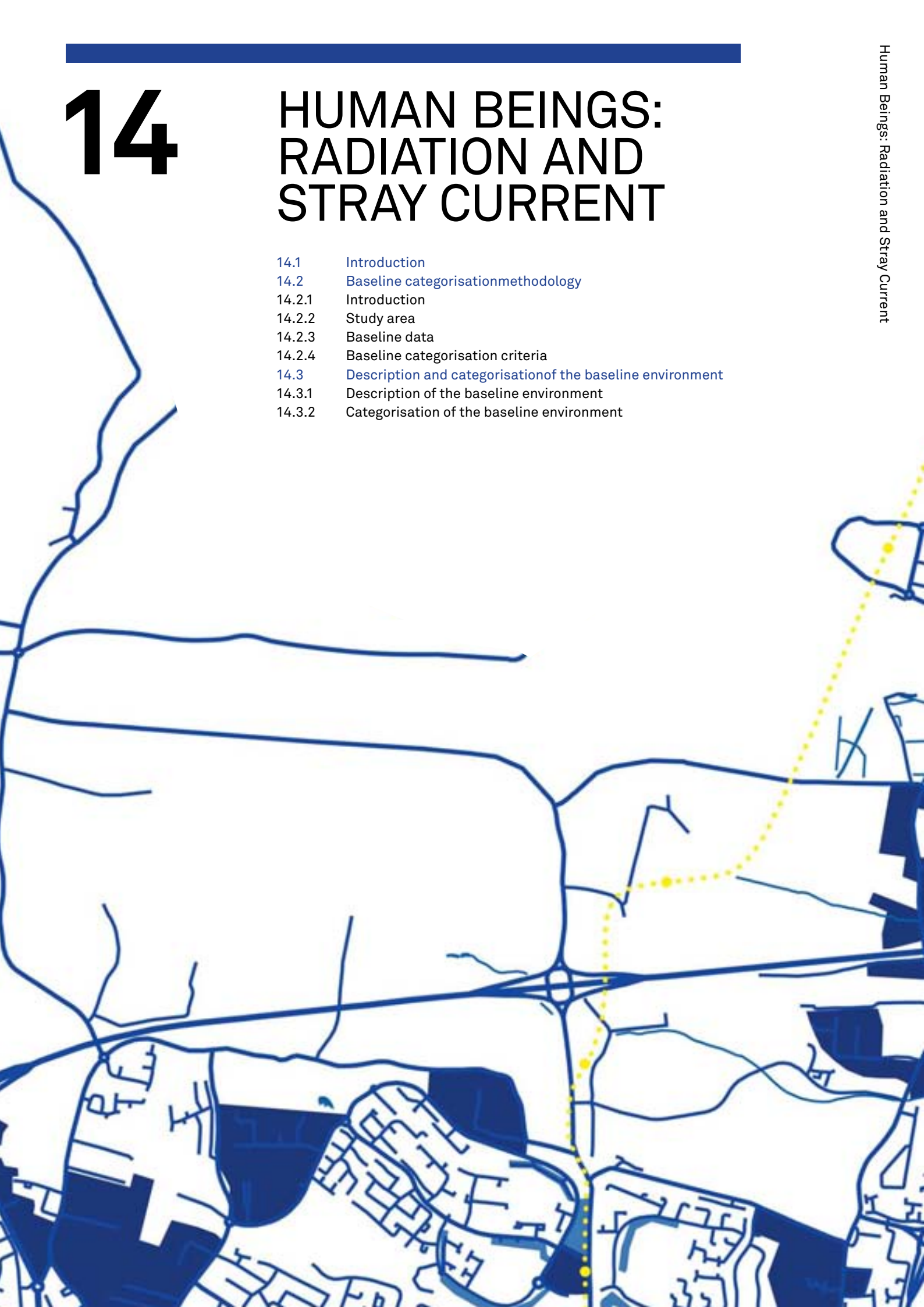
13.3.2 Categorisation of baseline environment

The results of the baseline categorisation are summarised in Table 13.4.

Table 13.4 Baseline categorisation

Area	Summary description	Functional value
MN101	- Primarily consists of open, agricultural land of Very low functional value.	(I)
	- Exceptions to this include a small number of residential areas. These areas have a Very high functional value.	(V)
MN102	- Primarily consists of areas of Very high and Very low functional value because of the fact that a number of residential areas exist and commercial premises and industrial uses are also present.	(IV) & (I) dominate
MN103	- Most areas within the Dublin Airport Zone are of Low functional value.	(III)
	- Some sensitive equipment may be present on this premises and this equipment is of Medium functional value.	(III)
	- The halting sites in this area are considered to be of High functional value.	(V)
MN104	- Dominated by agricultural uses which are considered to be of Very low functional value.	(I)
	- Some residential areas of High functional value.	(V)
MN105	- Dominated by residential, educational, institutional or community landuses of Very high functional value. - Areas of Medium and Very low functional value are also present.	(V) dominates (III) & (I) are also applicable
MN106	- This area is dominated by established residential landuses that are all considered to be of Very high functional value. - Mater Hospital and nearby medical facilities are located in this area and are considered to be of High functional value in light of the fact that sensitive equipment may be used on the premises.	(V)
	- Recreational areas such Albert College Park and St. Patrick's College playing fields occur in this area and are of Low functional value.	(III)
MN107	- The northern part of this area is dominated by residential landuses of High functional value. - Rotunda Hospital and Trinity college are also located in this area and are considered to be of High functional value in light of the fact that sensitive equipment may be used on the premises.	(V)
	- Moving south, areas of Medium and Low functional value become more common and include commercial landuses and recreational areas such as St. Stephen's Green.	(II)

14 HUMAN BEINGS: RADIATION AND STRAY CURRENT



Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter describes and evaluates the existing environment with respect to radiation and stray current.

14.1 INTRODUCTION

Radiation, in this context, comprises nuclear radiation and electromagnetic radiation. Any potential issues relating to radon gas are addressed in the Soils and Geology chapters of the EIS.

Electromagnetic Interference (EMI) relates to the ability of different electromagnetic (EM) devices to function properly when they are situated in the same environment i.e. it relates to the compatibility between different devices. Electromagnetic devices can generate and propagate electromagnetic energy thus causing EMI. Devices can also receive or be affected by interference generated and propagated by other devices in the same environment. If an EM device is not compatible with other devices in the same environment, EMI can lead to the device not functioning properly. This chapter has been prepared to set out the considerations that have been made to ensure electromagnetic compatibility (EMC) between the electromagnetic devices proposed in the scheme and the existing electromagnetic environment along the proposed transport corridor.

Stray currents can arise when electric current leaves the normal path and leak from the principal conductors in an uncontrolled and inevitably costly manner. Direct Current (DC) rail traction systems (including trams) are particularly susceptible to stray current when the infrastructure is of poor quality. Currents in the ground will search for paths of least resistance in the same way that lightning does, usually through structures and underground services. The consequence of such activity is corrosion, and then replacement.

A number of national, regional and local planning and policy documents were reviewed to ascertain if the documents contain any plans, policies or objectives relating to EMI and radiation. The following documents have been reviewed:

- Fingal County Development Plan 2005-2011;
- Airport Local Area Plan (2006);
- Dublin City Development Plan 2005-2011;
- Masterplan for the new Ballymun, (1998 (as amended)).

None of these documents specify any relevant policies, plans or objectives in relation to radiation or stray current.

14.2 BASELINE CATEGORISATION METHODOLOGY

14.2.1 Introduction

The baseline evaluation includes:

- A desktop study of existing available data;
- Consultation with relevant stakeholders to identify sensitive receptors.

14.2.2 Study area

The study area for this chapter is described in Table 14.1. EMI decreases very quickly with distance from the source at a ratio based on the square of the distance between the source and the receptor. Consequently, at distances of more than 100m, EMI is highly unlikely to have any impact on even the most sensitive equipment.

Disruption of 'normal' household appliances usually occurs when magnetic field strengths of 10 µT or more are present. However, very sensitive equipment such as electronic/laser equipment may be affected if the magnetic field strengths are greater than 0.16 µT. For schemes such as the proposed scheme, in the absence of stray current, magnetic field strengths of 0.16 µT do not persist at distances of more than 100m from the track. Stray current is generally minimised via technical and structural mitigation during construction. Therefore the study area is limited to 100m either side of the track alignment.

Table 14.1 Study area

Aspect	Width of study area (on both sides of the alignment)
Identification of landuses where sensitive and/ or highly sensitive equipment is used	100m

14.2.3 Baseline data

The data used to compile the baseline for this chapter is shown in Table 14.2.

Table 14.2 Baseline data

Information required	Data source
Sensitive landuses	Baseline Landuse maps prepared for Chapter Human Beings: Landuse
	Utilities maps (RPA, 2007)
	Ordnance Survey Ireland (OSI) Discovery series maps of Dublin
Specific sensitive receptors	Responses to questionnaires issued by RPA to sensitive stakeholders within 100m of the centre line of the proposed alignment

14.2.4 Baseline categorisation criteria

Categorisation of the baseline environment involves the allocation of overall 'functional values' to discreet areas within the study area. The functional value of the area is determined with reference to the 'importance' and 'sensitivity' of the area and as well as any 'existing adverse effects' that impact on the area. Each of these three terms is explained in detail in this section.

14.2.4.1 Importance

EMI can potentially affect medical equipment used at hospitals, navigational equipment (such as radios and communications equipment) used to ensure the safety of individuals on aircraft and signalling equipment used to ensure the safety of individuals on roads and railways. All of these types of equipment are considered to be very important because their failure could potentially have a detrimental effect on human health and the environment.

EMI may also have an effect on telecommunication cables, Cathode Ray Tube (CRT) computer screens and telecommunications equipment. These types of equipment are typically used by educational facilities, areas within Dublin airport, health facilities and some industries. Electrical substations may also be affected by electromagnetic radiation and are an important part of the basic infrastructure of the city. These types of equipment are considered important because individuals depend on them on a day-to-day basis and often their livelihood depends on the equipment performing its function in a reliable and dependable manner.

Sensitive electrical equipment that is used at home is also considered important to a certain extent e.g. old televisions with valves. Scientific instruments such as electronic microscopes and particle accelerators are also considered to be sensitive.

Ground embedded metal structures, such as pipes, rails, metal shielded cables and other metal structures may be affected by stray current. Electrochemical corrosion may occur and in the long-term this may have implications in terms of safety and/or environmental risks. Damage to infrastructure of economic value may also occur e.g. to utilities, large steel and reinforced concrete bridges/tunnels. High risk utilities, installations or facilities are considered to be very important and impact on these must be avoided.

14.2.4.2 Sensitivity

All of the equipment that is described above (e.g. hospital, navigational, signalling and telecommunications equipment) is considered to be sensitive to electromagnetic radiation. It is assumed that all equipment within the study area is designed according to the standards of the EMC Directive 2004/108/EC and therefore no exceptional cases of sensitivity exist. Sensitive equipment used by industry is often provided with protection against electromagnetic radiation because a number of items of equipment are often operated in one location. If the equipment has been provided with protection, then it is less sensitive to electromagnetic radiation. Electrical substations are also typically protected from electromagnetic radiation and therefore are not very sensitive.

Ground embedded metal structures, such as pipes, metal shielded cables and other metal structures are also considered to be sensitive to stray current. Some utilities are insulated, e.g. by plastic shielding and therefore are less sensitive to stray current. Measures are often in place to protect important infrastructure such as large pipelines and industrial structures from stray current e.g. cathodic protection against corrosion. These types of receptors are therefore also less sensitive to stray current.

14.2.4.3 Existing adverse effects

Significant areas adversely impacted by existing electromagnetic radiation or stray current are unlikely to exist within the study area because electromagnetic radiation and stray current from developments has been regulated for a number of years. Existing adverse effects within the study area are not therefore significant and are not discussed any further.

14.2.4.4 Functional value

The functional value of the baseline environment is evaluated by means of a number of specific criteria to take into account the importance and sensitivity of different features of the environment. The criteria that have been defined are described in Table 14.3.and Table 14.4.

Table 14.3 Criteria for baseline categorisation with respect to electromagnetic fields

Criteria	Functional value
Any facilities that have highly sensitive and very important equipment on the premises on a permanent basis: Public/private health facilities; Areas of Dublin Airport where sensitive safety equipment is located; Public/private scientific/research institutes.	Very high (V)
Not applicable	High (IV)
Any facilities that have sensitive and important equipment on the premises on a permanent basis: Universities, schools, colleges, lecture halls; Office uses; All areas of Dublin Airport with sensitive equipment that does not perform a safety function; Industries with sensitive equipment.	Medium (III)
Any facilities that have sensitive equipment on the premises on a permanent basis: Residential landuses; Mixed units with a residential component; Electricity substations with earthing equipment.	Low (II)
All other areas.	Very low (I)

Table 14.4 Criteria for baseline categorisation with respect to stray current

Evaluation criteria for stray current	Functional value
Any ground embedded metal shielded facility which has a high requirement for safety, e.g. high pressure gas or water pipes; Ground embedded fuel tanks e.g. at petrol stations; Chemical industry installations.	Very high (V)
Not applicable.	High (IV)
Prestressed reinforcement of tunnels, bridges or port structures other than the proposed scheme structures; Any ground embedded metal shielded facility which has a medium requirement of safety, e.g. low pressure gas or water pipes, heating pipes; Metal shielded cables.	Medium (III)
Other reinforced structures parallel to the alignment with a minimum length of 100m and a possible connection to the return current system of the proposed scheme.	Low (II)
Industrial facilities with large metal structures; All other areas.	Very low (I)

The results of the baseline categorisation in terms of functional value are shown in Table 14.5.

14.3 DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

14.3.1 Description of the baseline environment

14.3.1.1 Belinstown to the Airside Business Park

This area is dominated by open greenfield areas where sensitive receptors are very rare. These areas are considered to be of Very low functional value. Some residential areas of Low functional value exist between Estuary and Malahide Roundabout. A school is located on the west of the alignment to the south of Seatown Roundabout and has a Medium functional value. Houses in these areas are likely to have televisions and other equipment of low sensitivity. The Airside Business Park contains a number of office landuses and these areas have Medium functional value. All schools in this area are of Medium functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.1.2 The Airside Business Park to the northern boundary of Dublin Airport

This area is dominated by open green spaces of Very low functional value used for agriculture and recreation e.g. Forrest Little Golf Course. The Airside Retail Park is also located in this area and is considered to be of Low functional value because sensitive equipment is not thought to be used in this area. To the south of the retail park is the Tara Winthrop private health clinic, which is of Very high functional value. A number of residential areas of Low functional value are also located in this section including residential areas in the vicinity of Pinnock Hill Roundabout and Kilronan Equestrian centre, which is of Low functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.1.3 Dublin Airport Zone

This area is dominated by open green spaces and airport landuses. Consultation with Dublin Airport has indicated that the airport has sensitive equipment on the premises and therefore part of this area has been allocated a Very high functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value. The underground fuel tanks at Dublin Airport are considered to be of Very high functional value.

14.3.1.4 The southern boundary of Dublin Airport to Northwood

This area is dominated by areas of Low functional value e.g. open green spaces (such as sports grounds of Cumann Parnell and parts of Sillogue Golf Course and Sillogue Park) as well as the National Car Test Centre. Some limited areas of residential landuse of Medium functional value exist.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.1.5 Northwood to Albert College Park

This area is dominated by residential areas of Medium functional value. A number of schools are also located on either side of Ballymun Road and these schools all have a Medium functional value. A clinic is also located in the Civic Centre on Ballymun Road to the east of the alignment. For the purpose of this assessment, this clinic is assumed to have sensitive equipment and therefore has been allocated a Very high functional value. An electricity station is also shown on the utilities drawings for this area. This station is of Low functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.1.6 Albert College Park to the Mater Hospital

This area is dominated by residential areas of Medium functional value. Corpus Christi Girls National School on Home Farm Road, St. Patrick's College and the schools on the grounds of the college are also located in this area and both of these facilities are of Medium functional value. The Mater Hospital is located in this area and consultation with the hospital (public and private) has indicated that sensitive equipment is used on the premises. This area is therefore considered to have a Very high functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.1.7 Mater Hospital to St. Stephen's Green

The area to the south of the Mater Hospital is dominated by residential areas of Medium functional value. Moving south, the study area changes and commercial landuses of Very low functional value become more common. To the south of the Mater Hospital, two schools and a college are located on opposite sides of the alignment. To the south of this is Rotunda Hospital and Hari Clinic. In the absence of detailed information upon the location of sensitive equipment, the premises have been allocated a Very high functional value. To the southeast of Rotunda, DIT is located on Marlborough Street and this college is of Medium functional value. To the south of the Liffey, Trinity College is located to the east of the alignment. Consultation with this college has indicated that sensitive equipment is used on the premises. This area has therefore been allocated a functional value of Very high. The Royal College of Surgeons is also located to the west of St. Stephen's Green. The presence of sensitive equipment on these premises has not been confirmed. In the absence of this information, the premises have been allocated a Very high functional value. The area between the River Liffey and St. Stephen's Green is otherwise dominated by commercial landuses of Low functional value.

A number of high and medium voltage cables, water pipes and telecommunication cables are found in this area. These utilities supply the local area and are of Medium functional value.

14.3.2 Categorisation of the baseline environment

The results of the baseline categorisation are shown in Table 14.5.

Table 14.5 Baseline categorisation

Area	Summary description	Functional value with respect to EM fields	Functional value with respect to stray current
MN101	Dominated by open green areas	(I)	
	Some residential and office landuses	(III)	
	Utilities (pipes and cables)		(III)
MN102	Dominated by open green areas	(I)	
	Some commercial landuses	(I)	
	Some residential areas	(III)	
	Tara Winthrop private health clinic	(V)	
	Utilities (pipes and cables)		(III)
MN103	Dominated by open green areas	(I)	
	Some areas of Dublin Airport where safety equipment is used	(V)	
	Some areas of Dublin Airport where other sensitive equipment is used	(III)	
	Underground fuel tanks at Dublin Airport		(V)
	Utilities (pipes and cables)		(III)
MN104	Dominated by open green areas	(I)	
	Some limited residential areas	(III)	
	Utilities (pipes and cables)		(III)
MN105	Dominated by residential areas with a number of educational facilities	(III)	
	A health clinic	(V)	
	Utilities (pipes and cables)	(II)	(III)
MN106	Dominated by residential areas with a number of educational facilities	(III)	
	Irish Rail signalling equipment	(V)	
	Mater Hospital	(V)	
	Utilities (pipes and cables)		(III)
MN107	Residential areas are common in this area	(II)	
	Commercial premises are very common to the south of this area	(I)	
	Rotunda and Mater Hospital	(V)	
	Trinity College and the Royal College of Surgeons	(V)	
	Utilities (pipes and cables)		(III)

15 HUMAN BEINGS: TRAFFIC

Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter has been prepared in order to fulfil this requirement in respect of traffic.

15.1 INTRODUCTION

This chapter describes and evaluates the existing traffic environment in the area of the proposed scheme.

Prior to compiling this chapter, a number of national, regional and local planning and policy documents were reviewed to ascertain if the documents contain any plans, policies or objectives relating to traffic. The following documents have been reviewed:

- Transport 21;
- Fingal County Development Plan 2005-2011;
- Dublin City Development Plan 2005-2011;
- North Ballymun Local Area Plan (LAP);
- Dublin Airport LAP (Masterplan) (2006);
- Masterplan for the new Ballymun (1998 (as amended)).

The results of this review are detailed in the Planning and Policy Context chapter of this EIS (Volume 1, Chapter 4).

15.2 BASELINE CATEGORISATION METHODOLOGY

15.12.1 Introduction

This section presents the methodology used to assess the baseline traffic environment. As well as considering the relevant EPA guidance with respect to EISs (EPA, 2002, 2003), the scope and methodology for the baseline assessment has been devised with reference to the Environmental Assessment volume of the UK Department of Transport's Design Manual for Roads and Bridges (DRMB), Volume 11, which offers comprehensive advice for the staged assessment of major road schemes. The DMRB outlines the sequence of assessment to be followed in the classification of impacts on vehicular and pedestrian traffic, namely:

- data collection;
- prediction of impacts;
- development of mitigation measures;
- identification of residual or predicted impacts for the construction and operational stages.

15.2.2 Study area

Given the scale and length of the proposed scheme, the study area required to assess the impact of such a scheme is extensive in size. The proposed scheme will have both a strategic and localised traffic impact. The study area encompasses an area of approximately 2km either side of the proposed alignment as illustrated on maps (Traffic) included in Volume 3, Book 1 of 2.

15.2.3 Baseline data

If one is to accurately assess baseline traffic for a scheme as extensive as the proposed scheme it is important to develop comprehensive traffic modelling tools that are 'fit for purpose'. The proposed scheme is approximately 18km in length and therefore penetrates a large number of areas with very different receiving environments. These environments vary in terms of the existing concentration of traffic movements and the existing make up of that traffic (i.e. cars, pedestrians, cyclists, buses etc.). A number of traffic models with varying levels of sophistication have therefore been developed to assess baseline traffic levels within the study area. These models have been developed to ensure that the baseline traffic conditions for mechanised modes are represented accurately, thereby allowing the traffic impact of the proposed scheme to be tested in a robust manner.

The focus of this chapter is to describe the conditions pertaining to the scenarios. The traffic conditions for the base year and for the Do Minimum forecast years are detailed. Descriptions of both infrastructural provision and usage of that infrastructure by different modes of transport for the baseline scenario are discussed. This chapter, therefore, includes reference to the following modes:

- General traffic (cars, taxis, LGVs, HGVs) and buses;
- Light and Heavy Rail;
- Pedestrians and cyclists.

A Metro North Traffic Model (MNTM) was developed to assess existing traffic within the study area. The MNTM was developed from the Dublin Transportation Office Traffic Model (DTOTM). As mentioned above, the proposed scheme will have both strategic and localised traffic impacts. The assessment approach considers this and, for this reason the DTOTM is a multi-modal transport model that models all modes of mechanised transport within the Greater Dublin Area (i.e. cars, light vehicles, heavy goods vehicles, buses, heavy rail and light rail). The DTOTM models strategic transportation travel patterns very well on a city wide level. All major roads and junctions are represented within the model, including motorways, national primary roads, national secondary roads and regional roads within the Greater Dublin Area. However, being a strategic model, the DTOTM is not ideally suited for modelling travel behaviour and patterns on a detailed local level. For this reason the DTOTM was further enhanced in terms of network and landuse representation along the alignment of the proposed scheme. This enhanced model is the MNTM traffic model.

The DTOTM represents a three hour morning peak period (07.00-10.00) and an Off-Peak Period (14.00-15.00). The MNTM, therefore, represents the same time periods as the DTOTM. The AM peak period and Off-peak period form the basis for the traffic impact assessment of the proposed scheme.

Two other models were also developed to further assess in detail the traffic impact of the proposed scheme. A City Centre Vissim (Micro-simulation) Model (CCVM) and a Swords Vissim Model (SVM) for the R132 were also developed. A Vissim model was developed for the City Centre due to the complexity of the multi modal traffic environment. A Swords Vissim model was also developed to enable a full understanding of the operational traffic issues associated with junction reconfigurations along the R132, during the construction of the proposed scheme.

The CCVM is a one hour AM peak model (08:00 to 09:00hrs). The CCVM and the MNTM are interdependent so that the baseline can be used to assess strategic impacts (as determined from MNTM) and the local impacts (from CCVM).The CCVM has been developed using an existing LUAS Line BX Vissim model for the city centre.

The SVM has been developed for the R132 corridor in Swords. The corridor model area extends from the M1/Lissenhall Interchange in the north to south of Airside retail Park on the R132 in the south. The SVM is a one hour AM peak model (08:00 to 09:00hrs). The SVM and the MNTM are interdependent so that the strategic impacts (as determined from MNTM) and the local impacts (from SVM) are fully appreciated.

The MNTM, CCVM and SVM have all been validated to a baseline year of 2006. This year was chosen as the Base Year for the development of the traffic models because the DTOTM was rebased to that year and there was a large quantity of available traffic survey data for that year.

Do Minimum Future Scenario models have also been developed. These scenarios represent the future year(s) traffic conditions which will exist without the proposed scheme in place. They therefore represent the future year Do Minimum scenarios. The purpose of preparing do-minimum traffic information is to provide a baseline for comparison in order to estimate the traffic impact of the proposed scheme in future years. The following Do Minimum future years have been developed:

- 2011 (forecast construction year);
- 2014 (forecast opening operation year);
- 2029 (forecast horizon operation year).

The following list summarises the developments that have been taken into account when modelling the do minimum future scenarios:

- Changes in do-minimum landuse characteristics and associated trip demand. This is estimated based on population and employment forecasts given in the Regional Planning Guidelines population and employment forecasts
- Infrastructure developments included in Transport 21, in the case of Luas projects and the future year models within which they have been incorporated, include Luas extensions Line C1 and B1 and future Luas lines (BX, D and F); upgrades to heavy rail services; and road schemes including upgrading of the M50
- Schemes to enhance the Quality Bus Network
- The bus interchange proposed at Strand Street, adjacent to the Jervis Street Luas stop.
- Transport infrastructural schemes: The schemes that are included are those for which funding has been committed, or where the relevant local authority has indicated that the scheme will be completed at a certain point in the future.
- Other future developments: Some of the developments have been granted planning permission, whilst others are in the early stages of planning or comprise strategic objective of the current development plan.

A summary of significant planned developments taken into account along the alignment of the proposed scheme are:

- Swords is earmarked for general development, to provide for a much-expanded civic, cultural, retail, commercial and employment base at a level appropriate for a vibrant major County town;
- The Dublin Airport Local Area Plan makes provision for the development of Terminal 2 by 2009. To cater for the increase in patronage at this airport, there will be increased car parking facilities, improved pedestrian and cycle facilities and enhanced bus services;
- The Santry Demesne Parkland, located between the R108 and R132 and to the south of the M50 is currently being developed as a mixed use development;
- An Bord Pleanála and Fingal County Council have granted permission to Ikea to build an outlet on 12.6 hectares to the southwest of the M50 Ballymun interchange. Car parking will be provided as will a fully wheelchair accessible bus service between the development and Ballymun Town Centre, which will undergo significant development over the coming years;
- A number of developments are planned for the Phibsboro/ Drumcondra area including the former Smurfit printwork site, Dalymount Park, the Old Mountjoy Prison site and the extension of the existing Mater Hospital. These developments include residential, commercial, retail, social and hotel uses;
- Within the city centre there are two significant proposals; the expansion of the Arnotts retail store and the redevelopment of the former Carlton Cinema site.

The data used to build the baseline models is shown in Table 15.1.

Table 15.1 Baseline data

Information required	Data source
- Guidance with respect to the development of the Metro North Transport Model (MNTM) and other models for assessing the proposed scheme; - Identification of future year highway networks along the proposed scheme; - Identification of future year landuses in the vicinity of the proposed scheme.	- Consultation with: - Dublin City Council; - Fingal County Council; - the Dublin Transportation Office.
- Data related to the current highway network, including detailed junction arrangements, banned turns, junction priority and signal phase timings etc. - This data was used to refine the MNTM along the corridor of the scheme. - Data relating to pedestrian, cycle and bus operating facilities - used to assess the baseline scenario for these modes.	- On-site assessments
- Traffic surveys necessary to calibrate and validate the MNTM and also the city centre and Swords R132 Vissim models.	- Comprehensive set of traffic surveys undertaken during 2005 and 2006. A list of the junctions where traffic counts were undertaken is provided in Annex I, Volume 3, Book 2 of 2.
- Morning peak hour (8AM to 9AM) flow and the inter-peak hour (2PM to 3PM) flow.	- Journey time surveys commissioned by the DTO for several radial routes into the city centre and other orbital routes in 2004.
- Baseline pedestrian activity within the study area.	- Pedestrian counts undertaken at various stages between Spring 2005 and Autumn 2007

15.2.4 Baseline categorisation criteria

Unlike other elements of the environmental impact assessment, such as water, air and bio-diversity, traffic is not an environmental resource. Therefore it is not appropriate to carry out categorisation of the baseline environment based on the importance and sensitivity of traffic in specific areas

15.3 DESCRIPTION OF THE BASELINE ENVIRONMENT

15.3.1 Key transport infrastructure

Key transport infrastructure within the study area are:

- The M1 motorway to the east of Swords town centre is a motorway linking Dublin and Belfast cities. It is a two lane motorway and has interchanges at Lissenhall to the north of Swords and Drynam to the south of Swords.
- The R132 runs in a north-south direction parallel to the M1 through the Lissenhall Interchange, east of the centre of Swords, to the east of Dublin Airport and through Santry, before terminating at the interchange with the N1/ Swords Road at Shantalla Road. Swords QBC bus services operate along the R132, availing of significant levels of bus priority to the south of the Malahide Roundabout.
- The M50 motorway acts as an orbital motorway for Dublin, linking all national primary routes and a number of other radials. It is currently a two-lane motorway, however the motorway is currently being upgraded to provide substantially greater capacity through the addition of extra traffic lanes, a free flow tolling mechanism and the provision of a number of free-flow junctions. The M1/M50 interchange is to be a free-flow interchange facilitating unrestrained movement between the M1 and the M50.
- The Dublin Port Tunnel is a 5.6km two-lane motorway linking the M1 at Whitehall to Dublin Port. The primary function of the tunnel is to remove through HGV trips from the city centre. The achievement of this objective was reinforced following the introduction of a ban on 5-axle HGVs in Dublin city centre in February 2006. HGVs are not tolled for using the tunnel, whereas general traffic is tolled on a varying level depending on the time of day.
- The R108/Ballymun Road between the M50 and Griffith Avenue, has two lanes plus either a hard shoulder or a bus lane in each direction.

- The N2 is a national primary road linking Dublin and Derry. To the south of the M50, up to Mellowes Roundabout the N2 has two lanes of traffic plus a bus lane in each direction. South of here the N2 has one traffic lane and a bus lane in each direction. Finglas QBC bus services operate from the City Centre along the N2, to the south of Finglas Village.
- Collins Avenue Extension and Glasnevin Avenue run in an east-west direction and provide for orbital trips between Dublin City's northern suburbs such as Finglas, Glasnevin, Whitehall and Donnycarney. The roads have one lane of traffic in each direction, with localised widening on the approach to major junctions such as Ballymun Road.
- Griffith Avenue is located approximately 1km to the south of Collins Avenue and has a similar traffic carrying function and capacity as Collins Avenue.
- Swords Road, Drumcondra Road and Dorset Street represent a southern extension of the M1 through the north city. Its alignment varies significantly along its length, however the road carries large volumes of general traffic, bus and taxi flows.
- Dublin City Council have designated an Outer Orbital Route, which includes North Circular Road, North Wall Quay, East Link Toll Bridge, roads running parallel to the Grand Canal (Grand Parade, Grove Road, Parnell Road) and sections of the South Circular Road. The function of the route is to provide an alternative route for motorists crossing the city centre.
- Dublin City Council have designated an Inner Orbital Route which runs around the core inner city area. It extends from Parnell Square in the north to St. Stephens Green in the south and from Merrion Square in the east to Blackhall Place in the west. It serves a similar function to the outer orbital in addition to providing access to city centre multi-story car parks.
- The North Quays have one or two general traffic lanes whereas the South Quays have two lanes of general traffic. In addition both quays have significant lengths of bus priority in addition to general traffic lanes. These roads carry significant volumes of general traffic and bus flows and, as a result are important from a strategic viewpoint.
- The Maynooth Rail Line intersects with the alignment of the proposed scheme at the Drumcondra Stop. Suburban rail services from Maynooth and Mullingar operate on this line, in addition to InterCity services from Sligo. Frequency and capacity on suburban rail services has been significantly enhanced in recent years to cater for increased demand from growth in areas to the west of Dublin.
- The DART line connects Howth and Malahide in the north with Bray and Greystones in the south. The city centre DART stations, closest to the proposed scheme's stops, are Connolly station, Tara Street station and Pearse Street station.
- The Luas Green Line links Sandyford in south Dublin to Dublin city centre, terminating at St. Stephens Green. Light rail services currently operate at 4-minute headways during peak periods. The line is currently being extended from Sandyford to Cherrywood. The existing Green Line alignment terminates at St. Stephens Green, adjacent to the most southerly the proposed scheme's stop.
- The Luas Red Line links Tallaght in west Dublin to Dublin city centre, terminating at Connolly station. Light rail services currently operate at 5-minute headways during peak periods. The line is currently being extended from Connolly station to the Point Depot. The existing Red Line alignment intersects with the alignment of the proposed scheme at O'Connell Street.

15.3.2 Description of the seven areas of the alignment for the 2006 baseline scenario

Each mode is discussed in relation to each of the seven areas under the following headings:

- Infrastructure;
- Utilisation;
- Conditions experienced.

15.3.2.1 Area MN101

This area is illustrated on maps (Traffic) included in Volume 3, Book 1 of 2. Area MN101 is located between Belinstown and north of Pinnock Hill Roundabout.

Infrastructure
The M1 and R132 are the principal roads on the north-south axis through Area MN101. The M1 is a motorway with two interchanges within Area MN101; Lissenhall to the north of Swords and at Drynam to the south of Swords. The Lissenhall Interchange (full interchange) to the north of Swords links the M1 with the R132 and Swords.

Bus and taxis are the main public transport modes available to residents in Swords and surrounding areas. The Swords QBC commences at Fingal County Council offices on Main Street and joins the R132 at the Malahide Roundabout. The QBC links Swords, Dublin Airport and the city centre.

Footpaths along the R132 are limited. North of Estuary Roundabout and between Seatown Roundabout and Malahide Roundabout, footpaths are located along the southbound lane of the road. There are a number of pedestrian bridges across the R132 providing segregated crossing points between residential and employment areas of Swords. The bridges are situated within close proximity of bus stops, providing easy access to public transport services. The Seatown and Chapel Lane footbridges are heavily used by school students in the area. The Malahide Roundabout footbridge is an important pedestrian link between retail, employment and residential uses in the area.

There are no dedicated cycle lanes along the R132. The Swords QBC joins the R132 south of the Malahide Roundabout. The shared bus and cycles lanes are roughly 4m wide and generally continuous except at the junctions. There is no cycle infrastructure at the roundabouts.

Utilisation

2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN101 were extracted from junction traffic counts and Metro North Traffic Model output for 2006 and analysed. Within Area MN101, the M1 and R132 carry the highest general traffic volumes. The following table outlines the traffic flows on key links in this area.

Table 15.2 MN101, traffic flows on key links

Link	Direction of Traffic Flow	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)	
		Cars and LGVs	Bus & HGVs
R132, north of Estuary Roundabout	North	768	64
	South	1701	69
Seatown West	East	830	43
	West	902	18
Estuary Road at Estuary Roundabout	East	162	3
	West	209	3
R132, between Estuary and Seatown Roundabouts	North	812	49
	South	1,720	76
Seatown Road, west of Seatown Roundabout	East	289	3
	West	311	6
Estuary Road at Seatown Roundabout	East	472	15
	West	287	44
R132, between Seatown and Malahide Roundabouts	North	926	45
	South	1,627	89
Malahide Road, west of Malahide Roundabout	East	196	7
	West	269	11
Malahide Road, east of Malahide Roundabout	East	134	6
	West	276	22
Drynam Road	East	597	31
	West	215	12
R132, between Malahide and Pinnock Hill Roundabouts	North	1,159	54
	South	1,547	91
* M1, between Lisenhall and Drynam interchanges	North	1,237	272
	South	2,936	225

All data from junction counts, unless otherwise indicated:

* Metro North Traffic Model (MNTM) Output for 2006

Dublin Bus is the main bus operator in the area; other services are provided by Bus Éireann, Urbus and the recently launched Swords Express. In total, there are around 20 bus services an hour linking Swords and the city centre, many of which also serve the airport. Generally, within Swords, bus services are split between the Main Street and the R132 with a number of routes merging at the Malahide Roundabout. There are also some school buses servicing this area.

Pedestrian activity in the direct vicinity of the alignment in Swords is generally low. However there are a number of grade separated crossing points on the R132 with more significant pedestrian flows.

The highest volume of cyclists on the R132 travel across the road heading east on the Estuary Roundabout.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speeds in Area MN101, as extracted from the validated base year MNTM (2006) are 33.6 km/hour. This information is illustrated on maps (Traffic) included in Volume 3, Book 1 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. This decrease in speeds is because of a general increase in traffic volume throughout the seven areas.

The average bus speed from Swords Main Street to the Airside Retail Park (in Area MN102) is 18kph during the AM peak. By comparison, the corresponding average car speed for the same journey is 26kph.

Currently taxis experience the same congestion issues as per general traffic with delays in Swords Village and at the Malahide Roundabout.

Given the width of the R132 and the significant traffic flows in carries; the road acts as a significant barrier for pedestrian movements both along and across the road i.e. from Swords Town Centre to the eastern suburbs in Swords. This would in part explain the low pedestrian volumes in the vicinity of the alignment.

The R132 acts as a barrier to cycle movement in a similar manner to that for pedestrians. A combination of the wide road width, high traffic speeds, lack of cycling infrastructure, junction type (i.e. large radii roundabouts) along the R132 all combine to create a very inhospitable cycling environment. As a result, cycle activity in the direct vicinity of the alignment through Swords is low.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN101. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.3 MN101, number of personal injury accidents by link

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
Lissenhall Interchange	3	1	0	4
R132 from Lissenhall Interchange to and including Estuary Roundabout	6	0	0	6
R132 from Estuary Roundabout to Seatown Roundabout	6	1	0	7
R132 from Seatown Roundabout to Malahide Roundabout	9	0	0	9
R132 from Malahide to Pinnock Hill Roundabout	0	1	0	1
M1	4	1	0	5
Seatown Road between Estuary Roundabout and Bridge Street	5	0	0	5
Seatown Road between Bridge Street and Malahide Road	4	0	0	4

The links listed above in Area MN101 recorded 41 accidents between 2001 and 2006. Of these, 37 were minor in nature. Pedestrians and motorcyclists accounted for a small number of these, at 2% and 12% respectively. The frequency of accidents indicates that the area is not particularly sensitive.

15.3.2.2 Area MN102

Area MN102 extends from north of the Pinnock Hill Roundabout to south of Naul Road (Dublin Airport). The Airside Retail Park is located to the east of the R132, approximately 600m to the south of Pinnock Hill Roundabout. The Airside Retail Park is a significant generator of traffic in Swords and the development is dependent on the R132 to facilitate access and egress requirements. Access and egress to Airside Retail Park from the M1 is also possible via the Drynam Link Road and Drynam Interchange.

Infrastructure

The M1 and the R132 are the principal roads in Area MN102. The R132 has two general traffic lanes in each direction for most of its length. However it narrows to one general traffic lane (plus a bus lane in the northbound direction) between Nevinstown Lane and Pinnock Hill Roundabout. The southbound R132 carriageway also narrows to one lane in each direction between Nevinstown Lane and Cloghran Roundabout.

The Swords QBC continues along the R132 within Area MN102. There are significant levels of bus priority along the R132 where buses benefit from long sections of bus lane infrastructure. Taxis also benefit from bus priority infrastructure on the R132. In all other areas they share road space with general traffic.

North of the Pinnock Hill Roundabout there is a footpath providing pedestrian access to the bus stop on the northbound carriageway of the R132. There are footpaths on both sides of the R132 north and south of the junction with Nevinstown Lane. These footpaths provide pedestrian access to bus stops and the buildings on either side of the road. An at-grade signalised pedestrian crossing on the R132 is provided at Airside Retail Park.

There is no dedicated cycle infrastructure along the R132 within Area MN102. The Swords QBC continues along the R132 with wide bus lanes to accommodate both cyclists and buses. The shared bus and cycle lanes are generally continuous in the southbound direction except at the junctions. There are intermittent bus lanes northbound within Area MN102. There is no cycle infrastructure at the roundabouts. There are advanced stop areas for cyclists at the signalised junction at Nevinstown Lane.

Utilisation

2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN102 are contained were extracted from junction traffic counts and NRA Automated Traffic Counter (ATC) data, and analysed. Within Area MN102, the M1 and R132 carry the highest general traffic volumes. The following table outlines the traffic flows on key links.

Table 15.4 MN102, traffic flows on key links

Link	Direction of Traffic Flow	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)	
		Cars and LGVs	Bus &HGVs
R132, between Malahide and Pinnock Hill Roundabouts	North	1,159	54
	South	1,547	91
Dublin Road, north of Pinnock Hill Roundabout	North	175	1
	South	466	9
M1 Link Road (to Drynam Interchange)	North	318	11
	South	419	9
R132, between Pinnock Hill Roundabout and Fosterstown Junction	North	900	49
	South	1,424	93
Rathingle Road	East	632	11
	West	223	11
Airside	East	211	10
	West	143	10
R132 between Fosterstown Junction and Cloghran Roundabout	North	688	48
	South	1,553	92
Naul Road	East	584	28
	West	458	30
Clonshaugh Road	East	476	9
	West	431	9
R132, between Cloghran and Airport Roundabouts	North	733	92
	South	1,431	78
* M1, between Drynam and Airport Interchanges.	North	1,564	681
	South	3,211	697

All data from manual counts, unless otherwise indicated:
* NRA Automated Traffic Counter Data (January 2006)

A high volume of Swords QBC bus services operate along the R132 within Area MN102 and southbound bus services avail of significant levels of bus priority along the R132 to the south of the Malahide Roundabout.

In general, pedestrian volumes along and across the R132, within Area MN102, are low. Pedestrian activity is centred on movements to and from bus stops along the R132 and to and from Airside Retail Park. The National Show Centre is located off Kettles Lane near the junction with the R132. During major events there are pedestrian movements between the centre and the bus stops on the R132.

Traffic counts recorded very low volumes of cyclists within Area MN102. The highest number of cyclists on the R132 within Area MN102 was 5 per hour, which was recorded heading north between Pinnock Hill Roundabout and Fostertown Junction.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speeds in Area MN102, as extracted from the validated base year MNTM (2006) are 55 km/hour. This information is illustrated on maps (Traffic) included in Volume 3, Book 1 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

The average bus speed from Airside Retail Park to the Cloghran Roundabout is 23kmh-1 during the AM peak. By comparison, the corresponding average car speed for the same journey is 28kmh-1.

Access to the bus stops for pedestrians is poor and in some locations there are no footpaths connecting to the bus stops. Within Area MN102, there are a number of bus stops located in the vicinity of the Airside Retail Park.

As in Area MN101, the R132 acts as a significant barrier for pedestrian and cycle movements both along and across the road.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN102. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.5 MN102, number of personal injury accidents by link

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
R132 between Pinnock Hill Roundabout and Cloghran Roundabout	4	1	0	5
Naul Road between Cloghran Roundabout and Forest Road	4	1	0	5
Forest Road between Park Avenue and River Valley Road	5	1	1	7
M1 between Kettles Lane and Stockhole Lane	0	1	0	1
Feltrim Road between M1 and Kettles Lane	1	0	0	1

Of the 18 accidents recorded along the key routes within Area MN102, 17% involved motorcycles. There are no recorded pedestrian accidents. The frequency of accidents indicates that the area is not particularly sensitive.

15.3.2.3 Area MN103

Dublin Airport is a major trip attractor in north County Dublin and as a result is a significant contributor to traffic flows on roads in its vicinity.

Infrastructure

Road capacity in the vicinity of the airport and within the confines of the airport is significant. The primary access routes to the airport are via the M1 and R132. A full motorway interchange approximately 800m to the east of the airport on the M1 provides access to the airport from the north and south via a motorway slip road which connects the M1 with the R132 at the Airport Roundabout. Access to the airport from both the M1 and R132 is via the western arm of that roundabout, which is signal controlled. An additional access and egress route from the south is available via a signalised junction on the R132 to the south of R132/Airport Roundabout.

The Swords QBC, which operates on the R132, splits on approach to Dublin Airport from the north and south. Some QBC bus services heading south along the R132 continue on this road. Others access Dublin Airport before returning to the R132 at a location to the south of the airport. The airport is a major destination and generates a significant volume of bus trips. The diversion via the airport adds approximately 10 minutes to bus journey times. Bus stops are located at frequent intervals along the R132.

Taxis benefit from bus priority infrastructure on the R132 to the north and south of the airport, as detailed in previous sections. In all other areas they share road space with general traffic. The M1 and Dublin Port Tunnel are increasingly being used as a route for taxis travelling between the city centre and the airport. Along the airport access roads, taxis share the road space with general traffic.

Pedestrian/cycle facilities are provided on the R132 to the north and south of Dublin Airport. The airport is located some distance away from major residential areas and as a result, there are very low levels of cycle activity in the vicinity of the airport.

Utilisation

2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN103 were extracted from junction traffic counts and NRA Automated Traffic Counter (ATC) data, and analysed. The following table outlines the traffic flows on key links.

Table 15.6 MN103, traffic flows on key links

Link	Direction of Traffic Flow	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)	
		Cars and LGVs	Bus & HGVs
R132, north of Airport Roundabout	North	611	74
	South	1,115	53
Corballis Road North	East	609	19
	West	1,227	30
M1 Link Road to Airport Interchange	East	553	24
	West	1,267	67
R132, between Airport Roundabout and Corballis Rd South	North	332	44
	South	932	55
Corballis Road South	East	288	45
	West	491	58
R132, between Corballis Road South and Collinstown Cross	North	775	75
	South	1,428	81
* M1, between Drynam and Airport Interchanges.	North	1,236	664
	South	3,424	620
* M1, between Airport and M50 Interchanges.	North	2,481	794
	South	3,107	817

All data from junction traffic counts, unless otherwise indicated:
* NRA Automated Traffic Counter Data (January 2006)

Buses are an important access and egress mode to Dublin Airport with 22% of passengers and 16% of staff using bus services to the airport. A large number of bus services use Dublin Airport as a terminus; in particular dedicated airport bus services such as Dublin Bus Numbers 746, 747, 748 and the Aircoach. The R132 and M1 are used by a large number of scheduled bus services operating between the city centre and the airport.

Taxi is an important access/egress mode to Dublin Airport. Within the airport itself, there are high volumes of pedestrians moving between the terminal buildings, the bus stops, the taxi rank and the short-term car parks. There is a major pedestrian crossing between the short-term car park and the terminal building. Pedestrian/cycle movements between the airport and its environs are negligible.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speeds in Area MN103, as extracted from the validated base year MNTM for 2006 are 42.4 km/hour. This information is illustrated on maps (Traffic) included in Volume 3, Book 1 of 2. In the Do Minimum future year scenarios, a significant drop in average car speed to 22.0kph in 2029 occurs. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

There are limited lengths of bus priority in the vicinity of the airport with the exception of access restrictions for general traffic to the bus stop areas. Average bus speeds from Cloghran Roundabout to south of the airport via the airport are 18kph.

Bus services benefit from significant bus priority on the R132, particularly in the northbound direction. Aside from the internal road network within the airport, the surrounding roads are relatively uncongested in the AM peak. Swords QBC routes that do not serve the airport travel at an average speed of 34kph from the Cloghran Roundabout to south of the airport during the AM peak. By comparison, the corresponding average car speed for the same journey is 40kph.

During periods of high demand, access to the set down areas becomes congested and taxis suffer delays as a result.

Within the confines of the airport terminal pedestrian experience a good environment, with high levels of priority afforded to them at points of conflict with general traffic.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN103. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.7 MN103, number of personal injury accidents by link.

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
R132 between Cloghran Roundabout and M1	5	0	0	5
Naul Road between Cloghran Roundabout and Forest Road	2	1	0	3
Stockhole Lane	1	1	1	3
M1 between airport roundabout and M1 roundabout	1	2	1	4
Swords Road (R132) between the airport and Old Airport Road	2	0	0	2
Airport Zone	34	6	0	40
Clonshaugh Road between Baskin Lane and N32	1	0	0	1
Baskin Lane between Clonshaugh Road and Baskin Cottages	2	0	0	2

The numbers of accidents along the M1 and R132 within Area MN103 are relatively low, with few involving pedestrians and motorcyclists. The frequency of accidents indicates that this area is not particularly sensitive. However, a large number of both minor and serious accidents have occurred within the Airport zone between 2001 and 2006. Of the 40 recorded accidents, 17% of these involved motorcyclists and 20% involved pedestrians. Such frequency indicates the high sensitivity of the Airport Zone.

15.3.2.4 Area MN104

Area MN104 runs from south of the airport to north of the Ballymun Road/Santry Avenue/Balbutcher Lane junction.

To the north of Area MN104, there is an airport Park & Ride site served by a bespoke bus service linking the car park to the airport, which is accessed via the R132. Dublin Airport Authority (DAA) has a 5,600 space long-term Park & Ride site at Harristown. This site is accessed by car via the R108.

Dublin Bus opened a bus garage at Harristown Garage in October 2004 and the garage currently accommodates 200 buses. The garage is accessed from the R108 (extension of Ballymun Road) and the R122 (extension of St. Margaret's Road). A number of retail distribution and warehousing uses are also located in this area.

Infrastructure

The M50 is the main orbital route around Dublin City. It has a strategic traffic carrying function, linking a number of national primary roads which intersect with it, namely the M1, N2, N3, N4, N7 and M11. Given the distribution of development along the M50 and the significant number of interchanges with non-national roads, the M50 also serves a local function, by connecting employment, residential and retail centres located in close proximity to the road. The M50 is currently being upgraded to increase capacity. The M50 Upgrade scheme involves adding a third lane in each direction on the M50 over a distance of 31km between the M1 and Sandyford Interchanges and also upgrading junctions to free-flow interchanges at the M1,N3,N4,N7.

Work began on Phase 1 of the scheme in autumn 2006 and will be completed in 2008. It consists of upgrading 8km of the existing dual carriageway between the N4, N7) and Ballymount Interchange

The R108 to the north of the M50 is a single two-lane road, which connects the M50 Ballymun Interchange with lands to the north of the M50. This section of the R108 provides access to the airport from the M50. To the south of the M50, R108 connects the M50 with Main Street, Ballymun. The road is a dual two-lane road with hard shoulders. The Tesco distribution centre and Northwood development are accessed via a signalised junction on the R108.

The Swords QBC continues along the R132 to the east of Area MN104. A Dublin Bus depot is located at Harristown to the south of the R108. This garage is the largest Dublin Bus depot and has capacity for 240 buses.

Taxis avail of general traffic and bus infrastructure within Area MN104 and conditions as regards levels of congestion are considered good.

The M50 and M1 act as a significant barrier for pedestrian and cycle movements across the roads in Area MN104 due to there being only one location at which they can cross them. In addition, pedestrian and cycle movements along these two roads are prohibited.

Utilisation

2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN104 were extracted from junction traffic counts and NRA Automated Traffic Counter (ATC) data, and analysed. Within Area MN104, the M1 and M50 carry the highest general traffic volumes. The R132 and the R108 also carry significant general traffic volumes. The following table outlines the traffic flows on key links.

Table 15.8 MN104, traffic flows on key links

		Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)	
Link	Direction	Cars and LGVs	Bus & HGVs
R132, between Corballis Road South and Collinstown Cross	North	762	89
	South	1,398	100
R132 south of Collinstown Cross	North	411	93
	South	1,218	85
Old Airport Road (along southern perimeter of Airport)	East	878	60
	West	370	50
R108, between Old Airport Road and M50	North	798	58
	South	363	71
R108, between M50 and Santry Avenue	North	933	87
	South	947	65
* M50 between R108 and M1 Interchanges	North/East	2,971	866
	South/West	2,317	815
* M1 between M50 and Airport Interchanges	North	2,481	794
	South	3,107	817

All data from junction traffic counts, unless otherwise indicated:
*NRA Automated Traffic Counter Data (January 2006)

The landuses within Area MN104 do not generate a significant volume of bus trips and, as such, there are low numbers of bus passengers within the area.

There are not any major residential developments or significant social infrastructure within Area MN104. As a result, there are very low levels of pedestrian and cycle activity in the area.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speed in Area MN104, as extracted from the validated baseline MNTM for 2006, is 28.2 km/hour. This information is illustrated on maps (Traffic) included in Volume 3, Book 1 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. For example, on the R108 South, the car speeds for 2006 are 21.19kph which reduces to 10.14kph in 2029. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

The bus operating environment within Area MN104 is quite good with significant elements of bus priority on the R132 and sufficient capacity elsewhere to accommodate bus movements along with general traffic.

The pedestrian and cycle experience within Area MN104 is poor as a result of severance associated with the M1 and M50. This results in very limited opportunities to move within the area, prohibition of pedestrian and cycle activity on the M1 and M50 and very low pedestrian and cycle activity generally. This in turn acts as a barrier to growth of these modes.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN104. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.9 MN104, number of personal injury accidents by link.

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
Old Airport Road between R108 and Swords Road (and cross between Old Airport Road and Swords Road)	6	0	0	6
Clonshaugh Road between N32 and Baskin Lane	1	0	0	1
M50 / M1 Roundabout	9	2	0	11
M50 between Ballymun Roundabout and M1 Roundabout	3	1	0	4
Swords Road (R132) between Old Airport Road and Santry Avenue	1	1	0	2
Turnapin Lane between Swords Road and Turnapin Green	0	1	1	2
R108 between Old Airport Road and Ballymun / M50 Roundabout	4	0	0	4
Northern Cross Route (M50) between Finglas Roundabout and Ballymun / M50 Roundabout	1	0	0	1
Ballymun / M50 Roundabout	5	0	0	5
R108 between Ballymun / M50 Roundabout and Santry Avenue	3	0	0	3
Ballymun Road between Ballymun Main Street and Santry Lodge	1	0	0	1
St Margaret's Road (R104) between Jamestown Road and Balbutcher Lane	3	1	0	4
Balbutcher Lane (All the Loop)	5	0	0	5
Clonshaugh Road between N32 and Oscar Traynor Road	4	0	0	4
Newbury Avenue	1	0	0	1

The numbers of accidents on the links within Area MN104 are relatively low. However, the M50/M1 Roundabout has been the site of 11 accidents between 2001 and 2006, though none of these involved pedestrians or motorcyclists. Overall, the frequency of accidents in Area MN104 indicates that this area is not particularly sensitive.

15.3.2.5 Area MN105

Area MN105 extends from North of Ballymun Road/Santry Avenue junction to Ballymun Road at Albert College Park (Dublin City University). The key features within Area MN105 are Ballymun Town Centre, Dublin City University and the Omni Park Shopping Centre.Ballymun is located to the north of this area. The R108 (Main Street, Ballymun) passes through the centre of the town. The area has traditionally suffered from high levels of social deprivation and unemployment. As a result, the area has low levels of car ownership and is highly dependent on bus as the main mechanised transport mode. To address the high levels of social deprivation and unemployment in the area, Ballymun Regeneration Ltd. (BRL) was established to plan and implement a regeneration programme which will result in a new town with new and improved facilities for 30,000 people. Major elements of the regeneration of Ballymun have yet to be completed.

Dublin City University (DCU) is located to the east of Ballymun Road and to the south of Collins Avenue. The main access and egress point to the campus is located on Collins Avenue.

Infrastructure
Within Area MN105, the principal north-south roads are the Main Street, R132 and M50/Dublin Port Tunnel. The Main Street extends into the Ballymun Road to the south of Ballymun has two lanes of traffic and a bus lane in each direction. The R132 is a single lane, two-way road with southbound bus lanes at intervals along its length. The M50 and Dublin Port Tunnel is a two lane motorway linking the M1/M50 interchange with Dublin Port.

The major east-west roads in Area MN105 are Santry Avenue (a single lane two-way road connecting the R108 and R132) and Glasnevin Avenue/Collins Avenue Extension (a single lane two-way road). Glasnevin Avenue/Collins Avenue Extension is an important orbital road in the northside of Dublin City.

Buses and taxis are currently the only form of public transport available to the residents in Ballymun and the surrounding areas. The Ballymun QBC commences at the civic offices on the Ballymun Road and extends along the Ballymun Road (R108) towards the city centre. A high level of bus priority is provided along the R108 and there is a high frequency of bus services from Ballymun to the city centre. Bus stops are located at frequent intervals on both sides of the R108 between Gateway Avenue and Albert College Park. These are well connected with pedestrian infrastructure both in terms of footpath provision and pedestrian crossing facilities.

Taxis benefit from the bus priority measures along the Ballymun Road as detailed above. There is a taxi rank facility near the Arts Centre with capacity for 10 taxis.

Footpaths are located on both sides of Ballymun Road along the length of Area MN105. There are signalised pedestrian crossings on the Ballymun Road at a number of locations.

Cycle lanes have been provided in conjunction with the Ballymun QBC. Cycle facilities are integrated with the bus lanes on both northbound and southbound carriageways for the entire length of the Ballymun Road within Area MN105.

Utilisation
2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN105 were extracted from junction traffic counts and the Metro North Traffic Model and analysed. The roads which carry the highest volumes of general traffic are the M50/Dublin Port Tunnel, R132 and R108. Glasnevin Avenue/Collins Avenue Extension and Santry Avenue also carry significant orbital traffic volumes. The following table outlines the traffic flows on key links.

Table 15.10 MN105, traffic flows on key links

Link	Direction	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs) Cars and LGVs	Bus & HGVs
R108 between M50 and Santry Avenue	North	933	87
	South	947	65
Balbutcher Lane	East	18	3
	West	8	3
Santry Avenue	East	468	33
	West	359	50
Main Street, Ballymun, between Santry Ave and Sillogue Road	North	428	50
	South	352	34
Main Street, Ballymun, between Sillogue Rd and Collins Avenue	North	612	47
	South	923	42
Glasnevin Avenue	East	514	27
	West	511	35
Collins Avenue Extension	East	716	16
	West	419	34
Ballymun Road, between Collins Ave and St. Pappins Road	North	830	46
	South	847	51

All data from junction traffic counts, unless otherwise indicated.

A number of bus routes terminate within Area MN105 and many routes are branched off the main Ballymun Road spine. The varied routeings of the radial routes provide good access to bus services and together with a small number of local and orbital routes, the level of bus coverage in Area MN105 is high.

A high volume of Ballymun QBC bus services operate along the Ballymun Road. There are medium levels of congestion within Area MN105. Dublin Bus operates the majority of bus services in the area. There are over 30 buses an hour from Ballymun to the city centre during the AM peak. In addition, a number of dedicated school bus services connect the Ballymun Road to the schools around Griffith Avenue.

Pedestrian volumes along the Ballymun Road in Area MN105 are quite high as a result of considerable social infrastructure in Ballymun in the vicinity of the R108 and number of schools which are accessed by significant numbers of pedestrians.

North of the town centre, there are low volumes of cyclists using the R108. The volume of cyclists increases considerably further south.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speed in Area MN105, as extracted from the validated baseline MNTM for 2006 is 17.6 km/hour. This information is summarised in Annex I, Volume 3, Book 2 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

The average bus speed on the Ballymun Road from the Civic Offices to the Griffith Avenue is 17kph during the AM peak. By comparison, the corresponding average car speed for the same journey is 13kph.

The pedestrian environment through Area MN105 is typical of the remainder of the built up urban area of Dublin with continuous pedestrian facilities along roads and numerous locations with pedestrian crossings.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN105. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.11 MN105, number of personal injury accidents by link.

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
Coolock Lane / Oscar Traynor Road between M1 / Coolock Lane Roundabout and Clonshaugh Road	7	0	0	7
Skelly's Lane between Shantalla Road and Kilmore Road	2	0	0	2
Shantalla Road between M1 and Kelly's Road	2	1	0	3
Junction between Swords Road / Shantalla Road and M1	5	2	1	8
Coolgariff Road Avenue between Ballyshannon Road and Shantalla Road	0	1	1	2
M1 between M1 / Coolock Lane Roundabout and Junction between Swords Road / Shantalla Road and M1	1	0	0	1
M1 / Coolock Lane Roundabout	7	1	1	9
Coolock Lane between M1 / Coolock Lane Roundabout and Swords Road	2	1	0	3
Swords Rd between Coolock Lane and M1	6	1	0	7
Santry Av. between Swords Rd and Ballymun Rd	3	1	0	4
Collins Av. Extension between Swords Rd and Ballymun Rd	4	0	0	4
Ballymun Rd between Collins Av. and Griffith Av.	9	0	0	9
Ballymun Rd between Balbutcher Lane and Collins Av.	11	0	0	11
Ballymun Rd between Balbutcher Lane and M50 / R108 Roundabout	5	0	0	5
Silloge Rd between Sandyhill Ave and Balcurris Rd	11	0	0	11
Balcurris Rd between Silloge Rd and Balbutcher Lane	6	1	0	7
Balcurris Rd between Balbutcher Lane and R108 (North)	3	0	0	3
Balbutcher Lane between Sandyhill Ave and Balcurris Rd	5	0	0	5
Shangan Rd between Coultry Rd and Shangan Avenue	5	1	0	6
Glasvenin Av. between Beneavin drive and Ballymun Rd	2	1	0	3
Coultry Rd between Ballymun Rd and Coultry Av.	2	0	0	2
Shanliss Rd between Ballymun Rd and Shanliss Grove	1	1	0	2
Ballygall Rd East between Glasvenin Av. and Griffith Av.	1	0	0	1
Belclare Crescent	0	1	1	2

The Sillogue Road between Sandyhill Ave and Balcurris Rd has a particularly high number of accidents, with 82% involving minor injury to pedestrians. 25 accidents have occurred on the Ballymun Road, between the M50/R108 Roundabout and Griffith Avenue, between 2001 and 2006, 24% of these involved pedestrians and motorcylists. Given the frequency of accidents within Area MN105, the area can be classed as being mdoerately sensitive.

15.3.2.6 Area MN106

Area MN106 extends from Albert College Park to the south of Dublin City University and Dorset Street in Dublin's north inner city. The area is largely residential in nature and includes Glasnevin and Whitehall in the north of this area. Drumcondra and Phibsborough are located to the south of Area MN106 and are major residential, retail, commercial and entertainment centres in the north of the city. Griffith Avenue is a low density residential road within Area MN106, i.e. from the Ballymun Road to the Swords Road. Drumcondra is a major urban centre and there is a large quantity of social infrastructure in the vicinity of Drumcondra Road.

The Maynooth Suburban Rail Line runs in an east-west direction through Area MN106 and has a station located adjacent to the proposed stop at Drumcondra.

Croke Park is the national GAA stadium and is located approximately 400m to the east of the proposed stop at Drumcondra. The stadium has a capacity of 82,300 people and is extensively used throughout summer months for GAA football and hurling championship games.

The Mater Hospital is a major hospital in Dublin's north inner city, located to the west of Dorset Street and to the south of the North Circular Road.

Infrastructure

Within Area MN106 the principal north-south road corridors include the R108, Swords Road, Drumcondra Road, Dorset Street and the N2 corridor. The R108 corridor includes Ballymun Road, St. Mobhi Road and Botanic Road. The Swords Road, Drumcondra Road and Dorset Street corridor varies from one to two general traffic lanes in each direction. This corridor also has substantial lengths of bus lane along its length. The N2 corridor includes Finglas Road, Prospect Road and Phibsborough Road. This corridor varies from one to two general traffic lanes in each direction, in addition to significant sections of bus lanes. This corridor merges with the R108 corridor at Prospect Road.

The major east-west road corridors in Area MN106 are Griffith Avenue and the North Circular Road. Griffith Avenue is a single lane two-way road and is an important orbital road in the northside of Dublin City. Griffith Avenue connects the N2, Ballymun Road, Swords Road and Malahide Road. The North Circular Road in Dublin's inner city links the main arterial roads on their approach to the city i.e. Old Cabra Road, New Cabra Road, Phibsborough Road, Drumcondra Road, Summerhill Parade and North Strand. At its westernmost extremity, the road connects with Conyngham Road and from there to the south city via the South Circular Road. At its eastern most extremity, the road provides access to the south city via the Eastlink Toll Bridge. A new bridge, the Macken Street Bridge, which is currently under construction, will provide a more direct connection between the North Circular Road and the south city. North Circular Road generally is a single lane two-way road. There are a number of other important east-west roads in this area, including Homefarm Road, Botanic Avenue, Richmond Road, Clonliffe Road and Whitworth Road.

The Ballymun QBC extends along the R108 from Ballymun through Glasnevin, Drumcondra and Phibsboro. The Ballymun QBC diverges at Griffith Avenue with some buses continuing along the R108 (Mobhi Road, Botanic Road) and some services routed via the Drumcondra Road. The Swords QBC also operates within Area MN106 as it extends towards the city centre along the Drumcondra Road.

Taxis benefit from the bus priority measures along the Ballymun QBC and Swords QBC as detailed above. Elsewhere taxis share road space with general traffic.

All roads within Area MN106 have continuous pedestrian facilities along them. Pedestrian crossing points are located at key points across major roads in this area. Signalised pedestrian crossings are integrated within all signalised junctions.

There are extensive cycle lanes located on the Ballymun Road/St. Mobhi Road/Botanic Road corridor. There are a number of schools on Griffith Avenue east of the Swords Road and there are important cycle links along Griffith Avenue connecting these schools with residential areas to the east and west. Drumcondra Road also has extensive cycle infrastructure within Area MN106. Cycle lanes are provided in both directions along the road. For much of their length, the cycle lanes are segregated from the roadway and run adjacent to the footpaths. At other locations, the cycle lanes are provided in conjunction with the Swords QBC bus lanes.

Utilisation

2006 AM peak hour (08:00 to 09:00hrs) traffic flows for key roads within Area MN106 were extracted from junction traffic counts Counts and Metro North Traffic Model output and analysed. The following table outlines the traffic flows on key links.

Table 15.12 MN106, traffic flows on key links

		Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)		
Link	Direction	Cars and LGVs	Bus	HGV
* Ballymun Road between St Pappins Road and St Mobhi Rd	North	774	16	90
	South	1,389	19	42
* Griffith Avenue between St Mobhi Road and Ballymun Rd	West	1,058	21	91
* Ballymun Road between Griffith Ave and St Mobhi Road	North	847	20	102
* St Mobhi Road between Ballymun Road and Griffith Ave	South	1,462	23	50
* St Mobhi Road between Griffith Ave and Home Farm Road	North	578	16	62
	South	902	20	13
Griffith Avenue between St Mobhi Road and Bantry Road	East	667	3	22
	West	491	5	18
Bantry Road	North	4	0	0
	South	273	0	0
Griffith Avenue between Bantry Road and Drumcondra Rd	East	423	3	20
	West	516	5	17
Swords Road between Collins Avenue and Griffith Ave	North	718	56	101
	South	542	47	8
Drumcondra Road between Griffith Ave and Home Farm Road	North	777	62	94
	South	477	55	13
Home Farm Road	East	150	3	20
	West	63	5	17
Richmond Road	East	426	0	6
	West	214	0	1
Botanic Avenue	East	250	0	3
	West	134	0	11
Drumcondra Road between Botanic Ave and Clonliffe Road	North	1,016	65	91
	South	1,084	64	7
Clonliffe Road	East	532	1	1
	West	332	1	25
Drumcondra Road between Clonliffe Rd and Whitworth Road	North	941	64	87
	South	809	63	9
Whitworth Road	East	573	24	17
	West	174	21	23
Dorset Street between Whitworth Rd and North Circular Road	North	858	74	70
	South	1,340	87	24
North Circular Road to the West	East	338	5	32
	West	296	4	63

Link	Direction	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs) Cars and LGVs	Bus	HGV
North Circular Road to the East	East	430	1	34
	West	333	0	63
Dorset Street between North Circular Road and Gardiner Street	North	988	78	70
	South	1,416	91	0
Synnott Place	East	222	0	0
	West	141	0	5
Gardiner Street	East	627	31	0
	West	342	29	43
Dorset Street between Gardiner Street and Eccles Street	North	729	49	33
	South	961	60	0
Eccles Street	East	333	3	3
	West	193	3	5
Temple Street	East	398	0	2
	West	178	0	8
Dorset Street between Eccles Street and Fredrick Street	North	672	52	25
	South	824	63	0

All data from traffic counts unless otherwise indicated:
* Metro North Traffic Model (MNTM) Output for 2006

Car speeds increase slightly in 2029 compared to the existing 2006 scenario from 11.0kph to 13.4kph. This decrease in speeds is because of a general increase in traffic throughout the seven areas.

There are a high number of dedicated school bus services servicing the schools in the area around Griffith Avenue. The majority of the regular scheduled services are operated by Dublin Bus. There are also high volumes of public bus passengers within Area MN106. There are a significant number of bus services in the vicinity of the Mater hospital.

Given the significant level of bus priority along Drumcondra Road, a large volume of taxis use this road, some of whom use it as their chosen route from the city centre to the airport. There are three taxi ranks in the vicinity of the Mater Hospital.

Pedestrian volumes within Area MN106 are quite high as a result of the relative compactness of the area, its proximity to the city centre and the considerable social infrastructure in Drumcondra, Glasnevin and Phibsborough town centres.

There are very high volumes of cyclists within the Drumcondra area. Given its proximity to the city centre and the level of cycle infrastructure provided. The Drumcondra Road is an attractive route for cyclists.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speeds in Area MN106, as extracted from the validated base year MNTM (2006) are 11 km/hour. This information is summarised in Annex I, Volume 3, Book 2 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

There are significant levels of bus priority and there are bus lanes in both directions along the Drumcondra Road. As a result, bus speeds are considerably faster than general traffic speeds where bus priority is provided.

Taxi operating conditions are generally good within Area MN106, as a result of the high levels of bus priority on the key radial routes. Elsewhere, within the area taxis share road space with general traffic and as a result experience congestion during peak hours.

Given the extensive pedestrian facilities within Area MN106, the pedestrian environment within this area is considered to be of a high standard.

Conditions for cyclists are generally good within Area MN106 with cycle facilities located on the principal north-south and east-west roads within this area. Low traffic speeds, as experienced within this area are also conducive to cycle use.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN106. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

Table 15.13 MN106, number of personal injury accidents by link.

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
Cross between Ballymun Road and St Mobhi Road	3	0	0	3
Griffith Avenue between St Mobhi Road and Dumcondra Road Upper	1	1	0	2
Dumcondra Road Upper	11	1	0	12
Dumcondra Road Lower between Botanic Av. and Richmond Rd	7	0	0	7
Dumcondra Road Lower between Botanic Av. and Clonliffe Rd	13	0	0	13
Cross between Dumcondra Road Lower and Clonliffe Rd	10	0	0	10
Dumcondra Road Lower between Clonliffe Rd and Whitworth Rd	10	1	0	11
Dumcondra Road Lower between Whitworth Rd and North Circular Rd	14	0	0	14
North Circular Rd between Dumcondra Rd Lower and Berkeley St	11	1	0	12
Berkeley St	6	2	0	8
North Circular Rd between Berkeley St and Phisborough Rd	12	1	0	13
Cross between Gardiner St Upper and Dorset St Lower	12	0	0	12
Dorset St Lower between Gardiner St Upper and Frederick St North	6	1	0	7
North Circular Rd between Dorset St Lower and Sherrard St Upper / Sherrard St Lower Junction	11	0	0	11
North Circular Rd between Sherrard St Upper / Sherrard St Lower Junction and Summerhill Parade	10	1	1	12

The frequency of accidents within Area MN106 is quite high with 146 in total, of these, 137 were minor, while the remaining 9 were serious in nature and 1 fatal accident. 25% of these accidents involved motorcycles, while 33% involved pedestrians. The area can be classed as being highly sensitive.

15.3.2.7 Area MN107

Area MN107 extends from Dorset Street in the north to Leeson Street in the south. The city centre is a very significant residential, commercial, educational, retail, entertainment and cultural location.

The city centre is also significant from a multi-modal transportation perspective in that it has a dense road network which caters for very high flows throughout the day. Distinct peaks exist during AM and PM periods. Pedestrian flows are also very significant within the city centre generally.

Many businesses within this area are also dependent on streets to accommodate loading/ unloading and parking requirements.

The two main retail areas in the city centre are centred around Grafton Street (including the St. Stephens Green and Powerscourt Shopping Centres) and Henry Street (including the ILAC and Jervis Shopping Centres). Both of these streets are pedestrianised, as are a number of streets in their vicinity.

Employment opportunities are distributed across the full city centre area; however the International Financial Services Area has a concentration of office based employment opportunities. Kildare Street and Dawson Street areas are also significant in view of the large number of Government departments located in their vicinity.

Temple Bar is a significant cultural and recreational area in Dublin and attracts significant numbers of tourists. The area consists of a dense network of pedestrianised streets. The alignment runs along the eastern extent of this area.

There are a number of cultural and entertainment centres located within Area MN107 including galleries, theatres and cinemas. Some hospitals and Garda stations are also located within this area, as are a number of universities and schools.

Infrastructure

The principal routes within the city centre are the Outer Orbital Route and the Inner Orbital Route. The Outer Orbital Route includes North Circular Road, North Wall Quay, East Link Toll Bridge, roads running parallel to the Grand Canal and sections of the South Circular Road. The function of the route is to provide an alternative route for motorists crossing the city centre. The Inner Orbital Route skirts the core inner city area. It extends from Parnell Square in the north to St. Stephens Green in the south and from Merrion Square in the east to Blackhall Place in the west.

The north and south quays are also important traffic routes, catering for east-west movement through the city centre.

Within Area MN107, there are approximately 13 multi-story car parks with in excess of 6,700 car parking spaces.

Area MN107 covers a significant proportion of the city centre. The city centre is a major destination for bus passengers and there are very high volumes of bus services operating within the area.

At present bus operations benefit from general traffic management measures in place in the city centre. The east west bus movement through the city centre is facilitated through the provision of significant lengths of bus lanes along the north and south quays. Buses also benefit from a continuous bus lane on the north quays, which has recently been provided.

In addition to the local and commuter services, the city centre is a key destination for inter urban coach services. There are a multitude of bus operating companies serving the city centre, the largest of which are Dublin Bus and Bus Éireann.

City centre bus stops are very heavily used. The city centre is also an important terminus for bus services. Many of the radial city bus routes terminate within Area MN107. A number of key streets including Parnell Square West, Marlborough Street and Fleet Street are used for the turnaround of buses to facilitate the operation of inbound and outbound services where passengers board and alight in the core city centre.

Bus services link with heavy rail services at Heuston, Connolly and Tara Street and with Luas services at O'Connell Street and St Stephen's Green.

In addition to the on street bus stops, Bus Éireann have an off street bus station at Busáras, Beresford Place. Bus Éireann also has important bus stops on O'Connell Street, the Quays and Amiens Street.

There are presently two light rail lines in Dublin city centre: the Red and Green Luas Lines. The Luas Green Line is a light rail line which links Sandyford in south Dublin to Dublin city centre. This line terminates at St. Stephens Green adjacent to the most southerly of the proposed scheme's stops. The Luas Red Line is a light rail line which links Tallaght in west Dublin to Dublin city centre. This line terminates at Connolly station. The line is currently being extended from Connolly station to the Point Depot. The existing Red Luas Line alignment intersects with the alignment of the proposed scheme at O'Connell Street.

The city centre is a major destination for taxi trips and there is a large volume of taxis in Area MN107. There are approximately 11,000 licensed taxis and limos in the Dublin taximeter area. The peak periods for taxi demand are during the evening peak and Friday and Saturday nights.

One of the principal pedestrian corridors is the Parnell Square to St. Stephen's Green corridor. This corridor comprises O'Connell Street, O'Connell Bridge, College Green and Grafton Street. The corridor provides the main north-south pedestrian route through the city. There are wide footpaths along its length and increased time given to pedestrians at crossings in order to facilitate pedestrian movement as much as possible. Furthermore, all footpaths and crossings are of a standard suitable for the mobility impaired.

There are four large pedestrianised areas in the city centre:

- Henry Street/Earl Street - shopping thoroughfare;
- Temple Bar – historic area with tourist and retail facilities;
- Trinity College – educational facility;
- Grafton Street – shopping thoroughfare.

All of these areas are heavily used. These areas form part of, or are adjacent to, the main north-south city spine from Parnell Square to St. Stephen's Green.

The Ha'penny and Millennium Bridges are pedestrian bridges across the Liffey which connect Temple Bar to the Henry Street/Earl Street area. All of these pedestrian areas and bridges are heavily used. These areas form part of, or are adjacent to, the main north-south city spine from Parnell Square to St. Stephen's Green. These two bridges and the routes to either side of them provide alternative routes for pedestrians moving between the Grafton and Henry Street retail areas.

There is a bus lane along Parnell Square East which continues on to the northern end of O'Connell Street, before becoming a dedicated cycle lane. This forms a continuous route which facilitates cyclists travelling into the city centre from the north. The northbound carriageway of O'Connell Street also has a bus lane available for cyclists going in the opposite direction. There are also cycle lanes along the north and south quays to aid east-west travel. However, there are no dedicated cycle lanes or bus lanes available to aid travel to the south city centre.

Designated cycle parking facilities are provided at a large number of key destinations in the city centre.

Utilisation

Area MN107 comprises the city centre. As a result the road network is very extensive. Traffic flow data for key roads was extracted from junction traffic counts and the MNTM and analysed. The following table outlines the traffic flows on key links.

Table 15.14 MN107, traffic flows on key links

		Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs)		
Link	Direction	Cars and LGVs	Bus	HGV
North Frederick Street	South	122	159	2
Dorset Street, between North Frederick Street and Granby Row	North	591	40	33
	South	828	3	26
Granby Row	North	191	93	11
* Parnell Square West	North	460	112	80
* Parnell Square North	East	381	3	50
* Parnell Square East	South	485	127	10
* Parnell Street, West of O'Connell Street	West	960	127	78
* Parnell Street, East of O'Connell Street	East	133	0	4
	West	521	0	57
* O'Connell Street, between Parnell Street and Cathal Brugha St	North	30	132	14
	South	0	138	0
O'Connell Street, between Abbey Street and O'Connell Bridge	North	496	108	40
	South	488	133	16
Bachelors Walk	East	1,114	100	113
Eden Quay, between O'Connell St and Marlborough St	East	855	20	104
	West	0	26	0
Marlborough Street, between Abbey Street and Eden Quay	North	26	0	1
	South	101	16	4

Link	Direction	Traffic Flow by user class (Vehicle numbers between 08:00 to 09:00hrs) Cars and LGVs	Bus	HGV
Eden Quay, between Marlborough St and Beresford Pl	East	935	36	107
	West	0	26	0
O'Connell Bridge	North	670	109	43
	South	916	240	28
Aston Quay	West	594	75	173
Westmoreland Street, between Fleet Street and O'Connell Bridge	North	772	164	48
D'Olier Street	South	1,417	248	53
Burgh Quay	West	993	28	193
Hawkins Street	South	2	10	0
Fleet Street, between Westmoreland St and D'Olier Street	East	166	70	6
Townsend Street, between D'Olier Street and Tara Street	East	487	76	15
Pearse Street, between Tara Street and D'Olier Street	West	131	58	3
College Street, between D'Olier Street and Westmoreland St	West	1,359	329	41
Westmoreland Street, between College Street and Fleet Street	North	1,012	237	55
College Green, between College Street and Grafton St	North	889	191	47
	South	1,236	283	33
College Green, between Grafton Street and Dame St	West	517	120	18
Grafton Street	South	719	163	15
Nassau Street, between Grafton Street and Dawson St	East	719	163	15
	West	80	81	21
Dawson Street, between Nassau St and Molesworth Street	North	737	92	47
Leinster Street South	East	1,378	174	41
Kildare Street, between Nassau St and Molesworth Street	South	401	138	9
Kildare Street, between Molesworth Street and St. Stephens Green North	South	882	141	35
St. Stephens Green North, between Kildare Street and Dawson Street	West	1,589	83	16
Dawson Street, between Molesworth Street and St. Stephens Green North	North	1,426	83	38
St. Stephens Green North, between Dawson St and King Street South	East	59	0	22
	West	222	0	0
St Stephens Green West	North	2	0	0
	South	190	0	0
King Street South	West	9	0	1

All data from junction traffic counts, unless otherwise indicated:
* Metro North Traffic Model (MNTM) Output for 2006

Area MN107 has the greatest concentration of bus services and bus passengers in the Greater Dublin Area. A very large proportion of all bus trips start and finish within the city centre. Bus services in the city centre provide access to a very wide catchment area that covers not only Dublin County but also the outlying counties and connects to all major urban centres in Ireland. The existing QBC network converges in the city centre.

The Luas Lines each have a capacity in excess of 5,000 passengers/hour/per direction.

Pedestrian movement surveys have been undertaken in the areas of St. Stephens Green, O'Connell Bridge and Parnell Square East. These surveys indicate that the busiest hours in terms of pedestrian movements are on Saturday afternoon. The busiest hours are between 16:00 to 17:00hrs for both St. Stephens Green and O'Connell Bridge and between 14:00 and 15:00hrs for Parnell Square East.

Very high volumes of cyclists were surveyed at city centre locations. This is particularly true near Trinity College, along Parnell Square East, O'Connell Street, the north side quays, St. Stephen's Green North and West.

Cycle parking facilities at the key destinations within the city centre are usually heavily over-subscribed. Consequently, there are significant levels of informal cycle parking activity due to the lack of capacity in official parking bays.

Conditions experienced

Average AM peak hour (08:00 to 09:00hrs) general traffic network speed in Area MN107, as extracted from the validated baseline MNTM for 2006 is 5.5 km/hour. The road network in this area during the AM peak period is considered to be congested. This information is summarised in Annex I, Volume 3, Book 2 of 2. In the Do Minimum future year scenarios, average car speeds reduce in most years when compared to the 2006 baseline situation. This decrease in speeds is because of a general increase in traffic volumes throughout the seven areas.

Current bus speeds in the city centre are low. The average bus speeds for majority of the existing QBCs in the central area (Parnell Square – O'Connell Street – Westmoreland Street – St Stephen's Green) are between 7kph and 10kph during the AM peak hour. The low bus speeds reflect the congestion experienced within the city centre and the long dwell time of buses at busy city centre stops due to large number of passengers boarding and alighting.

An analysis of bus monitoring results indicates that there is a large degree of variation between the minimum and maximum bus speeds. This high level of variation in bus speeds adversely impacts on the reliable operation of bus services. In addition to varying within the peak hours, traffic conditions can change significantly from day to day within the central area. This is a result of the unpredictable nature of general traffic congestion in this area i.e. speeds and levels of congestion are very sensitive to minor changes in the operating environment.

Luas operating conditions in the city centre are generally good. Luas Red Line services operate on a greater length of city streets and have to cross a greater number of major junctions than Green Line services.

On weekday mornings, the pavements on St. Stephen's Green West provide a reduced level of service compared to the rest of the pedestrian areas around the Green. This reduced level of service occurs because of the congestion that occurs due to the combination of high numbers of passengers alighting at the terminus of the Luas Green Line through pedestrian movements.

On Saturdays, the greatest congestion occurs on Grafton Street, which is almost at capacity. The building-side footpath on St. Stephen's Green North is also heavily congested due to its restricted width.

At O'Connell Bridge, the highest levels of pedestrian congestion are experienced at the pedestrian crossings. The most congested crossing was recorded on Saturday afternoon at the junction of Westmoreland Street and Aston Quay. This level of congestion makes it extremely difficult for cross-flow movements between pedestrians moving north-south along Westmoreland Street and those going east-west along the Quays.

The footpaths along Parnell Square East are not usually congested. The eastern footpath is more heavily used than the western on both Thursday and Saturdays. This is probably due to the presence of a school, crèche, café and numerous offices as well as several bus stops along the eastern side of the square.

Dublin city centre does not represent an ideal cycle environment. This is primarily due to the fragmented nature of the cycle network, heavy traffic volumes, significant levels of congestion and extensive bus related kerbside activities. Furthermore there are large numbers of one-way systems in place, which result in significant detours for cyclists.

Accident data

The Road Safety Authority has provided the RPA with their traffic accident database, which in itself is derived from the National Roads Authority accident database for the period 2001-2006. This information is condensed from the national Garda reporting system which categorises accidents on the basis of the severity of injury incurred, i.e. fatal, serious or minor.

The following table illustrates the number of accidents which have occurred on particular links within Area MN106. It should be noted that these figures relate to the number of accidents and not to the number of individuals involved.

The frequency of accidents within Area MN107 is very high. O'Connell Bridge recorded the highest number of accidents, with 43 occurring between 2001 and 2006. 58% of these involved pedestrians though were primarily minor in nature. All of the Quays in the City Centre recorded high numbers of accidents, with 117 recorded in total at Burgh Quay, Georges Quay, Eden Quay, Custom House Quay, Merchant's Wood Quay, Essex Quay, Ormond Quay Lower, Bachelors Walk, Wellington Quay and Aston Quay. 41% of these accidents involved pedestrians, while 11% involved motorcyclists. Due to the frequency of accidents within Area MN107, the area can be classed as highly sensitive.

Table 15.15 MN107, number of personal injury accidents by link

Location	Minor Injury Accidents	Serious Injury Accidents	Fatal Accidents	Total
Burgh Quay – Georges Quay	23	3	0	26
Church St between Inn's Quay and King St	9	0	0	9
Church St between King St and Western Way	11	2	0	13
Dame St - College Green	13	0	0	13
Eden Quay – Custom House Quay	22	1	0	23
Gardiner St	8	2	1	11
High St Bridge St	9	3	1	13
Lombard St	6	0	0	6
Merchant's Wood Quay – Essex Quay	8	0	0	8
O'Connell Bridge	40	3	0	43
Ormond Quay Lower – Bachelors Walk	28	7	4	39
Parnell Square East	10	0	0	10
Pearse St	24	2	0	26
St Stephens Green	12	0	0	12
Wellington Quay – Aston Quay	22	3	1	26

16 FLORA AND FAUNA

Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement (EIS) must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter of the EIS has been prepared in order to fulfil this requirement in respect of flora and fauna.

16.1 INTRODUCTION

This chapter describes the baseline nature conservation interests along the route.

Prior to preparing this chapter, a number of planning and policy documents were reviewed to ascertain if the documents contain any plans, policies or objectives relating to flora and fauna within the study area. The following documents have been reviewed:

- Fingal County Development Plan 2005-2011;
- Dublin City Development Plan 2005-2011;
- National Heritage Plan 2002;
- Dublin City Heritage Plan 2002-2006;
- Fingal Heritage Plan 2005-2010;
- National Biodiversity Plan 2002;
- Dublin City Biodiversity Action Plan 2007-2010.

The findings of this review are summarised in the Planning and Policy chapter of this EIS (Volume 1, Chapter 4).

16.2 BASELINE CATEGORISATION METHODOLOGY

16.2.1 Introduction

This section presents the methodology used in assessing the baseline ecological environment. As well as considering the relevant EPA guidance with respect to EISs (EPA, 2002, 2003), the scope and methodology for the baseline assessment has been devised in consideration of the following guidelines:

- 'Guidelines for the Assessment of Ecological Impacts of National Road Schemes' (NRA, 2006);
- 'Design Manual for Roads and Bridges' (UK Highways Authority, 1993);
- 'Guidelines for Ecological Impact Assessment in the United Kingdom' (Institute of Ecology and Environmental Management (IEEM), 2006).

The baseline ecological environment has been defined through a desktop study, consultation with relevant stakeholders and field surveys.

16.2.2 Study area

The study area for individual aspects of this environmental topic is set out in Table 16.1. As shown in the table, in general the study area comprises any area within 500m of the centre line of the proposed alignment (as illustrated in Figure 16.1).

The study area for designated sites comprises all areas within 10km of the central line of the proposed alignment. This is in accordance with best practice in Ireland (IEMA, 2006).

Table 16.1 Study area

Environmental aspect	Habitats to be surveyed	Width of study area (on both sides of the alignment)
Designated Sites	Special Areas of Conservation (SAC), Special Protection Areas (SPA), Natural Heritage Areas (NHA), Nature Reserves, Ramsar Sites, National Parks, Refuge for Fauna	10km
Badger	Woodland habitats and hedgerows	500m
Otter	Rivers and streams in the area of above ground sections of the proposed alignment	500m
Bats	Man-made structures (buildings, bridges and culverts) and aquatic habitats including rivers, streams and still water habitats associated with hedgerows, scrub woodlands etc.	500m
Birds	Suitable habitats for birds as identified as part of the Phase 1 Habitat Survey. Specific survey to record flight heights of wintering birds in the area of the Broad Meadow Swords SPA	500m
Amphibians	Specific aquatic habitats identified during the Phase I Habitat Survey as having a high potential to provide amphibian habitat e.g. lakes, ponds, rivers	500m
Habitats Phase I	All accessible habitats	500m

16.2.3 Baseline data

The data sources used to compile the baseline are shown in Table 16.2.

Table 16.2 Data sources

Information required	Data source
- Designated conservation sites	- National Parks and Wildlife Service's (NPWS) database of designated conservation sites
- Protected species	- NPWS's records of protected species
- Red Data Book species	- Red Data Book (Whilde, 1993)
- General information	- Consultation undertaken with appropriate representatives of the NPWS, the Eastern Regional Fisheries Board (ERFB) and other relevant conservation groups and agencies (as set out in the Consultation chapter of this EIS (Volume 1, Chapter 7)
- Habitat identification prior to field surveys	- High resolution aerial photography
- Habitat and species identification, mapping and evaluation	- Field surveys carried out by ERM between 2006 and 2008

16.2.3.1 Field surveys

Phase I Habitat Survey

A Phase I survey of habitats was carried out in August/September 2006 and March 2007. This survey comprised all areas within 500m of the central line of the proposed alignment. The survey was carried out using an approach that follows guidance produced by the Heritage Council (The Heritage Council, 2002). The survey classified habitats according to a hierarchical framework described in Fossit (2000):

- Level 1 habitats: habitat type;
- Level 2 habitats: habitat sub-groups;
- Level 3 habitats: individual habitats.

The evaluation of the hedgerow habitats as part of the Phase I Habitats Survey is based on principles set out in the NRA guidelines (NRA, 2008).

The Phase I Habitat Survey could not be safely carried out along areas of the Cuckoo Stream because it lies within the boundary of Dublin Airport and close to the runway. The fact that this area could not be accessed does not however affect the quality of the EIA because the baseline habitats could be determined through review of aerial photography. Furthermore, the Cuckoo Stream will not be impacted upon by the proposed scheme because the scheme will pass under the Cuckoo Stream in a tunnel.

Detailed fauna surveys

The Phase I Habitat Survey identified habitats which are suitable for a range of protected fauna species that could be affected by the scheme. Consideration of the findings of the habitat survey led to more detailed surveys being undertaken in 2007 and 2008 for badger (*Meles meles*), otter (*Lutra lutra*), bats (*Chiroptera*) and amphibians (*Amphibia*). A flight-line survey of wintering birds in the area of the Broad Meadow Swords SPA was also carried out to inform the impact assessment. The findings of these surveys are summarised within the baseline evaluation.

16.2.4 Baseline categorisation criteria

The habitats along the route corridor have been divided up into a series of 'habitat complexes'. The value of each of these complexes is categorised according to the criteria set out in the NRA guidance on assessing the ecological impacts from road schemes (2006). These criteria evaluate the baseline in respect to the ecological habitat resources that occur within a defined geographical context.

16.2.4.1 Importance

Importance is defined in consideration of a number of factors including: statutory designations (regional, national or international), potential to support biodiversity or potential to support protected or endangered species.

16.2.4.2 Sensitivity

Sensitivity is defined in consideration of a number of factors including: population/habitat size, abundance or status (declining, stable or increasing).

16.2.4.3 Existing adverse effects

The NRA guidelines recognise that some habitats may be affected by factors such as anthropogenic modification or poor water quality. These existing adverse effects must be taken into consideration when categorising the baseline.

16.2.4.4 Functional value

The application of the criteria outlined in Table 16.3, in conjunction with the guidance documents referred to above, facilitates the assignment of a value to the habitats that are present within the study area. For the purpose of this report, the functional value is considered to reflect the NRA categories as shown in Table 16.3.

Table 16.3 Criteria for baseline categorisation (NRA)

NRA category	Qualifying criteria	Functional value
A Internationally Important	- Sites of international importance designated or qualified for designation as SAC or SPA under the EU Habitats or Bird Directive; - Undesignated sites containing good examples of Annex I priority habitats under the EU Habitats Directive 92/43/EEC; - Major salmon river fisheries; - Major salmonid (salmon, trout or char) lake fisheries.	Very high (V)
B Nationally Important	- Sites or waters designated or proposed as NHA or statutory Nature Reserves; - Undesignated sites containing good examples of Annex I habitats under the EU Habitats Directive 92/43/EEC; - Undesignated sites containing significant numbers of resident or regularly occurring populations of Annex II species under the EU Habitats Directive 92/43/EEC or Annex I species under the EU Birds Directive or species protected under the Wildlife Act, 1976 and Wildlife (Amendment) Act, 2000; - Major trout river fisheries; - Water bodies with major amenity fishery value; - Commercially important coarse fisheries.	High (IV)
C Locally Important – High Value	- Sites containing semi-natural habitat types with high biodiversity in a local context and a high degree of naturalness, or significant populations of locally rare species; - Small water bodies with known salmonid populations or with good potential salmonid habitat; - Sites containing any resident or regularly occurring populations of Annex II species under the EU Habitats Directive 92/43/EEC or Annex I species under the EU Birds Directive; - Large water bodies with some coarse fisheries value.	Medium (III)
D Locally Important – Moderate Value	- Sites containing some semi-natural habitat or habitat considered to be locally important for wildlife; - Small water bodies with some coarse fisheries value or some potential salmonid habitat; - Any water body with unpolluted water (Q-value rating 4-5).	Low (II)
E Locally Important – Low Value	- Artificial or highly modified habitats with low species diversity and low wildlife value; - Water bodies with no current fisheries value and no significant potential fisheries value.	Very low (I)

As well as the criteria set out above, the baseline categorisation also takes into consideration the criteria set out by the Institute of Ecology and Environmental Management (IEEM, 2006). The results of the baseline categorisation in terms of functional value are shown in Table 16.7 and illustrated on maps (Baseline Flora and Fauna - Habitat Complexes and Bat Records).

16.3 DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

16.3.1 Description of the baseline environment

16.3.1.1 Designated sites

Designated sites identified within 10km of the proposed alignment comprise:

- Special Protection Areas (SPAs);
- candidate Special Areas of Conservation (cSACs);
- proposed Natural Heritage Areas (pNHAs).

The sites within 10 km are listed in Table 16.4 and described in the following sections.

Table 16.4 Designated sites within 10km of the proposed alignment

Site name	Site code	Status	Approximate minimum distance to the proposed alignment
Broad Meadow/Swords Estuary	004025	SPA	732m
Baldoyle Bay	004016	SPA	6,237m
North Bull Island	004006	SPA	5,065m
Rogerstown Estuary	004015	SPA	3,216m
Sandymount Strand/Tolka Estuary (northern subsite)	004024	SPA	2,226m
Sandymount Strand/Tolka Estuary (southern subsite)	004024	SPA	3,013m
Baldoyle Bay	000199	cSAC	6,237m
Malahide Estuary	000205	cSAC	242m
North Dublin Bay	000206	cSAC	5,075m
Rogerstown Estuary	000208	cSAC	1,959m
South Dublin Bay	000210	cSAC	3,011m
Malahide Estuary	000205	pNHA	242m
North Dublin Bay	000206	pNHA	1,829m
Rogerstown Estuary	000208	pNHA	1,959m
Portraine Shore	001215	pNHA	6,423m
Feltrim Hill	001208	pNHA	1,837m
Sluice River Marsh	001763	pNHA	5,179m
Baldoyle Bay	000199	pNHA	6,237m
Santry Demesne (northern subsite)	000178	pNHA	361m
Santry Demesne (southern subsite)	000178	pNHA	683m
Royal Canal	002103	pNHA	0m
Grand Canal	002104	pNHA	669m
Dolphins, Dublin Docks	000201	pNHA	4,130m
South Dublin Bay	000210	pNHA	3,011m
Booterstown Marsh	001205	pNHA	4,794m

Site name	Site code	Status	Approximate minimum distance to the proposed alignment
Dalkey Coastal Zone and Killiney Hill	001206	pNHA	9,958m
Fitzsimon's Wood	001753	pNHA	7,694m
Bog of the Ring (eastern subsite)	001204	pNHA	9,976m
Bog of the Ring (central subsite)	001204	pNHA	9,646m
Bog of the Ring (western subsite)	001204	pNHA	9,995m
Liffey Valley (eastern subsite)	000128	pNHA	5,691m
Liffey Valley (western subsite)	000128	pNHA	9,672m
Dodder Valley	000991	pNHA	7,184m

Broad Meadow/Swords/Malahide Estuary contains a SPA (Site Code 004025), a cSAC and a pNHA (Site Code 000205). The boundaries of these designated sites differ considerably. The SPA is located approximately 0.7km east of the alignment and between the towns of Malahide and Swords, while the candidate SAC and a proposed NHA is located 0.2km east of the alignment and to the north of Malahide and east of Swords. The River Broad Meadow, flows into this estuary which is lagoonal in character. At low tide, the outer part of the estuary is completely emptied, exposing extensive intertidal sand and mud flats. In parts of the outer and extreme inner estuary there are salt marsh habitats. The site is of international importance due to the population of light-bellied brent geese that visit the site each winter. The site is of high conservation importance due to the high diversity of birds which feed, roost and spend winter there. Three species regularly observed on the site (golden plover, bar-tailed godwit and ruff) are listed on Annex I of the EU Birds Directive. Many other species of birds are to be found at the site. This site is one of the few sites in eastern Ireland where substantial numbers of Goldeneye and a duck species of the sub-family *Anatinae* can be found. The site was selected for the presence of the following seven habitats listed in Annex I of the Habitats Directive: Fixed Grey Dunes, *Salicornia* Mud, Atlantic Salt Meadows, Mediterranean Salt Meadows, *Spartina* Swards, Shifting Dunes of *Ammophila*, Mudflats and Sandflats.

Baldoyle Bay contains a SPA (Site Code 004016), a cSAC and a pNHA (Site Code 000199). The boundaries of these designated sites differ considerably. The SPA, cSAC and pNHA are located approximately 6.2km to the east of the alignment. The cSAC and pNHA extend from Portmarnock village to the west pier of Howth Harbour and include the seaward side of the Portmarnock spit. The SPA includes the area between Portmarnock village and Sutton Cross and only includes the area on the landward side of the Portmarnock spit. The Mayne and Sluice rivers drain into the inner part of the estuary. At low tide large areas of intertidal flats are exposed. Baldoyle Bay supports an internationally important population of pale-bellied brent geese along with many other species of birds and has therefore been designated as a SPA under the EU Birds Directive. The inner estuarine area of the site has been designated as a wetland of international importance under the Ramsar Convention and is a Statutory Nature Reserve (site of importance for wildlife protected under Ministerial Order). The site is a cSPA under the EU Habitats Directive. Qualifying interests of the site include four Annex I listed habitats: 'Salicornia and other annuals colonising mud and sands', 'Mediterranean salt meadows (*Juncetalia maritimi*)', 'Atlantic salt meadows (*Glauco-Puccinellietalia maritimiae*)' and 'Mudflats and Sandflats not covered by seawater at low tide'. Within the Mayne marsh, part of Baldoyle Bay, there are two plant species legally protected under the Flora (Protection) Order, 1999.

North Dublin Bay / North Bull Island contains a SPA (Site Code 004006) and a cSAC and pNHA (Site Code 000206). Each of the designations, although within the same location has different boundaries. The SPA is approximately 5.1km east of the alignment and extends from Dublin Bay on the northside to Drumleck Point at Howth Head. The SPA also encompasses the coast from Clontarf to Sutton including North Bull Island. The pNHA is located 1.8km to the east of the alignment and covers the inner part of north Dublin Bay and the seaward boundary from the Bull Wall lighthouse to the Martello Tower at Howth Head. The cSAC is the smaller of the three designations and covers the area from the mainland shore to the Bull Wall lighthouse to Martello Tower at Howth Head, including North Bull Island, and is located 5.1 km to the east of the alignment.

The island consists of a well-developed dynamic dune system on the seaward side. Found on the island are three rare plant species, lesser centaury (*Centaurium pulchellum*), hemp nettle (*Galeopsis angustifolia*), meadow saxifrage (*Saxifraga granulata*) protected under the Flora (Protection) Order, 1999. Two species of plant found on North Bull Island are listed in the Red Data Book, wild sage *(Salvia verbenaca)* and spring vetch *(Vicia lathyroides)*. The landward side of the island is a saltmarsh area and is a roosting site for wintering birds. The SPA is one of the most important sites in Ireland for wintering waterfowl. It is of international importance due to the numbers of brent geese and bar-tailed godwit as well as the regular presence of the EU Birds Directive Annex I species. It is also of national importance for another fifteen bird species and three insect species. A rare liverwort, *Petalophyllum ralfsii*, which is listed on Annex II of the EU Habitats Directive, has also been observed on the site. North Dublin Bay is also of International importance due to its population of light-bellied brent geese, knot and bar-tailed godwit. Nationally important species are also present in the site. The site also contains at least seven species of regionally or nationally important invertebrates. The island and the surrounding tidal flats are part of two separate Statutory Nature Reserves. The site is also a Wildfowl Sanctuary (areas that are excluded from the 'open season order', so that birds can remain undisturbed), a Ramsar Convention site, a Biogenetic Reserve, a Biosphere Reserve and Special Area Amenity Order site. Ten habitats listed on Annex I of the EU Habitats Directive are to be found within the site, one of which is listed with priority status.

Rogerstown Estuary SPA (Site Code 004015) is located approximately 3.2km to the east of the alignment and 2km north of Donabate. This estuary is small and is protected from the open sea by a sand and shingle peninsula. The SPA extends eastwards beyond the low water mark and includes and area of shallow marine water. Both the Ballyboghil and Ballough rivers drain into the estuary. The site has good examples of habitats listed on Annex I of the EU Habitats Directive. The estuary is an internationally important site for pale-bellied brent geese and is of national importance for another 14 species. It is a statutory Nature Reserve and a cSAC under the EU Habitats Directive.

Sandymount Strand/Tolka Estuary SPA (Site Code 004024) is located approximately 2.2km east of the alignment. This SPA comprises a large area of Dublin Bay including the tidal area of the south of the bay and much of the estuary of the Tolka River. The south bay intertidal flats are 3km wide at their widest point. The site is of international importance due to it supporting a population of light-bellied brent goose and supporting an autumn roost for terns. It also supports six bird species of national importance. Bar-tailed godwit, Mediterranean gull and tern species are all listed on Annex I of the EU Birds Directive.

Rogerstown Estuary cSAC and pNHA (Site Code 00208), which is approximately 2.0km to the east of the alignment, has saltmarshes fringing parts of the estuary, especially on the southern shores and on parts of the outer spit. Two plant species, which are legally protected under the Flora (Protection) Order, 1999, are present on the site. The outer area of the estuary is designated as a Statutory Nature Reserve and is a SPA under the EU Birds Directive. Within the site there are several habitats listed on Annex I of the EU Habitats Directive. The site is of international importance for waterfowl and is a breeding ground for little terns. Three rare plants found on the site add to its importance, hairy violet (*Viola hirta*).and meadow barley (*Hordeum secalinum*).

South Dublin Bay cSAC and pNHA (Site Code 000210) is located approximately 3.0km to the east of the alignment and extends from the South Wall of the River Liffey to the west pier of Dun Laoghaire Harbour. The site is important for waterfowl and also supports species of terns including roseate tern and bar-tailed godwits, all listed on Annex I of the EU Birds Directive. This site is an example of a coastal system of sand and mudflats, a habitat listed on Annex I of the EU Habitats Directive.

Portraine Shore pNHA (Site Code 001215) is located approximately 3km east of Donabate and approximately 6.4km east of the alignment. The site is a stretch of rocky shore with some intertidal area towards the south. Above the rocky shore is a narrow strip of vegetation. Various species of plant and birds are to be found on this site. The site is also important because of its habitat diversity and geology.

Feltrim Hill pNHA (Site Code 001208) is located approximately 2km from the proposed alignment. A site synopsis has not yet been produced and only the site boundary is available (NPWS, 2008).

Sluice River Marsh pNHA (Site Code 001763) is located approximately 1km west of Portmarnock Village and approximately 5.2km east of the alignment. The Sluice River flows into Baldoyle Estuary. This site is host to numerous species of plants and birds. Mallard, snipe, grey heron, moorhen and reed bunting are present on the site with herons nesting nearby. This site is also important due to it being a relatively rare habitat in County Dublin.

Santry Demesne pNHA (000178) is located south of the M50 and east of Ballymun Road. The two sub-sites of Santry Demesne pNHA are approximately 0.4km and 0.7km to the east of the alignment. This site comprises the remnant of a former demesne. This site is designated a pNHA due to the presence of the hairy St. John's wort (*Hypericum hirsutum*), which is protected under the Floral (Protection) Order, 1999.

Royal Canal pNHA (Site Code 002103) is an artificial structure connecting the River Liffey to the River Shannon. Along the canal a number of habitats are to be found, including: hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland. Otter spraints are commonly found where the canal passes over a river or stream. The canal also supports the rare and protected opposite-leaved pondweed (*Groenlandia densa*) and the rare stonewort (*Tolypella intricate*), which is listed as 'Vulnerable' in the Irish Red Data Book. The diversity of species present along the length of the canal makes this pNHA a site of significant ecological value.

Grand Canal pNHA (Site Code 002104) is an artificially constructed waterway which connects the River Liffey with the Shannon River at Shannon Harbour and the Barrow Rover at Athy. At the nearest point it is approximately 0.7km to the south of the alignment. Within the pNHA are to be found various different habitats including hedgerow, tall herbs, calcareous grassland, reed fringe, open water, scrub and woodland. Otter spraints are to be found along the towpath, especially where the canal passes a river or stream. The ponds at Gollierstown in Co. Dublin support common newt, a protected species. A number of sites in the eastern section of the Main Line, between Lowtown and Ringsend Basin contain the rare and opposite-leaved pondweed (*Groenlandia densa*), which is protected under the Flora Protection Order, 1999. This site is of importance due to the ecological value of the diversity of species it supports.

Dolphins, Dublin Docks pNHA (Site Code 000201) is a tern breeding site at the entrance to the Port of Dublin near the old sewage works at Ringsend. This site is located approximately 4.1km to the east of the alignment. The site consists of two moorings that are used by common and arctic terns and roosting cormorants. The terns regularly nest in the Dolphins. This site is important due to the tern colony, especially the arctic tern which is scarce on the east coast.

Booterstown Marsh pNHA (Site Code 0001205) is located approximately 3km south of Dublin City and 4.8km to the south-east of the alignment. It is bordered on the east by the Dublin – Wexford railway line and on the west by the Dublin – Blackrock road. The marsh is situated on glacial tills which are underlain by Black Limestone. Two streams, the Trimelston stream and the Nutley stream, run through the site. The site supports numerous species of birds including kingfishers, an Annex I species under the Birds Directive. Various other rare species of birds have also been observed on the site such as little egret and yellow wagtail. It is the only saltmarsh in south Dublin and is a valuable habitat for birds and plants.

Dalkey Coastal Zone and Killiney Hill pNHA (Site Code 001206), located approximately 10km to the south-east of the alignment, is a pNHA, consisting of the coastal stretch from Scotman's Bay to south of White Rock, and taking in the Dalkey Island Group, Dalkey Sound and Killiney Hill. This site is coastal system with a range of habitats ranging from sub-littoral to coastal heath. There are numerous scarce species succeeding in the area including species of the Order *Nudibrachia* and the Spiny Starfish (*Marthasterias glacialis*). The islands are an important site for birds such as roseate tern ands arctic tern. The site is also of geological importance.

Fitzsimon's Wood pNHA (Site Code 001753) is located approximately 7.7km to the south of the alignment. The site supports a resident population of sika deer, an active badger sett and a smooth newt population (http://www. dlrcoco. ie/Meetings/2003/CountyCouncil/spmtg_25mar. pdf). The NPWS has not published a site synopsis for this site.

Bog of the Ring pNHA (Site Code 001204) is situated 5km south-west of Balbriggan. This site consists of three separate sub-sites of which two are approximately 10km north of the alignment and the other is 9.6km, also to the north of the alignment. The site is a flat low lying area with poor drainage. This site is one of only a few marshes in County Dublin. The site is host to a variety of bird and plant species.

Liffey Valley pNHA (Site Code 000128) is a potential NHA along the River Liffey between Leixlip Bridge and Palmerstown. This site consists of two separate subsites, one of which is 9.7km to the west of the alignment and the other is 5.7km to the west of the alignment. The rare and legally protected hairy St. John's wort (*Hypericum hirsutum*) has been recorded on this site, along with the threatened yellow archangel (*Lamiastrum galeobdolon*). Both are Irish Red Data Book listed species. This site is included in the Liffey Valley Special Amenity Area Order 1990. The diversity of aquatic and terrestrial habitats and the presence of rare and threatened plant species make this site very important.

Dodder Valley pNHA (Site Code 000991) is a potential NHA stretching for approximately 2km from Firhouse Bridge to Oldbawn Bridge in the south-west of Dublin city. This site is located approximately 7.2km to the south-west of the alignment. The vegetation on this site is predominantly woodland scrub. There is diversity of plant species in the wild flower meadows along the river banks. Forty-eight bird species have been recorded within the site such as kingfisher and little grebe, and it also supports a breeding colony of sand martens. This site is the only remaining area of natural river bank vegetation of the Dodder within the Greater Dublin Area.

16.3.1.2 Habitats and flora

The habitats recorded within the study area are illustrated on maps (Baseline Flora and Fauna - Habitat Complexes and Bat Records) included in Volume 3, Book 1 of 2. Six general (Level 1) habitat groups were identified along the proposed scheme. These habitat groups have been categorised using the classifications that are defined in the 'Guide to Habitats in Ireland' (Fossit, 2000) (Table 16.5).

Table 16.5 Habitat Classification System

Level 1 Habitat Type	Level 2 Habitat sub-group	Level 3 Habitats
Freshwater (F)	FW1	Eroding/upland rivers
	FW2	Depositing/lowland rivers
	FW3	Canals
	FW4	Drainage ditches
	FL8	Other artificial lakes and ponds
Grassland (G)	GA1	Improved agricultural grassland
	GA2	Amenity grassland (improved)
	GS1	Dry calcareous and neutral grassland
	GS2	Dry meadows and grassy verges
	GS4	Wet grassland
	GM1	Marsh
Woodland & Scrub (W)	WS1	Scrub
	WS2	Immature woodland
	WS3	Ornamental/non-native shrub
	WL1	Hedgerows
	WL2	Treelines
Cultivated & Built Land (B)	BC1	Arable crop
	BC2	Horticultural land
	BC3	Tilled land
	BC4	Flower beds and borders
	BL3	Buildings and artificial surfaces
Exposed Rock & Disturbed Ground (E)	ED1	Exposed sand, gravel or till
	ED2	Spoil and bare ground
	ED3	Recolonising bare ground
	ED5	Refuse and other waste
Coastland (C)	CW2	Tidal Rivers

The most frequently occurring habitats within the study area are cultivated land, built land and improved agricultural grassland. Several watercourses are also located within study area. The majority of the habitats recorded have been modified by human activity and do not represent natural or semi-natural habitats. Each of the Level 1 Habitat Types and Level 2 Habitat subgroups specified in Table 16.5 are described in the following sections.

Freshwater habitats (F)

A number of rivers, ponds and drainage ditches are located within the study area in the vicinity of the proposed alignment.

A number of freshwater habitats occur within the study area and are listed:

- Broad Meadow and Ward Rivers which drain to the Malahide Estuary cSAC and Broad Meadow/ Swords Estuary SPA and pNHA;
- Sluice River (both tributaries) which feeds into the River Marsh pNHA;
- River Mayne;
- Santry River;
- Tolka River (which feeds into the Tolka Estuary SPA);
- Royal Canal (pNHA);
- River Liffey;
- Drainage Ditches;
- Artificial Ponds.

Broad Meadow River
The part of the Broad Meadow River which is within the study area is tidal (CW2) due to its close proximity to the Broad Meadow Estuary. The section of the Broad Meadow River within the study area experiences fluctuations in water levels, salinity and turbidity typical of tidal rivers and also displays characteristics of a low lying depositing river. To the east of the proposed alignment the river is bordered on both sides by established woodland habitat. It includes a range of tree species notably poplar (*Populus* spp.), sycamore (*Acer pseudoplatanus*), small-leaved lime (*Tilia cordata*), horse chestnut (*Aesculus hippocastanum*), field maple (*Acer campestre*) and birch (*Betula pendula*). This habitat is predominantly immature containing some mature trees. Shrub species such as hazel (*Corylus avellana*) and some larch (*Larix decidua*) are also present. In stream vegetation includes duckweeds (*Lemna* spp.) and pondweeds (*Potamogeton* spp.).

Biological sampling, undertaken by the Environmental Protection Agency (EPA) in 2005 recorded a Q-value of 2-3 for the Broad Meadow River at Lissenhall Bridge. This Q-value indicates moderately polluted water (see the Surface Water chapter of this EIS (Volume 1, Chapter 19)). Even though the water quality is degraded, the Broad Meadow River and the associated riparian vegetation, particularly to the east of the alignment, still supports a number of protected fish and mammal species and is also directly linked to the Broad Meadow/Swords/Malahide Estuary cSAC, SPA and pNHA.

Ward River
The confluence of the Ward River and the Broad Meadow River is located within the study area. The Ward River is a depositing river with sections that have undergone anthropogenic modification with the installation of canalised sections, weirs, culverts and bridges. Natural bankside vegetation borders the river at other sections within the study area, such as at Swords linear park. Bankside vegetation to the north of Swords is dominated by herbaceous plants and grasses while sections bordered by woodland occur within the urban areas of Swords. Species inventory comprise typically nitrophilic species of damp ground such as great willowherb (*Epilobium hirsutum*), common comfrey (*Symphytum officinale*) and meadowsweet (*Filipendula ulmaria*) while dock species (*Rumex* spp.) and field bindweed (*Convolvulus arvensis*) are also present. Woodland species comprise willow (*Salix* spp.), alder (*Alnus glutinosa*) and elm (*Ulmus* spp.) Recent biological sampling of the Ward River undertaken by the EPA (2005) at Scotchstone Bridge and Killeeck Bridge recorded a Q-value of 2-3, which indicates moderately polluted water. While the water quality is degraded, the Ward River, like the Broad Meadow River, still supports a range of wildlife species.

Sluice River
The Sluice River is characteristic of an eroding/ upland river (FW1) within the study area. Steep banks, colonised by natural riparian vegetation are associated with this river. Large areas of shading have resulted in a low diversity of in-stream vegetation. The river bed is characterised by coarse material such as gravel, rocks and pebbles. This river flows into a designated conservation area (Baldoyle Bay cSAC) and supports national and European protected fauna species.

Mayne River
Within the study area, the Mayne River is located within the grounds of the Dublin Airport Authority. The river is not crossed by the proposed alignment and therefore is not discussed in detail in this chapter. A description of this river is provided in the Surface Water chapter of this EIS (Volume 1, Chapter 19).

Santry River
The Santry River (FW2) feeds the artificial ponds of the Santry Demesne pNHA and provides a habitat for the protected hairy St. John's wort. The river is culverted where it crosses the existing Ballymun Road. The section of the river to the south-west of the M50 Roundabout is characterised by species poor stands of water cress (*Rorippa nasturticum-aquaticum* agg.).

Tolka River
Tolka River, a depositing lowland river (FW2) is characterised by predominantly concrete embankments and beds which provide very little potential for in-stream vegetation. The section to the west of the proposed scheme is located within urban parkland characterised by amenity grassland and mature trees such as willow (*Salix* spp.), horse chestnut (*Aesculus hippocastanum*) and sycamore (*Acer pseudoplatanus*). The section to the east of the river is characterised by vertical retained walls to either side of the watercourse which prevent the establishment of riparian vegetation.

Royal Canal
The proposed alignment passes under the Royal Canal. Riparian vegetation present on the banks of the Royal Canal is characterised by species poor amenity grassland (GA2). Species poor stands of reed sweet-grass (*Glyceria maxima*) exist, as well as reed canary grass and amphibious bistort (*Persicaria amphibian*) directly adjacent to the water body. The section of the Royal Canal occurring within the study area is also part of the designated NHA and as such is an ecological resource of national importance.

River Liffey
The tidal River Liffey (CW2) are crossed by the proposed alignment. This river is highly modified and is characterised by retained walls which canalise the river over the entire width of the study area, and no in-stream vegetation was recorded.

Drainage Ditches
Drainage ditches (FW4) occur within the northern half of the study area, mainly between the areas north of the M50 and Lissenhall, and are associated with hedgerows and field boundaries. The species diversity of the ditches varies, but many comprise stagnant water, often choked by aquatic vegetation, such as water starwort (*Callitriche stagnalis*) and duckweeds (*Lemna* spp.). Some of the drainage ditches in the area of Lissenhall also show signs of contamination.

Artificial Ponds
Artificial ponds (FL8) were recorded at the following locations:

- Blessington Street Park comprises intensively managed lawns and shrub plantations enclosing an open waterbody. The waterbody is predominantly free of water plants and the perimeter comprises concrete banks. A small area of broadleaved woodland, dominated by native tree species such as willows (*Salix* spp.), is located on an island in the middle of the pond. Waterfowl such as mallards occur in large numbers in and around the waterbody.
- Crowscastle Barryspark at Fosterstown South: The site comprises two artificial lakes, adjoining the Airside Shopping Centre access road. The lakes are fed by surface water from the shopping centre car park, and as a result display signs of poor water quality, with visible traces of oil on the surface of the water. Broad-leaved Pondweed (*Potamogeton natans*) is common throughout the lakes. Other aquatic vegetation is largely restricted to shallow areas around the lake margins and includes: bulrush (*Typha latifolia*) with an approximate cover of 10m² within the western pond; common spike rush (*Eleocharis palustris*); and soft rush (*Juncus effusus*).
- Santry Demesne: The Santry River enters this site from the west and feeds a system of artificial ponds within the demesne. An artificial pond is located to the north of Santry Demesne. The shallow waters of the pond are surrounded by gently sloping banks.
- Within the parklands at St. Stephen's Green: St. Stephen's Green is an intensively managed amenity parkland located within Dublin's city centre. This park contains a number of artificial ponds and woodland habitats. The banks of open water bodies are either concrete or stone walls. Water weeds within the pond system comprise rigid hornwort (*Ceratophyllun demersum*) and common duckweed (*Lemna minor*). The dominant trees surrounding the banks of the ponds are London plane (*Platanus x hispida*) and willows (*Salix* spp.).

Grassland habitats (G)
Grassland habitats are one of the main habitat types recorded within the study area. Improved agricultural grasslands (GA1) in particular are the dominant habitat type between Lissenhall and Swords, and also occur at Fosterstown. These grasslands are characterised by low species diversity and are dominated by rye grasses (*Lolium* spp.). The grasslands are intensively managed for livestock grazing. They are of low botanical value, although they provide habitat for a range of fauna species.

Amenity grasslands (improved) (GA2) were identified in a number of areas within the study area. These include parklands and residential gardens within the urbanised city centre and suburbs of Dublin and Swords. This type of grassland is species poor and is dominated by daisy (*Bellis perennis*), dandelion (*Taraxacum* spp.), plantain (*Plantago* spp.), clover (*Trifolium* spp.) and buttercup (*Ranunculus* spp.). This habitat in itself is highly modified and of low ecological value, although it occurs in parkland areas (e.g. St. Stephen's Green). Some of these parkland sites are of local value due to their location in highly urbanised areas.

Dry meadow grasslands (GS2) were identified at a number of locations within the study area to the north of Dublin Airport and at Lissenhall. Many of these grasslands are not grazed, or are only grazed irregularly, which allows a more species rich grassland habitat to establish, with tussocky coarse grasses dominating. Species include cock's foot (*Dactylis glomerata*), Yorkshire fog (*Holcus lanatus*), false oat-grass (*Arrhenatherum elatius*) and rye grass. Broadleaved herb species included clover, nettle (*Urtica dioica*), ragwort (*Senecio jacobaea*), thistles (*Cirsium* spp.), great willowherb (*Epilobium hirsutum*) and purple loose-strife (*Lythrum salicaria*). If these fields continue to remain undisturbed by grazing, a decline in species richness is likely to occur.

Woodland habitats (W)

There are no extensive woodland stands in the study area, but small stands of woodland are present in areas outside the city centre. These are typically linear and are associated with established parks, the riparian zone of the Broad Meadow River and surrounding old estate houses. The dominant woodland type is mixed broadleaved woodland (WD1) characterised by native species such as silver birch (*Betula pendula*), pedunculate oak (*Quercus robur*) and ash (*Fraxinus excelsior*) as well as non-native species such as beech (*Fagus sylvatica*), sycamore (*Acer pseudoplatanus*), poplar (*Populus* spp.) and lime (*Tilia* spp.). While the Broad Meadow and Ward River support mature/semi-mature woodland habitats in specific locations, the majority of the woodland habitats within the study area are immature or semi-mature woodland. This is especially the case in areas parallel to the R132 in Swords and the M50.

Immature and mature linear woodland habitats (WS2 & WD1) are located along road developments such as the M50 and the M1 Airport Link Road. The species associated with these woodlands includes birch, holly (*Ilex aquifolium*), rowan (*Sorbus aucuparia*), sycamore, hybrid black poplar (*Populus canadensis*), hawthorn (*Crataegus monogyna*) and hazel (*Corylus avellana*). The species mixes proposed in the landscape planting as part of this scheme has drawn largely on the findings of the habitat surveys.

Hedgerows (WL1) and treelines (WL2) are mainly restricted to the grassland habitats to the north of the M50. Hedgerows function as important ecological corridors in a modified landscape and can provide linkages between habitats of high ecological resource. Hedgerows are the dominant type of field boundary and vary greatly in structure and diversity. The dominant species recorded include hawthorn, immature to semi-mature ash, blackthorn (*Prunus spinosa*), bramble (*Rubus fruticosus*), gorse (*Ulex europeaus*) and elder (*Sambucus nigra*). Occasional mature trees of ash, beech and oak also occur with hedgerow habitats. Hedgerows also occur in association with other habitats such as drainage ditches and treelines with some hedgerows maturing into treelines dominated by ash.

While a number of hedgerows are of low ecological value due to the effects of regular management, the majority are of moderate ecological value and are locally important. Those hedgerows are characterised a number of criteria such as species richness, average canopy height, presence of drain, connections to other hedges etc. as defined by the National Roads Authority (NRA).

Treelines are located throughout the study area. They predominantly consist of broadleaved tree species such as ash, beech and oak, but are also characterised by non-native coniferous species such as Leyland cypress (*Cupressocyparis leylandii*). Mature plane treelines (*Platanus x hispanica*) are present along Griffith Avenue. Some of the broadleaved treelines outside the urban areas of Dublin city have hedgerows or scrub dominated by bramble (*Rubus fruticosus* spp.) developing at the base.

Cultivated and Built Land habitats (B)

Built land (BL3) is the dominant habitat type recorded within the study area. The built land comprises the urbanised areas of Dublin and Swords, which is characterised by housing and industrial estates, roads and motorways. Cultivated agricultural arable fields (BC1) have been recorded to the north of the M50 in the area of Lissenhall. Hedgerows and drainage ditches of varying ecological quality are associated with the arable field systems recorded within the study area. Habitats in this category are generally of very low ecological value. However, areas of private gardens that form patterns within the urban landscape can support wildlife and increase the ecological value of an area, including acting as wildlife corridors.

Disturbed Ground habitats (E)

Development is ongoing in a number of areas including the area north of Dublin Airport for the airport extension. Further areas are located to the north of Ballymun and north of the M50 and are characterised by typical plant communities dominated by annual plants such as silverweed (*Potentilla anserina*) and knotgrass (*Polygonum arviculare*). These sites represent spoil and bare ground habitats (ED2); and recolonising bare ground habitats (ED3), both of which are of low local ecological value.

Coastland habitats (C)
The western edge of the Broad Meadow River/ Swords Estuary is located within the Phase 1 Habitat survey area. As this site is of international importance and is designated as a cSAC and SPA (details of which are provided in Section 16.3.1.1), the area is considered to of international ecological value.

16.3.1.3 Fauna

Otter
Otters are protected under Annex II(a) and IV(a) of the EU Habitats Directive (92/43/EEC) which is transposed into Irish law by means of the European Communities (Natural Habitats) Regulations 1997 - 2005. They are also protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000. Otters predominantly inhabit linear habitats along watercourses.

Suitable habitats for supporting otters occur within the study area along the Ward River, Broad Meadow River (Collins, 2004) and also along the Sluice River (NPWS, 2008). Otter surveys undertaken in 2004 for Fingal County Council recorded otter activity along the entire length of the Broad Meadow and Ward Rivers (Collins, 2004). Three potential holt sites were identified within the wider surrounding area, while spraints and fish remains were recorded in the estuary and along the Ward River in Swords. The three possible holt sites are exclusively located along the Broad Meadow River under bridge of the R130, 7.6km to the east of the proposed alignment, sixty metres downstream from Rolestown Bridge (5.7km to the east of the alignment) and at the estuary after the Broad Meadow and Ward River have coalesced (Collins, 2004). Possible holt sites have not been recorded along the Ward River (Collins, 2004). A notable sprainting site was identified under a small footbridge upstream from Balheary Road, by Willowbrook House (Collins, 2004) within the 500m survey area. While the water quality of both the Ward and Broad Meadow Rivers is degraded (Q-Values of 3 for both recorded in 2007), extensive stretches of linear riparian vegetation banks both rivers offering good cover and shelter for holt sites.

Despite the above records no signs of otters were recorded during the field survey for this project in areas upstream and downstream of the locations where the proposed scheme will cross these rivers as illustrated on maps (Baseline Flora and Fauna - Habitat Types) included in Volume 3, Book 1 of 2. However, given that otters are known to occur along these watercourses, are known to range over large areas, and that signs can be affected by heavy rainfall, it has been assumed that otters will pass along the rivers including through the areas where works will be undertaken.

Bats
Bats are protected under Annex II(a) and IV(a) of the EU Habitats Directive (92/43/EEC) and are also protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

The study area to the north of Swords supports a number of foraging corridors such as the Ward and Broad Meadow River corridors, hedgerows and woodlands. This part of the study area also contains a number of buildings (such as large disused farm barns and farmhouses) that have the potential to support roosting bats. The construction of the proposed scheme does not require the demolition of any these buildings. A number of foraging routes were identified during the bat survey and are illustrated on maps (Baseline Flora and Fauna - Habitat Complexes and Bat Records) included in Volume 3, Book 1 of 2.

Two confirmed bat roosts are located within the survey area to the south of Swords (*Pipistrellus* spp.) and also at Santry Demesne where a single unidentified bat was found. Further bat detector surveys recorded the presence of soprano pipistrelle, common pipistrelle and Leisler's bats within the area of Santry Demesne (Bat conservation Ireland, 2008).

Although no confirmed roost sites were recorded during the ERM field surveys a number of locations were found to be of high importance for foraging bat species such as St. Stephen's Green, Blessington Street Park, Broad Meadow/Ward River and hedgerows to the north of Swords.

The Broad Meadow River, Ward River and the area north of Swords village provide foraging habitat for three bat species: Daubenton's bats (*Myotis daubentoni*), Leisler's bat (*Nyctalus leisleri*), common pipistrelle (*Pipistrellus pipistrellus*) and soprano pipistrelle (*Pipistrellus pygmaeus*). The three species were recorded during the ERM field surveys in 2006 and 2007. The Ward River/Broad Meadow River confluence is regarded as an important foraging habitat for these three species.

Activity surveys carried out within urban parkland areas such as St. Stephen's Green and Blessington Street Park indicate that these areas are also of particular importance for a number of species (Roche, 2000; and ERM 2007b).

A number of common bat species are known to forage within St. Stephen's Green including Leisler's bats (*Nyctalus leisleri*), common pipistrelle (*Pipistrellus pipistrellus*), soprano pipistrelle (*Pipistrellus pygmaeus*) and whiskered/Brandt's bat bats (*Myotis mystacinus*) (ERM, 2007/8, Kelleher, 2008, Roche, 2000). The presence of whiskered Brandt's bats is of particular note as the species is recorded infrequently in Ireland (Whilde, 1993). Although the park contains a number of suitable roost sites such as buildings and mature trees, no bat roosts have been confirmed during the field surveys (ERM, 2007, Kelleher, 2008). Activity levels vary throughout the year in the park. High levels of activity were recorded in October 2007 (ERM, 2007). However the survey carried out in June 2008 (Kelleher, 2008) during the bat mating season recorded much lower numbers of bats.

Although no activity was recorded in or adjacent to Albert College Park a number of trees were identified as having the potential to support roosting bats. Additional surveys have been carried out during June, July and August 2008 in consultation with the NPWS and is detailed in Annex D (Volume 3, Book 2 of 2).

Leisler's bat was recorded in the lands surrounding Dublin Airport (Dublin Airport Authority, 2006).

Badgers

Badgers and their habitat are afforded protection in Ireland through the Wildlife Act 1976 (as amended) and under Schedule III of the Bern Convention (Convention on the Conservation of European Wildlife and Natural Habitats).

One four-hole active badger sett was recorded to the north of Dublin Airport within the study area which was still active in summer 2008 (Keeley, 2008). A second, three-hole sett, recorded within a hedgerow to the north of Swords, was dormant and no evidence of current badger activity was recorded.

At least one inactive badger set was recorded on the boundary of St. Albert's College Park (Keeley, 2008). Although the area is considered to be poor for badgers, it is possible that further setts are present within this habitat complex and sightings have been reported by residents (Keeley, 2008).

Amphibians

Amphibian are protected under Annex V of the EU Habitats Directive (92/43/EEC) ('Animal and plant species of community interest whose taking in the wild and exploitation, may be subject to management measures'). All species are also fully protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000.

Common frogs occur in a number of locations within Dublin City, with suitable spawning sites occurring in private gardens and water bodies in the public open space (IPPC, 2006).

The surveys aimed on the evaluation of habitat suitability for spawning frog populations carried out on four stillwater ditches and four rivers/streams. The four watercourses of Broad Meadow and Ward River, Tolka River and the Royal Canal which are crossed above ground level and do not support amphibian populations due unsuitable habitat conditions such as a high flow rate (ERM, 2006f). No direct or indirect impacts occur at Blessington Street Park and Santry Demesne. The proposed scheme causes the loss of a pond habitat at St. Stephen's Green. However, no amphibians were recorded at St. Stephen's Green. Reproduction of common frogs (*Rana temporaria*) was recorded at the western pond at Airside Business Park. Generally undisturbed semi-natural grassland habitats and associated hedgerows provide suitable wintering and summer habitat and it is seen as likely that the species uses these areas outside the breeding season.

ERM reported further potential spawning sites of common frog within the area of Balheary. One adult frog was found along a field ditch towards the end of the spawning season. The majority of field ditches within this area have a low potential to provide suitable spawning habitat for amphibian. The majority of these habitats are characterised by shallow water tables and are seasonably dry.

Irish hare

The study area includes areas of semi-natural grassland predominantly to the north of Swords and Dublin Airport which are suitable for Irish hare (*Lepus timidus hibernicus*). This species is protected under the Wildlife Act 1976 (as amended).

One single hare was recorded by ERM during the June 2008 surveys within an area of semi-natural grassland habitat (GS2) to the north of the proposed depot.

Birds

Birds are protected under Annex I of the Birds Directive (Council Directive 79/409/EEC) and are also protected under the Wildlife Act 1976 and the Wildlife (Amendment) Act 2000 with the exclusions as listed in above mentioned legislations.

Information on the presence of bird species and the potential for breeding habitat was recorded during the Phase I Habitat Assessment. Hedgerows, treelines, woodlands and dry meadow grasslands support a variety of song birds while wildfowl species occur along the linear watercourses and parkland areas such as St. Stephen's Green and Santry Demesne.

The species that were recorded within the study area are shown in Table 16.6.

Table 16.6 Bird species recorded within the study area

Common name	Scientific name	Conservation/ Protection Status	Habitat/Location
Barn Swallow	*Hirundo rustica*	P, AL	Cultivated land, Balheary, Cloghran
Blackbird	*Turdus merula*	P	Hedgerows throughout the study area
Blackcap	*Silvia atricapilla*	P	Hedgerows north of Dublin Airport
Black-headed gull	*Larus canus*	P, RL	Lissenhall/Balheary
Blue Tit	*Parus caeruleus*	P	Hedgerow and scrub throughout the survey area
Chaffinch	*Fringilla coelebs*	P	throughout the survey area
Collared Dove	*Streptopelia decaocto*	P	Woodland alongside Braod Meadow River
Common buzzard	*Buteo buteo*	P	Lissenhall/Balheary
Common gull	*Larus ridibundus*	P, AL	Lissenhall/Balheary
Coot	*Fulica atra*	P, AL	St. Stephen's Green
Dunnock	*Prunella modularis*	P	Hedgerows throughout the study area
Goldcrest	*Regulus regulus*	P	Hedgerows Lissenhall/ Balheary
Goldfinch	*Carduelis carduelis*	P	Hedgerows Lissenhall/ Balheary
Great tit	*Parus major*	P	Woodland habitat throughout the study area
Greenfinch	*Pyrrhula pyrrhula*	P	Hedgerows Lissenhall/ Balheary
Grey heron	*Ardea cinerea*	P	Broad Meadow River
Herring gull	*Larus argentatus*	RL	Throughout the study area
Hooded crow	*Corvus corone cornis*		Throughout the study area
House Martin	*Delichon urbica*	P, AL	Broad Meadow River, Lissenhall/Balheary
House sparrow	*Passer domesticus*	AL	Throughout the study area
Jackdaw	*Corvus monedula*		Throughout the study area
Lapwing	*Vanellus vanellus*	P, RL	Lissenhall/Balheary
Light-bellied Brent Goose	*Branta bernicla hrota*	P, AL	Lissenhall/Balheary
Little Egret	*Egretta garzetta*	P,	Broad meadow River
Long-tailed tit	*Aegithalos caudatus*	P,	Throughout the study area
Magpie	*Pica pica*		Throughout the study area
Mallard	*Anas platyrhynchus*		alongside waterourses throughout the study area
Meadow pipit	*Anthus pratensis*		semi-natural grassland, arable crop habaiat throughout the study area
Moorhen	*Gallinula chloropus*	P	Broad Meadow River, St. Stephen's Green
Mute Swan	*Cugnus olor*	P, AL	Broad Meadow River,

Common name	Scientific name	Conservation/ Protection Status	Habitat/Location
Oystercatcher	*Haematopus ostralegus*	P, AL	Amenity grassland north of Swords
Pheasant	*Phasanius colchicus*	P	Cultivated land throughout the study area
Reed Bunting	*Emberiza schoeniclus*	P	Sluice River
Robin	*Erithacus rubecula*	P	Throughout the study area
Rook	*Corvus frugilegus*		Throughout the study area
Skylark	*Alauda arvensis*	P, AL	Cultivated land throughout the study area
Song thrush	*Turdus philomelos*	P	Cultivated land throughout the study area
Sparrow hawk (?)	*Accipiter nisus*	P	Lissenhall/Balheary
Starling	*Sturnus vulgaris*	AL	Throughout the study area
Tufted duck	*Aythya fuligula*	P, AL	St. Stephen's Green
Wood pigeon	*Columba palumbus*	P	Throughout the study area
Wren	*Troglodytes troglodytes*	P	Hedgerows throughout the study area
Yellowhammer	*Emberiza citrinella*	P, RL	Hedgerows throughout the study area

Three species of international importance (those listed in Annex I of the European Birds Directive) were recorded in the ornithological study area:

- Light-bellied brent goose (*Branta bernicla hrota*);
- Kingfisher (*Alcedo atthis*);
- Little egret (*Egretta garzetta*).

Light-bellied brent geese were recorded crossing the proposed alignment at heights exceeding 50m north of Swords. The presence of this species is of particular note as the Broad Meadow/Swords Estuary SPA has been selected for the conservation of the species. The site holds internationally important populations of brent geese, 4.8% of the national total (NPWS, 2004). Brent geese, although usually associated with coastal wetlands during the winter period, often feed on wet pasture and grassland further inland during daytime. Suitable foraging and resting habitat (although somewhat limited) occurs to the north of Swords and is associated with agricultural and amenity grassland. Brent geese also feed on temporarily flooded and water-logged grassland habitats. As those habitat characteristics are predominantly absent within the study area it is regarded as unlikely that the species occurs in greater numbers in these areas.

Little egret are highly associated with the watercourse of Broad Meadow River. Little egrets were recorded foraging along the river corridor. The behaviour of the species indicates that the proposed development may cause an increase in animal mortality as the species currently crosses the existing N1 at low elevations. Little egrets are also listed on the Amber List of species of medium conservation concern in Ireland (http://www.bto.org, accessed on the 1st April, 2008).

Kingfishers are also associated with the watercourse of the Broad Meadow River. The Broad Meadow River provides suitable foraging habitat for this species of international importance. Suitable foraging was recorded predominantly to the east of the proposed alignment during the Extended Phase 1 Habitat Survey. Risks to this species are associated with the crossing of the proposed alignment for foraging reasons. In addition to its Annex I status, this species is also listed in the Amber List of Ireland as a species of medium conservation concern (http://www.bto.org, accessed on the 1st April, 2008).

15 bird species of Conservation Concern in Ireland, listed on the Red and Amber Lists were recorded within the study area. Large flocks of lapwing and black-headed gulls cross the proposed alignment at Lissenhall while the latter species also uses the area as a resting/foraging site. St. Stephen's Green supports two species of conservation including coot and tufted duck on the western pond.

Agricultural farmland and associated hedgerow habitat to the north of Swords is of particular importance for a number of typical lowland farmland birds and support large numbers and diversities of passerine species. Besides widespread and common species such as wren, robin, blue and great tit and blackbird this area supports large number of yellowhammer, a species of Conservation Concern in Ireland.

Oystercatcher, a species listed on the Amber List of Species of Conservation Concern (Lynas et al., 2007) was recorded within the study area feeding in flocks of varying size on amenity grassland habitats to the north of Swords adjacent to Ward River.

Waterfowl species such as mallard (*Anas platyrhynchos*), coot (*Fulica atra*), tufted duck (*Aythya fuligula*), mute swan (*Cygnus olor*) and moorhen (*Gallinula chloropus*) were recorded at a number of locations throughout the study area such as St. Stephen's Green, the Royal Canal, Blessington Street Park and most of the rivers. The hedgerows within the study area support a number of song birds such as long-tailed tit (*Aegithalos caudatus*), robin (*Erithacus rubecula*), greenfinch (*Carduelis chloris*), blackbird (*Turdus merula*), wren (*Troglodytes troglodytes*), chaffinch (*Fringilla coelebs*) and songthrush (*Turdus philomelos*) while pheasants were recorded within a field to the south of Airside Business Park and north of the Sluice River. The urban landscape of Swords and Dublin supports large numbers of rook (*Corvus frugilegus*), jackdaw (*Corvus monedula*), woodpigeon (*Columba palumbus*) and magpie (*Pica pica*).

Flocks of lapwings were recorded while crossing the area in flight and within field to the north of Lissenhall Little Golf Course. Lapwings are listed as a species of high conservation concern in Ireland (Lynas et al., 2007).

Fish

None of the rivers occurring within the study area is currently designated under the European Freshwater Fish Directive (ERFB, 2008). A review of existing data indicates that the following rivers support salmonid species: Broad Meadow River, Ward River, Sluice River, Tolka River and River Liffey. The Eastern Regional Fisheries Board (ERFB) has recently carried out a stock rehabilitation program on the Mayne River. The river supports populations of eel (*Anquilla anquilla*) and stickleback (*Gasterosteus* spp.).

In 2003, the ERFB undertook a survey of fish stocks in the Tolka and Ward River Valley Parks at the request of the Parks Department of Fingal County (ERFB, 2003). On Tolka River, brown trout (*Salmo trutta*) was recorded at all six sites examined within the scope of this survey. The six survey sites are located upstream along Tolka Valley Park outside the study area. Other species recorded comprise minnow (*Leuciscus phoxinus*), eel (*Anquilla anquilla*), stone loach (*Nemacheilus barbatus*), perch (*Perca flavescens*) and roach (*Rutilus rutilus*).

The Ward River supports salmon (*Salmo salar*) and brown trout, which is also present at Sluice River. Salmon spawning ground has been recorded to the west of the proposed scheme at the Ward River Valley Park.

Fish fauna recorded at Broad Meadow River include Atlantic salmon (*Salmo salar*), listed on Annex II of the EU Habitats Directive, brown trout (*Salmo trutta*), eel (*Anquilla anquilla*) and minnow (P*hoxinus phoxinus*). Mullet (*Chelon* spp.) was recorded as the dominant fish species between Balheary Bridge and the estuary (Collins, 2004).

Salmonid species are currently not present in the Santry River and the Cuckoo Stream which is a tributary of the Mayne River. According to the ERFB no salmonid species are currently associated with the Cuckoo Stream. However, plans are in place to carry out restoration works to improve the aquatic habitats of this stream in advance of a restocking programme.

16.3.2 Categorisation of the baseline environment

The ecological value of habitat complexes within the study area is evaluated by means of a number of specific criteria which are shown in Table 16.3. The results of this categorisation are summarised in Table 16.7.

Table 16.7 Baseline categorisation

Site No	Location	Description	Functional Value (FV)
HC-01	Between proposed depot location and Broad Meadow/ Ward River	**Habitats/Flora:** - Predominantly arable cropland (BC1) associated with Hedgerows (WL1) of low value; - Some areas of semi-natural grassland (GS2); - Improved agricultural grassland (GA1) associated with Hedgerows (WL1) of moderate value and Drainage ditches (FW4) with permanent water. **Fauna**: - Three-hole inactive badger sett; - Single record of common frogs; - Single record Irish hare; - Foraging/commuting habitat for common bats species (Leisler's bat, common pipistrelle and soprano pipistrelle); - Locally important for breeding passerine bird species including species of Conservation Concern in Ireland such as yellowhammer; - Roosting and foraging habitat for waders (oystercatcher). **Summary:** The area is considered to be of moderate ecological value due to the presence of protected species and bird species of Conservation Concern within an area of intensive agricultural farmland. Some semi-natural habitat of local ecological importance occurs and is utilised to facilitate species movement. Areas of predominantly artificial surfaces comprising the Emmaus Retreat Centre to the north of Broad Meadow River and greenhouses buildings within the northern section of this site are included in this area assessment and are considered to be of very low ecological value.	Medium

Site No	Location	Description	Functional Value (FV)
HC-02	Broad Meadow/ Swords Estuary cSAC, SPA and pNHA to the east of the proposed alignment	**Habitats/Flora:** - Designated Conservation Area (cSAC); - Tidal rivers (CW2) with associated (Mixed) broadleaved woodland (WD1), scrub (WS1) and Marsh (GM1). **Fauna:** - Ecological function: important corridor habitat for wildlife movements. - Known Otter area: holts have been previously recorded alongside Broad Meadow River and otter signs noted from the Ward Rivers, sprainting sites are recorded at Balheary Road and near Ward River Valley Park; - Known Salmonid fisheries (Ward and Broad Meadow Rivers); - Foraging habitat for kingfisher and little egret; - Foraging/commuting habitat for common pipistrelle, soprano pipistrelle, Daubenton's bat **Summary:** The area is of very high ecological value due to its conservation status and high number of protected species it is known, or is likely, to support. The presence of marsh habitats and the pre-existing fisheries inventory are also of significant ecological interest. It is also considered likely that the area acts as a wildlife corridor.	Very high

Site No	Location	Description	Functional Value (FV)
HC-03	Broad Meadow/ Ward River confluence outside designated areas	**Habitats/Flora:** - The Ward River is a depositing lowland river associated with wet grassland habitat which is species rich in some sections to the west of the proposed alignment; - To the east of the proposed alignment mixed broadleaved woodland (WD1) exists adjacent to the Broad Meadow River; - Wet grassland (GS4) is often dominated by herbaceous plants typically occurring along river banks. **Fauna:** - Important corridor habitats for a variety of protected species; - Recorded Otters: holts are present upstream of the Broad Meadow and Ward River confluence, sprainting sites are recorded at Balheary Road and near the Ward River Valley Park; - Known salmonid fisheries (Ward and Broad Meadow); Ward River supports salmon spawning sites within the area of the Ward River Valley Park and also supports brown trout; - Foraging habitat for little egret and kingfisher; - Foraging habitat for common pipistrelle and soprano pipistrelle. **Summary**: The area is of high ecological value due to the high number of protected species and the fish species inventory it supports. Also of note is the fact that the area acts as an important wildlife corridor habitat.	High

Site No	Location	Description	Functional Value (FV)
HC-04	Swords and associated urban areas	**Habitats/Flora:** - Artificial surfaces (BL3) comprising predominantly roads and buildings, associated with Amenity grassland (GA2), some areas of scattered trees and parkland (WD5) are also present (Ward River Valley Park); - Linear habitat types comprise hedgerows (WL1) to the west of Pinnock Hill Roundabout and adjacent to the N1 and treelines (WL1) to the east of the proposed alignment north of Kettles Lane; - Included in this area assessment are areas of Amenity grassland (GA2) which are associated with public and private open space; while small areas are currently under agricultural use. Agricultural grassland (GA1) was recorded to the west of the Pinnock Hill Roundabout; - Disturbed ground habitats (ED2 and ED3) occur to the north and south of Nevinstown Lane; - Private gardens may provide some habitat for wildlife. **Fauna:** - Roosting pipistrelle within urban areas of Swords; - Generally low ecological value due to high proportions of buildings and artificial surfaces. **Summary:** The area is of low ecological value due to the dominance of habitats of very low ecological value and the presence of large areas of man made surfaces (buildings, roads and pavements) and disturbance caused by the high level of existing adverse effects (traffic noise and human activity). Suitable foraging habitat for common bat species occurs within the wider area of this Habitat Complex.	Low
HC-05	Recreational area to the north of Estuary Roundabout to the west of the proposed alignment	**Habitats/Flora:** - Amenity grassland (GA2) to the east and west of Ward River, Immature woodland (WS2) and mixed/ broadleaved woodland (WD1). **Fauna:** - Foraging oystercatcher which occur in nationally important populations at Malahide Estuary SPA. **Summary:** The area is of low ecological value. However, the area is likely to be of importance for foraging oystercatcher.	Low

Site No	Location	Description	Functional Value (FV)
HC-06	North of Airside Business park	**Habitats/Flora:** - Different stages of recolonising bare ground (ED3) and Spoil and bare ground (ED2), associated with semi-natural grassland (GS1 and GS4). This habitat complex is currently not subject to human disturbance and shows a strong potential for supporting frogs during the summer and/or winter months; - Linear habitat types such as hedgerows (WL1) of local importance and linear water bodies such as drainage ditches (FW4). **Fauna:** - Breeding population of common frog was recorded at a system of two artificial ponds (FL8). **Summary:** Hedgerow habitats may support wintering frog populations and provide suitable habitat structures during the summer months. This habitat complex is of medium ecological value due to the presence of protected species and a high proportion of semi-natural habitat.	Medium
HC-07	Fosterstown and Swords south	**Habitats/Flora:** - Areas of agricultural grassland (GA1) and semi-natural grassland (GS2) occur to the east and west of the proposed route; - The area is characterised by a network of hedgerows of moderate value, locally important. **Fauna:** - No protected species were recorded within the area but hedgerows are likely to act as stepping stone habitats supporting species movement and migration and may also provide foraging and commuting habitat for local bat populations. **Summary:** The ecological value of this habitat complex was identified as low due to dominance of highly improved agricultural grassland. However the hedgerows are considered to be of local importance and so are considered to be of moderate value.	Low

Site No	Location	Description	Functional Value (FV)
HC-08	South of Pavilions Shopping Centre	**Habitats/Flora:** - Area is part of agricultural pasture land to the south-east of Swords characterised by the dominance of agricultural grassland (GA1); - Associated treelines provide some ecological value in regards to feeding habitat for birds and bats. **Fauna:** - No protected species were recorded from the 2006/2007 surveys. Species diversity is estimated as low due to the intensive agricultural landuse. **Summary:** The ecological value of this habitat complex is very low due to intensive agricultural landuse associated with low species diversity and lack of suitable habitat for protected species.	Low
HC-09	South-east of Fosterstown	**Habitats/Flora:** - Area is part of extensive agricultural land between Swords and Dublin Airport; - Dominated by Arable land (BC1) between and to the north of Sluice River including tributary. **Fauna:** - No protected species were recorded. Species diversity is estimated as low due to the intensive agricultural landuse. **Summary:** The ecological value of this habitat complex is very low due to intensive agricultural landuse associated with low species diversity and lack of suitable habitat for protected species.	Very low
HC-10	Sluice River	**Habitats/Flora:** - Eroding upland river (FW1) and artificial pond habitat (FL8) to the east and west of the proposed alignment, associated with riparian woodland (WN5), - River feeds into Baldoyle Bay SPA; - Bramble scrub dominant along the banks of the northern tributary (WS1); - The scrub and riparian habitats are likely to act as wildlife corridors **Fauna:** - Medium potential for the presence of otter; - Four-hole active badger sett along the bank o f the Sluice River; - Potentially suitable habitat for Kingfisher; - Sluice River supports Atlantic salmon and trout. **Summary:** The Sluice river including tributary supports protected species and act as important corridor habitats within an intensely use agricultural environment. Salmonid fisheries also contribute to the ecological value of this area.	High

Site No	Location	Description	Functional Value (FV)
HC-11	North of Dublin Airport	**Habitats/Flora:** - Large areas of semi-natural grassland (GS2) occur to the north and south of Naul Road north of Dublin Airport; - Areas of spoil and bare ground (ED2) are associated with ongoing construction in relation to the Dublin Airport extension. **Fauna:** - No evidence of protected species recorded during the 2006/7/8 surveys **Summary:** The area is of low ecological value as it supports semi-natural habitats while no evidence of the presence or protected species could be made.	Low
HC-12	Dublin Airport	**Habitats/Flora:** - Artificial surfaces (BL3) and Amenity grassland habitats (GA2) are dominating at Dublin Airport; - Landscaped woodland plant species adjacent to the access roads to Dublin Airport which has been categorised as Mixed/broadleaved woodland (WD1). **Fauna:** - Surveys on protected species were not carried out on Dublin Airport property. **Summary:** Dublin Airport supports predominantly highly modified habitats of very low ecological value. There is a high level of existing adverse effects due to the high noise levels caused by air traffic.	Very low
HC12a	Mayne River	**Habitats/Flora:** - The stretch of the river located within the study area could not be accessed due to the location in close proximity to airport runways. **Fauna:** - The river is not known to support salmonid species however it has the potential to do so. **Summary:** As this river flows into a conservation area (Baldoyle Bay SPA, cSAC and pNHA) it is regarded as of high ecological value.	High

Site No	Location	Description	Functional Value (FV)
HC-13	Between Airport and M50	**Habitats/Flora:** - Agricultural area dominated by Arable crops (BC1) and occasional horticultural fields (BC2); - A sports ground and Sillogue Golf Course to the south of Dublin Airport are typically associated with Amenity grassland (GA2); - Corridor habitats such as hedgerows (WL1) are predominantly of low ecological value. **Fauna:** - The area is of low value for wildlife and no protected species were recorded from the 2006/7/8 surveys. **Summary:** This habitat complex is predominantly highly modified and under intensive agricultural use. It supports some corridor habitat (hedgerows).	Low
HC-14	M50	**Habitats/Flora:** - Mixed broadleaved/conifer woodland (WD2) to the north and south of the M50 supports predominantly native species. **Fauna:** - No records of protected species from the 2006/7/8 surveys. **Summary:** This habitat complex has some ecological value for species migration and foraging/commuting bats within the local area.	Low
HC-15	Between the M50 and Ballymun	**Habitats/Flora:** - Semi-natural grassland (GS1) occurs directly to the north of Ballymun and is extensively grazed by horses, - Santry River south-west of the M50 Roundabout has the character of drainage ditch within this area towards the west of Ballymun Road; - Areas of recolonising bare ground (ED2 and ED3) occur to the west of the proposed scheme and are dominated by perennial ruderals and grasses; - Hedgerows (WL1) of moderate value and locally importance also occur and are often associated with drainage ditches. **Fauna:** - No protected species were recorded from the 2006/7/8 surveys. **Summary:** This area is of low ecological value but supports semi-natural habitats and locally important corridor habitats.	Low

Site No	Location	Description	Functional Value (FV)
HC-16	Santry Lodge to the south-east of the M50 Roundabout	**Habitats/Flora:** - Mixed/broadleaved/conifer woodland (WD2) of this area comprises of mature trees, broadleaved and conifer alike; - Associated treelines (WL2) and highly modified habitats such as amenity grassland also occur. **Fauna:** - No records of protected species were made during the 2006/7/8 surveys. **Summary:** Although mature trees provide some habitat for wildlife, habitat types within this area are predominantly highly modified due to the designed character. Ecological value is considered to be minor	Medium
HC-17	Santry River outside the site designation	**Habitats/Flora:** - Eroding upland River (FW2) towards the eastern section of the river; - Banks dominated by linear woodland (WL1). **Fauna:** - No protected species found during the 2006/7/8 surveys. **Summary:** Although Santry River is not known support salmonid species and it is moderately polluted (Q value 2-3) its ecological value is identified as moderate as it feeds directly into the pNHA Santry Demesne.	High
HC-18	pNHA Santry Demesne	**Habitats/Flora:** - Santry River is characterised as a depositing lowland river (FW2) in this section before it feeds into a system of artificial ponds at Santry Demesne NHA; - Mixed/broadleaved woodland (WD1) present within the demesne supporting a species rich ground flora; - supports protected plant species such as hairy St. John's wort located outside the study area. **Fauna:** - Common and soprano pipistrelle and Leisler's bat records; - One unidentified bat species was recorded at the demesne. **Summary:** The demesne woodland supports a rare plant species and bat species and is an important corridor habitat for species migration.	High

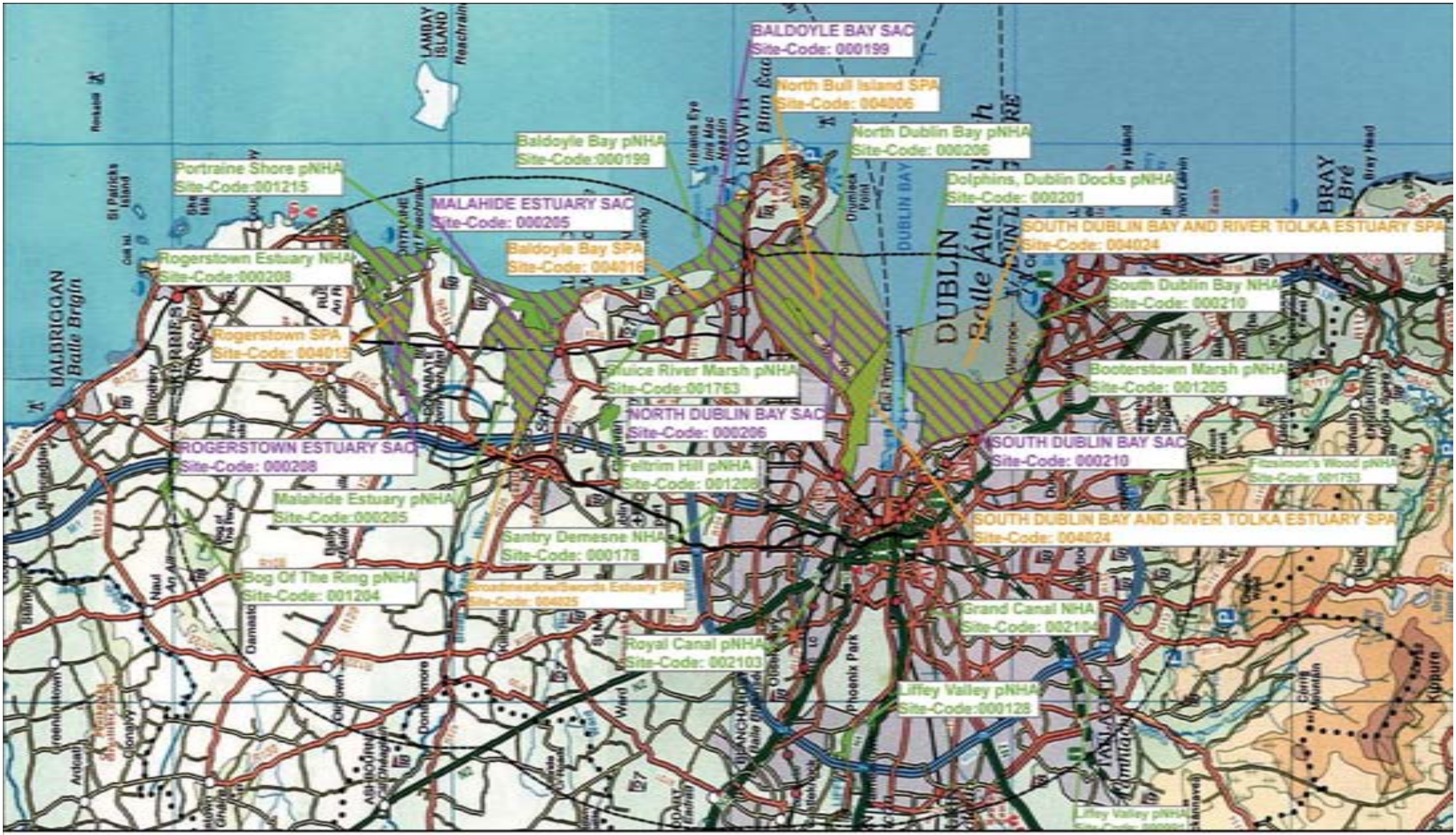
Site No	Location	Description	Functional Value (FV)
HC-19	Area between Ballymun and northern bank of Tolka River	**Habitats/Flora:** - Area is dominated by recently built housing estates (BL3) to the south of Santry River; - Amenity grassland (GA2) habitats are associated with public and private open space and sports grounds; - Treelines (WL2) occur at either side of Glasnevin Avenue/Collins Avenue while mature poplar treelines (WL2) also occur to either side of Griffith Avenue. **Fauna:** - The area is of low value for wild flora and fauna. **Summary:** As this habitat complex supports predominantly artificial surfaces and associated amenity grassland its ecological value is very low. Private gardens add some ecological value to the area as it provides feeding and breeding habitat and also acts as stepping stone habitats in the urban context of this habitat complex.	Very low
HC-20	Albert College Park	**Habitats/Flora:** - Extensive areas of scattered trees and parkland (WD5) and amenity grassland (GA2) are dominant at this area. **Fauna:** - Although linear 'woodland' of this parkland area provide suitable foraging habitat for bat species no bats were recorded here; - Badger activity was recorded within the park. **Summary:** Due to the large size of this area within the urban context this habitat complex is evaluated to have a low ecological value however it is an important stepping stone habitat.	Low
HC-21	Griffith Park	**Habitats/Flora:** - Griffith Park is characterised by Scattered trees and Parkland (WD5), amenity grassland is also present (GA2); - The park supports a number of mature trees predominantly non-native species. **Fauna:** - Resting areas for birds; - Mature willow trees act as important habitat for invertebrates. **Summary:** The area of Griffith Park supports a number of very mature trees, predominantly non-native species. Willow species are of note as they support a high number of invertebrates. This is an important stepping stone habitat within the urban context.	Medium

Site No	Location	Description	Functional Value (FV)
HC22	Tolka River	**Habitats/Flora:** - Flow rate of the river differs throughout the urban sections due to in-water constructions such as weirs. The section crossed by the proposed scheme was identified as a depositing lowland river (FW2); - The Tolka River corridor within this section is highly artificial associated with concrete embankments lacking riparian vegetation. **Fauna:** - River supports populations of Brown Trout recorded north of Ashtown. Spawning gravels occur at Tolka Valley Park outside the study area of Metro North; - Watercourse supports common waterfowl species such as mallard. **Summary:** The Tolka River is characterised by predominantly artificial habitats. Riparian habitat along the watercourse is not very common. However, the river is of note due to the fact that it supports salmonid species and feeds into the Tolka Estuary SPA.	High
HC-23	Area between south of Tolka River and north of the Royal Canal	**Habitats/Flora:** - Building and artificial surfaces dominant (BL3); - Amenity grassland (GA2) dominant while scattered trees and parkland (WD5) and ornamental/non-native scrub (WS3) are also present at public open space such as the southern part of Griffith Park and Holy Cross College; - Private open space is overall sparse. **Fauna:** - Low value for fauna. **Summary:** Griffith park provides resting habitat for waterfowl present on Tolka river. Due to the large extend of artificial surfaces and building the functional value was defined as Very low.	Very low
HC-24	Royal Canal pNHA	**Habitats/Flora:** - Proposed Natural Heritage Area (pNHA); - This canal habitat (FW3) supports a species poor riparian flora. **Fauna:** - Supports some waterfowl species such as mallard; - Important corridor habitat for aquatic and terrestrial fauna. **Summary:** The Royal Canal is a proposed Natural Heritage Area and an important corridor habitat for migrating fauna and so is judged to be of high ecological value.	High

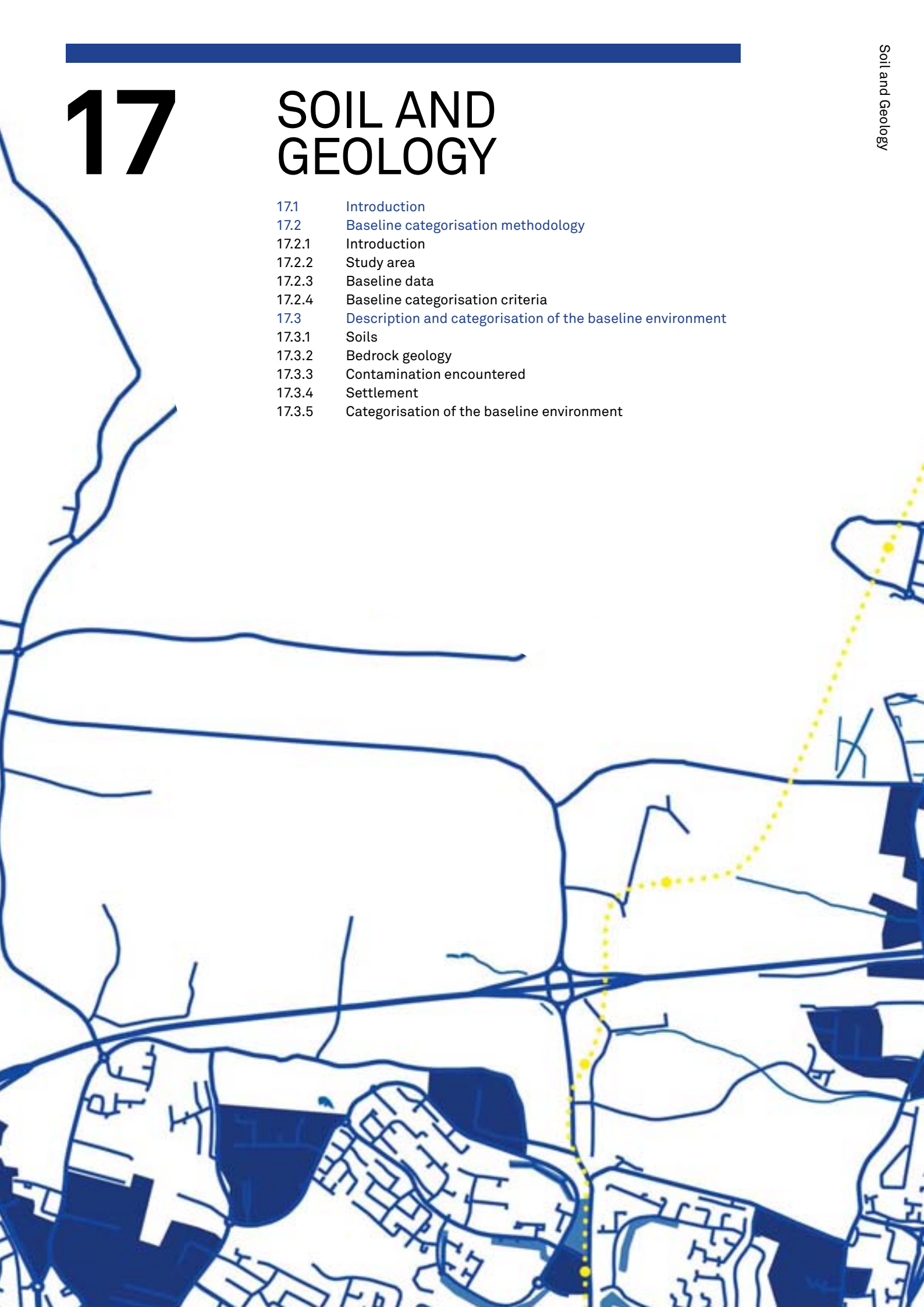
Site No	Location	Description	Functional Value (FV)
HC-25	Section between Royal Canal and River Liffey	**Habitats/Flora:** - Building and artificial surfaces dominant (BL3) dominant; - Blessington Street Park has been defined as an artificial lake and pond habitat (FL8); - Areas of amenity grassland (GA2) and scattered trees and parkland (WD5) overall sparse associated with private and public open space, larger areas associated with Holy Cross College; - Mature treelines at Drumcondra Road of note. **Fauna:** - Although not recorded during the field survey period the area of Blessington Street Park may provide spawning habitat for common frogs; - Records of Common pipistrelle and Leisler's bat. **Summary:** The functional value of this habitat complex is identified with Low. However, the area supports some foraging habitat for protected bat species.	Low
HC-26	River Liffey	**Habitats/Flora:** - The river in this section is tidal (CW2); - Artificial embankments and lack of riparian vegetation decreases the ecological value of this habitat. **Fauna:** - Although not designated the river is known to support salmonid species; - No further protected species were recorded in 2006/7/8 surveys. **Summary:** The River Liffey is one of the most important corridor habitats in Dublin City. It feeds into a complex Dublin Bay which is designated as SAP, cSAC and pNHA due to the habitat and wildlife it supports, consequently this area is considered to be of high ecological value.	High
S-27	South of River Liffey areas surrounding St. Stephen's Green	**Habitats/Flora:** - Building and artificial surfaces dominant (BL3); - Areas of amenity grassland (GA2) overall sparse; - Scattered trees and parkland (WD5) present in Iveagh Gardens. **Fauna:** - Low value for fauna. **Summary:** The functional value of this habitat complex is identified with Very low. However, the area supports provides some stepping stone habitats (Iveagh Gardens).	Very low

Site No	Location	Description	Functional Value (FV)
HC-28	St. Stephen's Green	**Habitats/Flora:** - Dominant habitat type is scattered trees and parkland (WD5) associated with flower beds and borders (BC4), amenity grassland (GA2) and artificial lakes and ponds (FL8). **Fauna:** - Foraging common pipistrelle, soprano pipistrelle, whiskered bat (tentative identification) and Leisler's bat; - Wildfowl species such as moorhen, mallard and several gull species; - Suitable for common frog although not recorded here. **Summary:** St. Stephen's Green is an important feeding habitat for three bat species although roosting was not evident. However, this area is seen as an important stepping stone habitat and foraging habitat for bats within the urban context and so is considered to be of medium ecological value.	Medium
HC-29	Iveagh Gardens	**Habitats/Flora:** - Dominant habitat type is scattered trees and parkland (WD5) associated with amenity grassland (GA2) and artificial lakes and ponds (FL8). **Fauna:** - No surveys on protected species were carried out within this Habitat Complex. **Summary:** Iveagh Gardens is regarded as an important stepping stone habitat within the urban context of Dublin city.	Medium

Figure 16.1
Designated sites within 10 km of the proposed scheme


BALDOYLE BAY SAC
Site-Code: 000199
North Bull Island SPA
Site-Code: 004006
Baldoyle Bay pNHA
Site-Code:000199
North Dublin Bay pNHA
Site-Code: 000206
Portraine Shore pNHA
Site-Code:001215
MALAHIDE ESTUARY SAC
Site-Code: 000205
Dolphins, Dublin Docks pNHA
Site-Code: 000201
SOUTH DUBLIN BAY AND RIVER TOLKA ESTUARY SPA
Site-Code: 004024
Baldoyle Bay SPA
Site-Code: 004016
Rogerstown Estuary NHA
Site-Code:000208
South Dublin Bay NHA
Site-Code: 000210
Rogerstown SPA
Site-Code: 004015
Sluice River Marsh pNHA
Site-Code:001763
Booterstown Marsh pNHA
Site-Code: 001205
NORTH DUBLIN BAY SAC
Site-Code: 000206
ROGERSTOWN ESTUARY SAC
Site-Code: 000208
SOUTH DUBLIN BAY SAC
Site-Code: 000210
Feltrim Hill pNHA
Site-Code: 001208
Malahide Estuary pNHA
Site-Code:000205
SOUTH DUBLIN BAY AND RIVER TOLKA ESTUARY SPA
Site-Code: 004024
Santry Demesne NHA
Site-Code: 000178
Bog Of The Ring pNHA
Site-Code: 001204
Broadmeadow/Swords Estuary SPA
Site-Code: 004025
Grand Canal NHA
Site-Code: 002104
Royal Canal pNHA
Site-Code: 002103
Liffey Valley pNHA
Site-Code:000128
Proposed Alignment
Study Area
Designated Sites:
Candidate Special Area of Conservation (cSAC)
Special Protection Area (SPA)
Proposed Natural Heritage Area (pNHA)
N
0 2 4 6 Kilometres
RPA
Railway Procurement Agency
METRO
Figure 16.1
Designated Sites within 10km
of the proposed scheme
Final
August 2008

17 SOIL AND GEOLOGY



Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter of the EIS has been prepared in order to fulfil this requirement in respect of soil.

17.1 INTRODUCTION

This chapter describes and evaluates the existing geological and soil environment in the area of the proposed scheme.

Prior to preparing this chapter, a number of planning and policy documents were reviewed to ascertain if the documents contained any plans, policies or objectives relating to the protection of soil and geology in the area of the proposed scheme.

None of the planning or policy documents that apply to the study area contained any specific objectives relating to soil or geology. Under EU and national legislation many designated ecological sites are protected by law and this designation can include the soil and geology of the site. These sites are described in detail in the Flora and Fauna chapter of this EIS (Volume 1, Chapter 16).

17.2 BASELINE CATEGORISATION METHODOLOGY

17.2.1 Introduction

This section presents the methodology used in assessing the baseline soil and geology environment. As well as considering the relevant EPA guidance with respect to EISs (EPA, 2002, 2003), the scope and methodology of the baseline assessment has been devised in consideration of the EPA document 'Developing a soil protection strategy for Ireland' (EPA, 2002).

17.2.2 Study area

The study area has been defined with reference to the potential for impact from the proposed scheme and the availability of relevant information. The dimensions of the study area are shown in Table 17.1.

Table 17.1 Study area

Criteria	Width of study area (on both sides of the alignment)
Soils	500m
Geology	500m
Landuse	500m
Ecology	500m
Main Ground Investigation (MGI) Soil Sampling Locations	Boreholes targeted along the alignment corridor

17.2.3 Baseline data

The sources of information used to establish the baseline environment are shown in Table 17.2.

Table 17.2 Sources of information

Information acquired	Data source
- Soil types and geology along the alignment	- On-line Geological Survey of Ireland (GSI) geology maps (GSI website, 2008) - On-line Teagasc soils maps (GSI website, 2008) - Exploratory Investigations along the proposed alignment for Dublin Metro North (Geotechnical Interpretative Report, Working Paper No. 60, Parsons Brinckerhoff, April 2007 and Dublin Metro North Ground Investigation, IGSL March 2007)
- Soil types and geology along the Port Tunnel Route	- Dublin Port Tunnel EIS
- Soil Analytical Results	- Results provided by IGSL, 2008 and Norwest Holst, 2008

17.2.4 Baseline categorisation criteria

Categorisation of the baseline environment involves the allocation of overall 'functional values' to discreet areas within the study area. The functional value of the area is determined with reference to the 'importance' and 'sensitivity' of the area as well as any 'existing adverse effects' that impact on the area. Each of these three terms is explained in detail below in the context of soils and geology.

17.2.4.1 Importance

Soil, including the bedrock from which it is sourced and by which it is supported, is an important natural resource that performs many functions. These functions are:

- Biomass production: food production, renewable energy and raw materials;
- Filtering, buffering and transforming action: cycling of major elements required by biological systems, regulation and partition of water flow, provision of nutrients and minerals to groundwater, sorption reactions and microbial and biochemical transformations;
- Biological habitat and gene reserve: soil biomass, supporting biological habitat and gene reserve, retention of water for use by vegetation;
- Physical medium: support for built structures, waste disposal and recreation activities;
- Protecting and preserving cultural heritage: protects archaeological and paleontological sites and contributes to the appearance of the landscape.

Soils and sediment with a high clay and organic matter content provide nutrients and minerals to groundwater and habitats. These soils and sediments are recognised to be important. Soils and sediment that support areas of natural vegetation are also recognised to be important because of the natural habitats and biomass that they support.

The bedrock within the study area is important because of the aquifers/groundwater it contains. This has been addressed in greater detail in the Groundwater chapter of this EIS (Volume 1, Chapter 18).

17.2.4.2 Sensitivity

Soils are susceptible to contamination from direct contact or through contact with contaminated water. This chapter only deals with contamination due to direct contact. The sensitivity of any groundwater resource in the bedrock is assessed in the Groundwater chapter of this EIS (Volume 1, Chapter 18). Potential sources of direct contamination include: contaminated sites; activities involving hazardous materials; and intensive farming.

The soil sensitivity depends on a number of properties including clay content, organic matter content and permeability. The soil sensitivity depends on a number of properties including clay content, organic matter content and permeability. Soils with a low sorption potential are considered to be of low sensitivity because potential contamination will not be retained. Soils with high sorption potential (high organic/clay content) will retain contamination from an external impact and are therefore are considered to be more sensitive to contamination.

17.2.4.3 Existing adverse effects

In some cases, the potential for soil and sediment to perform environmental functions is reduced due to existing adverse impacts. For example, if areas of soil are paved, then they cannot support natural habitats and retain/filter rainwater.

Industrial and commercial activities can also reduce the functional value of soil. In order for soil to perform many of its ecological and socio-economic functions, it must be of high quality. Any existing or historic landuse that has or had a negative impact on the quality of the soil therefore constitutes an existing adverse effect. For example, soils upon which industrial premises are located may become contaminated with hydrocarbons or other pollutants. Soils located within 50m of a heavily trafficked road may also be subject to high levels of contamination. Fertiliser input to soils used for agriculture may also constitute an existing adverse effect if it affects the soils ability to perform any of its normal functions. In contrast, soils that are undisturbed or are used for natural grassland or areas of organic farming are subject to lower levels of existing adverse effects and therefore have a higher functional value.

17.2.4.4 Soil Contamination

The MGI undertaken in 2007 involved the installation of boreholes along the alignment. As part of the drilling process, the contractors sampled the soil arisings and submitted a proportion of these samples for analysis to determine the presence of contamination at each chosen location. The analytical parameters required to assess the presence of contamination were determined based on the present and historical landuses adjacent each borehole location.

The assessment of land contamination is based on the principles of risk assessment, where risk is determined by the combination of the probability of a hazard occurring and the magnitude of its consequences. This principle is applied to land contamination through the use of the 'source-pathway-receptor' concept. The concept relies on the identification of a contaminant (source) in on or under the land at a concentration sufficient to have the potential to cause harm and also the presence of a receptor, which may suffer harm and a pathway by which the receptor may be exposed to the contaminant. As such not all sites at which contaminants are present will require remedial action. Where all three are present, a 'pollutant linkage' can be identified. All receptors (humans, controlled waters, ecology, crops/livestock and buildings) should be considered if there is the potential for them to be adversely affected by exposure to contamination.

The risk based assessment of land contamination is undertaken in accordance with the 'suitable for use' approach. ERM follow the tiered framework outlined in the 'Guidelines for Environmental Risk Assessment and Management' (DETR, 2000 and CLR11, 2004). Under this framework, decisions may be informed by a Generic Quantitative Risk Assessment or by a more site specific Detailed Quantitative Risk Assessment (DQRA). DQRA are generally appropriate where generic guideline values are not available, or where they are not appropriate given the specific circumstances of the pollutant linkage. They may also be required where a greater level of certainty is needed to support the decision making process. For the assessment ERM have undertaken a GQRA.

The Environment Agency (EA) policy statement (EA, 2004) on Human Health risk assessment, identifies that when assessing chronic risks to human health from contaminated soils, in the absence of appropriate UK derived Soil Guideline Values (SGV), a Site specific Detailed Quantitative Risk Assessment will be required and should be undertaken in accordance with the techniques and protocols set out in the Contaminated Land Report series of publications (CLR 7, 9 & 10 and associated daughter reports). The policy statement further identifies that an appropriate conceptual exposure model for a Site should be developed, a relevant exposure 'averaging area' should be defined, that soil concentration values representative of that area should be obtained, and that an appropriate tool (technical guidance, spreadsheet or dedicated software) is used to develop appropriate criteria taking into account the conceptual model and exposure scenarios at the site.

In order to assess the suitability of the analytical results provided ERM have in the first instance undertaken the assessment using the published Soil Guideline Values for properties from a commercial, and residential with consumption of home grown vegetables, setting. Where these criteria are unavailable equivalent Generic Assessment Criteria (GAC) have been developed for contaminants of concern which have been recorded at concentrations above the detection limits.

GAC have been developed for a residential landuse by ERM using a combination of the software package RISC 4.05 supplemented by ERM's in-house plant uptake tool (utilising a combination of the Travis & Arms and the Briggs and Ryan uptake models) using similar exposure assumptions and receptor characteristics to those used for the development of the SGVs.

In the first instance the GAC have been developed by calculating the sum of the reciprocal of all the identified exposure pathways consistent with the assumption that intake from all pathways will contribute to a systemic effect. The SGVs and GAC are considered to be concentrations, which represent an acceptable level of risk when assessed against a representative indicator of receptor exposure.

As the extent of contamination can not be determined by a single borehole, the results of the assessment are presented visually on maps (Baseline Soil and Geology) included in Volume 3, Book 1 of 2 of this EIS. The maps indicate boreholes that have exceeded the commercial assessment criteria and the residential with consumption of home grown vegetables criteria.

17.2.4.5 Functional value

The functional value of the baseline environment is evaluated by means of a number of specific criteria to take into account the importance and sensitivity of different features of the baseline environment. The criteria that have been defined are describing in Table 17.3.

Table 17.3 Criteria for baseline categorisation

Criteria	Functional value
- Soils that support areas of natural or semi-natural vegetation and habitats - Soils with a high sorption potential (due to e.g. high clay/organic matter content) - Soils of low permeability.	Very high (V)
- Uncontaminated soils; - Farmland where artificial fertilisers are not used or are used in only limited quantities (e.g. dairy and organic farming); - Areas located more than 50m of a heavily trafficked road; or - Areas of very low industrial/commercial activity.	High (IV)
- Soils that support non-natural vegetation or habitats - Soils with a medium sorption potential (due to e.g. medium clay/organic matter content) - Soils of moderate permeability - Farm land where fertilisers are used or the ground is disturbed. - Green Areas where fertilisers are used or the ground is disturbed.	Medium (III)
- Unpaved areas within 50m of a heavily trafficked road; - Unpaved areas used for light industrial activity; or - Soil that contains minor contamination but does not represent a risk. - Spoil, disturbed and made ground. - Soils with a low sorption potential (due to e.g. low clay/organic matter content) - Soils of high permeability	Low (II)
- Soil that is highly contaminated and represent a risk - Areas where soil is absent i.e. exposed bedrock - Soils with a low sorption potential (due to e.g. low clay/organic matter content) - Soils of high permeability - Unpaved areas used for heavy industrial activity. - Paved areas - Bedrock	Very low (I)

The results of the baseline categorisation in terms of functional value are shown in Table 17.4 and illustrated on maps (Baseline Soil and Geology) included as Volume 3, Book 1 of 2.

17.3 DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

17.3.1 Soils

Boulder Clay (Limestone Derived Till)
The Dublin boulder clay/till occurs habitually across the Dublin basin overlying the Carboniferous limestone. This clay was formed from deposits accumulating at the base of glaciers. The clay is highly consolidated and consists of a very stiff clay and silt matrix containing sand, gravel, cobbles and boulders. This clay is generally grey to black in colour. However, the boulder clay present in the area of the proposed route is brown in colour and has higher sand and lower gravel content.

Glaciofluvial Sands and Gravels
Pockets of glacial sands and gravels occur within the Dublin boulder clay described above. These sands and gravels are likely to have been deposited in glacial ponds or streams and are generally water bearing. These sand and gravel pockets normally occur in isolated areas. However, more extensive linear deposits may occur in the Fosterstown South and Balheary Demesne areas as a result of deposition in glacial river channels.

Alluvial deposits
Alluvial deposits are present along the proposed route. In particular these deposits are likely to occur along the river areas such as the Tolka River, Ward River, Sluice River and Santry River, river and estuarine areas such as the Broad Meadow River and the area adjacent Forest Little golf course.

The deposits are likely to consist of soft silts and sandy clays. Where dehydration has occurred, these deposits are likely to be stiff to very stiff. Localised pockets of these alluvial deposits are also likely to have occurred in historic ponds and streams.

Made Ground
Made ground is observed normally as the upper layer in the geological unit underlying Dublin city. Materials ranging from builders rubble to industrial, inert and municipal waste were used to fill natural depressions and areas of earth works such as quarries around the Swords, Airport and Drumcondra areas. Made ground was also used in the reclamation of tidal flats along the River Liffey Estuary.

17.3.2 Bedrock geology

Bedrock beneath the proposed route consists of Lower Carboniferous limestone with following main formations; the 'Calp' formation, the Tober Colleen formation, Waulsortian limestones and the Boston Hill formation. These formations are described below.

Malahide (Boston Hill) Formation
This formation consists of nodular and muddy argillaceous limestone with relatively uniform bed thickness. This is a fossiliferous limestone and is interbedded with thin shale beds. The formation contains major units of very distinctive, laminated fine limestone. This formation is found in the Lissenhall area.

Waulsortian Limestones
This unit consists of massive unbedded lime-mudstones. These beds are biomicritic in nature with distinctive stromatactis. The sediments generally formed mounds or reefs. The Waulsortian limestones are generally dolomitised. These limestones are found in the area around Dublin Airport.

Calp (Lucan) Formation
The Calp Formation refers to various units of basinal limestone and shale formed from carbonate sediment deposits. The Calp limestone consists of muddy limestone beds inter-bedded with calcareous shale beds.

The limestone beds are grey to black in colour and classified as strong to very strong. The limestone bed thickness, grain size and colour vary commonly. Chert and some fossils, such as corals and braciopods, occur in localised areas. The fossils, however, are generally limited.

The shale beds are less substantial and dark grey to black in appearance. These are typically moderately strong and are more susceptible to weathering than the limestones. This formation occurs across the remainder of the alignment.

Tober Colleen Formation
The Tober Colleen formation is the lowest Calp formation and consists of calcerous mudstone interbedded with very argillaceous micrite. The lower levels of this formation can include reef derived debris and large slumped reef blocks.

17.3.3 Contamination encountered

As stated previously, in order to assess the analytical results provided ERM have in the first instance undertaken the assessment using the published Soil Guideline Values (SGV) for properties from a commercial and residential with consumption of home grown vegetables setting. Where these criteria are unavailable equivalent Generic Assessment Criteria (GAC) have been developed for contaminants of concern which have been recorded at concentrations above the detection limits.

The analytical parameters for all samples analysed were below the assessment criteria for commercial properties.

In general the vast majority of analytical parameters for samples analysed were below the assessment criteria for residential properties. However, some parameters did breach the assessment criteria and these are detailed below:

- Metals: Cadmium and Nickel were elevated above their respective assessment criteria in a large percentage of the samples analysed. Arsenic was elevated above its assessment criteria for seven boreholes. These exceedances may be as a result of naturally occurring levels, however, this would require a more detailed assessment.
- Hydrocarbons: The aromatic hydrocarbon chain C12-C16 was elevated above its assessment criteria at 12 sampling locations. Benzo(a)pyrene, a polycyclic aromatic hydrocarbon (PAH), was elevated above its assessment criteria at 6 sampling locations. Five of these elevated PAH locations are also elevated for the aromatic hydrocarbon chain C12-C16. These are indicative of fuel contamination such as diesel, heating oil, lighting/oil stove or coal fuels.
- Volatile organic compounds bromochloromethane and dichloromethane were elevated above their respective assessment criteria at one location only each. These are indicative of solvent use.
- Naphthalene, a semi-volatile organic compound, was elevated in one location only. This is indicative of coal use.

17.3.4 Settlement

The baseline environment will be determined by undertaking Baseline Movement Surveys. Ground movement assessment studies undertaken have identified property, including buildings, structures, and infrastructure along the route that could be potentially affected by construction generated ground movements. Using this information, taking account of the presence of sensitive or prominent structures, and ground conditions, sample property will be selected for monitoring for a period of 6 to 12 months just prior to construction to enable ambient background levels, survey and seasonal variations to be identified along the route. During the construction phase this information will be used to identify ground movements generated by construction from those that are attributable to the baseline environment. By undertaking the baseline movement monitoring over a period as close as possible to the construction phase enables the greatest benefit and understanding to be derived when interpreting data recorded during construction.

It is not envisaged that the Baseline Movement Surveys will show a significant fluctuation in ground movements along the route of the proposed scheme due to the natural environmental conditions.

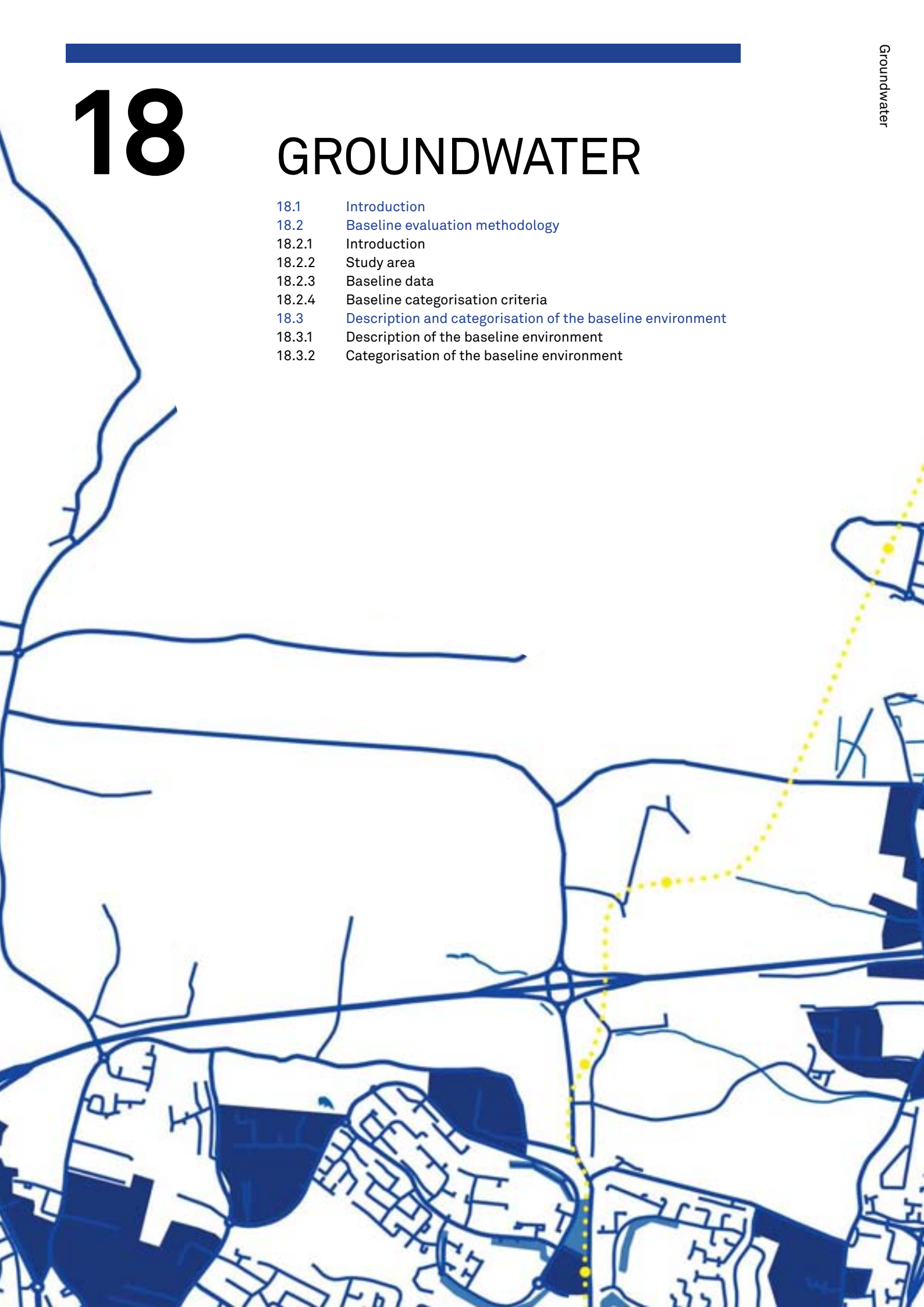
17.3.5 Categorisation of the baseline environment

The results of the baseline categorisation are summarised in Table 17.4.

Table 17.4 Baseline categorisation

Area	Description	Functional value
MN101	The area between Belinstown and Estuary Roundabout is predominantly farmland or amenity grassland where fertilisers are used. However, it is interspersed with paved areas, areas of made ground, areas of semi-natural grassland and wetland.	Predominantly (III) with some (I), (II), (IV) and (V)
	This area between Estuary Roundabout and the Swords Stop is predominantly paved.	Predominantly (I) with (II), (III), (IV) and (V) also present
	The area between Swords Stop and the entrance to Airside Retail Park is predominantly paved. However, it is interspersed with areas of vegetation.	Predominantly (I) with (II), (III) and (IV)
MN102	The area between the entrance to Airside Retail Park and the northern airport boundary is predominantly farmland.	Predominantly (III) with some areas of (I), (II) and (IV)
MN103	Airport predominantly paved with some grassed areas.	Predominantly (I) with some (II), (III) and (IV)
MN104	Airport southern boundary to Santry Avenue. Predominantly farmland interspersed with paved areas and areas of semi-natural grassland.	Predominantly (III) with (I), (II) and (IV) also present
MN105	Santry Avenue to the entrance to DCU. Predominantly paved interspersed with areas of farmland, amenity grassland and local green spaces	Predominantly (I) interspersed with (II)
MN106	DCU to Eccles Street. Predominantly paved interspersed with local green spaces	Predominantly (I) interspersed with (II), (III) and (IV) also present
MN107	Eccles Street to St. Stephen's Green. Predominantly paved interspersed with local green spaces	Predominantly (I) interspersed with (II)

18 GROUNDWATER



Section 39(2)(b) of the Railway Infrastructure Act, 2001 specifies that an environmental impact statement must contain a description of the aspects of the environment that are likely to be significantly affected by the proposed scheme. This chapter of the EIS has been prepared in order to fulfil this requirement in respect of groundwater.

18.1 INTRODUCTION

This chapter describes and evaluates the existing groundwater environment in the area of the proposed scheme.

Prior to compiling this chapter, a number of national, regional and local planning and policy documents were reviewed to ascertain if the documents contain any plans, policies or objectives relating to groundwater. The results of this review are detailed in the Planning and Policy Context chapter of this EIS (Volume 1, Chapter 4).

18.2 BASELINE EVALUATION METHODOLOGY

18.2.1 Introduction

The section presents the methodology used to evaluate the baseline environment. In addition to the EPA Guidelines (EPA, 2002 and EPA, 2003), the scope and methodology for the baseline assessment and evaluation was devised with reference to the following guidelines:

- Guidelines for the Crossing of Watercourses During the Construction of National Road Schemes (Natura and the NRA, 2005);
- Design Manual for Roads and Bridges (UK Highways Agency et al, 1997 (with ongoing updates));
- Geology in Environmental Impact Statements – A Guide (Institute of Geologists of Ireland, 2002);
- Greater Dublin Strategic Drainage Study, (National Development Plan and Dublin Drainage, 2005).

18.2.2 Study area

The geographical scope of the assessment comprises an area 500m to either side of the proposed alignment. In terms of groundwater, potential impacts of the construction and operation of the scheme will most likely be restricted to within this study area.

18.2.3 Baseline data

A detailed desktop review was carried out in order to establish the baseline groundwater environment within the study area. The baseline data that was acquired is shown in Table 18.1.

Table 18.1: Baseline data

Information required	Data source
Aquifer characteristics	- Well Card Data Geological Survey of Ireland (GSI, 2007);
- Groundwater depth*;	- Factual Ground Investigation Report for Dublin Metro North. IGSL Limited (February 2007);
- Regional direction of groundwater flow;	- Ground Investigation Report (Group A) for Dublin Metro North. Main Ground Investigation IGSL Limited (April 2008);
- Aquifer hydraulic conductivity;	- Ground Investigation Report (Group B) for Dublin Metro North. Main Ground Investigation IGSL Limited (March 2008);
- Water-bearing stratum;	- Dublin Metro North. Main Ground Investigation Section 6 and 7 Norwest Holst Limited (March 2008);
- Nature and thickness of overlying strata.	- Hydrogeological, Three Dimensional Numerical Flow Modelling of the Dublin Port Tunnel and Region (Rooney, 2002), submitted as part of a Masters in Science to the Pennsylvania State University;
	- Discovery Series Maps, Sheet 50: Dublin, Kildare, Meath, Wicklow (OSI, 1995);
	- The Geology of Kildare and Wicklow (GSI, 1994).
Aquifer importance	
- Aquifer classification;	- National Draft Bedrock Aquifer Map (GSI, 2007);
- Aquifer productivity.	- Groundwater abstraction yields in Well Card Data (GSI, 2007).
Groundwater quality	
- Potential for groundwater contamination from historic activities;	- Report: 'Identification of Possible Areas of Contamination and Proposals for Location of Soils and Groundwater Monitoring Points for Metro North' (AWN Consulting Ltd, 2007);
- Potential for groundwater contamination from current activities.	- Groundwater analytical results for monitoring wells located along the Dublin Metro North route (White Young Green, 2008).
Aquifer Sensitivity	
- Aquifer vulnerability;	- Eastern Interim Groundwater Vulnerability Map (GSI, 2007);
- Source Protection Zones;	- Source Protection Zone Map (GSI, 2007);
- Depth of groundwater;	- Well Card Data (GSI, 2007);
- Nature of subsoils overlying the aquifer;	- Factual Ground Investigation Report for Dublin Metro North. (IGSL Ltd, 2007);
- Groundwater quality.	- Ground Investigation Report (Group A) for Dublin Metro North. Main Ground Investigation (IGSL Ltd, 2008);
	- Ground Investigation Report (Group B) for Dublin Metro North. Main Ground Investigation (IGSL Ltd, 2008);
	- Report: 'Identification of Possible Areas of Contamination and Proposals for Location of Soils and Groundwater Monitoring Points for Metro North' (AWN Consulting Ltd, 2007).

* Groundwater strike information, an indicator for groundwater depth, where reported in this chapter, only provides an indication of the level of the water table. This is because the sampling methodology that is typically used does not allow sufficient time for groundwater to reach a state of equilibrium i.e. the static groundwater level.

Groundwater levels are also subject to diurnal, seasonal and climatic variations and can also be affected by other factors including drainage conditions and tidal variations.

18.2.4 Baseline categorisation criteria

The categorisation of the baseline environment involves the allocation of overall 'functional values' to discreet areas within the study area. The functional value of the area is determined with reference to the 'importance', 'sensitivity' of the area and any 'existing adverse effects' that impact on the area. Each of these three terms is explained in detail below in the context of groundwater.

18.2.4.1 Importance

The GSI has defined Source Protection Zones in the Dublin area and these areas are recognised to be particularly important and must be protected because the groundwater in these areas is used as a drinking water supply.

The level of importance associated with an aquifer is also related to its productivity. The GSI has classified the bedrock aquifers in the Dublin area in terms of their productivity. According to this classification system, 'regionally important' aquifers have good (100 to 400m³/day) to excellent (>400m³/day) groundwater yields. 'Locally important' aquifers have moderate (40 to 100m³/day) groundwater yields and 'poor' aquifers have poor groundwater yields (<40m³/day). The groundwater yield of each of the aquifers within the study area is determined through review of the GSI groundwater database.

18.2.4.2 Sensitivity

The sensitivity or 'vulnerability' of an aquifer is governed by a number of factors including the groundwater depth, nature and thickness of the overlying geological strata and groundwater quality. For the surface sections of the route, the depth to groundwater and the permeability of the soil type overlying the groundwater are key in determining the rate at which contaminants may travel to the groundwater. For tunnelled sections, groundwater sensitivity is determined by groundwater depth and groundwater quality.

The GSI Eastern Vulnerability Map does not currently specify vulnerability classes for aquifers in County Dublin because a survey of the area has not yet been completed. In the absence of this information, AWN assessed the vulnerability of the aquifers along the proposed alignment using:

- Available information regarding the nature and thickness of the overlying geological deposits and groundwater depth as taken from the Factual Ground Investigation Report for Dublin Metro North (IGSL Ltd, 2007);
- GSI guidelines for aquifer vulnerability rating as shown in Table 18.2.

Table 18.2 GSI guidelines for aquifer vulnerability rating

	Hydrogeological conditions		
	Subsoil permeability (type) and thickness		
Vulnerability rating	High permeability (sand/gravel)	Moderate permeability (e.g. sandy soil)	Low permeability (e.g. clayey subsoil, clay, peat)
Extreme (E)*	0.0 - 3.0m	0.0 - 3.0m	0.0 - 3.0m
High (H)*	> 3.0m	3.0 -10.0m	3.0 - 5.0m
Moderate (M)*	Not applicable	>10.0m	5.0 - 10.0m
Low (L)*	Not applicable	Not applicable	>10m

* Release point of contaminants is assumed to be 1-2m below the ground surface.

18.2.4.3 Existing adverse effects

Existing groundwater quality also needs to be taken into account when determining functional values for the baseline environment. In some cases, the quality of a groundwater resource may be diminished due to historic and/or current contamination. Criteria relating to groundwater quality have been defined to take into account the fact that the quality of aquifers in urban areas with a long history of industrial activity and wastewater disposal may, in some cases, have been compromised.

18.2.4.4 Functional value

The functional value of the baseline environment is evaluated by means of a number of specific criteria to take into account the importance and sensitivity of different features of the environment. The criteria that have been defined are described in Table 18.3.

Table 18.3 Criteria for baseline categorisation

Criteria	Functional value
- Source Protection Zones are present; - Some of the wells in the area are used, or are proposed to be used, for potable water supply; - Regionally important aquifer with good (100 to 400m³/day) to excellent (>400m³/day) groundwater yields; - Aquifer of high to extreme vulnerability; - Groundwater quality is likely to be good (e.g. Greenfield areas).	Very high (V)
- Source Protection Zones are not present; - Aquifer of moderate to high vulnerability; - Regionally Important Aquifer with good (100 to 400m³/day) to excellent (>400m³/day) groundwater yields; - Contamination of groundwater may exist due to development in the area. or - Locally Important Aquifer with moderate groundwater yields (40 to 100m³/day); - Groundwater quality is likely to be good (e.g. Greenfield areas).	High (IV)
- Source Protection Zones are not present; - Locally Important Aquifer with moderate groundwater yields (40 to 100m³/day); - Aquifer classified as being of moderate to extreme vulnerability; - Contamination of groundwater may exist due to development in the area.	Medium (III)
- Source Protection Zones are not present; - Potable water supply abstraction wells are not present; - Groundwater quality is likely to be impacted upon to some extent by existing development in the area; - Locally Important Aquifer with moderate groundwater yields (40 to 100m³/day) ; - Aquifer of low vulnerability. or - Poor Aquifer with poor groundwater yields (<40m³/day); - Aquifer of moderate to extreme vulnerability.	Low (II)

Criteria	Functional value
- Source Protection Zones are not present; - Potable water supply abstraction wells are not present; - Poor Aquifer (<40m³/day); - Aquifer of moderate to low vulnerability; - Groundwater quality is likely to be poor (e.g. contaminated areas).	Very low (l)

The functional value of the lands within the study area, as evaluated using these criteria, is shown in Table 18.4. This information is also illustrated on maps (Baseline Surface Water and Groundwater) in Volume 3, Book 1 of 2 of this EIS.

18.3 DESCRIPTION AND CATEGORISATION OF THE BASELINE ENVIRONMENT

18.3.1 Description of the baseline environment

The following sections detail the results of the desktop review of all of the hydrogeological data that is currently available and applicable to the study area (as detailed in Table 18.1).

18.3.1.1 Belinstown Stop to Lissenhall Stop

Geology
According to the GSI, subsoils in the area consist predominantly of till derived chiefly from Carboniferous limestone and undifferentiated alluvium. According to the Factual Ground Investigation Report for Dublin Metro North - RPA Contract No. M7081 (IGSL Ltd., 2007), typical ground conditions in this section of the alignment comprise up to 1.8m of made ground, which is underlain by thick deposits of glacial till.

GSI well card data does not provide any information with respect to the depth to bedrock but according to the GSI database, the bedrock underlying this area consists of the Malahide Formation and is composed of shales, siltstones, sandstones and thin limestones. The IGSL report (2007) indicates that the boreholes in this area confirm the presence of limestone and that the depth to bedrock ranges from 4.0m bgl (below ground level) to 20.9m bgl.

Aquifer type
The primary aquifer in this area is the Dublin Limestone Aquifer (Rooney, 2002 and Daly & Reilly, 1979). Reference to the GSI National Draft Bedrock Aquifer Map indicates that the part of the aquifer that underlies this area is classified as a 'locally important aquifer that is moderately productive in local zones' (Ll). The potential for gravel aquifers cannot be confirmed because the GSI has not yet completed a gravel aquifer classification survey in this area.

The GSI well card data does not provide any information on groundwater use, yields or water-bearing strata. However, it is likely that there are groundwater users in this area.

Groundwater depth
The GSI well card data does not include any records of groundwater strikes in this area. According to the IGSL report (2007), the main water-bearing stratum in Lissenhall and the surrounding area is the sandy, gravely clay stratum. However, there are a small number of areas where gravels and limestone act as an aquifer for groundwater. According to the IGSL report (2007), the depth of groundwater in this section of the study area is generally shallow and ranges from 1.8m bgl (below ground level) (at a location close to the Broad Meadow River) to 5.8m bgl. Groundwater levels along the alignment are illustrated on maps (Baseline Surface Water and Groundwater) included in Volume 3, Book 1 of 2. These levels were calculated by AWN based on data provided in the IGSL report (2007), IGSL Report (2008a) and IGSL Report (2008b) and provided by the project engineers (Jacobs Engineering Ireland Ltd.).

Groundwater flow
The Dublin Limestone Aquifer is highly sensitive to small-scale changes in recharge rates, which can have significant impacts on the artesian heads in the surrounding area. The hydraulic conductivity of the Dublin Limestone Aquifer is due to fracture permeability and ranges from 3.6x10-6 to 6.95x10-7m/s. However, the connection of the limestone aquifer to more hydraulically transmissive units (such as sands, gravels and silts) also plays an important role in the hydrogeological regime in the area. The study by Rooney (2002) predicts that recharge rates in the Dublin Limestone Aquifer and the overburden sediments are in the range of 1.38x10-9m/s.

According to Rooney (2002), the deposits of glaciomarine silts, alluvial silts, sands and gravels act as conduits for groundwater flow from the study area towards the Irish Sea. An unnamed watercourse also flows in a south-easterly direction through the Lissenhall area and is likely to influence the direction of groundwater flow around the watercourse. Topography is considered to be the main factor governing the groundwater regime in this area and groundwater typically flows from high areas to low areas. The general direction of groundwater flow within this section of the study area is expected to be in a south-easterly direction from areas of high ground towards lower lying coastal areas.

Groundwater vulnerability
According to the GSI Eastern Interim Vulnerability Map, the proposed alignment crosses an area where the groundwater vulnerability ranges from high to low. The precise vulnerability of the groundwater in this area has not yet been determined because the GSI has only carried out an interim study to date.

AWN has reviewed all of the information available for this area and has used the criteria detailed in Table 18.2 to define the groundwater vulnerability as extreme (the subsoil consists of low permeability glacial tills and the groundwater is encountered within 3m of the surface).

P**otential contamination**
Potential sources of historic/current contamination in this area are limited to activities associated with farming practises e.g. fertilisation, use of pesticides etc.

AWN carried out a review of groundwater analytical results (RPA, 2008) for monitoring wells located along the proposed alignment. White Young Green undertook the groundwater monitoring program on behalf of the RPA in 2008. The groundwater analytical results are included in Annex E, Volume 3, Book 2 of 2. The groundwater samples collected within the study area were analysed for a range of parameters, which included metals, pesticides, SVOCs (including PAH and phenols), TPH, VOCs, alcohols and glycols. AWN compared the groundwater analytical results against the EPA's Interim Guideline Values (IGV) for groundwater that are contained in Table 3.1 in the publication 'Towards Setting Guideline Values for the Protection of Groundwater in Ireland - Interim Report' (EPA, 2003). Generally levels of contaminants in the groundwater along this section of the proposed scheme were below method detection limits or present at low concentrations. However, exceedances of the EPA's IGVs were registered in a number of monitoring wells for the pesticide Malathion, zinc, lead, ammonical nitrogen, sulphate, nitrite and TPH. These contaminants would be considered typical for areas used for agricultural purposes and urban development.

18.3.1.2 Lissenhall Stop to Dublin Airport Stop

Geology
According to the GSI, subsoils in the area of Dublin Airport and Swords predominantly consist of made ground. According to the GSI, the remaining areas consist of 'till derived chiefly from Carboniferous limestone', undifferentiated alluvium and glaciofluvial carboniferous limestone sands and gravels.

According to the IGSL report (2007), typical ground conditions in this area comprise made ground (ranging in depth from 0.2 to 2.3m bgl) underlain by thick deposits of glacial till (up to 38m bgl).

According to GSI, the bedrock in this area consists of the Malahide Formation which extends from Lissenhall to just north of the airport where it meets the Waulsortian Formation. The geology associated with the Malahide Formation has already been described. The Waulsortian Formation is a poorly-bedded, pure limestone with distinctive cavity-filling stromatactis structures.

The GSI well card data included in Annex E (Volume 3, Book 2 of 2) indicates that the depth to bedrock within Swords can be shallow (approximately 1.5m bgl). The GSI well card data does not provide any further information on depths to bedrock in this area. According to the IGSL report (2007), the depth to bedrock varies significantly across this area and ranges from 2.0 to >38m bgl.

Aquifer type
The primary aquifer in this area is, as before, the Dublin Limestone Aquifer. This part of the aquifer is classified as a 'locally important aquifer that is moderately productive in local zones' (Ll). According to the GSI, this part of the study area has not yet been surveyed to determine the potential for the presence of gravel aquifers.

According to the GSI well card data, groundwater in this area is used for industrial purposes. The exact use and number of abstraction wells is unknown. The GSI well card data indicates that the abstraction yield for groundwater wells in the Swords area is good (100-400m³/day), which is consistent with the expected yield from the Malahide Formation. There are three faults running through the Malahide Formation in this area. These faults provide potential for higher localised groundwater permeabilities than is normal in the surrounding areas and therefore higher yields may be expected in the vicinity of these faults. The GSI publication entitled 'The Geology of Kildare – Wicklow' (GSI, 1994), indicates that the Waulsortian Formation may produce water yields in the region of 300–1500 m³/day. However, this publication does not provide any site-specific information for the area around Dublin Airport and the GSI well card data does not provide any information regarding groundwater yields from this area.

Groundwater depth
The GSI well card data does not include any records of groundwater strikes in this area. According to the IGSL reports (2007, 2008a and 2008b), the depth of groundwater in the Swords area ranges from 1.0m bgl approximately to 7.5m bgl. The water-bearing stratum in this area is the sandy, gravely clay (glacial till).

To the south of Swords (Nevinstown, Crowscastle, Cloghran and Fosterstown), the groundwater that was encountered by IGSL primarily occurred in the sandy gravely clays (glacial till). Groundwater along this section of the proposed scheme ranges in depth from 1.0m bgl approximately to 12.12m bgl. The presence of streams in these areas is likely to influence the direction of groundwater flow.

In the area of Dublin Airport, the groundwater depths that were measured during the course of the IGSL site investigation work (February 2007 to April 2008) ranged from 1.34m bgl to 23.22m bgl.

Groundwater levels along the alignment are illustrated on maps (Baseline Surface Water and Groundwater) included in Volume 3, Book 1 of 2. These levels were calculated by AWN based on data provided in the IGSL reports (2007, 2008a and 2008b) and by Jacobs Engineering Ireland Ltd.

Groundwater flow
The findings of the study by Rooney (2002) on hydraulic conductivities and transmissive geological units in the Dublin Limestone Aquifer have already been discussed in this chapter and are also applicable to this section of the study area. In general, the groundwater in this area is expected to flow in an easterly direction towards the lower lying coastal areas. The glacial deposits encountered in this area would typically act as conduits for groundwater flow from the study area towards the Irish Sea.

The Ward River, which flows in a north-easterly direction through Swords, and the Broad Meadow River, which flows in an easterly direction through Swords, are likely to influence the direction of groundwater flow in the vicinity of Swords. The Mayne River, which flows in an easterly direction towards Dublin Bay from the east of Dublin Airport, is likely to influence the direction of groundwater flow in this localised area.

Groundwater vulnerability
The GSI has not identified any source protection zones in this area. Reference to the GSI Eastern Interim Vulnerability Map indicates that the section of the proposed alignment, which extends from Lissenhall Stop to the Dublin Airport Stop, crosses an area where the groundwater vulnerability ranges from high to low. The precise vulnerability of the groundwater in this area has not yet been determined because the GSI has only carried out an interim study to date.

AWN has reviewed all of the information available for this area and has used the criteria detailed in Table 18.2 to define the groundwater vulnerability as high to extreme (the subsoil consists of low permeability glacial tills and the groundwater is encountered within 3-5m of the surface).

Potential contamination
According to the AWN report (2007), potential sources of historic/current contamination in this area include the following:

- Business parks/industrial landuse (including Eve Ltd, Estuary and Bostik Evode Industries) along the R132;
- A wastewater treatment plant east of Estuary Roundabout;
- A vehicle recovery yard at Lissenhall Bridge;
- Swords Business Park east and south of Seatown Roundabout;
- Tionscail Industrial Estate adjacent to Seatown Roundabout;
- Historic quarries adjacent to Chapel Lane;
- Airside Business Park south of R132 at Pavilions Shopping Centre;
- Petrol station and scrap yard adjacent to the entrance to Boroimhe Estate;
- Aircraft hangars, aircraft refuelling areas and car parks in Dublin Airport;
- Light industrial premises (kitchen manufacturers and car modification firm) at Dublin Airport;
- Historic quarries at Dublin Airport.

As previously mentioned, AWN carried out a review of groundwater analytical results (RPA, 2008) for monitoring wells located along the proposed alignment. The groundwater analytical results are included in Annex E, Volume 3, Book 2 of 2. The groundwater samples collected within the study area were analysed for a range of parameters, which included metals, pesticides, SVOCs (including PAH and phenols), TPH, VOCs, alcohols, glycols inorganics and PCBs. The comparison of the groundwater analytical results against the EPA's IGVs indicated that the level of contaminants in the groundwater along this section of the scheme were below method detection limits or present at low concentrations. However, exceedances of the EPA's IGVs were registered in a number of monitoring wells for the pesticide Malathion, zinc, lead, ammonical nitrogen, sulphate, nitrite and TPH. These contaminants would be considered typical for areas used for agricultural purposes and urban development.

18.3.1.3 Dublin Airport Stop to Dublin City University (DCU) Stop

Geology
According to the GSI, subsoils in this area predominantly consist of made ground around Dublin Airport, Ballymun and Glasnevin North. According to the IGSL report (2007), made ground extends to approximate depths of 1m bgl in the Ballymun area and is underlain by deposits of glacial till that extend to limestone bedrock.

The naturally occurring subsoils within this section of the scheme consists of till derived chiefly from Carboniferous limestone with undifferentiated alluvium also reported in the Santry Demesne area.

The GSI report that bedrock in this area consists of the Tober Colleen and Lucan Formations, predominantly dark grey argillaceous and cherty limestones and shales. These formations are generally referred to as 'Calp' Limestone.

According to the GSI well card data included in Annex E (Volume 3, Book 2 of 2), the depth to bedrock in the area of Ballymun ranges from 20 to 23m bgl. According to the IGSL report (2007), the depth to bedrock ranges from 18.5 to >30m bgl in the area of Ballymun. Neither the GSI well card data, nor the IGSL report (2007), provides any information regarding the depth to bedrock in any of the other areas within this section.

Aquifer type
The Dublin Limestone Aquifer continues to be the primary aquifer in this area (Rooney, 2002). The characteristics of this aquifer have already been discussed. According to the GSI National Draft Bedrock Aquifer Map, the part of the aquifer that underlies this area is a 'locally important aquifer that is moderately productive in local zones' (Ll). The GSI describes the Calp Formation as being predominately of low permeability. However, the GSI also notes that there are a number of nonconformities and boulder beds that occur at a number of horizons in the Calp. These nonconformities indicate periods of faulting, uplift and erosion. Permeability and well yields are expected to be higher than usual in these areas. According to GSI, one major fault runs in a north/south direction between Ballymun and Santry and permeability/well yields can be expected to be higher in this area as a result.

According to the GSI well card data, the groundwater abstraction yield for wells in this area ranges from moderate (40-100m³/day) to excellent (>400m³/day). Data on groundwater usage in this area is not provided in the GSI well card data.

Groundwater depth
The GSI well card data only contains one record of a groundwater strike and this occurred at 60m bgl in Ballymun. This groundwater strike level is much deeper than those recorded during the IGSL site investigation (4.10 to 6.8m bgl). According to the IGSL report (2007), these groundwater strikes were encountered in the sandy gravely clays in this area. The main water-bearing stratum appeared to be the sandy gravely clays (glacial tills).

According to the reports from IGSL (2007, 2008a and 2008b) the depth to groundwater at Dublin Airport ranged from 1.34m bgl to 23.22m bgl. The IGSL reports indicate that the groundwater depth in the area that extends from the south of Dublin Airport to the Northwood Stop ranges from 0.44m bgl to 7.79m bgl. Groundwater was encountered by IGSL at depths ranging from 1.15m bgl to 12.18m bgl along the section of the proposed scheme that extends from the Northwood Stop to the DCU Stop.

Groundwater levels along the alignment are illustrated on maps (Baseline Surface Water and Groundwater) included in Volume 3, Book 1 of 2. These levels were calculated by AWN based on data provided in the IGSL reports (2007, 2008a and 2008b) and provided by Jacobs Engineering Ireland Ltd.

Groundwater flow
The general direction of groundwater flow in this area is expected to be in a south easterly direction towards the lower lying coastal areas. This flow is expected to be facilitated by the presence of glacial deposits that have the potential to act as conduits for groundwater flow towards the Tolka River and the Irish Sea.

Groundwater vulnerability
The GSI has not identified any Source Protection Zones in this area. Reference to the GSI Eastern Interim Vulnerability Map indicates that the section of the proposed scheme, which extends from Dublin Airport to DCU, crosses an area where the groundwater vulnerability ranges from high to low. As previously discussed, the GSI has only carried out an interim study to date so the precise vulnerability of the groundwater in this area has not yet been determined.

AWN has reviewed all of the information available for this area and has used the criteria detailed in Table 18.2 to define the groundwater vulnerability as high (the subsoil consists of low permeability glacial tills and the groundwater is encountered within 5m of the surface).

Potential contamination
According to the AWN report (2007), potential sources of historic/current contamination in this area include the following:

- Park & Ride facilities for Dublin Airport;
- Used car sales yards and a truck wash facility near Sillogue Golf Course;
- Tesco Distribution Centre south of M50;
- A Statoil petrol station on Ballymun Road;
- Northwood Business Park near Santry Demesne;
- An area where construction and demolition material has been disposed at St. Margaret's Road;
- An area where construction and demolition material is understood to have been disposed to the north of the M50 Roundabout in Sillogue.
- Ballymun Industrial Estate;
- Areas where waste is sometimes disposed of at Geraldstown Woods;
- An electrical substation at Coultry Drive.

As previously mentioned, AWN carried out a review of groundwater analytical results (RPA, 2008) for monitoring wells located along the proposed alignment. The groundwater analytical results are included in Annex E, Volume 3, Book 2 of 2. The groundwater samples collected within the study area were analysed for a range of parameters, which included metals, pesticides, SVOCs (including PAH and phenols), TPH, VOCs, alcohols, glycols inorganics and PCBs. The comparison of the groundwater analytical results against the EPA's IGVs indicated that the level of contaminants in the groundwater along this section of the scheme were below method detection limits or present at low concentrations. However, exceedances of the EPA's IGVs were registered in a number of monitoring wells for chromium, nickel, lead, ammonical nitrogen, fluoride, the pesticide malathion, COD. In addition, elevated levels of TPH were encountered in one well. These contaminants would be considered typical for areas used for urban development.

18.3.1.4 Dublin City University Stop to St. Stephen's Green Stop

Geology

According to the GSI, subsoils in this area generally consist of made ground. However, some areas in Whitehall, Glasnevin and Drumcondra consist of till derived chiefly from Carboniferous limestone with undifferentiated alluvium. This geology is also present in the area of DCU and the Tolka River.

According to the IGSL report (2007), to the south of DCU in the direction of the Mater Hospital, the depth of made ground increases and the average depth is about 1.5m bgl in Glasnevin and Drumcondra. Made ground in these areas is underlain by deposits of glacial till that extend to the bedrock. The depth to bedrock ranges from 12 to 16.5m bgl.

According to the IGSL report (2007), in the vicinity of Mountjoy Prison and the Mater Hospital, typical ground conditions comprise up to 3.0m of made ground. This made ground is underlain by deposits of glacial till that extend to bedrock. Limestone bedrock was encountered by IGSL at depths ranging from approximately 12 to 19m bgl.

According to the IGSL report (2007), made ground in the city centre extends to a depth of approximately 4m bgl. This made ground is underlain by up to 4m of deposits of sandy, gravely clay (glacial till), which is in turn underlain by gravel. These deposits are underlain by limestone bedrock. The depth to bedrock ranges from 7 to 27m bgl.

GSI well card data indicates that the depth to bedrock in this area ranges from 2.5m bgl at North Brunswick Street to 9.1m bgl at Parnell Street and Ormond Quay.

Aquifer type

The Dublin Limestone Aquifer continues to be the primary aquifer in this area. According to the GSI National Draft Bedrock Aquifer Map the part of the aquifer that underlies this part of the study area is a 'locally important aquifer that is moderately productive in local zones' (Ll). According to the GSI, the study area has not yet been surveyed to determine the potential presence of gravel aquifers. This section of the route is underlain by the Calp and no faults are recorded in the Calp in this area. However, the possibility of unrecorded, localised faulting cannot be ruled out and therefore higher permeabilities leading to higher extraction yields may be experienced in localised areas.

The groundwater abstraction yields recorded in the GSI well card data for Glasnevin range from poor (<40m³/day) in the limestone bedrock to excellent (>400m³/day) in shale bedrock. The groundwater abstraction yields recorded by GSI for Parnell Street, North Brunswick Street, Ormond Quay and Barrow Street are good (100-400m³/day). Limestone is indicated to be the water-bearing stratum. Groundwater in this area appears to be mainly used for industrial purposes (where the use is specified in the GSI well card data).

Groundwater depth

According to GSI, the water-bearing stratum in Drumcondra is the deposits of gravely clay. Based on the groundwater level measurements contained in the IGSL report (2007) and the Norwest Holst report (2008), the static depth of groundwater in Drumcondra ranges from 1.14m bgl to 6.8m bgl. The Tolka River is likely to influence the depth and direction of groundwater flow in the Drumcondra area.

According to the GSI well card data, groundwater strikes were encountered in wells in Dublin city centre at depths ranging from 2.2 to 6.2m bgl at Barrow Street. No other groundwater strikes are recorded in the GSI well card data for this area.

According to the IGSL report (2007), groundwater strikes were encountered during drilling in the vicinity of Mountjoy Prison and the Mater Hospital at depths ranging from 3.9 to 7.6m bgl (either in sandy, gravely clay or gravel deposits). The measured static groundwater levels ranged from 3.14m bgl next to the Royal Canal to 12.5m bgl at the Mater Hospital.

From Parnell Square to Trinity College Dublin, groundwater strikes were recorded mainly in the gravel aquifer at depths ranging from 4.1 to 8.0m bgl (IGSL, 2007). The measured static groundwater levels along these sections of the proposed scheme ranged from 8.0m bgl at Parnell Square to 3.7m bgl at Talbot Street.

The static groundwater levels from Trinity College Dublin to St. Stephen's Green ranged from 0.5m to 6.66m bgl, based on the groundwater level measurements contained in the IGSL report (2007) and the Norwest Holst Report (2008).

The shallow groundwater depth in this area of the proposed scheme is likely to be influenced by the proximity of the River Liffey. AWN has noted fluctuations of 0.2 to 0.3m in groundwater levels on other sites in the vicinity of the River Liffey in Dublin's Docklands due to the influence of high and low tides. These figures are provided as an indication only on the likely influence of the tide on groundwater levels in Dublin City Centre.

Groundwater levels along the alignment are illustrated on maps (Baseline Surface Water and Groundwater) included in Volume 3, Book 1 of 2. These levels were calculated by AWN based on data provided in the IGSL report (2007) and the report by Norwest Holst (2008) and provided by the project engineers (Jacobs Engineering Ireland Ltd.).

Groundwater flow

The findings of the study by Rooney (2002) on hydraulic conductivities and transmissive geological units in the Dublin Limestone Aquifer have already been discussed in this report and are applicable to this section of the study area.

According to Rooney (2002), the deposits of glaciomarine and alluvial silts, sands and gravels act as conduits for groundwater flow towards the Irish Sea. Historic infilling, which has taken place between DCU and St. Stephen's Green, could act as a further conduit for groundwater flow towards the Irish Sea. The topography of this area is also expected to influence groundwater flow in a south easterly direction towards the Irish Sea. The River Tolka, which flows in a south-easterly direction towards the harbour, is likely to influence the direction of groundwater flow in the Drumcondra area. The River Liffey, which flows in an easterly direction towards the harbour, is likely to influence the direction of groundwater flow in the city centre area.

Groundwater vulnerability

The GSI has not identified any Source Protection Zones in this area. Reference to the GSI Eastern Interim Vulnerability Map indicates that the section of the proposed scheme, which extends from DCU to St. Stephen's Green, crosses an area where the groundwater vulnerability ranges from high to low. The precise vulnerability of the groundwater in this area has not yet been determined because the GSI has only carried out an interim study to date.

AWN has reviewed all of the information available for this area and has used the criteria detailed in Table 18.2 to define the groundwater vulnerability as high (the subsoil consists of low permeability glacial tills and the groundwater is encountered within 5m of the surface).

Potential contamination

Historic and current industrial/commercial activities in this area may potentially have led to the contamination of the underlying aquifers. According to the AWN report (2007), potential sources of historic/current contamination in this area include the following:

- Shell petrol station on Collins Avenue;
- A petrol station on Ballymun Road;
- Car sales, cleaning and repair on Hollybank Road;
- A printers/photocopiers on Hollybank Road;
- A dry cleaners on Drumcondra Road near the junction with Richmond Road;
- A car rental company on Drumcondra Road, at the end of Botanic Road;
- An interior wood design workshop on Drumcondra Road;
- A dry cleaners on Drumcondra Road;
- 3 garages specialising in car sales, repairs and tyres on Russell Street;
- A laundrette on North Circular Road;
- A car sales garage on Dorset Street Lower;
- A laundrette on Dorset Street Lower;
- A photographic studio on Dorset Street Lower;
- A printing works (former tobacco works) at Botanic Road;
- A car sales garage close to the Mater Hospital;
- A photographic studio close to the Mater Hospital;
- The former Irish Times offices and printing press in D'Olier Street;
- Tara Street DART Station;
- Photographers on O'Connell Street;
- Printers on Abbey Street Middle and Lower;
- Asbestos manufacturers on Abbey Street Middle and Lower;
- Chemical manufacturers on Abbey Street Middle and Lower;
- Printers on Grafton Street, Dawson Street and Nassau Street;
- Photographers on Grafton Street, Dawson Street and Nassau Street;
- Dry cleaners on Grafton Street, Dawson Street and Nassau Street.

As previously mentioned, AWN carried out a review of groundwater analytical results (RPA, 2008) for monitoring wells located along the proposed scheme. The groundwater analytical results are included in Annex E, Volume 3, Book 2 of 2. The groundwater samples collected within the study area were analysed for a range of parameters, which included metals, pesticides, SVOCs (including PAH and phenols), TPH, VOCs, alcohols, glycols inorganics, PCBs, acids/bases, alkalinity, bacteriological contamination and organics.

The comparison of the groundwater analytical results against the EPA's IGVs indicated that the level of contaminants in the groundwater along this section of the scheme were below method detection limits or present at low concentrations. However, exceedances of the EPA's IGVs were registered for one well in the vicinity of the Mater Hospital for the total coliforms, sulphate and electrical conductivity.

18.3.2 Categorisation of the baseline environment

A summary of the functional values that were applied to each section of the alignment is provided in Table 18.4.

Table 18.4 Baseline categorisation

Area	Name	Summary Description	Functional Value
MN101	Lissenhall to Nevinstown	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of extreme vulnerability (groundwater encountered within 3m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity and agricultural practices.	(III)
MN102	Nevinstown to Fosterstown South	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of extreme vulnerability (groundwater encountered within 3m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity and agricultural practices.	(III)
MN103	Fosterstown South to Dardistown	- No Groundwater Source Protection Zones present; - Poor Aquifer with poor groundwater yields; - Aquifer of moderate to high vulnerability; - Groundwater quality is likely to be impacted to some extent by development in the area; - This section of the route is largely located underground in tunnel.	(II)
MN104	Dardistown to Northwood	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of extreme vulnerability (groundwater encountered within 3m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity.	(III)

Area	Name	Summary Description	Functional Value
MN105	Northwood to DCU	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of extreme vulnerability (groundwater encountered within 3m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity.	(III)
MN106	DCU to Mater	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of high vulnerability (groundwater encountered within 5m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity; - Tunnelled section of route.	(II)
MN107	Mater to St. Stephen's Green	- No Groundwater Source Protection Zones are present; - Locally Important Aquifer present with moderate groundwater yields; - Aquifer of high vulnerability (groundwater encountered within 5m from the ground level and overlain by low permeability glacial tills); - Groundwater quality impacted to some extent by long term urban activity; - Tunnelled section of route.	(II)