APPENDIX 1A: SEVESO REPORT

M28 Cork to Ringaskiddy Project

Seveso Report

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1 INTRODUCTION

This report has been prepared to accompany the planning application for the M28 Cork to Ringaskiddy Project. The document identifies the Seveso sites located in the study area and provides an assessment of the potential impact of the development on these sites.

This report is presented in the following format:

- Section 2: Legal and Planning Background including detail on the Seveso Regulations, the Health and Safety Authority requirements and the Cork County Development Plan 2011 to 2017.
- Section 3: An overview of the M28 Cork to Ringaskiddy Project including details of location, infrastructure and operation.
- Section 4: Identification and description of the Seveso sites located in the study area.
- Section 5: Risk assessment of the potential impact of the M28 Cork to Ringaskiddy Project and the Seveso sites.
- Section 6: Conclusions.

The detail is presented to facilitate a concise assessment of the impact of the development on the Seveso sites and this information is employed in the Environmental Impact Statement (EIS) that will accompany the planning application.

2 LEGAL AND PLANNING BACKGROUND

2.1 COMAH REGULATIONS

The Seveso III Directive (2012/18/EU) was adopted on 4th July 2012 and entered into force on 13th August 2012. The Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (the "COMAH Regulations"), implement the Seveso III Directive in Ireland.

The purpose of the COMAH Regulations is to lay down rules for the prevention of major accidents involving dangerous substances, and to seek to limit as far as possible the consequences for human health and the environment of such accidents, with the overall objective of providing a high level of protection in a consistent and effective manner.

The COMAH Regulations apply to any establishment that presents a major accident hazard because of the presence of dangerous substances in quantities that exceed specified thresholds. The dangerous substances and threshold quantities are specified in Schedule 1 to the Regulations. The specified thresholds identify what establishments are required to comply with COMAH and which are upper or lower tier establishments.

Part 1 of Schedule 1 lists the 21 categories of dangerous substance and their thresholds under the groups of:

- Health Hazards,
- Physical Hazards,
- Environmental Hazards, and
- Other Hazards.

Part 2 of of Schedule 1 contains the list of 48 named dangerous substances and their respective thresholds.

The requirements under the Regulations are dependent on the classification of an establishment as upper tier or lower tier. Both lower tier and upper tier establishments are obliged to do the following under the Regulations:

- Notification to the HSA and the local planning authority;
- Discharging certain general duties;
- Preparation and implementation of a major accident prevention policy (MAPP);
- Action in the event of a major accident; and
- Maintaining a register of notifiable incidents.

Upper tier establishments are also required to carry out the following additional tasks under the Regulations:

- Production of a Safety Report;
- Preparation of an internal emergency plan;
- Provision of information to those responsible for off-site emergency plans; and

- Provision of information for the safety of the public.

The Health and Safety Authority (HSA) has been designated as the competent authority for enforcement of the Regulations in Ireland.

2.2 HEALTH AND SAFETY AUTHORITY PLANNING GUIDANCE

The HSA has published guidance entitled "*A Guide to the Chemicals Act (Control of Major Accident Hazards Involving Dangerous Substances) Regulations 2015 (S.I. No. 209 of 2015)".* One of the functions of the HSA is to advise the relevant planning authority of a consultation distance for an establishment, following the receipt of a notification from the operator. Among the other HSA functions in relation to land use planning include:

- The HSA must be consulted for technical advice as appropriate by planning authorities on the types of development covered by the Regulations.
- The HSA will provide technical advice to a planning authority in response to a request under this Regulation.

The HSA have been consulted during the informal EIA consultation process undertaken with statutory and non-statutory organisations throughout the various project stages. However, it is noted that comments specific to the COMAH Regulations were not expressly sought from the HSA.

2.3 COUNTY DEVELOPMENT PLAN

The Cork County Development Plan 2014-2020 identifies the local land use policy in relation to the COMAH Regulations and the policy on "Seveso" Industries is set out in Chapter 14 Zoning and Land Use. The CDP states that the focus of this plan is to ensure that:

- Proposals for new establishments at risk of causing major accidents;
- Proposals for the expansion of existing establishments designated under the directive; and
- Other developments proposed near to existing establishments, all take into account the need to prevent major accidents involving hazardous substances and safeguard both the public and the environment.

The proposed M28 Road Project falls within the third bullet point, i.e. a development proposed near to existing establishments. The key objective listed in the County Development Plan for such developments is presented below:

ZU 5-3: Proposed Development Adjacent to Existing Establishments

a) The Health and Safety Authority have established consultation distances surrounding establishments designated as containing hazardous substances. Ensure in addition to normal planning criteria that development within these distances complies with the requirements of the Major Accidents Directive (Seveso II). The Council will consult with the Health and Safety Authority regarding any such proposals.

b) In areas where Seveso sites exist in appropriate locations ensure that proposed uses in adjacent sites do not compromise the potential for expansion of the existing Seveso use and in particular the exclusion of developments with the potential to attract large numbers of the public.

The CDP also lists the establishments within the Cork jurisdiction and those relevant to the M28 study area are listed in **Table 2.1**. These establishments are also presented in **Figure 2.1** relevant to both the existing N28 and proposed M28 infrastructure. Given the locations of the listed establishments are centred around the Ringaskiddy peninsula, the associated mapping is centred in this area.

Table 2.1 – List of COMAH Establishments in the Study Area

Establishment Name	Establishment Address
Carbon Chemical Group Ltd.	Raheens Industrial Estate, Ringaskiddy, Co. Cork
Hovione Ltd.	Loughbeg, Ringaskiddy, Co. Cork
*Novartis Ringaskiddy Ltd.	Ringaskiddy, Co. Cork
*Pfizer Ireland Pharmaceuticals	Active Pharmaceutical Ingredients Plant, P.O. Box 140, Ringaskiddy, Co. Cork
*SmithKline-Beecham (Cork) Ltd.	Currabinny, Carrigaline. Co. Cork

Note: * denotes Upper Tier establishment

2.4 CARRIGALINE ELECTORAL AREA LOCAL AREA PLAN

The Carrigaline Electoral Area Local Area Plan (January 2015) provides more detailed land use planning policy for the area and includes the broader area including the entire study area for the proposed M28 road project. The LAP notes that there are a number of existing industries in the Electoral Area that have "exclusion zones" under the Seveso Directive Regulations and these are listed in **Table 2.2**.

Table 2.2 illustrates that the consultation distances are only provided for the three Upper Tier establishments with none provided for the two Lower Tier establishments. In short, any development within 1,000m of the three Upper Tier establishments must be the subject of consultation with the HSA.

Table 2.2 –COMAH Establishment Consultation Distances

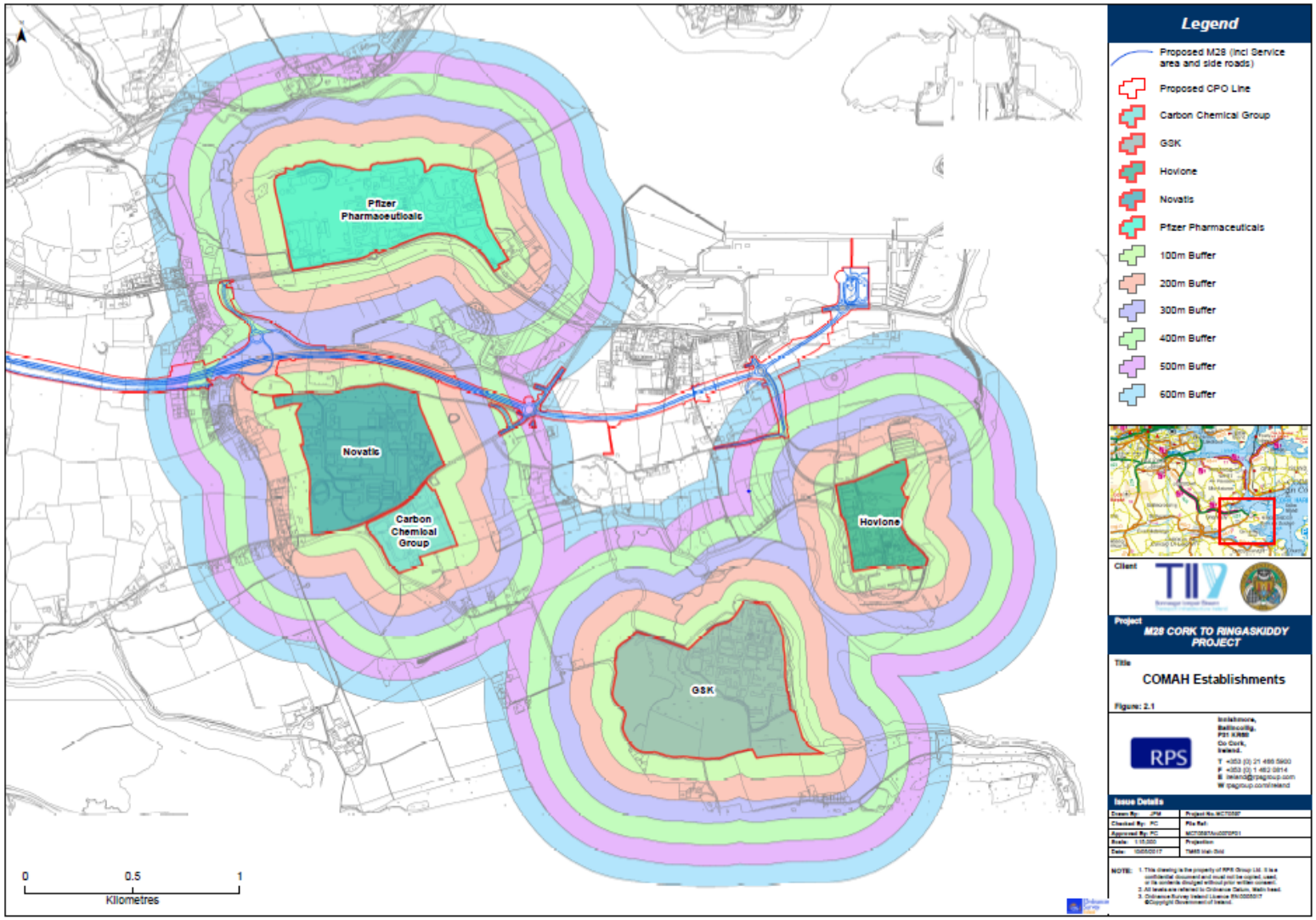
Establishment Name	Consultation Distance
Carbon Chemical Group Ltd.	-
Hovione Ltd.	-
Novartis Ringaskiddy Ltd.	1,000m
Pfizer Ireland Pharmaceuticals	1,000m
SmithKline-Beecham (Cork) Ltd.	1,000m

The draft Ballincollig Carrigaline Municipal District Local Area Plan (Nov 2016) is a more recent local planning policy document (albeit draft) and Section 3.7.35 states the following:

Three of the major employers within the development boundary of Ringaskiddy are designated under the Major Accidents (Seveso) Directive. These are Novartis Ringaskiddy Ltd., Pfizer Ireland Pharmaceuticals and SmithKline-Beecham (Cork) Ltd.

No updated or confirmed consultation distances are stated in this document.

Figure 2.1: Map showing the COMAH Establishments in the Study Area



3 PROJECT DESCRIPTION

3.1 EXISTING INFRASTRUCTURE

The existing N28 is characterised by a range of road types and qualities, reflecting the incremental improvement of the road over time. The road has a short section of dual carriageway at Bloomfield Interchange but is single carriageway for most of its length, with limited hard shoulder and overtaking opportunities. The horizontal and vertical geometry is sub-standard in many places and the cross-section varies along its length. The junction types and layouts also vary and are sub-standard in some cases.

The existing road network receiving environment experiences high peak hour travel demand. The N40, northern sections of the N28 as well as other N28 bottlenecks, such as the Shannonpark roundabout and the Shanbally roundabout regularly experience peak hour delay and congestion. As a result of the high travel demand, the morning and evening peaks extend well beyond the normally observed one hour peak.

3.2 PROPOSED CONSTRUCTION PHASE

The overall construction period for the proposed M28 Road Project is anticipated to be in the region of 30 – 36 months.

The construction of the section of road between Bloomfield Interchange and Carr's Hill Interchange has the potential to cause significant disruption to the local population, particularly in relation to traffic as there is considerable work required on the existing local road network. In particular the following works are noted:-

- Online widening and road reconfiguration between Bloomfield and Rochestown Road,
- Relocation of the existing Rochestown Road on-ramp,
- Provision of the M28 to N40 westbound link road and upgrades merge with the N40,
- Upgrade to Rochestown Road,
- Online widening of the proposed mainline between Rochestown Road and Carr's Hill,
- Demolition and replacement of Maryborough Hill overbridge,
- Upgrade of Maryborough Hill,
- Construction of Carr's Hill to Maryborough Hill link road and tie-ins, and
- Construction of the Carr's Hill Interchange.

The proposed works at each of these locations will cause disruption to the road users in an environment where there is limited capacity with significant peak hour demand and delays occurring frequently. To mitigate this potential impact, the following will be required in terms of the proposed order and sequence that the works will be undertaken in this area:-

- The existing N28 will remain open to two-way traffic at all times, except for short term managed road closures for critical works, such as the proposed demolition of the Maryborough Hill overbridge. This will entail careful phasing and sequencing of the works along the N28 in order to maintain traffic flows.

- All traffic movements will be accommodated on the section of the works between Bloomfield Interchange and Rochestown Road. Phasing of the works will be carefully planned and sequenced to maintain traffic flows at all times.
- Local road closures will not be permitted, except for critical works. Any road closures permitted will be for limited periods, e.g., night-time or weekend.
- Works on the local road network at the northern end of the project will not coincide. This means that works, say on Rochestown Road will not coincide with works on Maryborough Hill or Carr's Hill and so on.
- Construction of the Carr's Hill Interchange with temporary tie-ins to the existing N28 will be constructed early in the construction programme and prior to works at Rochestown Road and/or Maryborough Hill to facilitate local access to the N28.
- A section of the proposed overbridge at Maryborough Hill will be constructed prior to demolition of the existing bridge in order that one-way traffic from the east can be maintained whilst the remainder of the proposed bridge is constructed.
- Prior to demolition of the existing bridge at Maryborough Hill, construction of the proposed link road between Maryborough Hill and Carr's Hill. Construction access is proposed via Carr's Hill only.
- Prior to demolition of the existing bridge at Maryborough Hill, construction of the road widening works on the west side of Maryborough Hill will occur.
- Demolition of existing Maryborough Hill overbridge and opening of the partially constructed bridge to eastbound traffic one-way flow. A short-term N28 and Maryborough Hill road closure will be needed to facilitate this operation. A weekend possession is envisaged. The link road from Maryborough Hill to Carr's Hill will be open to traffic at this stage also.
- Existing merge to the N28 from Maryborough Hill to be closed only after the proposed bridge and realignment on Maryborough Hill and the proposed link road to Carr's Hill are fully completed and open to traffic.

Prior to the commencement of works the Contractor will be required to prepare and submit a detailed site specific traffic management plan to be agreed with Cork County Council and appropriate emergency services, i.e., An Garda Síochána, ambulance services and fire services. In the preparation of the temporary traffic management plan, the restrictions/requirements outlined above will be complied with to minimise disruption to local traffic flows. Off-peak and night working will be considered for works in critical locations. Any approval for night working will give consideration to the potential disruptive effects there may be on nearby residences and significant restrictions on noise and other adverse environmental emissions may be conditioned to any approval granted.

3.3 PROPOSED INFRASTRUCTURE

The proposed infrastructure will consist of the operation and maintenance of 10.9 kilometres of dual carriageway motorway from the N40 Bloomfield Interchange to Barnahely, 1.5 kilometres of single carriageway protected road from Barnahely to the eastern side of Ringaskiddy and a Service Area at the Port of Cork Facility at Ringaskiddy together with ancillary and consequential works. In summary the project includes the following elements:

- 10.9km of mainline motorway from Bloomfield to Barnahely;
- 1.5km of mainline single carriageway protected road from Barnahely to east of Ringaskiddy;
- 4.8km of new and realigned regional and local roads;

- 2.2km of accommodation works tracks;
- 1 full grade-separated interchange at Carr's Hill with associated roundabouts, slip roads and widening of the existing underbridge at Carr's Hill;
- 3 partial grade-separated interchanges at Bloomfield/Rochestown Road, Shannonpark and Shanbally, with associated roundabouts and slip roads, including 2 new underbridges, existing bridge at Rochestown retained as part of the project;
- 3 at-grade roundabouts at Barnahely, Loughbeg and eastern Port of Cork entrance;
- Provision of a M28 to N40 westbound link road and improvement of the westbound merge from the M28 to the N40;
- Removal of the existing sub-standard northbound on-ramp at Maryborough Hill;
- Upgrading of the existing sub-standard off-ramp to Mount Oval;
- 4 new road underbridges to allow the proposed M28 to pass over existing roads;
- 1 underbridge widening at Carr's Hill;
- 2 shared use pedestrian and cyclist underpasses, one at Carr's Hill and one at Old Post Office Road;
- Demolition of the existing Maryborough Hill overbridge and construction of a replacement overbridge at the same location. This overbridge will take Maryborough Hill over the widened M28 below;
- Various other structures including large retaining walls and stream culverts;
- Traffic signalised control to be implemented at key junctions on Rochestown Road, including the replacement of the Rochestown Road roundabout with a signalised junction, signalising of the merge to the M28 and signalising of the Clarke's Hill junction;
- Local road improvements and parallel access roads, etc;
- Accommodation works and farm accesses as required;
- Provision for footpaths and cycle facilities;
- Relocation of high voltage electricity pylons at Shanbally; and
- A proposed Service Area to serve HCV's within Port of Cork lands to the east of Ringaskiddy Village.

4 IDENTIFICATION OF KEY INFRASTRUCTURE

4.1 COMAH ESTABLISHMENTS

The name, address, nature of the operation and Seveso tier for each of the relevant establishments within the study area is presented in **Table 4.1**. The locations of the Seveso sites are presented in **Figure 2.1**.

Table 4.1 – Details of COMAH Establishments in the Study Area

Establishment Name	Establishment Address	Seveso Tier	Site Nature
Carbon Chemical Group Ltd.	Raheens Industrial Estate, Ringaskiddy, Co. Cork	Lower	Other Activity (General Chemicals manufacture)
Hovione Ltd.	Loughbeg, Ringaskiddy, Co. Cork	Lower	Production of pharmaceuticals
Novartis Ringaskiddy Ltd.	Ringaskiddy, Co. Cork	Upper	Production of pharmaceuticals
Pfizer Ireland Pharmaceuticals	Active Pharmaceutical Ingredients Plant, P.O. Box 140, Ringaskiddy, Co. Cork	Upper	Production of pharmaceuticals
SmithKline-Beecham (Cork) Ltd.	Currabinny, Carrigaline. Co. Cork	Upper	Production of pharmaceuticals

Note: * denotes Upper Tier establishment

Each of the five establishments listed above are obliged to prepare a Major Accident Prevention Policy (MAPP) under the COMAH Regulations. This applies to both lower and upper tier establishments. The three upper tier establishments are also obliged to prepare a Safety Report and submit a copy of same to the HSA.

A summary overview of the infrastructure at each of the COMAH establishments is provided in the following sections.

4.1.1 Carbon Chemical Group Ltd.

The site provides a range of services to industry in the area including consultancy services, supply of products and storage of materials. The site includes some on-site bulk storage facilities that may be used by customers for material storage.

4.1.2 Hovione Ltd.

The Hovione facility comprises of two distinct operational units; an active pharmaceutical ingredient (API) plant and a drug product (DP) plant. The API plant is a multi-purpose organic chemical synthesis plant capable of the custom manufacture of chemical products for the pharmaceutical industry. The DP (bulk tabletting) plant incorporates an active pharmaceutical ingredient at the appropriate dose into a solid tablet. The site also includes a large tank farm that is located on the south eastern quadrant of the site. Hovione operate an on-site Emergency Response Team which is

fully trained in the techniques for fire fighting, handling toxic release and handling spillage. This Emergency Response Team are available at all times (24 hours /day, 365 days /year). There is a dedicated site vehicle (fire appliance) available for use in emergency situations which contains equipment designed for dealing with leaks and spills.

4.1.3 Novartis Ringaskiddy Ltd.

The facility manufactures bulk pharmaceuticals used in the treatment of immunological, dermatological, cardiovascular, oncological and Central Nervous System (CNS) diseases. The site consists of three production buildings, warehouses, a solvent recovery unit (distillation), a wastewater treatment plant and two on-site incinerators, a solid waste incinerator (SWI) and a liquid/vapour incinerator (LVI). There is a large tank farm located to the north of the site. The site operates a full time rapid response on-site fire crew that can respond quickly to any incident. In addition, a comprehensive sprinkler system is located in the warehouses, tank farm and production building.

4.1.4 Pfizer Ireland Pharmaceuticals

Pfizer exports bulk pharmaceuticals, the active ingredients in Pfizer's medication for both humans and animals. The site includes four production facilities, solvent recovery operations, a wastewater treatment plant, a milling facility, laboratories, wastewater treatment plant control, warehousing and service utilities. Tanks farms are located at several locations around the site. The site maintains a fully trained emergency crews on a full time basis for fire fighting, handling toxic release and handling spillage. There is a dedicated site vehicle, available for use in emergency situations which contains equipment designed for dealing with leakage and spills.

4.1.5 SmithKline-Beecham (Cork) Ltd.

The site consists of eight production buildings, a milling/nanomilling facility, a research and development building, two warehouses, a tank farm for storage of waste and raw materials, an environmental control centre, a solid waste management facility and laboratories. Abatement equipment onsite includes two incinerators, two thermal oxidisers, a wastewater treatment plant, three solvent recovery plants and three firewater retention ponds. The site's tank farm is mainly located in the north eastern quadrant of the site. The site has a well-developed Emergency Procedure.

4.2 EMERGENCY SERVICES

4.2.1 Fire Service

Cork County Council operates 21 fire stations across the county with divisional headquarters in the fire stations of Bantry, Mallow, Midleton and Carrigaline. The study area lies within the Carriagline divisional area and the nearest fire station to the Ringakkiddy area is the one located at Strand Road in Carrigaline (CK35) with the next nearest station available at Crosshaven Fire Station (CK36).

Any fire tender from Carrigaline would likely take the R613 to Ringaskiddy as the shortest route to the five establishments in the event of any emergency. Approximate journey time of 5-10 minutes.

Similarly, any fire tender from Crosshaven would likely take the R612 to Carrigaline followed by the R613 to Ringaskiddy. Approximate journey time of 15-20 minutes.

Further support may be provided by the Fire Service HQ at Westpoint Business Park, Link Rd. Ballincollig. Tenders travelling from this location would likely take the N40 and the N28 to the area. Approximate journey time of 25-30 minutes.

4.2.2 Medical Service

Accident and Emergency Services are available at Cork University Hospital which is located at Wilton to the west of the city. Any ambulance travelling from this location would likely take the N40 eastbound and the N28 southbound to the area. Approximate journey time would be 20-25 minutes.

5 RISK ASSESSMENT

5.1 PROXIMITY OF THE COMAH SITES TO THE DEVELOPMENT

The potential risk of the proposed M28 Road Project (including the Service Area in Ringaskiddy) on the COMAH establishments or conversely the potential risk of the COMAH establishments on the M28 road project will be somewhat dictated by the relative proximities between the two. **Table 5.1** presents the distances from the establishment boundaries to the existing N28 and the proposed M28 Road Project and illustrates that four of the establishments will be moved closer in proximity to the proposed M28 relative to the existing N28. The Novartis facility will experience the greatest change with the relocation of the proposed alignment to the north of the site.

There is one site (Pfizer) which will be moved further away from the alignment. The existing N28 bounds the Pfizer site to the south and the proposed M28 will move much of this traffic further north away from the site. However, it is noted that the existing N28 will remain operational with the proposed M28 in operation albeit as a regional road with lower traffic throughput.

Table 5.1 – Proximity of the COMAH sites to the Road Infrastructure

Establishment	Proximity to the existing N28	Proximity to the proposed M28	LAP Consultation Distance
Carbon Chemical Group Ltd.	1,000m	500m	-
Hovione Ltd.	850m	600m	-
Novartis Ringaskiddy Ltd.	600m	**100m**	1,000m
Pfizer Ireland Pharmaceuticals	0m	**300m**	1,000m
SmithKline-Beecham (Cork) Ltd.	1,300m	**1,000m**	1,000m

The consultation distances for land use planning around each of the Upper Tier establishments as dictated by the Carrigaline LAP is 1,000m (refer **Section 2.4**). Any development within this distance requires the planning authority to consult with the HSA on the relative risk. **Table 5.1** clearly illustrates that the alignment of the proposed M28 lies within or at this consultation distance of each of the three Upper Tier establishments and hence consultation with the HSA is mandatory for the development.

No consultation distance is presented in local planning policy for the two Lower Tier establishments. However, given the lower risk profile of these establishments (relative to the Upper Tier establishments) and the relative distance to the road infrastructure (both existing and proposed) it is considered that the risk posed to/by these two Lower Tier establishments is low.

5.2 RISK POSED BY THE COMAH SITES TO THE DEVELOPMENT

This section of the report summarises the risks posed by the COMAH sites and the potential for impact on the proposed project. Under Regulation 25 of the COMAH Regulations, the Upper Tier establishments are required to provide information to the public on the level of risk. The following information has been collated from the Public Information on Upper Tier establishments published

in the HSA website[1]. **Table 5.2** identifies the hazard categories and dangerous characteristics applicable to the three Upper Tier sites. Given the similarity in the nature of the three operators, there is a degree of overlap between the substances identified in each of the sites. The substances are varied but include a large number of toxic and flammable substances.

Table 5.2 – Key Hazard Categories for the Upper Tier Establishments

Establishment	Hazard Categories / Named Substances	Dangerous Characteristics / H Phrases
Novartis Ringaskiddy Ltd.	E1 Hazardous to the Aquatic Environment, E2 Hazardous to the Aquatic Environment, H1 Acute Toxic Cat.1, H3 STOT Toxic Cat. 1, O1 Substances or mixtures with hazard statement EUH014, P5a Flammable Liquids, P5b Flammable Liquids, P5c Flammable Liquids, P8 Oxidising Liquids and Solids, Methanol	EUH014, H225, H226, H271, H301, H330, H331, H370, H400, H410, H411,
Pfizer Ireland Pharmaceuticals	E1 Hazardous to the Aquatic Environment, E2 Hazardous to the Aquatic Environment, H1 Acute Toxic Cat.1, H2 Acute Toxic Cat.2, H3 STOT Toxic Cat.1, O1 Substances or mixtures with hazard statement EUH014, O2 Substances and mixtures which in contact with water emit flammable gases, P2 Flammable gases, P5a Flammable Liquids, P5c Flammable Liquids, P7 Pyrophoric Liquids and Solids, Acetylene, Hydrogen, Hydrogen Chloride, Methanol	EUH014, H220, H224, H225, H226, H250, H260, H300, H310, H330, H331, H370, H400, H410, H411
SmithKline-Beecham (Cork) Ltd.	E1 Hazardous to the Aquatic Environment, E2 Hazardous to the Aquatic Environment, H1 Acute Toxic Cat. 1, H2 Acute Toxic Cat.2, O1 Substances or mixtures with hazard statement EUH014, O2 Substances and mixtures which in contact with water emit flammable gases, O3 Substances or mixtures with hazard statement EUH029, P2 Flammable gases, P5b Flammable Liquids, P7 Pyrophoric Liquids and Solids, P8 Oxidising Liquids and Solids	EUH014, EUH029, H220, H221, H225, H226, H250, H260, H272, H301, H330, H331, H400, H410, H411

[1] Available at: http://www.hsa.ie/eng/Chemicals/COMAH/

Table 5.3 presents the key hazards presented on the HSA website for the three Upper Tier establishments. As with the hazard categories and dangerous characteristics, the similarity between the three operations results in a degree of overlap between the hazards presented. Fires, explosions and releases of dangerous substances are hazards posed by all three establishments. However, impact distances for these hazards are not presented in the publically available data.

Changing the relative proximity of the road to these establishments may alter the risk rating of these hazards by potentially moving the "receptors" closer to the "source" of the hazard. The proposed project does not include for any residential or other development requiring long term occupancy of humans. However, the short term transient population using the proposed road network may potentially alter the societal risk posed by these establishments.

Similarly, the use of the proposed Service Area in Ringaskiddy by commercial traffic will introduce new infrastructure within 750m of the Hovione establishment but it is noted that as a Lower Tier establishment there is no consultation distance for this site. The occupancy of the Service Area will include both employees working typical day and night time shifts as well as customers who will be present for much shorter durations.

In terms of the Novartis facility, the increased proximity of the proposed M28 alignment relative to the existing alignment (refer **Table 5.1**) may increase the risk profile of this facility. For example, the tank farm to the north of the site (a potential fire/explosion risk) will be less than 200 metres from the proposed alignment. Depending on the impact distance for this hazard, the proposed alignment may increase the number of persons potentially affected by such an event. In this regard, the Novartis facility poses a potential slight increase in risk on the proposed development.

Conversely, the Pfizer facility which is currently bounded by the existing N28 will have the proposed M28 moved a greater distance from the facility and potential hazards (such as the tank farms, production and warehouses). The proposed alignment will be circa 300 metres from the Pfizer facility and may decrease the number of persons potentially affected by a fire, explosion or toxic release. As such, the Pfizer facility poses a potential slight decrease in risk on the proposed project.

The SmithKline-Beecham facility is currently located outside of the relevant consultation distance of 1,000m and is only located at this distance with the proposed M28 alignment. While this may potentially increase the risk, the net change in risk of the SmithKline-Beecham facility is considered to be negligible.

Overall, while the Novartis facility may pose a greater risk to the proposed alignment relative to the existing alignment, the converse is true for the Pfizer facility. Overall, a net negligible change in risk is predicted for the impact of the COMAH sites on the road infrastructure.

Notwithstanding this negligible overall change in risk, the Novartis facility may pose an increased risk and this should be taken into consideration in the Safety Report and MAPP prepared by the Novartis site and regulated by the HSA.

Table 5.3 – Key Hazards from the Upper Tier Establishments

Establishment	Nature of major accident	Scenario details	Potential human health effects
Novartis Ringaskiddy Ltd.	Release of dangerous substances with potential for adverse health effects. Release of dangerous substances with potential for adverse environmental effects.	Release of toxic gas (Hydrogen Chloride)	Airborne material that can cause burning of the eyes and, if inhaled the throat, coughing or breathing difficulties.
	Fire and Explosion	Extremely flammable Hydrogen fire / explosion	Potential for burns to body. Injuries caused by projectiles being ejected from the incident site.
	Fire and Release of dangerous substances with potential for adverse health effects. Release of dangerous substances with potential for adverse environmental effects.	Main warehouse fire toxic / eco-toxic	Very dense smoke may cause irritation of the lining of the air passages (nose, throat and lungs) the skin and the eyes.
Pfizer Ireland Pharmaceuticals	Release of dangerous substances with potential for adverse health effects.	Release of AHCL The scenarios identified that would result in a release of toxic gas are; 1. Cold Catastrophic failure of the HCI cylinder 2. Leak from cylinder/pipework 3. Release from a pressure relief valve	Substantial exposure to toxic chemicals (potentially fatal).
	Fire	Warehouse Fire which may result in the release of a smoke plume containing toxic combustion products evolved during a major fire at the on- site principal product storage warehouse (Building 164)	Temporary exposure to smoke from a fire from which generally fit and well people are unlikely to experience long-term health problems.
	Fire	Drum Store Pool Fire. Methanol was used as the model material Scenario 1: Pool Fire Scenario 2: Catastrophic Failure of an HCL Cylinder Scenario 3: Drum Projectile	Temporary exposure to smoke from a fire from which generally fit and well people are unlikely to experience long-term health problems. Injuries caused by projectiles being ejected from the incident site.

SmithKline-Beecham (Cork) Ltd.	Release of dangerous substances with potential for adverse health effects.	Release of ammonia gas from chiller system.	Airborne material that can cause burning of the eyes and, if inhaled the throat, coughing or breathing difficulties. Substantial exposure to toxic chemicals (potentially fatal).
	Fire and Explosion	Large flammable solvent spill and ignition resulting in large scale solvent fire	Potential for burns to body. Temporary exposure to smoke from a fire from which generally fit and well people are unlikely to experience long-term health problems.
	Fire and Explosion	Catastrophic failure during boiler operation resulting in explosion	Injuries caused by projectiles being ejected from the incident site. Potential for burns to body.

5.3 RISK POSED BY THE CONSTRUCTION OF THE DEVELOPMENT ON THE COMAH SITES

The construction of the proposed M28 Road Project (as described in **Section 3.2**) will have no direct effect on the operation or risk profile of the COMAH sites in the Ringaskiddy area. However, there are potential indirect effects, in particular the impacts from traffic management, which need to be addressed.

As noted in **Section 3.2**, the existing N28 will remain open to two-way traffic at all times during the construction phase, except for short term managed road closures for critical works, such as the proposed demolition of the Maryborough Hill overbridge. However, traffic delays in the area may be experienced and this may cause slight delays for emergency fire or medical services travelling from the Cork area to Ringaskiddy.

The proposed alignment of the M28 south of Carr's Hill is offline and, as such, the construction may be progressed without impacting on the capacity and operation of the existing N28.

Some localised impacts may be experienced such as the traffic management around the junction of the new road with the R613 to the north of the Novartis and Carbon Chemical facilities. These works may impair access to these facilities as well as the likely route for emergency access by fire services from Carrigaline to the Ringaskiddy area (refer **Section 4.2.1**).

All construction traffic management measures will be agreed with Cork County Council and appropriate emergency services, i.e., An Garda Síochána, ambulance services and fire services in advance of construction. For the works around the R613, consultation with the COMAH establishments impacted will also be carried out. In short, based on this management the impact of construction traffic on the risk profile and emergency response capacity of the five COMAH establishments is considered low.

5.4 RISK POSED BY THE OPERATION OF THE DEVELOPMENT ON THE COMAH SITES

At the operational stage, the proposed new infrastructure will have no direct impact on the five COMAH establishments in the area and will not alter the risk profile of these operations. The traffic modelling for the proposed route indicates that with an improved horizontal and vertical alignment (relative to the exiting N28) the existing bottlenecks will be removed and the efficiency of the traffic will increase. In this regard, the flow of traffic between the Ringaskiddy area and the Greater Cork Area will be improved and travel times will be reduced. The traffic model indicates an approximate time saving of 6-8 minutes during peak hours in 2020 (10-15 minutes in 2035) between Ringaskiddy and the Bloomfield N40/N28 Interchange relative to the existing alignment.

This reduced travel time will facilitate a faster response time for emergency medical services from Cork University Hospital and/or additional fire services if required from Ballincollig. As a result, the new infrastructure will improve the overall emergency response in the Ringaskiddy area and have a net slight positive impact in the area.

6 CONCLUSION

This report has been prepared to accompany the planning application for the M28 Cork to Ringaskiddy Project. The document identifies the COMAH establishments located in study area and provides an assessment of the potential impact of the development on these sites. The report considers the relative proximities between the existing and proposed alignments to these COMAH establishments and notes any potential change in risk.

Four of the five establishments will be moved closer in proximity to the proposed M28 relative to the existing N28 while one will be moved further away from the alignment. The three Upper Tier COMAH establishments will all be located at or within the 1,000m consultation distance presented within the Carrigaline Electoral Area Local Area Plan and the HSA must be consulted on this development.

With the changes in proximity to the proposed M28 and the existing N28, the Novartis facility may pose a greater risk to the proposed alignment relative to the existing alignment, the converse is true for the Pfizer facility. Overall, a net negligible change in risk is predicted for the impact of the COMAH sites on the road infrastructure.

Notwithstanding this negligible overall change in risk, the Novartis facility may pose an increased risk and this should be taken into consideration in the Safety Report and major accident prevention policy (MAPP) prepared by the Novartis site and regulated by the HSA.

The construction of the proposed M28 will have no direct effect on the operation or risk profile of the COMAH sites in the Ringaskiddy area. Construction traffic and diversions may potentially impair emergency services but all construction traffic management measures will be agreed with Cork County Council and appropriate emergency services, i.e., An Garda Síochána, ambulance services and fire services in advance of construction. For the works around the R613, consultation with the COMAH establishments impacted will also be carried out. Based on this management the impact of construction traffic on the risk profile and emergency response capacity of the five COMAH establishments is considered low.

At the operational stage, the proposed new infrastructure will have no direct impact on the five COMAH establishments in the area and will not alter the risk profile of these operations. The reduced travel time on the proposed M28 Road Project will facilitate a faster response time for emergency medical services from Cork University Hospital and/or additional fire services if required from Ballincollig. As a result, the new infrastructure will improve the overall emergency response in the Ringaskiddy area and have a net slight positive impact in the area.

In summary, an assessment of the likely significant effect of the proposed development on the COMAH network has been undertaken for both the construction and operation phases. Where sites are identified as posing a plausible risk, (i.e. within the consultation distances supplied by local planning policy) a more detailed review has been undertaken. In all cases the nature of the proposed development, coupled with the distances to the COMAH establishments has resulted in a low risk of impact.

APPENDIX 1B: EIA SCOPING REPORT AND HEALTH STUDY SCOPING STATEMENT

RPS

N28 Cork to Ringaskiddy Upgrade Scheme

EIA Scoping Report

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N28 Cork to Ringaskiddy Upgrade Scheme

EIA Scoping Report

Document Control Sheet

Client:	Cork County Council
Project Title:	N28 Cork to Ringaskiddy Upgrade Scheme
Document Title:	EIA Scoping Report
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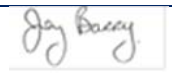
F01	Final	13th February, 2015	JB AF		AG		SJ	

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1 INTRODUCTION

Cork County Council proposes to upgrade the existing N28 carriageway from the Bloomfield Interchange, at the tie-in with the N40 South Ring Road, to Ringaskiddy Village. It is proposed that the upgraded N28 shall be classified as a motorway. The N28 is a national primary road, which links Cork City to Ringaskiddy and is situated on a peninsula located to the south-east of Cork City. It is also intended to provide a service area as part of the scheme.

In 2008 the scheme was previously developed in draft format (in accordance with Phases 1, 2, 3 and 4 of the NRA Project Management Guidelines). However, following An Bord Pleanála's decision to refuse the planning application for the proposed Port of Cork development at Ringaskiddy, a policy decision was taken in October 2008 to postpone further development work on the N28 Cork to Ringaskiddy Upgrade Scheme and publication of the EIS and CPO, until a later date.

In 2013, the Department of Transport, Tourism and Sport published the National Ports Policy. This document represents government policy in respect of the development of maritime trade in Ireland. It also provides a useful context for Irish Ports with respect to the European Union's TEN-T Transport Network (a trans-European transport network including rail, road, inland waterway connections, ports, airports and other transport terminals). The N28 Cork to Ringaskiddy Upgrade Scheme is in line with this policy, and as such work re-commenced on the project in early 2014.

As a first step to moving forward with the project, a thorough review of the work completed to date on route selection, including the draft EIS prepared in 2009 has been undertaken by the project team. This included an update of constraints in the study area, a review of changes to landuse and planning in the intervening years and an update to the traffic modelling. The review of the route includes confirmation of the type and number of junctions and the extent of the scheme including the need for the Ringaskiddy Bypass section. The outcome of the review was the identification of a number of additional alternative options which were subsequently assessed alongside the original routes proposed in 2008.

Figure 1 shows all of the options assessed in the recent route selection process.

Following the route selection review process, route option 6b was identified as the preferred route.

Figure 2 shows the location of the proposed road scheme as a result of this process. Route Option 6b consists of Option 2 plus a single carriageway extension along the existing services corridor between Barnahely and the L6517 Loughbeg Road. From the L6517 Loughbeg Road the route extends into the lands to the north of the Martello tower to the local road L2545 to Haulbowline. The Route is a dual carriageway to Barnahely and single carriageway from Barnahely to Ringaskiddy. This route consists of Option C + part of Option E2 + part of Option M as illustrated in **Figure 2**. This route will now be the subject of an EIS.

RPS has been commissioned to undertake an environmental assessment and prepare an Environmental Impact Statement (EIS) in respect of the proposed scheme. Scoping is an early stage in the EIA process and is designed to ensure that the environmental studies provide all the relevant information on the impacts of the project, in particular focusing on the most important impacts; the alternatives to the project; and any other matters to be included[1].

This Scoping Report outlines the proposed scheme and sets the context of the development in terms of the legal and planning background. It also provides preliminary information on the following:

- Information on the receiving environment including existing problems with a view to establishing the likelihood for significant impacts as a result of the proposal;
- The investigations proposed to assess the magnitude and duration of impacts on the receiving environment;
- The geographical and temporal scope of those assessments;
- The potential for significant impacts;
- Possible alternatives;
- The range and timing of surveys to be completed as part of the EIS for each specialist area to address potential impacts; and
- The contents of the EIS.

This Scoping Report will be circulated to the consultees listed in Section 5 of this report. Consultees are invited to contribute to the EIA process by suggesting / providing additional baseline data sources, comment on survey techniques and assessment approaches and potential impacts that should be addressed through the EIA process and in preparation of the EIS.

[1] Guidance on EIA Scoping, EC 2001.

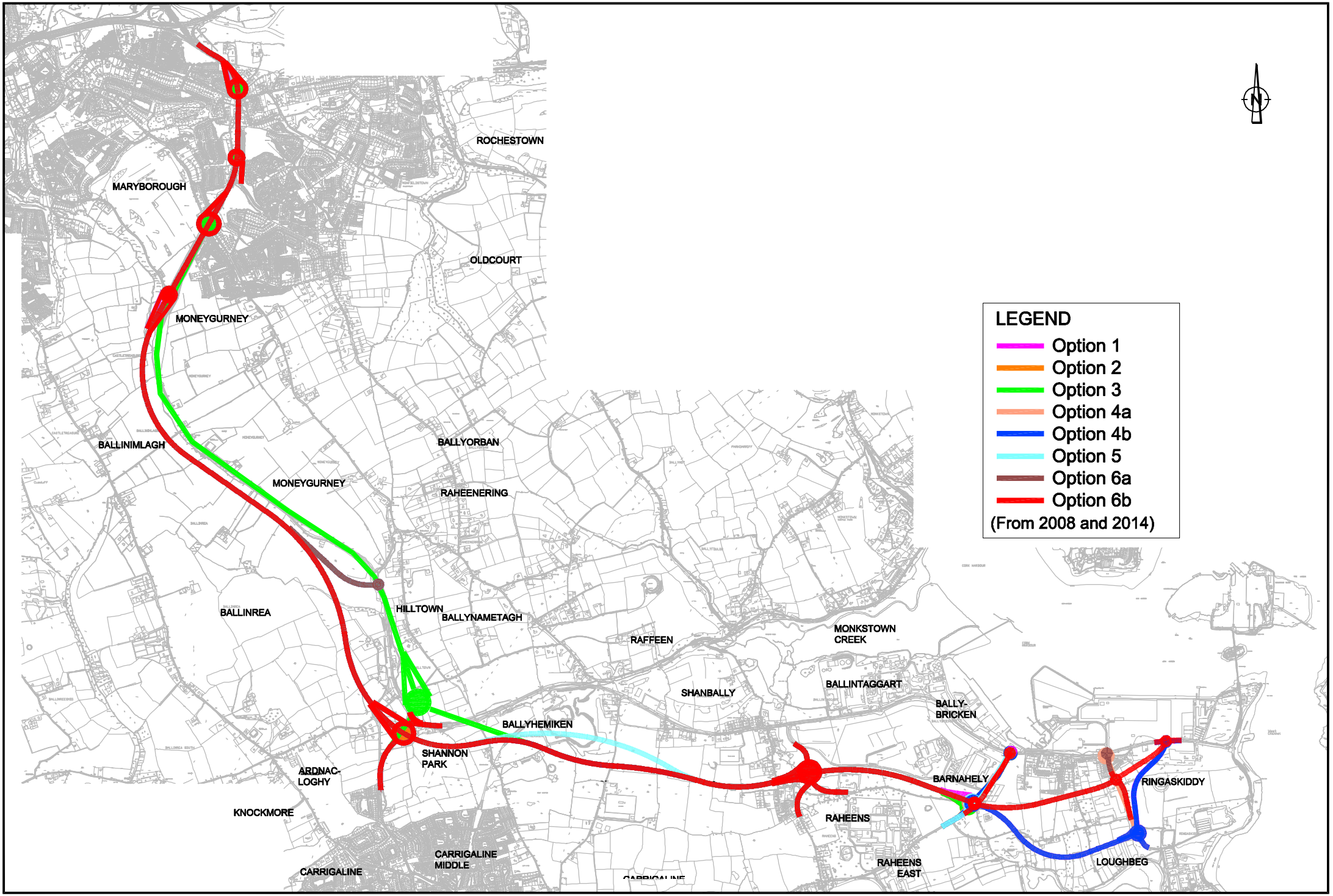


Figure 1 - N28 Route Selection Options

MCT0597SK2019

Figure 2 - Location of the Proposed Road Scheme

MCT0597SK2015

2 PROJECT DESCRIPTION

The N28 is a national primary road, which links Cork City to the village of Ringaskiddy and is situated on a peninsula located to the south-east of Cork City. The main settlements within the study area include Douglas and Rochestown at the northern extent of the proposed scheme, Carrigaline in the south and Ringaskiddy in the south east. The proposed route of the N28 Upgrade Scheme is illustrated in **Figure 2.**

A new feature of the updated scheme is the proposed addition of a service area along the route, comprising an amenity building, fuel facilities, parking and a picnic area. A service area options assessment is currently being undertaken to identify the preferred service area location. **Figure 3** illustrates the six potential service area locations. It is proposed that the preferred service area will be assessed as an integral part of the EIS.

Cork County Council proposes to upgrade the existing N28 carriageway from the Bloomfield Interchange (at the tie-in with the N40 South Ring Road) to Carr's Hill (south of Douglas), 2km approx. Thereafter, a new section of motorway, approximately 8.9 km in length, terminating at Barnahely is proposed. From Barnahely to east of Ringaskiddy village a single-carriageway cross-section is to be provided for 1.5km approx. The overall length of the proposed scheme is approximately 12.4km. The scheme also proposes the inclusion of a service area. The proposed development includes the following elements:

- Widening the existing N28 cross-section between Bloomfield and Carr's Hill;
- Construction of new off-line motorway from Carr's Hill to Barnahely;
- Construction of new off-line single-carriageway from Barnahely to east of Ringaskiddy;
- New overbridges;
- Grade-separated junctions;
- At-grade roundabouts;
- A number of retaining walls, local road improvements, parallel access roads etc.;
- Accommodation works and farm access as required;
- Landscaping and environmental mitigation measures; and
- A motorway service area including amenity building, fuel facilities, parking and a picnic area.

Figure 3 - Potential Service Area Locations

MCT0597SK2014

3 ENVIRONMENTAL IMPACT ASSESSMENT PROCESS

The EIA shall be carried out in accordance with relevant European and Irish legislation. The EIS will be prepared in accordance with the EPA Guidelines of Information to be contained in Environmental Impact Statements (2002) and EPA Advice Notes on Current Practice (2003). The general structure of the EIS is laid out in the following sections.

3.1 GUIDANCE

The EIS will be carried out in accordance with the following guidance documents:

- Service Area Policy (NRA, 2014);
- National Roads Project Management Guidelines (NRA, 2010);
- Project Appraisal Guidelines (NRA, 2010);
- Guidance from the EU Commission and DEHLG, Appropriate Assessment of Plans & Projects, Guidance for Planning Authorities (2009, Rev Feb. 2010);
- Appropriate Assessment of Plans and Projects in Ireland, Guidance for Planning Authorities (DOEHLG 2009, Rev 2010),
- Guidance document on article 6(4) of the "Habitats Directive" 92/43/EEC – Clarification of the concepts of; alternative solutions, imperative reasons of overriding public interest, compensatory measures, overall coherence, opinion of the commission; (EC, 2007);
- Interpretation Manual of European Union Habitats. Version EUR 27. (European Commission 2007);
- Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA, 2003);
- Environmental Impact Assessment of National Road Schemes, A Practical Guide (NRA, 2008);
- Guidelines on information to be contained in EIS (EPA, 2002);
- Assessment of Plans and Projects Significantly affecting Natura 200 Sites: methodological guidance on the provisions of Article 6(3) and (4) of the Habitats Directive 92/43/EEC, Office for Official Publications of the European Communities, Luxembourg (EC, 2002); and
- Managing Natura 2000 Sites: the provisions of Article 6 of the "Habitats Directive" 92/43/EEC, Office for Official Publication of the European Communities, Luxembourg (EC, 2000).

Further guidance documents will be referred to within each of the EIS Chapters and these are detailed in Section 4 below.

3.2 GENERAL STRUCTURE OF THE EIS

The following key chapters will form part of the EIS:

1. Introduction (including sections on the need for the scheme, planning context, consultation, legislative background, scheme objectives, etc.).
2. Description of Proposed Development (to include traffic and transport information and assessment).
3. Consideration of Alternatives.

4. The following Environmental Topics will be addressed:
   - Human Beings
   - Terrestrial Ecology
   - Aquatic Ecology
   - Soils, Geology and Hydrogeology
   - Water, Hydrology and Drainage
   - Air and Climatic Factors
   - Noise and Vibration
   - Landscape and Visual
   - Cultural Heritage including Archaeology and Architectural Heritage
   - Agriculture and Non-Agricultural Land Uses
5. Interrelationships of the Foregoing.
6. Summary of mitigation measures.
7. Appendices including Appropriate Assessment (AA) Screening /Natura Impact Statement (NIS).

For each environmental topic the following will be addressed as a minimum:

- Scope of Assessment;
- Methodology;
- Baseline Environment (desktop and field surveys);
- Impacts (incl. construction, operation and cumulative impacts);
- Mitigation Measures (avoidance, reduction or remedy); and
- Residual impacts.

The EIS will also include a non-technical summary which will be a condensed and easily comprehensible version of the EIS document.

3.3 APPROPRIATE ASSESSMENT

As noted above, the EIS appendices will include an AA Screening and NIS. The AA Screening has been prepared in respect of the scheme and has recommended that a Natura Impact Statement (NIS) be prepared to inform the appropriate assessment for the project. In addition to forming a standalone report which focuses on the requirements of the EU Habitats Directive the output will also be considered in the Biodiversity, Flora and Fauna chapter of the EIS.

4 ENVIRONMEMTAL SCOPE & EXISTING ENVIRONMENTAL CONSTRAINTS

Sections 4.1 to 4.12 provides an overview of the scope, key issues relevant standards and guidance and work completed to date in relation to each environmental topic to be considered in the EIS.

4.1 PLANNING CONTEXT

Scope of the EIS Chapter	The planning context of the scheme will be described within the introductory chapter of the EIS. It is proposed to review both the Strategic Policy and Statutory Development Plan contexts in respect of the proposed scheme. The policy context for the road will be set out in terms of strategic geographic based plans, strategic sectoral policy for the transport sector and EU and government policy in respect of the need for the road scheme. This will include amongst others the following plans and strategies:- ▪ Our Sustainable Future: A Framework for Sustainable Development, 2020; ▪ Planning Policy Statement 2015; ▪ National Ports Policy, 2013; ▪ NRA Service Area Policy, 2013; ▪ The Trans-European Transport Network, Regulation No 1315/2013; ▪ Infrastructure and Capital Investment 2012-2016 Medium Term Exchequer Framework; ▪ Smarter Travel "A New Transport Policy for Ireland" 2009-2020 ▪ National Development Plan 2007-2013; and ▪ National Spatial Strategy 2002 – 2020. The statutory planning context is set by and will be considered with reference to:- ▪ Cork County Development Plan 2014 - 2020; ▪ Cork City Development Plan Review, Issues Paper 2013; ▪ Carrigaline Electoral Area Local Area Plan, 2011; ▪ Regional Planning Guidelines for the South West Region 2010 – 2022; ▪ Cork City Development Plan 2009 - 2015; and ▪ Cork Area Strategic Plan and Update 2008; The planning context section of the EIS will also include a review of relevant planning history in the vicinity of the site and its immediate environs. This will primarily occur by means of studying the Planning Register, files and maps of the Planning Authority. This will identify any sensitive land uses in the area for consideration as part of the EIS.

4.2 TRAFFIC AND TRANSPORT

Scope of EIS Chapter	The traffic and transportation assessment and information on the scheme will be contained within the description of proposed development chapter of the EIS. This section of the EIS will include the following:
	▪ Present the existing conditions – observed base year traffic flows and traffic speeds in the N28 corridor.
	▪ Describe briefly the traffic growth assumptions used in the traffic modelling work, and the network changes assumed to occur in the Do-Minimum case.
	▪ Present data on forecast traffic flow and traffic speeds/delay that are likely to occur in the Do-Minimum case if the scheme is not built.
	▪ Present data on forecast traffic flow and traffic speeds/delay that are likely to occur in the Do- Scheme case if the scheme is built.
	▪ Present the principal impacts of the scheme in terms of:
	  ▪ Total net impact on traffic journey times;
	  ▪ Location and scale of changes in traffic flow and traffic congestion;
	  ▪ Changes in journey times for a sample of journeys; and
	  ▪ Note the origin-destination flows that suffer a worsening of travel times as a result of the scheme.
	▪ Identify mitigation measures as a result of impacts.
	▪ Discuss other modes of transport.
	Note: This section will not include the following;
	▪ Sensitivity tests.
	▪ Any details of model calibration, but will refer to a separate traffic modelling report.
	▪ Suggest that all forecast information is Medium growth, other than:
	  ▪ Do-Scheme flows are Low / Medium / High; and
	  ▪ Total travel time saving is Low / Medium / High.

Key Issues that will be considered in EIS Chapter	▪ Impact on N40 (in general terms). ▪ Extent to which the scheme attracts traffic into the corridor. ▪ Reductions in traffic on existing N28 through Shanbally and Ringaskiddy villages. ▪ (Where applicable) increased journey times for some local journeys. ▪ Impacts of slow moving vehicles.
Guidance Documents	▪ Traffic & Transport Assessment Guidelines (NRA, 2014); ▪ Project Appraisal Guidelines (NRA, 2010); ▪ Environmental Impact Assessment of National Road Schemes – A Practical Guide (NRA, 2008); and ▪ Guidelines on Information to be contained in an Environmental Impact Statement (EPA, 2002).
Work completed to date	▪ N28 Route Selection Report, (January 2015); and ▪ N28 Traffic Modelling Report, (in preparation).

4.3 HUMAN BEINGS

Scope of EIS Chapter	Relevant components of "Human Beings" to be considered in this section of the EIS are population profile, economic activity, social considerations and land-use. This section of the EIS will establish the current socio-economic and community characteristics through a review of the demographics of the study area, e.g., population, profile, household size, etc., as well as the availability of community facilities, recreational opportunities, etc. The chapter will then provide an assessment of the potential and predicted impacts on local communities as a result of the proposed development. An understanding of both the quantum and pattern of demography and employment in the area is of crucial importance to understanding the receiving human environment. The primary official record and analysis of demographic trends is the Central Statistics Office (CSO) Census of Population. The census records demographic information at state, county, and local levels. In this regard, the smallest geographical unit distinguished by the 2011 Census is the Electoral Division (ED). The most recent census was taken in 2011. RPS will undertake a detailed analysis of demographic trends within the study area and local and wider environs – identified by ED, in reference to the most recent (2011) census statistics. These results will then be compared with similar data recorded in the census publications of 2006 and 2002 (where relevant). This gives a ten-year profile of population and population change. Areas of analysis include:- ▪ Population numbers and change; ▪ Employment levels; ▪ Principal occupations; and ▪ Unemployment rates. The location of commercial premises within the study area will be obtained from the An Post Geodirectory. The commercial premises are mainly centred around the urban areas in the northern and southern portions of the study area. The southern portion of the study area contains high density of industrial and pharmaceutical developments. The majority of the land use within the central portion of the study area is in agricultural use which will also be assessed under community and employment within the EIS. Information on the demographic and employment characteristics of the resident population will be sourced from the Census of Population and the Live Register. Identification of sensitive communities and land uses in the vicinity of the site will be undertaken by a mix of site visits, review of aerial photography and development plan mapping. The issue of demolition, severance and loss of land will be assessed within the EIS chapters on agriculture and non-agricultural land uses but will be referred to within this chapter also. This human beings impact assessment will be carried out by way of a combination of desk-based studies and site visits and investigations.

Key Issues / Preliminary Baseline Environment	The main settlements in the study area are Ringaskiddy and Shanbally in the south east, Carrigaline to the south and Douglas / Rochestown to the north. There is also linear residential development along the existing road network within the study area. One off housing as elsewhere in Ireland is a feature of the study area. The community facilities within the study area have been identified from a review of the available mapping. In relation to amenity facilities there are three golf courses located at Douglas, Fernhill and Raffeen Creek. There are also a number of additional sports facilities within the study area including the Garryduff Sports centre, Carrigaline RFC, Douglas RFC, the sports complex utilised by Scoil Phadraig Naofa / Douglas Hall AFC, Carrigaline Hibernians and Shamrocks GAA. There is a proposal for the development of the dismantled railway line between Carrigaline and Raffeen Bridge as part of the Passage West to Carrigaline Greenway which will be considered with respect to amenities within the area. There are some minor areas of broad leaved forests in the area including the area south of Rochestown, Raffeen and adjacent to the Owenboy River west of Carrigaline which will also be considered as part of this section of the EIS. The area between Carrigaline and Ringaskiddy is a focused area for industrial development. Ringaskiddy is an important port and contains an important ferry terminal which attracts large numbers of tourists on an annual basis. Rapid industrial growth has taken place in the Ringaskiddy area in the last twenty years and the area is zoned for major growth in the future. Other development in the area includes the headquarters of the Irish Naval Service, the Ringaskiddy 'roll-on/roll-off' ferry terminal, the deep water port for Cork, the National Maritime College of Ireland, Spike Island (which now has a Masterplan) and Haulbowline Island (currently subject of a remediation project). These features will be considered as part of the EIS.
Relevant Standards and Guidance	▪ Service Area Policy (NRA, 2014) ▪ Environmental Impact Assessment of National Road Schemes, A Practical Guide (NRA, 2008); ▪ Guidelines on information to be contained in EIS (EPA, 2002); ▪ Advice Notes on Current Practice (in preparation of Environmental Impact Statements) (EPA, 2003);
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

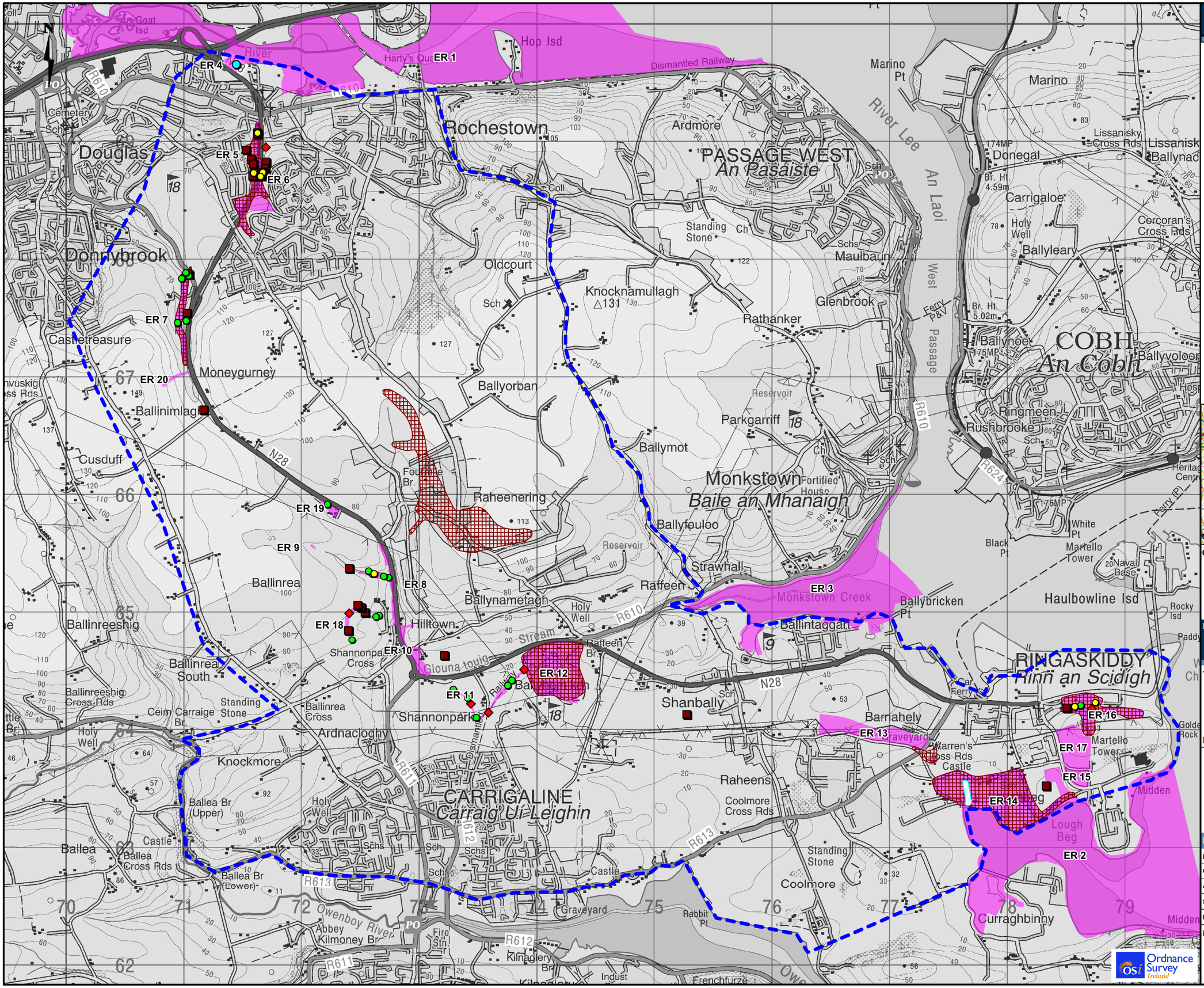
4.4 TERRESTRIAL ECOLOGY

Scope of EIS Chapter	In the preparation of this chapter of the EIS relevant information sources will be reviewed in order to establish the presence of rare or protected animal and plant species on or near the proposed road scheme. Sources that will be consulted include the National Parks and Wildlife Service (NPWS), Cork County Council, National Biodiversity Data Centre etc. EU Designated Sites (SPAs and cSACs) and nationally designated sites (pNHAs) will be identified. Potential impacts through habitat or species loss, fragmentation and severance, disturbance, deterioration of water quality and spread of invasive species to these key ecological considerations will be addressed as part of the scope of the EIS. The ecological assessment will be undertaken in accordance with the criteria for site evaluation outlined in the Guidelines for Assessment of Ecological Impacts on National Roads Schemes (NRA, 2009). Potential impacts will be identified in respect of the above listed items and mitigation measures will be specified as required. Residual and cumulative impacts will also be addressed as part of the assessment process. The statutory and non-statutory bodies outlined below will be consulted during the development of the Ecological Impact Assessment (EcIA) for the proposed N28 Cork to Ringaskiddy Upgrade Scheme. The scope of the consultation is outlined for each organization below. **National Parks and Wildlife Service (NPWS**) of Department of Arts, Heritage and the Gaeltacht (DAHG). Note: Pre-planning consultations with NPWS/DAHG related to a project will be initiated through the Development Applications Unit (DAU). ▪ Nature conservation sites within close proximity to the proposed scheme. ▪ Requirement for Appropriate Assessment. ▪ Scope of ecological surveys and proposed survey approach. ▪ Information on any protected flora and fauna records. ▪ Avoidance of potential impacts. ▪ Information/advice on any further constraints and mitigation that should be considered in the ecological impact assessment. **Inland Fisheries Ireland** ▪ Status of waterbodies crossed by the proposed scheme. ▪ Location of significant spawning areas for salmonid species. ▪ Location of significant areas for angling along the proposed scheme. ▪ Information/advice on any further constraints and mitigation that should be considered in the ecological impact assessment. ▪ Information on invasive species. **Heritage Officers/Biodiversity Officers of Cork County Council** ▪ Information on local areas of biodiversity value. ▪ Scheme/programmes for enhancement/restoration. ▪ Green linkages/networks relevant to the area. ▪ Information/advice on any further constraints and mitigation that should be considered in the ecological impact assessment. **BirdWatch Ireland** ▪ Information on species areas of importance within adjacent SPAs. ▪ Bird usage of the area. ▪ Survey data. ▪ Information/advice on any further constraints and mitigation that should be

	considered in the ecological impact assessment. **Bat Conservation Ireland** ▪ Bat species distribution records in the area. ▪ Suitability of the area for bats. **National Biodiversity Data Centre** ▪ Any relevant survey data for the area. **Cork County Bat Group** ▪ Bat species distribution records in the area. ▪ Suitability of the area for bats. **Minister for Communications, Energy and Natural Resources** ▪ Impacts to intertidal areas ▪ Formal written consultation will be undertaken with all of the groups mentioned above with follow-up contact via e-mail, telephone and / or face to face meetings if considered necessary.
Key Issues / Preliminary Baseline Environment	**Nature Conservation Areas:** Designated conservation areas are areas containing habitats or species of national or international conservation importance and include Special Areas of Conservation (SAC), Special Protection Areas (SPA) and proposed Natural Heritage Areas (pNHA). In addition, sites may be designated as statutory nature reserves and Ramsar sites. The proposed N28 Cork to Ringaskiddy Upgrade Scheme is in proximity to a number of designated areas including Loughbeg pNHA, the Douglas Estuary NHA, Cork Harbour SPA, and Loughbeg SPA. The EcIA will consider the potential for both direct and indirect impacts on these designations. The designated ecological sites within the study area are identified in below. **Rare and Protected Species:** A search was conducted for rare and protected species records held by the National Biodiversity Data Centre (downloaded from Biodiversity Maps on 22/04/14). Species protected under the EU Habitats Directive include; European Otter (*Lutra lutra*), Daubenton's Bat (*Myotis daubentonii*), Natterer's Bat (*Myotis nattereri*), Lesser Noctule (*Nyctalus leisleri*), Pipistrelle (*Pipistrellus pipistrelles*), Soprano Pipistrelle (*Pipistrellus pygmaeus*) and Brown Long-eared Bat (*Plecotus auritus*). Species protected under the Wildlife Act 1976 and Wildlife (Amendment) Act 2000, as amended include Common Frog (*Rana temporaria)*, Meadow Barley (*Hordeum secalinum)*, West European Hedgehog (*Erinaceus europaeus)*, Eurasian Badger (*Meles meles)*, Eurasian Red Squirrel (*Sciurus vulgaris)* and Eurasian Pygmy Shrew (*Sorex minutus).* Impacts to Rare and protected species will be addressed as part of the EIS. **Other Areas of Biodiversity Value:** Surveys to date have identified a number of ecological receptors (ER) with potential for habitat loss as a result of the proposed road. These include habitats such as Lower Saltmarsh and Mudflat habitats, woodland, stream and associated riparian corridor and adjacent valley slopes. The preferred route has potential to impact a number of ERs, relevant surveys are been conducted as part of the EIS to address potential impacts. **Birds:** Given the proximity of the scheme to wetlands in Cork Harbour SPA and the wetlands in Lough Beg pNHA and the presence of a feeding area for Curlew along the route further breeding and wintering bird surveys are currently being undertaken to determine the potential for impacts.

	Invasive Species: The Wildlife Acts, 1976 and 2000 contain a number of provisions relating to non-native invasive species. Ireland has also ratified a number of international conventions that oblige the Government to address the issues of non-native invasive species including the Convention on Biological Diversity, the Bern Convention and the International Plant Protection Convention. In addition, there are obligations under the EU Habitats Directive to address any threats to the conservation status of the various habitats and species listed for protection under the Directive. The 2009 EIS for the N28 Cork to Ringaskiddy Upgrade Scheme noted the presence of the invasive exotic Butterfly Bush (*Buddleja davidii*) and Travellers' joy (*Clematis vitalba*). Japanese Knotweed (*Fallopia japonica*) and Rhododendron (*Rhododendron ponticum*) have been recorded in the *Online Atlas of vascular plants 2012-2020* at Monfieldstown east of the route alignment. A survey for these species and all other non-native invasive species will be conducted as part of the ecological surveys. **Appropriate Assessment:** With regard to the SPAs in the vicinity of the proposed scheme, an Appropriate Assessment Screening has been undertaken to consider the potential for impacts on these sites, alone or in combination with other plans or projects in the area. This includes the proposed developments at Haulbowline Island and at the Port of Cork. This Appropriate Assessment Screening has recommended that a full assessment should be undertaken a Natura Impact Statement (NIS) produced. **Major Aquifers and Dependent Ecosystems:** The quarry at Ballyhemiken (John A Wood - Ballyhemiken Quarry) contains large limestone cliffs (exposed calcareous rock), a spring-fed wetland with marsh habitat and small areas of standing water. Peregrines nest on the cliffs and various waterbird species occur in the wetland. Additional surveys of the quarry and peregrine falcon have been undertaken to inform the EIS. The impact on Lough Beg wetland and groundwater features will be fully assessed and mitigation/avoidance measures to minimise the impact will be investigated with input from experts in hydrology, hydrogeology, ecology and drainage engineers.
Relevant Standards and Guidance	▪ Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009); ▪ Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008); ▪ Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008); ▪ Best Practice Guidelines for the Conservation of Bats in the Planning of National Road Schemes (NRA, 2005); ▪ A guide to habitats In Ireland. The Heritage Council, Ireland; Fossitt, J. (2000); ▪ The New Atlas of Breeding Birds in Britain and Ireland: Gibbons, D.W., Reid, J.W. & Chapman, A. (1993); ▪ Handbook of Biodiversity Methods: survey, evaluation and monitoring. Cambridge University Press, Cambridge; Hill, D, Fasham, M, Tucker, P, Shewry, M and Shaw, P (eds); ▪ Bat Mitigation Guidelines for Ireland. Irish Wildlife Manuals, No. 25. National Parks and Wildlife Service, Department of Environment, Heritage and Local Government, Dublin. Kelleher, C. & Marnell, F. (2006); ▪ The Atlas of Wintering Birds in Britain and Ireland. Lack P. (1986); ▪ New Atlas of the British & Irish Flora Oxford University Press. Preston, C.D., Pearman, D.A., & Dines, T.D. (2002); ▪ Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council. Smith, G, F, O'Donoghue, P, O'Hora, K, Delaney, E. (2011); and ▪ Bat Surveys: Best Practice Guidelines, 2nd Edition. Bat Conservation Trust, (2012).

Work Completed to Date	▪ To date RPS have undertaken constraints mapping and have fed into route selection to identify key ecological constraints and a route with the least impact on ecological receptors.
	▪ An Appropriate Assessment Screening Report has also been undertaken and has determined that a Natura Impact Assessment will be required in order to identify whether the scheme will have a significant effect on Natura 2000 sites.
	▪ The following surveys are ongoing as part of the ecology surveys to determine and evaluate the potential for impacts:
	  ▪ Wintering and breeding bird surveys (winter 2014/2015);
	  ▪ Habitat and flora mapping;
	  ▪ Mapping of invasive species;
	  ▪ Mammal surveys;
	  ▪ Bat surveys;
	  ▪ Peregrine Falcon survey in Ballyhemiken Quarry;
	  ▪ Summer barn owl surveys; and
	  ▪ Red Squirrel Survey in Bloomfield Wood.



Legend

- Study Area
- Badger Setts 2009
- Active Badger Setts 2014
- Inactive Badger Setts 2014
- Badger Signs 2014
- Otter Paths 2009 / 2014
- Otter Holt 2014
- Potential Bat Areas 2009 / 2014
- Ecological Receptors

Client: NRA National Roads Authority; Cork County Council

Project: *N28 CORK TO RINGASKIDDY UPGRADE SCHEME*

Title: **Ecological Sensitivity Map**

Figure **4**

RPS
Innishmore,
Ballincollig,
Co Cork,
Ireland
T +353 (0) 21 4665900
F +353 (0) 1 462 0814
E ireland@rpsgroup.com
W rpsgroup.com/ireland

Issue Details

Drawn by:	T Hurley	Project No.	MCT0597
Checked by:	A. Fitzgerald	File Ref.	MCT0597MI0069A01
Approved by:	L Barry		
Scale:	N.T.S.	Drawing No.	MI0069
Date:	July 2014	Rev.	A01

Notes
1. This drawing is the property of RPS Group Ltd. It is a confidential document and must not be copied, used, or its contents divulged without prior written consent.
2. All levels are referred to Ordnance Datum, Malin Head.
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4.5 AQUATIC ECOLOGY

Scope of EIS Chapter	The scope of the aquatic surveys to be completed as part of the EIS will include: ▪ Desktop study: A thorough search of available information pertaining to the development will be carried out in addition to email/phone consultations with relevant authorities, in particular the National Parks and Wildlife Service, Inland Fisheries Ireland and the Environmental Protection Agency. The surface water features of the study area and associated freshwater catchments will be identified, together with freshwater aspects of sensitivity. Relevant environmental protection legislation including EU directives and national regulations will be consulted as appropriate e.g. Water Framework Directive and Habitats Directive. The desk study will also influence the selection of survey locations. This will include review of any pertinent engineering reports associated with the development; ▪ Baseline aquatic ecological and fisheries habitat survey within selected watercourses to assess ecological status of the affected areas will be carried out. This will include surveys of macroinvertebrates, macroalgae, macrophytes, fisheries habitat, protected species habitat potential and presence/absence (e.g. white clawed crayfish and freshwater pearl mussel), together with physical features recording and physico-chemical parameter measurements on site (pH, dissolved oxygen, conductivity, and total dissolved solids). Protected species, invasive species and any other features of note related to aquatic ecology, and bankside terrestrial invasive species will be noted. ▪ Assessment of potential direct, indirect and cumulative impacts of the proposed development on aquatic species and habitats. ▪ Recommend mitigation measures in the design, construction, operation and maintenance of the new N28 road route and the N28 Service station. This information will allow the study team to: ▪ Characterise the ecological status of each of the sub-catchments using desktop information in combination with survey data i.e. water quality indices based on (i) benthic macroinvertebrates – Q-value; (ii) site descriptions and morphological characteristics, (iii) records of aquatic flora with cover value estimates for main groups and (iv) records of protected aquatic flora and fauna and other species of note; ▪ Provide site descriptions including riparian zone of watercourses to a suitable distance; ▪ Assess the suitability of the stream habitats for fish, salmonids in particular; ▪ Analyse the basic water chemistry parameters including pH, conductivity, and dissolved oxygen to broadly characterise the streams, using handheld equipment; ▪ Classify the freshwater habitats in terms of local, regional and national importance (e.g., SAC status, rare and/or protected species, significance of aquatic plant/animal communities); ▪ Determine potential impacts on freshwater habitats, and the potential effects on established ecological values, and ▪ Determine site vulnerabilities and recommendations for site-specific mitigation / management that will reduce potential impacts to watercourses. As part of the EIS, any potential impacts to watercourses will be avoided where possible and mitigation (e.g., design of culverts in consultation with the IFI) will be provided where impacts are unavoidable.

Key Issues / Preliminary Baseline Environment	A number of watercourses will also potentially be impacted by the proposed scheme including: ▪ The Woodbrook Stream (EPA Name Rochestown 19); ▪ The Donnybrook Stream (EPA Name Moneygurney 19); and ▪ Glounatouig Stream (EPA Name Hilltown 19). The two Natura 2000 sites within a 15km buffer of the study area, Cork Harbour SPA and Great Island Channel SAC, hold no freshwater aquatic features of interest. However, the study area does comprise of rivers and stream which flow into Lough Mahon and Monkstown Creek. Depositing/lowland river of local importance are characteristic of the study area. The Donnybrook and Woodbrook stream drain the northern section of the route while the Glounatoiug stream drains the southern extents of the route (Glounatouig Stream (EPA Stream Name: Hilltown 19), the Donnybrook Stream (EPA Stream Name: Moneygurney 19) and the Woodbrook Stream (EPA Stream Name: Rochestown 19). There are no Freshwater Pearl Mussel interests in the study area.
Relevant Standards and Guidance	▪ Guidelines for Assessment of Ecological Impacts of National Road Schemes (NRA, 2009); ▪ Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008); ▪ Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes (NRA, 2008); ▪ A guide to habitats In Ireland. The Heritage Council, Ireland; Fossitt, J. (2000); ▪ Handbook of Biodiversity Methods: survey, evaluation and monitoring. Cambridge University Press, Cambridge; Hill, D, Fasham, M, Tucker, P, Shewry, M and Shaw, P (eds); ▪ New Atlas of the British & Irish Flora Oxford University Press. Preston, C.D., Pearman, D.A., & Dines, T.D. (2002); and ▪ Best Practice Guidance for Habitat Survey and Mapping. The Heritage Council. Smith, G, F, O'Donoghue, P, O'Hora, K, Delaney, E. (2011);
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

4.6 SOILS, GEOLOGY AND HYDROGEOLOGY

Scope of EIS Chapter	In this chapter of the EIS it is proposed to assess the potential impacts arising from the proposed development on soils, geology and hydrogeology together with recommendations for mitigation measures to reduce or eliminate any significant negative impacts identified. An assessment of the residual impact, which will remain assuming that the recommended mitigation measures are fully and successfully implemented, will also be undertaken. This assessment will be based on site investigation data provided by the Engineering Team and will primarily include a review of site investigations surveys, geophysical surveys, hydrodynamic surveys, walk over survey and existing baseline data on the GSI database. A summary of the impacts will be presented in tabular format for each of the geological and hydrogeological attributes. Some preliminary desk top information has been gathered with respect to geology, aquifer classification and vulnerability which is set out below and will be used to inform the detailed assessment of the proposal. The following sources will be referenced in the preparation of this section of the EIS: ▪ Ordnance survey maps ▪ Aerial photography ▪ Soils maps (Teagasc; GSI). ▪ Geological maps (GSI). ▪ GSI Databases (Wells, Karst, Landslides, Quarries & Aggregate Resources). ▪ Groundwater Protection Scheme: aquifer classification and likely vulnerability. ▪ Review of available geotechnical data including GSI data base and any additional site investigation data for the scheme. ▪ Areas identified by the Geological Survey of Ireland as a Geological Heritage Area, proposed heritage area or as a county geological site will be identified. ▪ Identify any areas of Special Environmental Designation which may be impacted upon by geological or hydrogeological features. ▪ Identify active and former quarries. ▪ Identify potential areas of soft ground. ▪ Identify groundwater fed public water supply schemes served by springs or boreholes. ▪ Identify areas served by private wells.
Key Issues / Preliminary Baseline Environment	▪ No significant areas of soft ground such as marsh or peat have been identified within the study area. There is one area of marine / estuarine silts and clays in the areas to the west of Curraghbinny which have been included as a constraint. ▪ A number of karst features have been identified and in addition there is potential for karst features to develop in the areas of limestone bedrock in particular in the area underlain by the Waulsortian Limestone Formation. ▪ There are two quarries within the study area indicated by the GSI database. There is one quarry located at Raffeen named Ballyhemiken quarry, north of Strawhall on the eastern edge of the study area. There is also a quarry at Coolmore in the south of the study area. Both these sites represent a constraint. There are also a number of historic quarries and sand and gravel pits in the area which will be considered as part of this assessment. There is one geological heritage area located within the constraints study area which relates to the coastal section from Golden Rock to Lough Beg.

	▪ The GSI database does not indicate any source protection zones within the study area. There are no public water supply schemes in the area sourced from groundwater. There is potential for industrial supplies and domestic and farm supplies to be served by private wells. These would have to be identified and confirmed through a well survey. This will be carried out at EIS stage. The areas likely to be served by private wells have been based on the comparison of the known extent of the water mains to properties identified from the An Post Geodirectory. As the area is well served by water mains this is not likely to be a significant constraint. ▪ There is potential for presence of karst features to be intersected and in particular the Waulsortian Limestone Formation has the potential for development of karst. A significant portion of the study area has an extreme vulnerability rating with rock at or close to the surface and these areas would be more vulnerable to pollution from road runoff than the high vulnerability areas. A number of springs have been identified in the study area south of Rochestown, in the area near Monkstown Creek and close to the reservoir north west of Raffeen. The potential for associated impacts on ecology is discussed in Sections 4.4 and 4.5 above which relate to Terrestrial and Aquatic Ecology.
These will be Assessed as part of the EIS	▪ Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2008); and ▪ Geology in Environmental Impact Statements – A Guide (2002).
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

4.7 WATER, HYDROLOGY AND DRAINAGE

Scope of the EIS	The Water, hydrology and drainage chapter of the EIS will assess the potential impacts arising from the proposed development on surface water, hydrology, flooding and drainage. Mitigation measures will be recommended to reduce or eliminate any significant negative impacts identified. An assessment of the residual impact, which will remain assuming that the recommended mitigation measures are fully and successfully implemented, will also be undertaken. A summary of the impacts will be presented in tabular format for each of the hydrological attributes. Some preliminary desk top information has been gathered with respect to existing water bodies, areas with environmental designations and flooding history which is set out below and will be used to inform the detailed assessment of the scheme. The following sources will be referenced in the preparation of this section of the EIS: ▪ Ordnance survey maps; ▪ Aerial photography; ▪ EPA ENvision mapping; ▪ The Office of Public Works Flood Hazard Mapping; and ▪ OPW Hydro-data mapping.
Key Issues / Preliminary Baseline Environment	The hydrological constraints relate to the potential number of stream crossings that would be required in the vicinity of stream channels. The study area is located in the South Western River Basin District. The study area is located within Hydrometric Area 19 Lee, Cork Harbour and Youghal Bay and includes two river catchments these being:- ▪ Tramore Coastal River Catchment IE19_06; and ▪ Owenboy River Catchment IE19_05. There are also a number of smaller streams within the study area including:- ▪ The Glounatouig Stream (EPA Name - Hilltown 19) which flows in a north to south direction between Fourmile Bridge and Shannonpark Cross from where it flows in an east to west direction towards Raffeen before discharging to the Monkstown Creek. ▪ The Donnybrook Stream (EPA Name – Moneygurney 19) which drains the area at Castletreasure and Cusduff and flows northwards through Donnybrook and Douglas and discharges into the Douglas River. ▪ The Hop Island Stream (EPA Name – Hop Island) which occurs in the north east area, along the boundary of the study area, where it flows in a northerly direction and discharges to Lough Mahon. ▪ The Woodbrook Stream (EPA Name – Rochestown 19) which occurs in the north west corner of the study area and discharges to Lough Mahon. ▪ While the South Ballinrea (EPA Name – South Ballinrea) is located in the west of the study area and discharges to the Owenboy. A review of the Office of Public Works (OPW) Flood Maps (www.floodmaps.ie) indicates flooding in a number of areas: Raffeen NGR W743 656, Ballinrea NGR W726 645, Shanbally W759 640, Shannonpark W726 644 and Shanbally NGR W760 639. Based on the topography of the study area, higher runoff is expected from the higher ground in the northern part of the study area. Due to the flatter nature of the ground in the southern and south eastern portion of the study area and the more permeable nature of the bedrock runoff is lower with a higher proportion of recharge taking place to groundwater as evidenced by the lack of surface water features.

Relevant Standards and Guidance	▪ Guidelines on Procedures for Assessment and Treatment of Geology, Hydrology and Hydrogeology for National Road Schemes (NRA, 2008); ▪ The SuDs Manual C697 (CIRIA, 2007); and ▪ The Water Framework Directive 2000/60/EC (WFD).
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

4.8 AIR AND CLIMATIC FACTORS

Scope of EIS Chapter	The proposed methodology for assessing impacts to air will be based on a desktop assessment of EPA National Air Quality Monitoring Database and a local baseline assessment using a series of diffusion tubes around the road network of the proposed road. RPS will also document the existing air quality sources of the area (i.e., traffic). In addition RPS will identify the key environmental receptors including areas of residential housing, schools, hospitals, places of worship, sports centres and shopping areas, i.e. locations where members of the public are likely to be regularly present in the area. A number of residents have put forward their properties as potential monitoring locations as a result of public consultation days. These properties are currently being considered as monitoring locations. The main potential for impacts on air quality and climate from the scheme during the operational phase is from road traffic-derived pollution. Impacts as a result of the traffic alterations associated with the scheme will be assessed using the techniques outlined in the Local Air Quality Management Technical Guidance LAQM.TG (09). During the construction stage it anticipated that air quality impacts will be of limited duration and will be primarily from dust during the construction works and construction traffic. The potential impacts are likely to be limited to within 50m of the proposed works and within 20m of the proposed haul routes. Hazardous chemical or biological agents are not likely to be present which could become airborne during the proposed works. Locations with a high sensitivity to fugitive emissions of PM_{10} and NOx include hospitals, hi-tech industries, painting, furnishing and food processing facilities. Locations classed as being moderately sensitive to such pollutants include schools, residential areas and food retailers. Designated habitats are also potentially sensitive receptors and such sites within 2km of the study area should be considered as part of the assessment. The potential for impacts on the above receptors will be assessed further at the EIS Stage. The significant air quality and climate impacts will be assessed for the scheme. The current National Air Quality Objectives will be used as the reference criteria to determine the potential impacts. Where applicable, a series of mitigation measures will be presented. The Air Framework Directive deals with each Member State in terms of Zones and Agglomerations. For Ireland, four zones, A, B, C and D are defined in the Air Quality Regulations (2002). The main areas defined in each zone are: Zone A (Dublin Conurbation), Zone B (Cork Conurbation), Zone C (other named cities and large towns) and Zone D (Rural Ireland, i.e., the remainder of the State excluding Zones A, B and C). The study area is located within the EPA Zone B and the current air quality at Cork is considered good[2]. In order to identify potential impacts with respect to air and climate the high growth traffic growth scenario will be assessed to ensure a worst case assessment.
Key Issues / Preliminary Baseline Environment	The main potential source of air quality impacts from the proposed road will be related to potential traffic related emissions and dust during construction. The main potential for impacts on air quality and climate from the scheme during the operational phase is from road traffic-derived pollution.

[2] Source: http://www.epa.ie/air/quality/

Relevant Standards and Guidance	▪ Local Air Quality Management Technical Guidance LAQM.TG (09); ▪ Design Manual for Roads and Bridges (DMRB) screening air quality model; and ▪ Guidelines for the Treatment of Air Quality during the Planning and Construction of National Road Schemes (NRA, May 2011).
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

4.9 NOISE AND VIBRATION

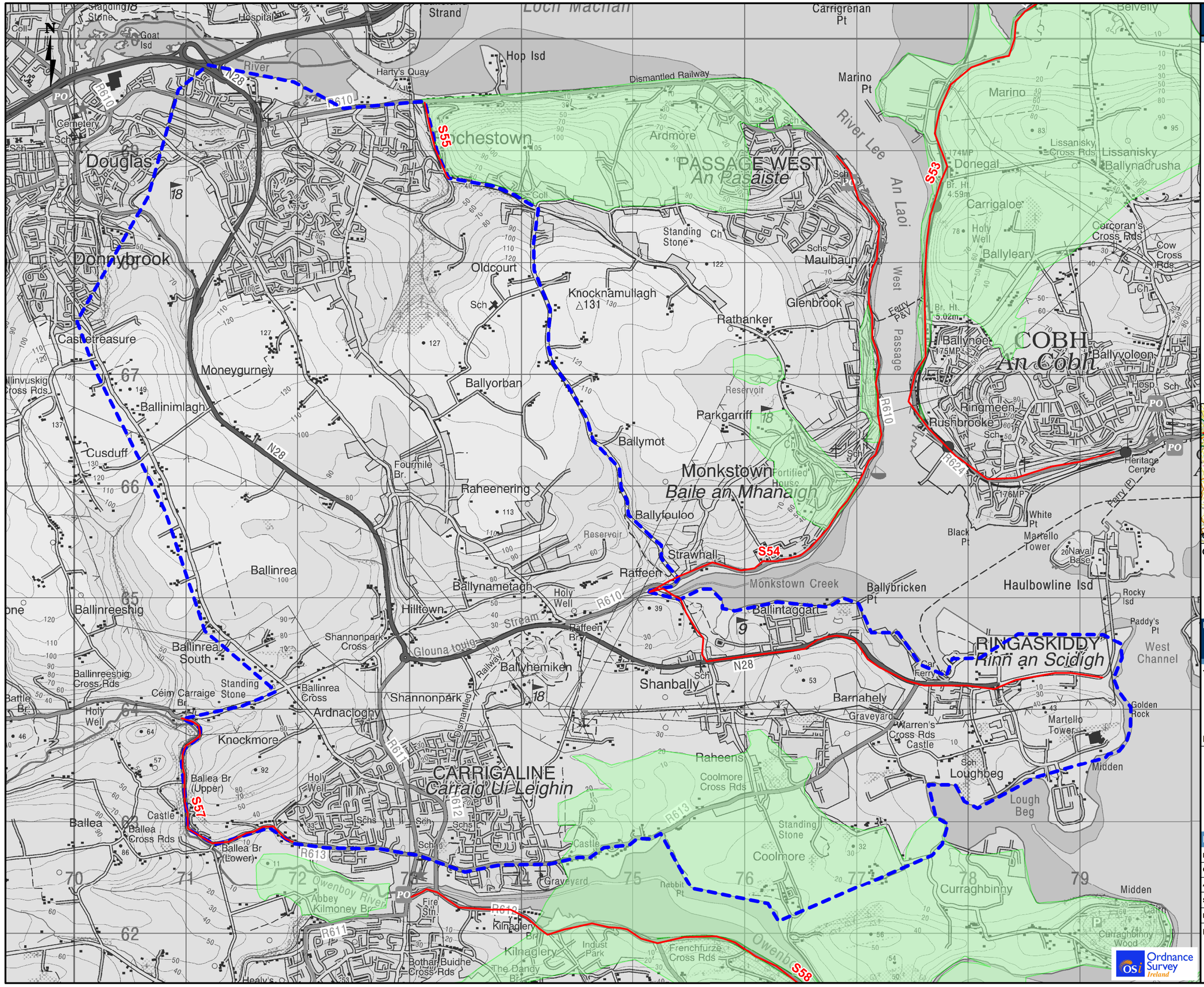
Scope of EIS Chapter	The impacts from noise and vibration will depend on the proximity of sensitive receivers to the construction works associated with the proposed scheme. It is therefore proposed to undertake noise monitoring as part of the assessment process for this chapter of the EIS. The main potential source of noise and vibration impacts from the scheme will be from potential traffic related emissions. The potential for impacts from construction associated machinery required during the construction stage will also be assessed. The Noise Action Plan for Cork identifies two high priority areas within the study area. One of these areas is located on the existing N28 and the other on the R611 at Carrigaline. Both of these areas will be taken into consideration in this assessment. It is proposed to undertake an attended baseline survey of noise levels in the receiving environment and at the boundary of the site during normal operating hours. Specifically, it is proposed that a survey be performed in accordance with ISO 1996-1:2003 - Description and Measurement of Environmental Noise. Measurements will be made using the shortened measurement procedure as described in the Calculation of Road Traffic Noise (CRTN) 1988. All measurements will be taken using Type 1 Precision Digital Sound Level Meters and associated hardware. The meter will be calibrated before and after each round of surveying to ensure that no unacceptable deviation from the standard calibration occurred during the measurement period and that results presented are reliable and accurate. The calibration certificate of the relevant equipment to be utilised during the survey will be provided with the final report as standard best practice. A total of 3 sets of 15-minute measurements will be taken at each location on a cyclical basis to obtain a representative measure of ambient noise levels in the area. The impacts of noise will be separately assessed for their impact on the nearest noise sensitive location and then combined to give a cumulative indicator of the likely noise impacts on the nearest noise sensitive locations. The impact assessment will take account of noise emissions related to the operation of the scheme; however this will primarily be related to traffic associated with the scheme. Where applicable, a series of noise propagation calculations will be performed to determine the quantitative impact of any site sources. This chapter will detail the results of baseline survey and impact assessments. The high traffic growth scenario will be assessed to ensure a worst case assessment in respect of noise impacts.
Key Issues / Preliminary Baseline Environment	Due to the presence of residential and commercial dwellings along the scheme it is likely that some properties will experience a change in noise level generated by the proposed works during the construction and operational stages. The main potential source of noise and vibration impacts from the scheme will be from potential traffic related emissions. The potential for impacts from construction associated machinery required during the construction stage will also be assessed. The Noise Action Plan for Cork identifies two high priority areas within the study area. One of these areas is located on the existing N28 and the other on the R611 at Carrigaline. Both will be taken into consideration in the assessment.
Relevant Standards and Guidance	▪ Guidelines for the Treatment of Noise and Vibration in National Road Schemes (NRA, 2004); ▪ ISO 1996-1:2003 - Description and Measurement of Environmental Noise; ▪ The Calculation of Road Traffic Noise (CRTN) 1988; ▪ UK Department of Transport Document 'Calculation of Road Traffic Noise' CRTN' 1988; and

	▪ British Standard BS5228:2009 Noise and Vibration Control on Construction and Open Sites.
Work Completed to date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

4.10 LANDSCAPE AND VISUAL

Scope of EIS Chapter	The EIS Landscape and visual impact assessment will be undertaken through site survey, analysis of up to date maps and aerial photography in conjunction with detailed plans and sections of the proposed development. The landscape will be appraised to allow it to be described and classified into landscape character areas which enable the categorisation of landscape quality. The proposed development is then applied to this baseline and potential landscape impacts recorded. The visual envelope for the proposed development will be identified on the visual envelope maps which outline the areas of land from which there is a view of any part of the proposal. By this method the visual impact of the proposal can be determined allowing the location of affected properties, recreation areas and sensitive receptors etc. to be recorded. Where significant landscape and visual impacts have been predicted suitable mitigation measures will be proposed.
Key Issues / Preliminary Baseline Environment	There are 3 no. scenic routes located within the study area as identified in **Figure 5** below. Scenic Route S55 is located on the northern boundary of the study area while Scenic Route S57 is located in the south west corner of the study area. A portion of Scenic Route S54 passes through the study area. Scenic Route S58 south of Carrigaline is located outside of the study area. The landscape character type of the northern portion of the study area is composed of Cork City Harbour & Estuary as identified in **Figure 5** below. The area between Moneygourney to Hilltown area is mapped as Broad Fertile Lowland Valley. The southern area, in the area south of the existing N28 as far east as Shanbally is mapped as Indented Estuarine Coast. The landscape character areas as outlined in the 2014-2020 County Development Plan and are as follows:- ▪ River Bride West (27) – broad shallow patchwork valley; ▪ Cork City & Harbour (19) city estuary harbour and island complex; and ▪ Crosshaven (45) incised patchwork and wooded estuary with mudflat islands. This route is located within Landscape Type 1 City Harbour and Estuary with the main features of land cover being Cork Harbour and Great Island. Within this landscape type both the Landscape Value and Landscape Sensitivity are classed as very high while the Landscape Importance is classed as being National. The overall landscape value is described as very high. The key characteristics of land use in the area are described as industry, residential, amenity, maritime, commercial and agricultural. The 2014-2020 County Development Plan also indicates that the study area is located within a High Value Landscape area which is specified as an area which is of county or national importance. The 2014 Cork County Development Plan states (Objective GI 7-2: Scenic Routes) that it is an objective to *"protect the character of those views and prospects obtainable from scenic routes and in particular stretches of scenic routes that have very special views and prospects identified in this plan".*

	In addition, Objective GI 7-3: Development on Scenic Routes, *"require those seeking to carry out development in the environs of a scenic route and / or an area with important views and prospects, to demonstrate that there will be no adverse obstruction or degradation of the views towards and from vulnerable landscape features. In such areas the appropriateness of the design, site layout, and landscaping of the proposed development must be demonstrated along with mitigation measures to prevent significant alterations to the appearance or character of the area.* The proposed N28 route avoids potential impacts on the woodlands at Lough Beg and the steep slope at Ringaskiddy north of Martello Tower. It also avoids direct impacts on Fernhill Golf and Country Club.
Relevant Standards and Guidance	▪ A Guide to Landscape Treatments for National Road Schemes in Ireland (NRA, 2006); and ▪ Guidelines on the Implementation of Landscape Treatments on National Road Schemes In Ireland (NRA, 2011).
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).



Legend

- Study Area
- Scenic Route
- Scenic Landscape

Client: NRA National Roads Authority; Cork County Council

Project: **N28 CORK TO RINGASKIDDY UPGRADE SCHEME**

Title: **Scenic Routes and Scenic Landscapes**

Figure **5**

RPS
Innishmore,
Ballincollig,
Co Cork,
Ireland
T +353 (0) 21 4665900
F +353 (0) 1 462 0814
E ireland@rpsgroup.com
W rpsgroup.com/ireland

Issue Details

Drawn by:	JPM	Project No.	MCT0597
Checked by:	A. Fitzgerald	File Ref.	MCT0597MI0071A01
Approved by:	L Barry		
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Date:	June 2014	Rev.	A01

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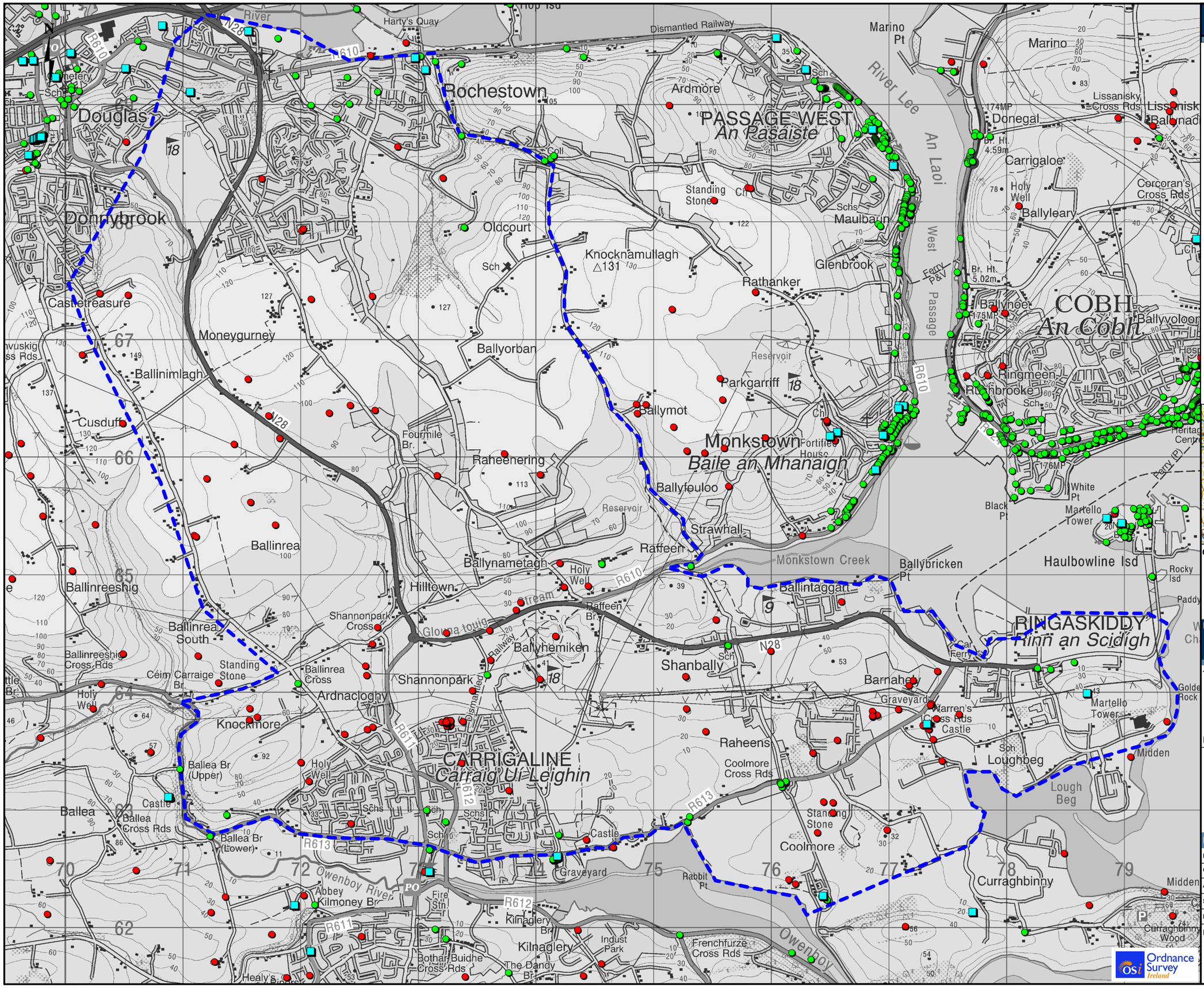
4.11 CULTURAL HERITAGE INCLUDING ARCHAEOLOGY AND ARCHITECTURAL HERITAGE

Scope of EIS Chapter	In accordance with the NRA guidance the following data sources have been consulted and will be reviewed on an ongoing basis throughout the EIS stage:- ▪ National Monuments identified by DAHG ▪ Record of Monuments and Places (RMP); ▪ Archaeological Inventory of County Cork Vol. II – East and South Cork; ▪ Cork County Development Plan 2014 and the Record of Protected Structures; and ▪ National Inventory of Architectural Heritage (NIAH) Building and Garden Survey. In order to carry out the cultural heritage section of the EIS, a review of existing documentation and supplementary research and field survey will take place where necessary in order to evaluate the archaeological constraints in terms of avoidance and mitigation measures. This approach will involve review of the following documentation: ▪ Archaeological Assessment of sub-route options for the N28 in the vicinity of Castle Warren, Barnahely (2004); ▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); ▪ Archaeological Assessment of the N28 at Barnahely – Geophysical Survey Report – ArchaeoPhysica Ltd., November 2005); and ▪ A report on the Archaeological Testing carried out at Castle Warren, Barnahely, (2004). In addition aerial photography and field surveys of the route will be carried out in order to inform the cultural heritage assessment. The reporting will take into account the following: ▪ Description of existing environment ▪ Review of key aspects of the heritage of the area ▪ Review of sensitivity/vulnerability of each of the key aspects ▪ Impact and Mitigation measures. Consultation will take place throughout the process with the Project Archaeologist, design team, other sub-consultants, Cork County Council and statutory authorities. All findings will be communicated in a timely and accurate manner.
Key Issues / Preliminary Baseline Environment	The study area is rich in archaeological heritage with archaeological sites ranging from ringforts, tower houses, fulacht fia (cooking areas), possible standing stones and holy wells (**Figure 6**). A total of 96 no. recorded monuments from various periods have been identified within the study area. There are 39 no. NIAH sites, 10 no. protected structures and 3 no. architectural conservation areas located within the study area. All recorded archaeological sites, their setting and visual amenities have been considered as cultural heritage constraints during the route selection phase and have been avoided where possible. The proposed road scheme passes through the former demesne grounds of Castle Warren a protected structure (RPS 01260) which incorporates the remains of the late 18th century country house, as well as those of the medieval tower house and bawn (RMP CO087-052001-004). The route also has potential to impact on a prehistoric enclosure site identified by geophysical survey in 2004 c 260m northeast of Castle Warren. Archaeological testing of this enclosure will be undertaken in February / March 2015 in order to inform the cultural heritage chapter of the EIS.

Relevant Standards and Guidance	▪ Guidelines for the Assessment of Architectural Heritage and National Road Schemes (NRA, 2005); ▪ Guidelines for the Assessment of Archaeological Heritage Impact of National Road Schemes (NRA, 2005);
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Archaeological Assessment of sub-route options for the N28 in the vicinity of Castle Warren, Barnahely, (2004); ▪ A report on the Archaeological Testing carried out at Castle Warren, Barnahely, (Ken Hanley, 2004). ▪ Archaeological Assessment of the N28 at Barnahely – Geophysical Survey Report – ArchaeoPhysica Ltd, (November 2005). ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (Cork County Council, 2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).



Legend

- Study Area
- National Inventory of Architectural Heritage (NIAH)
- Record of Monuments and Places (RMP)
- Record of Protected Structures 2009 (RPS)

Client

National Roads Authority
An tÚdarás um Bóithre Náisiúnta

Cork County Council

Project

N28 CORK TO RINGASKIDDY UPGRADE SCHEME

Title

Archaeological & Architectural Heritage

Figure **6**

RPS

Innishmore,
Ballincollig,
Co Cork,
Ireland

T +353 (0) 21 4665900
F +353 (0) 1 462 0814
E ireland@rpsgroup.com
W rpsgroup.com/ireland

Issue Details

Drawn by:	JPM	Project No.	MCT0597
Checked by:	A. Fitzgerald	File Ref.	MCT0597MI0070A01
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Notes

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4.12 AGRICULTURE AND NON AGRICULTURAL LAND USES

Scope of EIS Chapter	This section of the EIS will assess the significant effects upon agricultural and non-agricultural properties as a direct result of the proposed scheme in terms of demolition, severance and loss of land. As such these properties fall into four categories: ▪ Agricultural; ▪ Non Agricultural; ▪ Commercial; and ▪ Residential. This assessment will be based on review of the latest aerial photography, the current status of the properties affected by the proposed scheme. The report will be largely based on desk top study examining the extent of the proposed CPO fenceline and observations made on site. Impacts will be rated as not significant, minor, moderate, major or severe in accordance with the general criteria used for overall impact assessment outlined in the EPA Advice Notes on Current Practice (2003).
Key Issues / Preliminary Baseline Environment	The study area contains largely agricultural lands adjoining the proposed route corridor. However there is linear residential development along the existing road network within the study area. Urban areas lie adjacent to the route at Rochestown, Rafeen, Shanbally and Ringaskiddy. There are a number of commercial facilities including industry as well as community facilities and sports facilities within the vicinity of the proposed route which will be considered. Potential impact on agricultural and non-agricultural properties due to the demolition, severance and loss of land as a result of the proposed road scheme will be assessed as part of the EIS.
Relevant Standards and Guidance	▪ National Roads Project Management Guidelines (NRA, 2010); ▪ Project Appraisal Guidelines (NRA, 2010); ▪ Environmental Impact Assessment of National Road Schemes, A Practical Guide (NRA, 2008); ▪ Advice Notes on Current Practice (EPA, 2003); and ▪ Guidelines on information to be contained in EIS (EPA, 2002);
Work Completed to Date	▪ Draft N28 Cork to Ringaskiddy Constraints Report (2002); ▪ Draft N28 Cork to Ringaskiddy Route Selection Report (2005); ▪ Draft N28 Bloomfield to Ringaskiddy Improvement Addendum to Route Selection Report (2008); ▪ Draft N28 Bloomfield to Ringaskiddy Road Improvement Scheme: Environmental Impact Assessment (2009); and ▪ N28 Route Selection Report, (January 2015).

5 NEXT STEPS

5.1 CONSULTATION

The following consultees will be consulted for the purposes of this scoping process:

- The Minister for the Environment, Heritage and Local Government;
- The Minister for Transport;
- The National Tourism Development Authority – Failte Ireland;
- An Taisce – the National Trust for Ireland;
- An Comhairle Ealaion (The Arts Council);
- The Heritage Council;
- Cork City Council;
- Minister for Communications, Energy and Natural Resources;
- Inland Fisheries Ireland;
- Development Applications Unit (National Parks and Wildlife Service, National Monuments Service and Department of Arts, Heritage & Gaeltacht)
- Southwestern River Basin District;
- Bord Gáis Networks (Gas Networks);
- BirdWatch Ireland;
- Bat Conservation Ireland;
- National Biodiversity Data Centre;
- Cork County Bat Group;
- Irish Rail;
- Office of Public Works;
- Badgerwatch Ireland;
- ESB Networks;
- Geological Survey of Ireland;
- Health and Safety Authority; and
- Environmental Protection Agency.

Scoping is a dynamic process and is expected to continue throughout the EIA process, up to the publication of the EIS.

Table 1 below demonstrates the anticipated timescales for the project.

Table 1 - Next Steps

EIA Phase	Month
Informal EIS Scoping	February/March 2015
Publication of EIS and Motorway Order	April 2015

We would welcome comment and feedback in relation to the scope of this EIS by Friday 20th March 2015 (4 weeks from date of issue).

Please send comments and feedback to:

Joy Barry,
RPS Group
Innishmore,
Ballincollig,
Co. Cork,
Ireland.
Tel: **+353 (0) 21 466 5900**
Direct: **+353 (0) 21 4665963**
Email: **joy.barry@rpsgroup.com**

www: **www.rpsgroup.com/ireland**

M28 Cork to Ringaskiddy Motorway Scheme Health Study

Scoping Statement





Quality Management

Prepared by:	Tara Barratt BSc, MSc, DIC.	Assistant Environmental Consultant		17/02/2017
Reviewed & checked by:	Andrew Buroni PhD, MSc, BSc, FRSM	Associate		17/02/2017
	Aileen Fitzgerald BSc, DipHS, MSc	Associate		17/02/2017
Authorised by:	Andrew Buroni PhD, MSc, BSc, FRSM	Associate		17/02/2017
Date of issue:	27 February 2017		**Revision number:**	Rev3
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0	04/01/17	Draft	-	-
1	16/01/17	Draft		
2	24/01/17	Draft		
3	27/02/17	Final		

Contents

Tables, Figures and Appendices

Tables

Figures

1 Introduction

Background

1.1 RPS has been commissioned to carry out a Health Study (hereafter referred to as the Health Study) for the M28 Cork to Ringaskiddy Motorway Scheme in County Cork, Ireland.

1.2 The objective of the Health Study is to draw upon technical outputs supplied as part of the regulatory assessment in order to investigate, address and respond to community health concerns that may be raised during the consultation process. The final Health Study report will be provided as a key supporting document to gain planning consent and will be incorporated into the EIS where appropriate.

1.3 This Scoping Statement presents the draft scope and focus of the Health Study to be completed; we are seeking the input of Environmental Health Professionals for their review and comment. The final Scoping Statement will be appended to the final Health Study report, cataloguing the scoping process; defining the agreed aim, objectives and process; and will form the basis of any subsequent peer review.

1.4 The remaining sections within the Scoping Statement comprise the following:-

- Introduction: outlining the aims and objectives of the Health Study;
- Project Overview: describing the location of the development, and what will be included as part of the proposed Motorway Scheme construction and operation phases; and
- Approach and Methodology: outlining the structure of the final report, how the systematic delivery of the study will be carried out and the key health pathways to be assessed.

1.5 The following sections provide a brief introduction to what the Health Study will entail; outlining the agreed approach, process and methodology; listing the key health pathways to be investigated, and providing commentary on the core outputs to be delivered.

1.6 Responses and comments should be returned to aileen.fitzgerald@rpsgroup.com during the week commencing 20th March 2017.

2 Complimentary Health Study

Introduction

2.1 The Health Study will be undertaken by Dr Andrew Buroni with key inputs from the air, noise and socio-economic experts undertaking the relevant impact assessments for the EIS.

2.2 Andrew is a Fellow of the Royal Society of Medicine, a Fellow of the Royal Society for Public Health; is a temporary advisor to the World Health Organisation (WHO); a Framework HIA advisor to Public Health England; and holds a PhD in international Health Impact Assessment (HIA) methods and best practice.

Aim and Objective

2.3 The Health Study is designed to identify and assess the potential health and wellbeing effects (both adverse and beneficial) of the proposed project on the surrounding area, and to deliver evidence based recommendations that maximise health gains and reduce or remove potentially negative impacts or inequalities. In addition, the Health Study aims to address concerns raised by the local population regarding health.

2.4 Addressing health concerns is now common practice and is further reinforced through the Revised EIA Directive that will be transposed throughout EU Member States by May 2017, placing a greater emphasis upon scoping “population and human health” issues with statutory consultees through the regulatory assessment process.

2.5 The main principle of this Health Study is one of health protection, promotion and care, and provides both a structure and sufficient flexibility to explore, assess and address tangible and intangible health pathways which are important to maintaining good health, quality of life and wellbeing through planning.

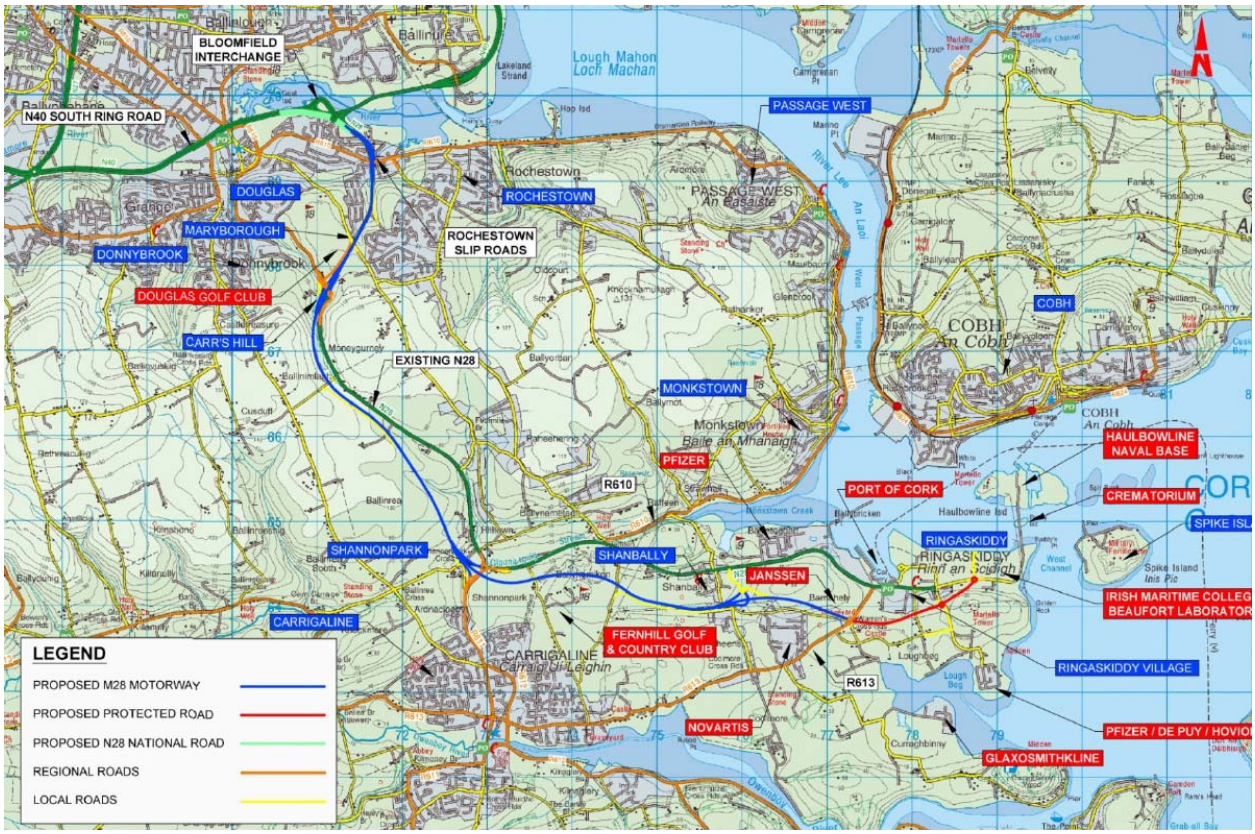
3 Project Overview

Location of Development

3.1 The proposed M28 Cork to Ringaskiddy Motorway Scheme is a motorway route from the interchange with the N40 (Bloomfield Interchange) to the R613 Carrigaline to Ringaskiddy road at Barnahely. From Barnahely, the proposed scheme consists of a single carriageway national road, N28 which will link to the east side of Ringaskiddy village. It is proposed that this link will be a protected road as defined under the Roads Act and will be designated 'Clearway' in order to meet TEN-T requirements for the Core road network. Together, the proposed M28 motorway and the N28 single carriageway national road will form the TEN-T route to the port complex at Ringaskiddy.

3.2 The proposed upgrade is substantially on-line between Bloomfield and Carr's Hill. South of Carr's Hill the route runs on the western side of the existing N28 to Shannonpark where it veers to an easterly direction, staying south of the existing road as far as the R613 at Barnahely. From there, traffic would continue either along the R613 toward the existing N28 and the western entrance to the port, or along the new single carriageway running immediately south of Ringaskiddy village to a proposed new eastern entrance to the port. The route of the proposed M28 motorway is shown in **Figure 3.1.**

Figure 3.1: Location of the proposed M28 motorway in addition to current roads.



Project Description

3.3 The M28 Motorway Scheme will address the existing problems with the N28 and wider road network in the area. The following issues include:-

- The N28 caters for all types of transportation demand;
- Accident risk from weaving movements along the single carriageway/lack of overtaking opportunities;
- Traffic volumes in excess of capacity and resultant congestion during peak travel times;
- Sub-standard diverge at Mount Oval and merge at Maryborough Hill;
- Frequent delays and collisions, capacity of Shannonpark roundabout exceeded especially during peak hours;
- Limitations of the existing route constraining sustainable growth in the Strategic Employment Zone and development of the Port of Cork facilities at Ringaskiddy; and
- Severance in the villages of Shanbally and Ringaskiddy.

3.4 The M28 Motorway Scheme will not only consist of the development of the new motorway, but will also include realignment of numerous side roads along the N28. The construction of the M28 Motorway Scheme will take significant volumes of traffic from the existing N28, providing better conditions for pedestrians and cyclists. In addition, there will be construction of a Motorway Service Area (MSA) within the Port of Cork lands at Ringaskiddy.

3.5 It is anticipated that the construction period of the proposed M28 Motorway Scheme will take between 24–30 months.

3.6 Lands surrounding the location of the proposed M28 Motorway Scheme are predominately rural in nature at the southern end with scattered residential dwellings with the exception of Shanbally and Ringaskiddy Villages. Land at the northern section comprises areas of higher residential density at Rochestown, Maryborough Hill and Douglas.

3.7 There will be direct and indirect job creation throughout the entire construction phase. It is anticipated that construction of the M28 Motorway Scheme will provide employment for up to 100 people while the construction of the adjoining MSA will provide further employment for up to 50 people. Requirements for local accommodation will depend on the contractor and the level to which local labour is employed.

3.8 The operation phase will supply indirect job creation through improved access and economic growth which the development will provide to the industrial area at Ringaskiddy which is designated a Strategic Employment Zone.

4 Approach and Methodology

Approach

4.1 The delivery of the Health Study is set on a broad socio-economic model of health that encompasses conventional health impacts such as communicable disease, accidents and risk along with wider determinants of health which are considered vital to achieving good health and well-being.

4.2 A key aspect of the Health Study will be to integrate with and build upon the process and technical outputs from the EIA process including, for example: baseline and assessment findings from the socio-economic, noise and vibration and air quality assessment disciplines. Such an approach will enable consistency between the Health Study and the Environmental Impact Statement (EIS, the written output of the Environmental Impact Assessment (EIA) process), and will prevent repetition of effort and ensure a solid basis to the assessment.

4.3 The final Health Study will be delivered as a supplementary document to inform the decision making process, but will also be applied as a resource to address and manage a range of local community health concerns.

Aim and Objectives

4.4 The overarching aim of the Health Study is to facilitate more health conscientious planning and decision making which will be achieved through the delivery of the following:

- profiling and communicating local community circumstance, existing burdens of poor health and relative sensitivity to inform planning and form the founding platform of the Health Study and its recommendations;
- quantifying the magnitude, distribution and likelihood of potential health outcomes (both adverse and beneficial);
- informing planning, the development of mitigation and strategy to minimise impacts and support the delivery of local health objectives and priorities;
- the development of a document suitable for submission as a supplementary planning document; and
- development of appropriate mitigation measures, including complementary mitigation and support initiatives to address potential risks, community disruption, health concerns and needs, and to facilitate the uptake of local health benefits.

Methodology

Scoping Exercise

4.5 Scoping is the preliminary stage, providing Environmental health professionals the opportunity to comment upon and influence the scope and focus of the study.

Health Pathways to be assessed

4.6 The key health pathways identified and to be assessed within the Health Study are listed in **Table 4.1.**

Table 4.1: Key health pathways for the proposed M28 Motorway Scheme for the construction and operation phases

Feature	Health Pathway	Health Determinant	Distribution
Construction Phase	Changes to local air quality (potential dust nuisance)	Environment	Local
	Changes in noise exposure	Environment	Local
	Changes in local transport nature and flow rates	Transport	Local/Regional
	Increased direct, indirect and induced employment opportunities	Socio-economic	Regional
Operation Phase	Changes to local air quality	Environment	Local/Regional
	Changes in noise exposure	Environment	Local
	Changes in local transport nature and flow rates	Transport	Local/Regional
	Increased direct, indirect and induced employment opportunities	Socio-economic	Regional

Assessment

4.7 The Health Study will build upon results of other technical EIA discipline outputs to be carried out for the proposed Motorway Scheme. This will ensure that the Health Study considers all the potential impacts to health that could result from implementation of the development proposals, based on realistic changes in environmental conditions that could potentially occur as a result of construction and operation activities.

4.8 The main technical disciplines which are expected to provide the basis against which the potential impacts to health and well-being both directly and indirectly can be evaluated include Air Quality, Noise and Vibration, Socio-economic and Traffic and Transport.

4.9 The assessment will seek to address each of the core health pathways identified and the community perceived risks received. As a minimum the assessment will consider the following health pathways within the assessment:

- quantitative exposure response modelling for changes in PM_{10}, $PM_{2.5}$ and NO_2 exposure during construction and operation (quantifying changes in life expectancy and local cardiovascular and respiratory hospital admissions);
- quantitative risk assessment from changes in construction and operational road traffic movements (risk of collisions directly attributed to the proposed development), disruption and community severance; and
- qualitative appraisal as to community disruption, annoyance and potential health outcome from changes in construction and operational noise.

Results, Recommendations and Conclusion

4.10 The results will be presented alongside the assessment section of the Health Study. Following this, conclusions and appropriate recommendations will be made to enhance or mitigate the expected results depending on if the health pathway is expected to be adverse or beneficial. These measures will be incorporated into the EIS as necessary.

APPENDIX 1C: HEALTH STUDY

M28 Cork to Ringaskiddy Project

Health Study



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Quality Management

Prepared by:	Tara Barratt MSc, DIC, BSc	Assistant Environmental Consultant		03/05/2017
Reviewed & checked by:	Andrew Buroni PhD, MSc, BSc, FRSM	Associate		03/05/2017
	Aileen Fitzgerald MSc, BSc, DiP	Associate		03/05/2017
Authorised by:	Andrew Buroni PhD, MSc, BSc, FRSM	Associate		10/05/2017
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0	17/02/17	Draft	First Draft Review	-
1	11/04/17	Draft	Receipt of Technical Inputs	-
2	03/05/17	Draft	Review	-
3	05/05/17	Draft	Receipt of Technical Inputs	
4	10/05/17	Final	Final Comments from Legal	

Executive Summary

Overview

A health study has been commissioned to draw from, supplement and interpret the findings of the technical assessments within the EIS. The outputs of the health study have been applied to further inform the decision making process and associated mitigation measures for Environmental Impact Assessment.

Construction of the proposed road project presents a number of potential health pathways. However, taking into account the level of emissions (air and noise) generated on-site, their intermittent nature/duration and minimal opportunity for community exposure, the risk to community health is not of a level to quantify any measurable adverse health outcome, and be further managed through the mitigation measures set out in the EIA approval process.

Once operational, the proposed road project is inherently designed to address a range of existing environmental and safety issues along the existing road network; will improve capacity and reduce congestion, and more importantly from a health perspective, will reduce residential exposure to air quality and noise over and above what can be achieved through the Do Minimum scenario.

In addition, the proposed road project is designed to improve connectivity between residential areas and strategic employment areas, and is key to the sustainable development of both, while further displacing existing and forecasted traffic away from villages, thereby creating indirect opportunities for urban renewal and improvement.

A review of potential health hazards demonstrates that the proposed project is designed to address existing hazards, offering a net reduction in community exposure from emissions to air and noise and improving road safety over and above what can be achieved through the alternative of ‘no change’ to the road. In addition, the proposed road project seeks to address congestion, improve connectivity between residential and employment areas, while further displacing traffic from existing villages and supporting sustainable development.

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Tables, Figures and Appendices

Tables

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1 Introduction

Background

1.1 Cork County Council (CCC), on behalf of the National Roads Authority (NRA), [known for operational purposes as Transport Infrastructure Ireland (TII)] is seeking approval for the M28 Cork to Ringaskiddy Project (hereafter referred to as the "proposed road project") in County Cork. The proposed road project is intended to support sustainable development by improving connectivity between current residential areas and the Strategic Employment Area of Ringaskiddy, and to address a number of existing problems on the existing N28 and wider road network in the area, including:

- road safety and accident risk;
- existing noise issues;
- traffic volumes in excess of capacity and resultant congestion during peak travel times;
- sub-standard divergence at Mount Oval and merge at Maryborough Hill;
- capacity of Shannonpark roundabout exceeded especially during peak hours;
- limitations of the existing route constraining sustainable growth in the Strategic Employment Area, International Development Agency (IDA) lands and development of the Port of Cork facilities (Phase 3) at Ringaskiddy; and
- severance of Shanbally and Ringaskiddy villages.

1.2 Once complete, the M28 is central to wider strategic development, regeneration and sustainable development to improve connectivity to education, employment and amenities; and to support population growth.

1.3 A health study has been prepared to further explore where any aspect of the proposed road project has the potential to impact upon local community health (both adverse and beneficial).

1.4 The approach of the study is set on a broad multidisciplinary model of health that encompasses conventional health impacts such as communicable disease, accidents and risk (EPA, 2016), along with wider determinants of health (IPH, 2011) important to achieving good health and well-being.

1.5 The study reviews the technical outputs of the EIS and their mitigation to establish any potential hazard directly attributable to what is proposed, contrasted against a Do Minimum scenario (i.e. no road change); and further considers local circumstance to establish any potential change in risk between the two scenarios.

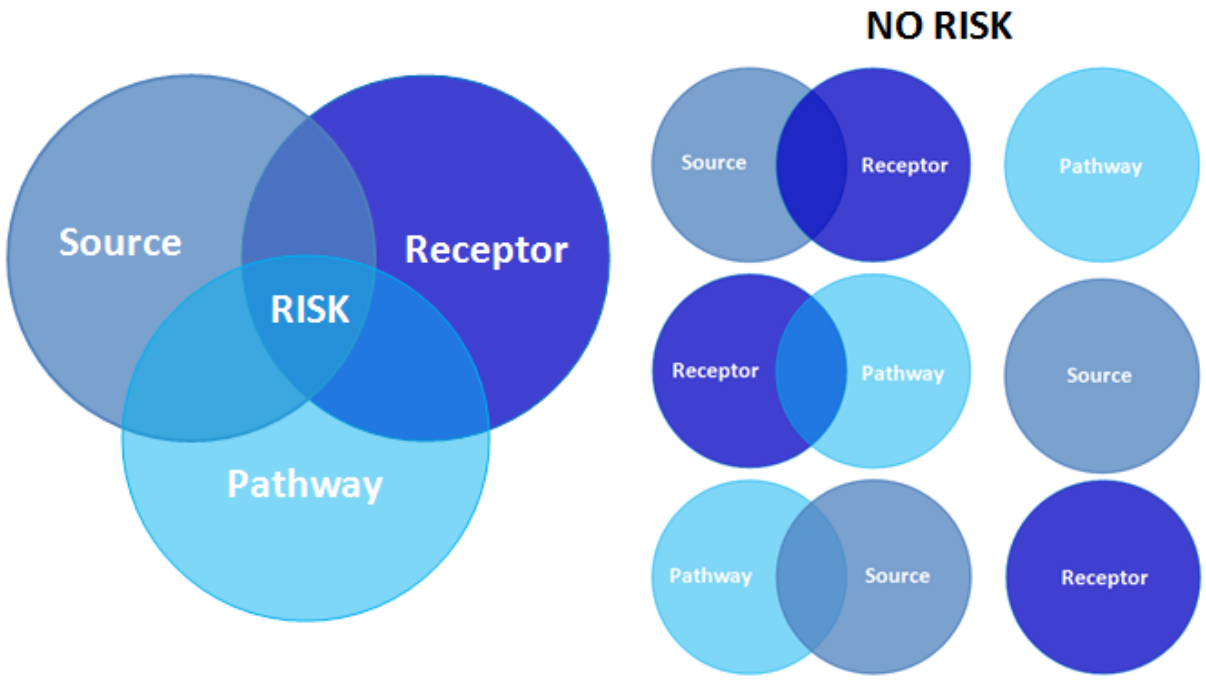
1.6 A common factor associated with many community health concerns, is a misunderstanding of the terms hazard and risk, and how they are addressed through planning in Ireland through avoidance and mitigation.

1.7 In its simplest form, a hazard is any agent with the potential to cause harm, and a risk is the likelihood of harm occurring.

1.8 As shown in **Figure 1.1,** a hazard by itself does not constitute a risk; it is only when there is a hazard source, a receptor (i.e. a person or population) and a pathway of exposure connecting the two that there is any potential for risk to health:

- A “source” is when a hazardous substance or activity is present;
- A “pathway” is a potential route for the hazardous substance or activity to come into contact with a receptor where it could cause harm; and
- A “receptor” is a person, population or environment where the hazard could result in harm.

Figure 1.1: Assessing Risk through the Source-Pathway-Receptor Concept



1.9 Where a credible source-pathway-receptor linkage exists, the study considers the nature of the specific hazard source, and the change in concentration of exposure to establish what that potential change in risk between the two scenarios is.

1.10 However, it is important to note that the potential hazards associated with transport projects are well known, understood, and are inherently addressed through the regulatory assessment process set to be protective of health. However, due to the multidisciplinary nature of health, they are structured into individual technical disciplines with their own legislative requirements, polices and guidance.

1.11 For clarity, the EIS includes the following:

- Chapter 5: Traffic and Transportation: is a pathway that investigates the impact of changes in transport flow and nature upon local road networks, safety, public access and community severance.
- **Chapter 7**: Socio-economic: is a pathway that investigates the potential impact upon income, employment, housing and wider determinants of health important to social, mental and physical health;
- **Chapter 8**: Agricultural Land Uses: is a pathway establishing the interaction of communities with the area, important to social, mental and physical health;
- **Chapter 9**: Hydrology & Drainage: is a pathway investigating the risk of flooding and potential impacts on water quality and public water supplies from construction and operation.
- **Chapter 10**: Aquatic Ecology: is a pathway that investigates the potential impact to local aquatic fauna, flora, surface water quality and areas of conservational value for current and future communities.
- **Chapter 11**: Soils, Geology & Hydrogeology: is a pathway that investigates the potential impacts on soil and groundwater quality, and public water supplies during construction and operation.
- **Chapter 12**: Terrestrial Ecology: is a health pathway that investigates the potential impact to local terrestrial fauna, flora and areas of conservational value for current and future communities.
- **Chapter 13**: Air and Climatic Factors: is a pathway which investigates construction and operational emissions to air.
- **Chapter 14**: Noise and Vibration: is a pathway which investigates the potential impact of construction and operational noise upon the environment.
- **Chapter 15**: Cultural Heritage (including Archaeology and Architectural Heritage): is a pathway that investigates the potential impact upon local heritage important to wellbeing at a national, regional and local level.
- **Chapter 16**: Landscape and Visual: is a pathway that investigates the potential impact upon visual amenity.
- **Chapter 17**: Material Assets is a pathway which investigates the potential impact of construction and operational waste generated by the project upon the environment.

1.12 This study draws from and expands upon the EIS outputs to improve the consultation process, and form an overarching health conclusion.

Aim and Objectives

1.13 The overarching aim of the study is to:

- review community health concerns;
- establish local circumstance, relative sensitivity and needs through a review of the demographic data collated and reported upon in the Socio-economic Assessment within the EIS, supplemented by available health data; and
- consider and assess potential health outcomes (both adverse and beneficial) directly attributable to the proposed road project contrasted against a do minimum scenario (i.e. no road change).

2 Project Profile

Overview

2.1 For the sake of brevity, the study does not seek to repeat the full project description of the proposed road development. For further details of the proposed road project, please refer to **Chapter 3 Description of the Proposed Road Development** of the EIS.

Project Description

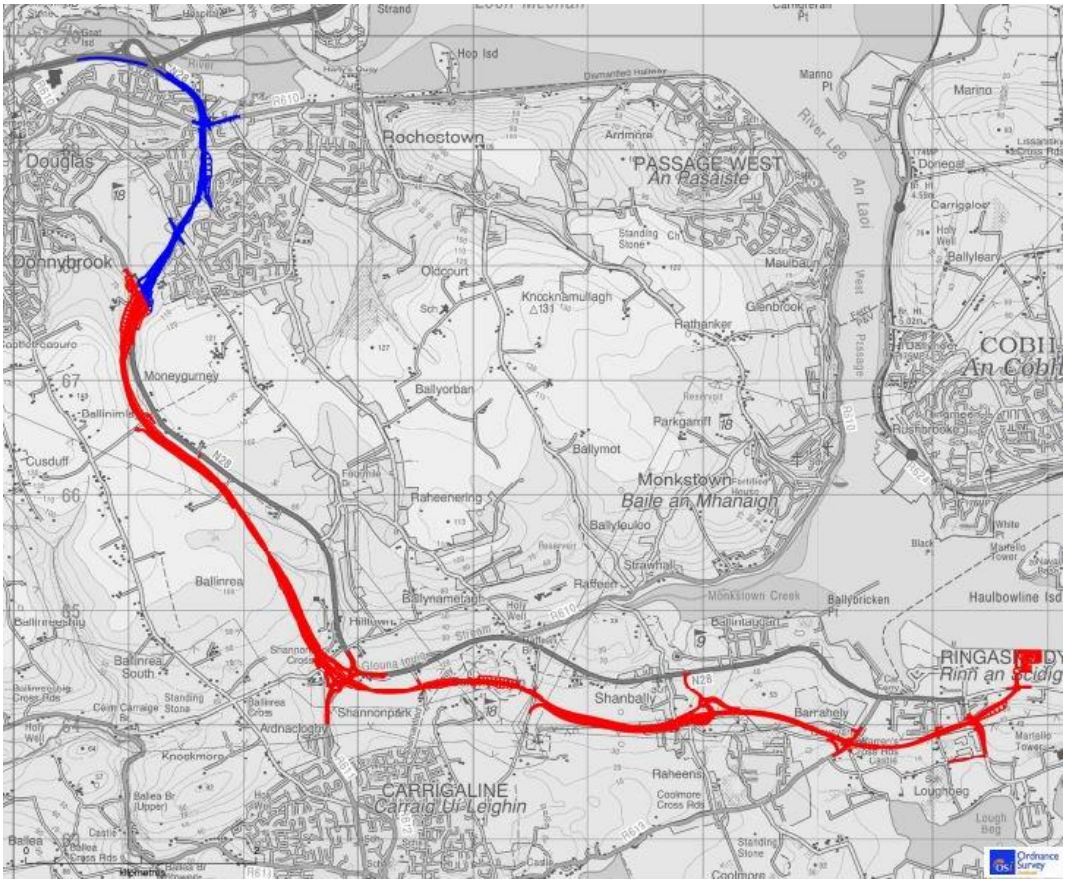
2.2 The proposed road project will upgrade the N28 National Primary Route from the N28/N40 South Ring Road Bloomfield Junction to Ringaskiddy on the Ringaskiddy Peninsula in County Cork, Ireland.

2.3 As shown in **Figure 2.1**, works undertaken will primarily consist of the construction, operation and maintenance of 10.9 kilometres of dual carriageway motorway from the N40 Bloomfield Interchange to Barnahely, 1.5 kilometres of single carriageway protected[1] road from Barnahely to the eastern side of Ringaskiddy and a Service Area (SA) at the Port of Cork Facility at Ringaskiddy. The proposed road project will improve access to and from the Strategic Employment Area of Ringaskiddy, will serve as a direct connection to Cork City, and is designed to address a number of existing problems on the existing N28 and wider road network in the area.

2.4 The first two kilometres will be an online upgrade (as depicted in Red on **Figure 2.1**), while the remainder of the proposed road will be offline (depicted as Blue on **Figure 2.1**) below.

[1]No access points other than designated junctions will be permitted to this road.

Figure 2.1: Overview of the Proposed Road Project



Key: Blue (Section 1), Red (Section 2)

Site Location and Setting

2.5 The land surrounding the offline section of the proposed road project is predominantly rural in nature comprising of scattered residential dwellings. The northern online section, which primarily involves widening of the existing M28 route, will maintain its position surrounded by areas of higher residential density at Rochestown, Maryborough Hill and Douglas. Additionally, the southern section of the proposed road project runs parallel to, and is set back from the villages of Shanbally and Ringaskiddy which are located along the existing N28 route.

2.6 The Electoral Divisions (ED) surrounding the proposed road project making up the study area comprise: Douglas, Carrigaline, Monkstown Rural, and Monkstown Urban. The majority of commercial activity in Ringaskiddy and the surrounding area is predominantly pharmaceutical, IDA and port related.

Construction Phase

Construction Activities

2.7 Construction activities will include: clearance, demolition, compounding, stockpiling, hauling of material, blasting, and rock breaking and the use of a variety of equipment including excavators, rock breakers, generators, concrete mixers, lifting equipment, compressors, pumps, lighting, and dumper trucks. There will be vehicular movements to and from the site.

2.8 The proposed road project will involve a landtake of approximately 130 ha and a number of properties, This is described in detail in the EIS in particular **Chapter 3**, together with the measures to avoid, reduce and remedy any significant adverse effects as described in the individual chapters and summarised in **Chapter 19** of the EIS.

Health Pathways

2.9 A health pathway can be described as the way in which an activity influences a known determinant of health. A health pathway is identified when such influences have the opportunity to impact on communities with the potential to cause a positive or negative health outcome (IPH, 2017). The identification of potential health pathways helps to define and rationalise the scope of the assessment, from which it is possible to develop an appropriate evidence base and an informed community profile. The distribution, magnitude and significance of potential health pathways are then investigated within the assessment section of this study.

2.10 **Table 2.1** outlines the health pathways associated with the construction and operation of the proposed road, further defining the scope and focus of this study.

Table 2.1: Key Health Pathways

Feature	Health Pathway	Health Determinant	Distribution
Construction Phase	Changes to local air quality (including potential dust nuisance)	Environment / Quality of Life	Local
	Changes in noise exposure	Environment / Quality of Life	Local
	Changes in local transport nature and flow rates	Transport / Environment	Local/Regional
	Increased direct, indirect and induced employment opportunities	Socio-economic	Regional
	Displacement	Social	Local
Operation Phase	Changes to local air quality	Environment / Quality of Life	Local/Regional
	Changes in noise exposure	Environment / Quality of Life	Local
	Changes in local transport nature and flow rates	Transport / Environment / Social	Local/Regional
	Increased direct, indirect and induced employment opportunities	Socio-economic	Local/Regional
	Change in quality of the urban environment	Social / Quality of Life	Local

3 Community Profile

Introduction

3.1 Different communities express varying sensitivities to health outcomes (both adverse and beneficial) as a consequence of relative socio-economic status, deprivation, and existing health burden. A community profile not only provides a means to establish changes in community exposure to certain health pathways, but also provides a means to further interpret the distribution and significance of potential health outcomes associated with the proposed road.

3.2 The community profile draws from and builds upon the baseline information within the EIS socio-economic assessment (**Chapter 7**), providing an overview of local health circumstance, contrasted against regional and national trends.

Demography

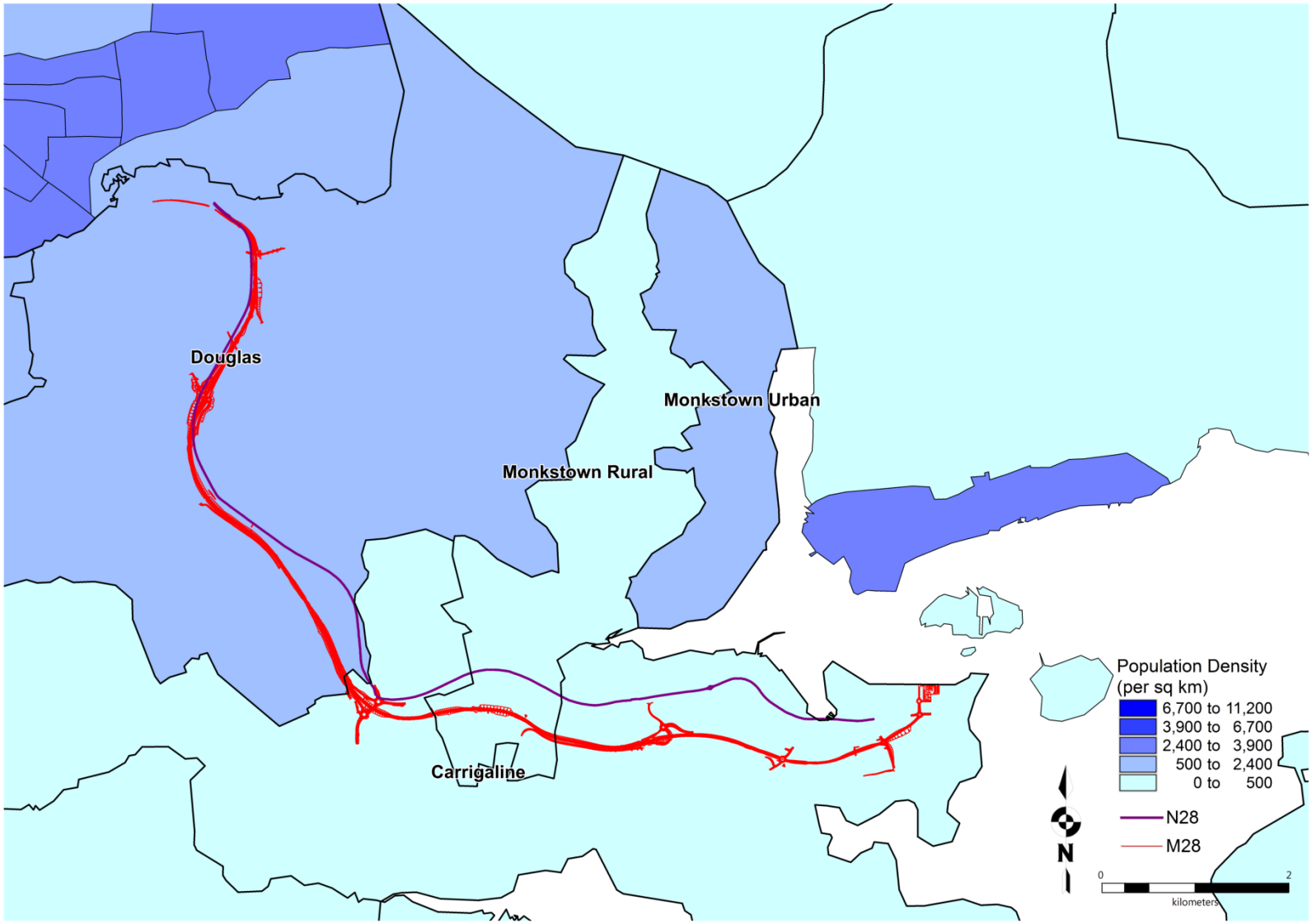
Population Size and Density

3.3 As shown in **Table 3.1** and **Figure 3.1**, the average population density of the study area is typically higher than both the county and national averages, with the highest population density located along the on-line section through Monkstown Urban, and declines thereafter.

Table 3.1: Area Size, Population and Calculated Population Density

Area	Area Size (sq. km)	Population (2016)	Population Density (per sq. km)
Carrigaline	25.56	12,111	473
Douglas	27.74	20,913	754
Monkstown Rural	7.24	1,083	150
Monkstown Urban	4.03	5,234	1,299
Study Area All	77.77	39,341	506
County Cork	7,500	542,196	72
Ireland	70,273	4,757,976	68
Source: (All-Island Research Observatory, n.d.)			

Figure 3.1: Population Density

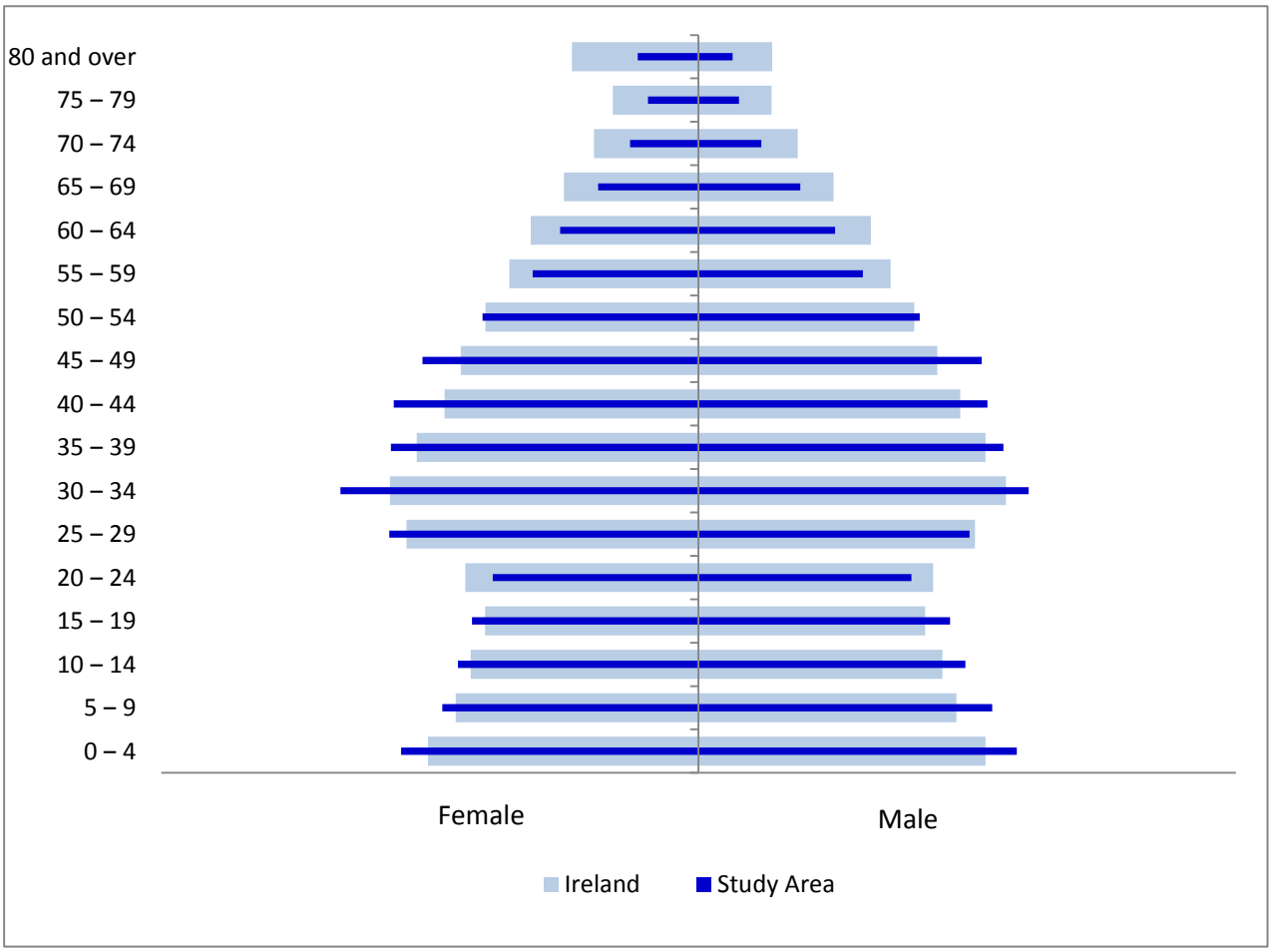


Population Structure

Age

3.4 As shown in **Figure 3.2**, the study area has a lower proportion of 20-24 year old and 55-80+ year olds when compared to the national average. Overall, the study area displays a younger population compared to the national average.

Figure 3.2: Study Area Age Structure



Source: (CSO, 2011)

3.5 The Ringaskiddy area is designated as a Strategic Employment Area in the Cork County Development Plan, 2014, and has the largest direct investment employment centre in Ireland outside the Greater Dublin area. When considering relative population density, it is clear that a high proportion of the current working age population within the study area are commuters, and that effective transport is critical to regional sustainable development (in terms of economic and residential growth areas).

3.6 Within County Cork, approximately 76% of the population drive to work in a car or van compared to the national average of 66% (CSO, 2016). When considering population growth and increased life expectancy, demand is likely to increase, as will the strategic economic importance of Ringaskiddy at a local, regional and national level.

Ethnicity

3.7 As shown in **Table 3.2**, national statistics suggests a relatively low ethnic diversity, similar to the national trend. The majority of those who live in the study area are 'White Irish' (ranging from 85% to 88%) compared to the county and national averages of 86% and 87% respectively.

Table 3.2: Ethnicity

Area	White Irish	White Irish Traveller	Other White	Black or Black Irish	Asian or Asian Irish	Other	Not Stated
Carrigaline	85	0	11	2	1	1	1
Douglas	86	0	9	1	2	1	1
Monkstown Rural	88	0	11	1	1	0	0
Monkstown Urban	85	0	10	2	1	1	1
Study Area All	84	0	10	2	2	1	1
County Cork	86	0	9	1	1	1	1
Ireland	87	1	7	1	1	1	2
Source: (CSO, 2011) C0501							

Population Growth

3.8 As shown in **Table 3.3**, while there has been exceptional population growth within County Cork (+35.6%), with the exception of Monkstown Rural, population growth within the study area has remained lower than the national average.

Table 3.3: Population Change

Area	Population (2011)	Population (2016)	Population Change (%)
Carrigaline	11,818	12,111	2.5
Douglas	20,397	20,913	2.5
Monkstown Rural	1,007	1,083	7.5
Monkstown Urban	5,122	5,234	2.2
Study Area All	38,344	39,341	2.6
County Cork	399,805	542,196	35.6
Ireland	4,574,888	4,757,976	4.0
Source: CD115 (CSO, 2016)			

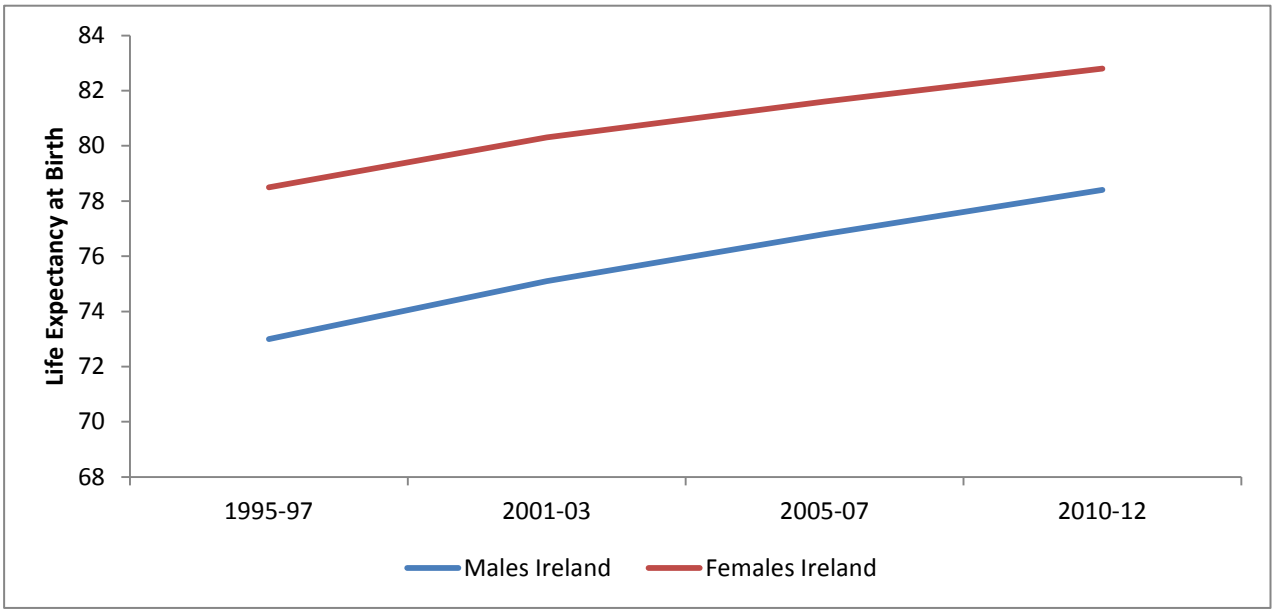
3.9 This again suggests a highly mobile population, and the need to develop sustainable links between residential and employment areas.

Existing Health Status

Life Expectancy

3.10 As shown in **Figure 3.3**, life expectancy in Ireland has been increasing for both males and females. The gender gap has marginally decreased during this time period; reducing from 5.5 years in 1995-97 to 4.4 years in 2010-12. In 2010-12, the average life expectancy was 82.8 years for females and 78.4 years for males.

Figure 3.3: Life Expectancy Trend for Males and Females



Source: (CSO, 2016)

Self-Reported Health

3.11 **Table 3.4** shows the self-reported health statistics for the South-West region compared to Ireland. As shown, self-rated health in the South-West is typically consistent with the national trend, albeit with a marginally higher percentage of individuals reporting fair and bad/very bad health.

Table 3.4: Self-Reported Health

Area	Very Good (%)	Good (%)	Fair (%)	Bad/ Very Bad (%)
South-West	41	44	12	4
Ireland	41	42	14	3
Source: IH006 (CSO, 2016)				

All-Age All-Cause Mortality

3.12 As shown in **Table 3.5**, County Cork has a marginally better age standardised mortality rate when compared to the national average.

Table 3.5: Mortality Rate from All Causes

Area	Death Rate (per 100,000 population)
County Cork	554.2
Ireland	556.7
Source: DHA15 (CSO, 2016)	

Cancer

3.13 When commenting on cancer prevalence and aetiology it is important to note that there are different forms of cancer, with varying environmental and lifestyle related risk factors, as well as confounding factors and genetic predisposition. Equally, as life expectancy increases, so too does the risk of experiencing some form of cancer.

3.14 The National Cancer Registry (NCRI) has documented strong patterns of cancer inequality in Ireland. There are markedly higher cancer prevalence rates in older patients for most major cancers, in particular cervical cancer. However, this trend is reversed for breast and prostate cancers. Generally, for males and females aged 75+, cancer incidence rates were approximately ten and four times higher respectively compared with the younger age group of 45-54. Older cancer patients have a higher prevalence of comorbidities (i.e. two or more diseases existing at the same time) and as a consequence, lower survival rates (NCRI, 2016).

3.15 Generally, there is also a higher prevalence of cancer within more deprived populations, including higher proportions of later stage cancers, and patients with co-morbidities; which ultimately will contribute to the lower survival rates and higher mortality rates within deprived populations (NCRI, 2016).

3.16 There is some spatial variation with moderately higher cancer prevalence in urban areas compared to rural areas. In particular, this includes stomach, lung, melanoma, male colorectal, female breast and cervical. For prostate cancer, lymphoma, leukaemia and female colorectal cancer there was no significant variation between urban and rural populations (NCRI, 2016).

3.17 **Table 3.6** shows the 2010 crude and age-standardised prevalence rates for all invasive cancer, bar non-melanoma skin cancer. In both instances, County Cork has higher incidence rates of cancer when compared to Ireland's national average.

Table 3.6: Cancer Incidence Rates Excluding Non-Melanoma Skin Cancer

Area	All Invasive Cancers (C00-C43, C45-96)	
	Crude Incidence Rate	EASR*
County Cork	453	445
Ireland	411	407
Source: (IPH, n.d.) *EASR – European Age-Standardised Incidence Rate		

3.18 **Table 3.7** shows the number of deaths and subsequent death rate (per 100,000 population) from malignant neoplasms for County Cork and Ireland. Similarly to what can be seen for cancer prevalence, County Cork has a slightly higher mortality rate than Ireland's national average.

Table 3.7: Number of Deaths and Death Rate from Cancer

Area	Deaths (Number)	Death Rate (per 100,000 population)
County Cork	1,037	197.4
Ireland	8,814	191.9
Source: DHA12 (CSO, 2016)		

Cardiovascular Disease

3.19 **Table 3.8** shows the mortality rate (per 100,000 population) for a range of diseases of the circulatory system. When comparing the rates for County Cork and Ireland, they are relatively similar suggesting health status in County Cork is broadly comparable to the national average.

Table 3.8: Number of Deaths and Death Rates for Diseases of the Circulatory System

Condition	County Cork		Ireland	
	Deaths (Number)	Death Rate (per 100,000 population)	Deaths (Number)	Death Rate (per 100,000 population)
Diseases of the circulatory system	1,134	215.9	9,654	210.2
Ischaemic heart disease	503	95.8	4,731	102.6
Acute myocardial infarction	233	44.4	2,139	46.6
Other heart disease	195	37.1	1,551	33.8
Cerebrovascular disease	251	47.8	2,001	43.6
Other diseases of the circulatory system	185	35.2	1,389	30.2
Source: DHA12 (CSO, 2016)				

3.20 **Table 3.9** shows self-reported clinical diagnoses of particular cardiovascular diseases comprising Coronary Heart Disease (CHD), hypertension and strokes. Consistent with clinical diagnosis, County Cork has a self-reported prevalence rate for CHD, hypertension and stroke that is comparable to the national average.

Table 3.9: Self-Reported Clinical Diagnosis of Cardiovascular Diseases in the Previous 12 Months

	Percentage of population diagnosed in past 12 months		
Area	**CHD (Angina or Heart Attack)**	**Hypertension**	**Stroke**
County Cork	2.8	14.2	0.8
Ireland	2.6	13.7	0.7
Source: (IPH, n.d.)			

Respiratory Disease

3.21 **Table 3.10** summarises a variety of respiratory hospital admissions data for County Cork and Ireland, including the general rate of admissions; hospitalisations for asthma and Chronic Obstructive Pulmonary Disorder (COPD); and self-reported clinical diagnoses of chronic bronchitis, COPD or emphysema.

3.22 As shown, County Cork displays lower clinical admissions and hospitalisation rates than the national average. The self-reported clinical diagnosis of chronic bronchitis, COPD or emphysema, County Cork is again, consistent with the national trend.

Table 3.10: Summary of Respiratory Hospital Admissions

Measure	County Cork	Ireland
Rate of admissions to hospital for respiratory conditions per 100,000 European standard population	2225.1	2633.6
The age and sex standardised rate of hospitalisations of people aged 15 years and older with a principal diagnosis of asthma per 100,000 population	30.1	39.9
The age and sex standardised rate of hospitalisations of people aged 15 years and older with a principal diagnosis of COPD per 100,000 population	276.5	385.3
Self-reported, clinical diagnosis of chronic bronchitis, COPD or emphysema in the previous 12 months	2.7	2.6
Source: (IPH, n.d.)		

3.23 As shown in **Table 3.11,** the respiratory disease mortality rate for County Cork is again, consistently better than the national trend.

Table 3.11: Respiratory Disease Mortality Rate

Condition	County Cork		Ireland	
	Deaths (Number)	Mortality Rate (per 100,000 population)	Deaths (Number)	Mortality Rate (per 100,000 population)
Diseases of the respiratory system	378	72.0	3581	78.0
Influenza	1	0.2	16	0.4
Pneumonia	104	19.8	989	21.5
Chronic lower respiratory disease	181	34.5	1706	37.1
Asthma	5	1.0	54	1.2
Other diseases of the respiratory system	92	17.5	870	18.9
Source: DHA12 (CSO, 2016)				

3.24 On the above basis, respiratory health in County Cork is typically better than the national trend, however pockets of health inequality exist, typically within higher density urban areas and in areas of socio-economic deprivation.

Infant Mortality

3.25 The measure of infant mortality refers to children aged 0-1 years and includes all possible causes of mortality. **Table 3.12** presents the infant mortality rate (per 1,000) for County Cork compared to Ireland. As shown, County Cork is again consistent with the national trend.

Table 3.12: Number of Infant Deaths and Infant Mortality Rate

Area	Infant Deaths (Number)	Infant Mortality Rate (per 1,000 live births)
County Cork	27	3.4
Ireland	228	3.3
Source: (IPH, n.d.)		

3.26 On the above basis, physical health within the study area is typically consistent with, or better than the national trend and does not indicate a population that is excessively sensitivity to environmental health pathways.

Mental Health

3.27 As shown in **Table 3.13,** the percentage of people receiving benefits for depression or anxiety is slightly higher in County Cork when compared to the national trend. The number of admissions

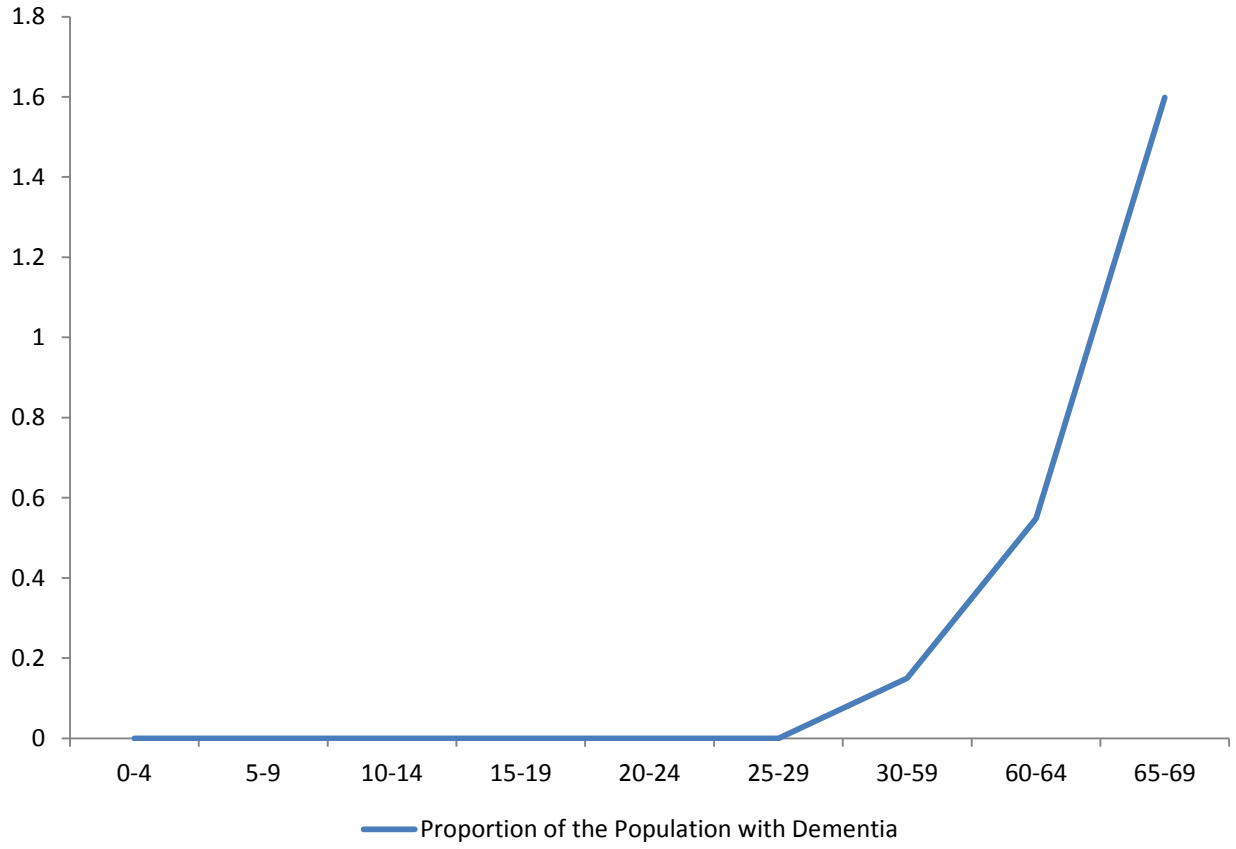
to hospital for anxiety or depression in County Cork is consistent with the national trend and the number of suicides in County Cork is lower than the national trend.

Table 3.13: Mental Health Indicators

	County Cork	Ireland
Number of suicides occurring (per 100,000 population)	9.6	11.5
Number of admissions to hospital for anxiety or depression (per 1,000 people)	2.0	2.0
Percentage of the working age population aged 15-64 years in receipt of benefits for depression and/or anxiety	1.2	1.1
Source: (IPH, n.d.)		

3.28 Figure 3.4 displays the estimated proportion of people with dementia in Ireland by age group as no data is available at regional level. Overall, the estimated prevalence of dementia is 1% of the population (all ages) and 1.8% of the population (30+ years) based on the population at the time of the 2011 census and dementia prevalence rates from European data (as this statistic is not available directly in Ireland) (Pierce, et al., 2014).

Figure 3.4: Proportion of people with dementia (2011)



Source: Trinity College Dublin (Pierce, et al., 2014)

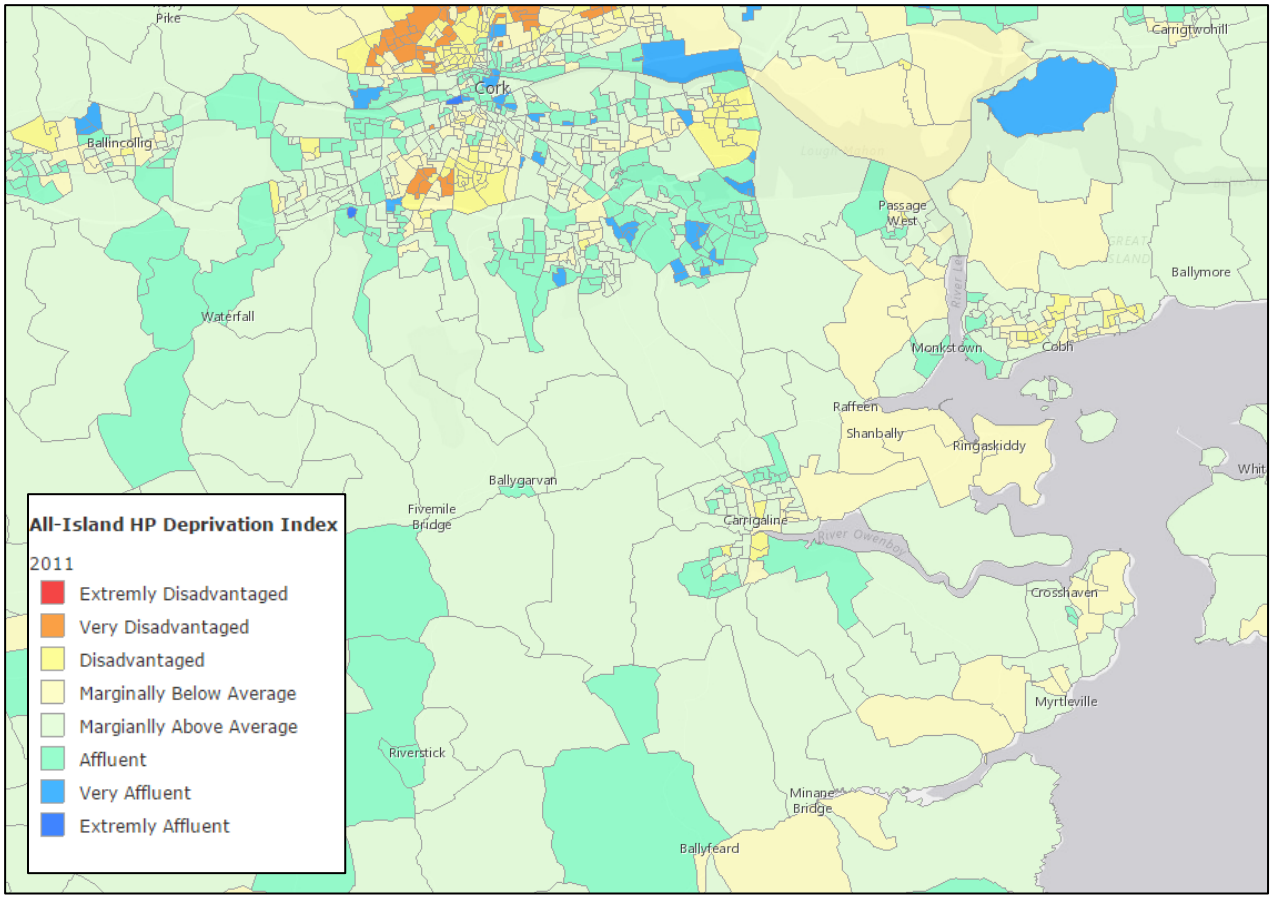
3.29 Autism is a spectrum disorder which is thought to affect approximately 1% of the Irish population. Each year the prevalence of autism shows signs of an increase, however, this is likely to be attributed to improved diagnosis, as opposed to an actual increase in prevalence (Autism Ireland, 2017). While a relatively low proportion of population with no particular spatial variation, There is a residential facility at Shannonpark (owned by the Brothers of Charity), that provides accommodation and care for those with intellectual disability or autism. Due to nature of the facility, the site and its occupants are considered particularly sensitive to changes in environmental setting and quality during both construction and operation, and will be considered further within the assessment.

Socio-Economic

3.30 The 2011 All-Island Haase and Pratschke (HP) Deprivation Index provides a measure of relative deprivation for small area units within the Republic of Ireland and Northern Ireland. The Index utilises 10 indicators to measure deprivation under three broad categories; education, social class and unemployment (All-Island Research Observatory, 2011). The output is a deprivation rank and category ranging from ‘extremely disadvantaged’ to ‘extremely affluent’.

3.31 As shown in **Figure 3.5,** small areas within the EDs of interest range from ‘disadvantaged’ to ‘affluent’ with most areas displaying a deprivation index category within the median of the range (i.e. ‘marginally above average’).

Figure 3.5: Ireland HP Deprivation Index (2011)



Source: (All-Island Research Observatory, 2011)

3.32 **Table 3.14** summarises the relative deprivation scores of these small areas for each ED within the study area. Deprivation scores range from +3.7 in Monkstown Urban to +12.8 in Douglas. Overall, the study area has an average deprivation score of +7.2 and can be categorised as being marginally better that the median of the national score ('marginally above average').

Table 3.14: Relative Deprivation Score and Category

Area	Relative Deprivation Score (2011)	Deprivation Category
Carrigaline	+5.5	Marginally above average
Douglas	+12.8	Affluent
Monkstown Rural	+6.7	Marginally above average
Monkstown Urban	+3.7	Marginally above average
Study Area	+7.2	Marginally above average
Ireland average deprivation score	-0.7	
Source: (All-Island Research Observatory, 2011)		

3.33 On the above basis, the study area is not regarded as deprived, demonstrating greater resilience to socio-economic health pathways.

3.34 As shown in **Table 3.15,** the largest proportion of the working age population within the study area is employed within the 'Higher & Lower Professionals' (26%) and 'Non-Manual & Manual Skilled Labour' (26%) categories. The figure for the Higher & Lower Professionals occupation category is higher than the County Cork and national trends, as is the proportion of individuals categorised as 'Employers and Managers'.

3.35 The only other notable variation from the regional and national trend, is that there is a lower proportion of 'Farmers and Agricultural Workers' (1%) in the study area than in County Cork and Ireland (9% and 6% respectively).

Table 3.15: Occupation

Occupation	Study Area All	County Cork	Ireland
Employers and Managers	22	16	16
Higher & Lower Professionals	26	18	17
Non-Manual & Manual Skilled Labour	26	26	27
Semi-Skilled and Unskilled Labour	11	13	12
Own Account Workers	6	7	6
Farmers & Agricultural Workers	1	9	6
Unknown	10	12	16
Source: (CSO, 2011)			

3.36 Unemployment rates and economic inactivity rates differ in the sense that those who are unemployed are actively seeking, and are available to start a job. Whereas, those who are economically inactive are those who are unemployed but are not seeking employment. Common reasons for economic inactivity include long-term sickness or disability, being a carer, a student, or being retired (Barham, 2002).

3.37 As shown in **Table 3.16,** the study area indicates a higher proportion of individuals at work and less people unemployed and economically inactive than the Ireland national average. This is consistent with relatively high working age demographic displayed previously in **Figure 3.2**, and reinforces the small area deprivation data.

Table 3.16: Employment Status

Employment Status	Study Area All (%)	County Cork (%)	Ireland (%)
At Work	87.9	83.5	81.0
Looking for 1st Regular Job	0.9	1.2	1.5
Economically Inactive	34	37	37
Unemployed	11.1	16.4	19.0
Source: (CSO, 2011)			

3.38 The Department of Social Protection (DSP) (DSP, n.d.) live register, further indicates that the rate of unemployment for Ireland is improving, declining from 13.4% in January 2011 to 7.1% by January 2017.

3.39 As shown in **Table 3.17,** Cork City and County have a marginally higher total income and higher disposable income per person compared to the Ireland national average.

Table 3.17: Total and Disposable Income per Person

Area	Total Income per Person (Euro)	Disposable Income per Person (Euro)
Ireland	25,435	19,309
Cork City and County	25,950	19,532
Source: CIA01: Estimates of Household Income by County and Region, Year and Statistic (CSO, 2016)		

3.40 While pockets of socio-economic deprivation exist, the study area is not regarded as socio-economically deprived, or excessively sensitive to socio-economic health pathways.

3.41 As shown in **Table 3.18**, when compared to the county and national averages, the study area generally has lower proportions of the population with low levels of education (such as no formal education and primary education), and higher proportions of the population with high levels of education (such as bachelor's or postgraduate degree). Overall, this suggests that the study area indicates an education attainment that is comparable to or better than the county and national trend.

Table 3.18: Level of Education Completed

Level of Education Completed	Study Area All (%)	County Cork (%)	Ireland (%)
No Formal Education	0	1	1
Primary Education	6	11	14
Lower Secondary	12	17	17
Upper Secondary	21	20	20
Technical or Vocational qualification	9	10	9
Advanced Certificate/Completed Apprenticeship	6	7	6
Higher Certificate	3	5	5
Ordinary Bachelor Degree or National Diploma	10	8	7
Honours Bachelor Degree, Professional qualification or both	14	9	9
Postgraduate Diploma or Degree	12	7	8
Doctorate (Ph.D) or higher	1	1	1
Not stated	3	4	5
Source: (CSO, 2011)			

3.42 As shown in **Table 3.19,** between 2011 and 2016, the maximum increase in housing stock was 1.9% seen in Monkstown Urban, marginally higher than the national rate increase. However, Carrigaline and Douglas display housing stock rate increases lower than both the county and national rate.

Table 3.19: Housing Stock and Housing Stock Percentage Change

Area	2011	2016	Percentage Change (%)
Carrigaline	4,362	4,379	+0.4
Douglas	8,323	8,365	+0.5
Monkstown Rural	485	492	+1.4
Monkstown Urban	2,107	2,146	+1.9
Study Area All	15,277	15,382	+0.7
County Cork	172,042	175,046	+1.7
Ireland	1,994,845	2,022,895	+1.4
Source: (CSO, 2011) (All-Island Research Observatory, n.d.)			

3.43 **Table 3.20** shows the breakdown for housing tenure categories in the study area compared to County Cork and Ireland.

3.44 The study area shows a significantly higher proportion of housing which is owner occupied with a mortgage (45.3%) compared to County Cork (37.0%) and Ireland (34.6%). In addition, the study area displays a higher proportion of private rented housing (21.1%) compared to County Cork and Ireland (16.2% and 18.7% respectively). Proportions of owner occupied with no mortgage, social rented housing, and housing occupied free of charge are all lower in the study area when compared with County Cork and national averages.

Table 3.20: Housing Tenue

Tenure	Study Area All	County Cork	Ireland
Owner occupied with mortgage (%)	45.3	37.0	34.6
Owner occupied no mortgage (%)	28.3	37.7	35.2
Private rented (%)	21.1	16.2	18.7
Social rented (%)	3.6	5.6	8.4
Occupied free of charge (%)	0.8	2.0	1.6
Source: (All-Island Research Observatory, n.d.)			

3.45 This is again indicative of a relatively young and economically active population.

3.46 **Table 3.21** shows the housing affordability based on an 84% loan to value ratio for a single first time buyer and a working couple first time buyer. Where there is a lower repayment as a percentage of net income, the housing is considered more affordable. As shown, housing in Cork County is generally more affordable for single and working couple first time buyers than the national rate.

Table 3.21: Housing Affordability

Area	Repayments as % of Net Income	
	Single First Time Buyer	Working Couple First Time Buyer
Cork County	25.4	16.7
Ireland	50.7	20.7
Source: (EBS DKM, 2016) *Based on an 84% loan to value ratio		

Lifestyle

3.47 It is widely accepted that the lifestyle choices that individuals make significantly influence the health inequalities which are experienced within communities.

3.48 National alcohol consumption data records indicate that alcohol consumption in terms of litres per capita for people aged 15 years and over, increased to a peak of 14.5 litres in 2001, after which it has gradually declined to 10.6 litres in 2013 (OECD, 2014). The 2014 alcohol consumption in Ireland report (HRB, 2013) has highlighted that approximately one fifth of drinkers engage in binge drinking at least once per week, and more than half of 18-75 year old drinkers were

classified as harmful drinkers using the WHO AUDIT-C screening tool. Overall, it is estimated that there were between 1.3–1.4 million harmful drinkers in Ireland in 2013 which constitutes 28–31% of the Irish population (CSO, 2013).

3.49 As shown in **Table 3.22,** drug related hospital admissions in County Cork are significantly lower than the Ireland national average. However, the rate of alcohol related hospital admissions in County Cork is higher than the national trend.

Table 3.22: Hospital Admissions for Drug and Alcohol Related Conditions

	County Cork	Ireland
DSR hospital admissions for drug related conditions (per 100,000 population)	50.8	70.4
DSR hospital admissions for alcohol related conditions (per 100,000 population)	2,414.6	1,960.8
Source: (IPH, n.d.) DSR – directly age and gender standardised to the European Standard Population.		

3.50 Smoking is the largest cause of preventable death, accounting for approximately 5,200 deaths in Ireland each year from tobacco related disease (HSE, 2015). **Table 3.23** shows that smoking prevalence in County Cork is marginally lower than the national trend.

Table 3.23: Smoking Prevalence

Area	Percentage of people who currently smoke cigarettes
County Cork	26.0
Ireland	28.5
Source: (IPH, n.d.)	

3.51 Approximately a third of the Irish population (32%) achieve the recommended high level of physical activity. This involves undertaking vigorous activity on a minimum of three days a week or alternatively a combination of vigorous, moderate and/or walking activity can be undertaken on seven days per week. An estimated 37% are categorised as moderately active, while 31% have low activity levels. Women are less likely than men to engage in highly level of physical activity (24% compared to 40%) (Department of Health, 2015).

3.52 Where there is an imbalance between food intake and physical activity, fat will accumulate. Where excess body fat has accumulated to such an extent that health is affected, one is said to be obese. Obesity has been linked to some cancers, adversely affects the efficiency of the circulatory system which contributes to cardiovascular disease, and also raises blood insulin levels which increases likelihood of suffering from type 2 diabetes (Irish Heart Foundation, n.d.) (Department of Health, 2015).

3.53 In Ireland, it is estimated that 37% of the population are overweight and a further 23% are obese. This means that the majority of the Irish population are not of a weight which is considered normal and are likely to be affected by the health problems associated with excess weight. Men are more likely to be overweight than women (43% for men compared to 31% for women) but the

proportion of obese men and women are very similar (25% for men compared to 22% for women) (Department of Health, 2015).

3.54 **Table 3.24** shows the percentage of people who are physically inactive, obese, and eat less than five fruit and vegetables per day in County Cork and Ireland. County Cork has slightly lower proportions of people who are physically inactive or who eat less than five portions of fruit and vegetables per day.

Table 3.24: Percentage of Physical Inactivity, Obesity, and Eat <5 portions of Fruit/Veg Daily

Area	Physical Inactivity	Obesity	Eat <5 Portions of Fruit/Veg Daily
County Cork	26.5	14.7	32.6
Ireland	28.4	14.4	34.4
Source: (IPH, n.d.)			

3.55 Violent crime impacts on health directly and through its impact on the wider community in terms of perceived risk and the influence this can have on behaviour, and social/recreational activities and networks (particularly within the elderly community).

3.56 **Table 3.25** shows various crime indicators for County Cork and Ireland including recorded burglaries, thefts, criminal damage offences, and violent crimes. As shown below, County Cork has significantly lower levels of all types of crime when compared to the national average.

Table 3.25: Crime Indicators

Type of Crime (per 100,000 population)	County Cork	Ireland
Number of recorded burglaries (2012-13)	322.2	612.9
Number of recorded thefts (2012-13)	1,242.4	1,664.6
Number of recorded criminal damage offences (2012)	613.4	700.3
Number of recorded violent crimes (2012)	386.5	404.2
Source: (IPH, n.d.)		

Community Profile Summary

3.57 Population density along the proposed road project varies, with the highest density along the northern online section, and decreasing thereafter. The study area displays a relatively young population with a higher proportion of working age and a lower proportion of retirees. The ethnicity of the demographic within the study area is consistent with the national trend. All EDs in the study area are categorised as marginally above average or affluent. This is further supported by education and employment statistics at or better than the national trend.

3.58 The relatively higher level economic active individuals also demonstrate a high degree of mobility, where approximately 76% of the population drive to work in a car or van compared to the national average of 66%. While pockets of socio-economic deprivation exist, the study area is not

regarded as socio-economically deprived, or excessively sensitive to socio-economic health pathways, but is reliant on effective/sustainable transport options to connect residential areas to employment areas, and is a feature important to the sustainable development of both.

3.59 Lifestyle data shows that County Cork has higher alcohol related hospital admissions when compared to the national average but has lower drug related hospital admissions, suicides, and crime. Figures are broadly similar for smoking, physical activity, diet, and most mental health indicators, but would benefit from improved opportunities for physical activity. Physical and mental health is generally consistent with or better than the national trend, and the study area is not regarded as excessively sensitive to changes in environmental health pathways.

3.60 The Brothers of Charity facility at Shannonpark and the proposed school site in Ringaskiddy are considered particularly sensitive receptors to environmental health pathways.

4 Assessment

Overview

4.1 The following assessment investigates:

- the potential health outcome from changes in exposure to air emissions (construction and the redistribution of traffic once operational);
- the potential health outcome from changes in exposure to noise (construction and from the redistribution of traffic once operational); and
- the potential health outcome from changes in exposure to road movements (risk of accident and injury and community severance).

4.2 Contrasted against the do minimum scenario (i.e. no road change)

Health Impact from Changes in Air Quality

Air quality and health

4.3 A core health pathway associated with the construction of the proposed road project is the generation of emissions to air and subsequent community exposure. Research into the potential health effects of emissions is extensive and provides statistically significant associations between many classical air pollutants (e.g. Particulate Matter, Nitrogen Dioxide and Sulphur Dioxide) and effects on a wide range of cardiovascular and respiratory health outcomes. The following section applies the current scientific evidence base to explore the potential health outcome from emissions relating to the construction and operational phases directly attributable to the proposed road project against a “do minimum” scenario (i.e. no road change).

Construction Emissions to Air

4.4 As detailed in **Chapter 13 (Air and Climatic Factors) of the EIS**, during the construction phase, dust is considered the principle pollutant to atmosphere, with limited generation of and community exposure to particulate matter (PM_{10} and $PM_{2.5}$) and NO_2 from equipment or fixed plant on both the online and offline sections.

Particulate Matter (PM_{10})

4.5 Applying the available evidence base (COMEAP, 2009; Department of Health, 2007; European Comission, 2001; WHO, 2000), community exposure to PM_{10} construction emissions are temporary, intermittent and not of an order of magnitude or duration to quantify any meaningful change in life expectancy. This is based on the exposure response coefficients developed by the UK Department of Health's Committee on the Medical Effects of Air Pollutants (COMEAP) that established there is a 0.75% increased risk in the background rate of all-cause mortality per 10 $\mu g.m^{-3}$ increase in PM_{10} per 100,000 individuals exposed (Department of Health, 2007). In this

instance, both emission concentration and community exposure are orders of magnitude lower than is necessary to quantify any change in local health outcome.

4.6 On this basis, it is concluded that the construction of the proposed road project would not result in localised PM_{10} emissions of a level to result in any meaningful change in local cardiovascular or respiratory hospital admissions.

Particulate Matter ($PM_{2.5}$)

4.7 Evidence suggests that increased exposure to $PM_{2.5}$ is potentially more hazardous to human health than larger particles (COMEAP, 2009). However, the changes in emission concentration exposure directly attributed to the construction of the proposed road project are not of a level or duration to quantify any meaningful change in life expectancy.

4.8 On this basis, temporary $PM_{2.5}$ construction emissions from construction activities are not of a level to quantify any meaningful change in life expectancy.

Nitrogen Dioxide

4.9 Potential NO_2 emissions are limited to fixed plant, equipment and construction vehicles; constituting a temporary and intermittent localised source. However, such emission concentration and community exposure are not of an order of magnitude to quantify any meaningful change in health outcome. On this basis, it is concluded that potential changes in NO_2 community exposure would not be of a level to result in any measurable adverse health outcome.

Dust

4.10 Dust generating activities include stone importation, excavation, earth moving and backfilling. The potential for dust nuisance is dependent on meteorological factors such as rainfall, wind speed and wind direction.

4.11 While dust does not present the same physical risk to health as particulate matter (i.e. cardiovascular and respiratory), it can modify behaviour and impact upon the more intangible aspects of health, namely quality of life and wellbeing. In this instance and as noted in **Chapter 13 (Air and Climate Factors)** of the EIS, prior to mitigation, the construction phase has the potential to cause temporary and localised impacts through dust nuisance at the nearest sensitive receptors.

Table 4.1: Dust Impact Scale and Distances from Key Areas of Construction

Area	Impact Scale	Potential Distance for Significant Effects
Main Alignment of the N28/M28 from Bloomfield to Ringaskiddy	Moderate	50m
Service Area in Ringaskiddy	Major	100m

4.12 There are 186 properties located within 50m of the proposed road project. There are 2 additional commercial receptors approximately 50m north of the proposed Service Area. Prior to mitigation these properties have the potential to be affected by dust nuisance during the construction phase of the project.

4.13 On this basis, and prior to mitigation, potential dust emissions during construction of the proposed road project are, temporary, localised with the potential for re-suspension, but are not of a level to impact upon physical health. A Construction Environmental Management Plan (CEMP), including a dedicated Dust Minimisation Plan (DMP) is to be developed in line with the mitigation measure set out in the EIS as part of the implementation of the mitigation strategy proposed.

Operational Emissions to Air

4.14 Once operational, the proposed road project will result in the redistribution of traffic along an existing section and a new road, presenting two different community exposure scenarios between the online and offline sections.

4.15 For the purposes of the air quality assessment the scheme has been divided into two sections (refer to Figure 2.1 above):

- Section 1 the online 2km section of motorway from the Bloomfield Interchange to Carr's Hill; and
- Section 2 the remaining 10.5km of offline route from Carr's Hill to east of Ringaskiddy.

4.16 As detailed in **Chapter 13 (Air and Climatic Factors)** of the EIS and summarised in **Table 4.2**, shows the 2020 and 2035 pollutant level impacts when comparing the do-minimum and do-something scenarios.

4.17 Despite a forecasted increase in road movements when the proposed road project becomes operational, there will be an overall net reduction in the number of properties that will be exposed to air pollution. The overall reduction in exposure to air pollution is most evident in Section 2 of the proposed road project where the new offline section moves the alignment away from the properties located along the existing N28. This is because the existing N28 is the main road through the villages of Shanbally and Ringaskiddy (where the route ends); therefore, diverting the majority of traffic, congestion and associated emissions away from communities and onto the M28.

4.18 As Section 1 (up to Carr's Hill) is largely online (i.e. follows the existing N28), the number of properties is largely unaffected as there will be limited change to traffic redistribution. The highest expected increases in air pollutant concentrations are located at junctions connecting to the M28 due to increased demand to use this route.

Table 4.2: Difference in Air Quality Between Do-Minimum and Do-Something Scenario

		Annual Average NO_2 ($\mu g/m^3$)	Annual Average PM_{10} ($\mu g/m^3$)	24-hour Average PM_{10} ($\mu g/m^3$)	Annual Average $PM_{2.5}$ ($\mu g/m^3$)
Kiltegan Park	2020 Impact	0.27	0.14	0.68	0.07
	2035 Impact	0.17	0.14	0.64	0.07
Delford Drive	2020 Impact	0.19	0.08	0.42	0.05
	2035 Impact	0.11	0.08	0.4	0.05
St. Patricks Church	2020 Impact	-0.08	-0.05	-0.03	-0.04
	2035 Impact	-0.09	-0.08	-0.06	-0.04
Wainsfort	2020 Impact	-0.08	-0.05	-0.21	-0.04
	2035 Impact	-0.1	-0.09	-0.66	-0.04
Newlyn Vale	2020 Impact	-0.27	-0.09	-0.73	-0.07
	2035 Impact	-0.23	-0.19	-1.58	-0.09
Rochestown Rise	2020 Impact	-0.41	-0.11	-0.4	-0.08
	2035 Impact	-0.32	-0.24	-1.16	-0.11
Mount Oval	2020 Impact	-1.24	-0.3	-0.73	-0.4
	2035 Impact	-0.88	-1.35	-3.48	-0.6
Maryborough Heights	2020 Impact	-0.89	-0.22	-0.87	-0.19
	2035 Impact	-0.65	-0.65	-2.5	-0.29
Edgewood Close	2020 Impact	-0.88	-0.17	-0.77	-0.2
	2035 Impact	-0.61	-0.74	-2.96	-0.32
Carr's Hill to Shannonpark	2020 Impact	-0.91	-0.19	-0.04	-0.12
	2035 Impact	-2.44	-1.01	-0.38	-0.61
Shannonpark Roundabout	2020 Impact	0.74	0.43	0	0.25
	2035 Impact	0.79	0.38	0	0.23
M28 Junction at Shanbally	2020 Impact	1.59	0.48	0	0.29
	2035 Impact	1.79	0.46	0	0.28
Shanbally Village	2020 Impact	-3.11	-1.09	-0.18	-0.654
	2035 Impact	-5.4	-1.98	-0.51	-1.188
Old Post Office Road, Ringaskiddy	2020 Impact	1.9	0.55	0	0.33
	2035 Impact	3.56	0.91	0	0.55
Ringaskiddy Village	2020 Impact	-1.3	-0.59	0	-0.35
	2035 Impact	-1.72	-0.78	0	-0.47
Key	Lower than the Do Minimum Scenario				
	Higher than the Do Minimum Scenario				

Particulate Matter (PM_{10})

4.19 As shown, the proposed road will facilitate a net reduction in community exposure to PM_{10} than can be achieved within the Do Minimum Scenario. The worst case expected increase in air pollutant concentrations at any location occur at the junction at the Old Post Office Road (Section 2), representing a 0.55 µg/m^3 increase by 2020, and a 0.91 µg/m^3 by 2035. Applying the previously discussed air quality-health evidence base, such a change in concentration and exposure are not of an order of magnitude to quantify any meaningful change in life expectancy.

4.20 To clarify, the UK Department of Health's Committee on the Medical Effects of Air Pollutants (COMEAP) established that there is a 0.75% increased risk in the background rate of all-cause mortality per 10 µg.m^{-3} increase in PM_{10} per 100,000 individuals exposed. The maximum annual-mean PM_{10} contribution of 0.91 µg.m^{-3} by 2035 represents a potential increase in background respiratory and cardiovascular hospital admission rates of 0.068% (typically quantified per 100,000 people).

4.21 On the above basis, the proposed road project will facilitate a net reduction in PM_{10} exposure over and above what can be achieved in the Do Minimum scenario. However, the potential change in PM_{10} community exposure is not of a level to result in any measurable health outcome (both adverse and beneficial) at any location.

Particulate Matter ($PM_{2.5}$)

4.22 The worst case expected increase in air pollutant concentrations at any location occur at the junction at the Old Post Office Road (Section 2), representing a 0.33 µg/m^3 increase in $PM_{2.5}$ by 2020, and a 0.55 µg/m^3 by 2035. Such a change in concentration and exposure are not of an order of magnitude to quantify any meaningful change in life expectancy.

4.23 The Committee on the Medical Effects of Air Pollutants UK (COMEAP), reviewing epidemiological data regarding air pollutant exposure and health, has suggested as a best estimate that there is a 6% increase in relative risk of mortality (all causes) associated with long-term exposure to a 10 µg.m^3 increase in ambient $PM_{2.5}$ concentration, and that this scales linearly in the exposure range 7 µg.m^3 to 30 µg.m^3.

4.24 The maximum annual-mean $PM_{2.5}$ contribution of 0.55µg.m^3 by 2035 at the Old Post Office represents a potential increase in background all-cause mortality of 0.3% (per 100,000 people exposed). As before, neither the change in concentration nor exposure at this location is sufficient to quantify any measurable risk to local community health.

4.25 On the above basis, the proposed road project will facilitate a net reduction in $PM_{2.5}$ exposure over and above what can be achieved through the Do Minimum scenario. However, the relative change in $PM_{2.5}$ community exposure is not of a level to result in any measurable health outcome (both adverse and beneficial) at any location.

Nanoparticles

4.26 There is no universally accepted international definition of a nanoparticle. However, the term nanoparticle generally refers to particles with a mean aerodynamic diameter of 100 nanometres, equal to 0.1 microns, or less. Nanoparticles are a subset of $PM_{2.5}$ and, therefore, a subset of PM_{10}.

4.27 The approach to quantifying potential risk from changes in exposure to nanoparticles is addressed through the UK COMEAP assessment of PM_{10} and $PM_{2.5}$. The COMEAP review of toxicological and epidemiological research was applied to develop risk ratios for a broad range of particulate fractions including the nanoparticle fraction. Although COMEAP did not seek to establish the specific risk ratio for nanoparticles, the potential health risk is applied within the broader PM_{10} and $PM_{2.5}$ exposure response risk ratios (HPA, 2009).

4.28 As previously discussed, the proposed road project will facilitate a net reduction in community exposure to particulate emissions, including the nanoparticulate fraction, and the maximum increase at any location is not of a concentration or exposure to quantify any meaningful change health outcome.

Nitrogen Dioxide (NO_2)

4.29 As previously discussed, the proposed road project presents a net reduction in community exposure to NO_2 than can be achieved within the Do Minimum scenario. The worst case expected increase in air pollutant concentrations at any location occur at the junction at the Old Post Office Road (Section 2), representing a 1.9 $\mu g/m^3$ increase in NO_2 by 2020, and a 3.56 $\mu g/m^3$ by 2035.

4.30 Applying the worst case maximum process contribution of 3.56$\mu g/m^3$, the proposed road project might represent a potential annual increase in background respiratory hospital admission rates for those communities exposed of 0.178%.

4.31 On the above basis, the proposed road project will facilitate a net reduction in NO_2 exposure over and above what can be achieved through the Do Minimum scenario. However, the relative change in NO_2 community exposure is not of a level to result in any measurable health outcome (both adverse and beneficial) at any location.

Dementia

4.32 The overarching engagement process indicated some community concern regarding a recent study on increased prevalence of dementia in proximity to main roads in Canadian province of Ontario (H. Chen, 2017). Upon review, it was found that the study comments upon an observed association, but does not establish a causal link, and used distance from roads as proxy indicator as opposed to any actual change in exposure to air quality or noise.

4.33 In addition, the study was undertaken in Canada, so the environmental and social context are different to Ireland, and as such caution is required when interpreting the results, and when attempting to apply them to a different environmental or social context. As an example, the

topography, meteorology, design and quality of homes all differ, as do the environmental constraint and controls on vehicle emissions, not to mention the nature and size of the roads they considered. Equally, population density and relative sensitivity is also very different as is the relative demography (age, sex, ethnicity), which presents a range of different risk factors to consider.

4.34 These limitations can result in confusing an association with causation or a potential hazard with an actual risk. In addition, because the paper is quite expensive, the public generally won't acquire the full report and draw what they can from the internet and the abstract, neither of which are particularly informative and can often lead to incorrect or unfounded perceptions of risk, which if left unaddressed can result in needless stress and anxiety.

Health Impact from Changes in Community Noise Exposure

Overview

4.35 Noise has the potential to affect health in a variety of ways; some of the effects can be auditory and occur as a direct impact of the noise. Direct auditory effects usually result in damage to the ear, in particular damage to the inner ear, from intense and prolonged exposure. Such risks are usually associated with occupational health or prolonged exposure to loud music and managed though good working practice and the provision of appropriate personal protection equipment to construction workers. Such auditory effects do not present a risk to local communities.

4.36 Community effects are more typically associated with non-auditory health effects that may be associated with exposure to environmental noise, although the pathways and strength of association for these are not fully understood and can vary between individuals. Examples of non-auditory health effects include:

- annoyance;
- mental health;
- cardiovascular and physiological;
- cognitive performance (tasks and academic); and
- night-time effects (sleep disturbance).

4.37 A consensus on the level and duration of noise required to instigate potential health impacts is not clearly defined. The main emphasis of noise standards and regulations is therefore placed on annoyance and sleep deprivation, as these are the most immediate consequences of noise impacts, and are applicable to everyone.

Construction Noise

4.38 As detailed in **Chapter 14 of the EIS (Noise and Vibration),** the construction stage is expected to take 30-36 months to complete during both day and night time periods.

4.39 During construction, Best Practicable Means, including the recommendations of BS 5228 Code of practice for noise and vibration control on construction and open sites – Part 1: Noise. And BS 5228-2:2009+A1:2014 Code of practice for noise and vibration control on construction and open sites – Part2: Vibration (together referred to as B.S. 5228). Control of Dust from Construction and Demolition Activities' (BRE 2003), together with the specific conditions and/or restrictions of any EIA Approval and the Construction Environmental Management Plan (CEMP) as part of the implementation of mitigation measures will be applied.

4.40 As construction is temporary, noise exceedances are more generally accepted but mitigation measures will be implemented to reduce this impact as much as possible.

Operation Noise

4.41 As detailed in **Chapter 14 (Noise and Vibration)** of the EIS, the proposed road project is designed to address an existing noise issue, and will result in an improvement to the existing road network (including the provision of low noise road surface and acoustic barriers) on the northern online section, within a relatively high population density; and the redistribution of traffic away from communities on the southern offline section. In effect, the proposed road addresses noise at source to minimise both generation and community exposure.

4.42 As shown in **Table 4.3** and **Table 4.4**, following mitigation, the effect is a net reduction in day evening and night time noise and associated community exposure, over and above what can be achieved through the Do Minimum scenario.

Table 4.3: Change in Noise Levels (L_{den}) at Residential Properties

Noise Level Range dB(A)	Do Minimum	Do Something (with Mitigation)	Change
<55	1196	1374	+178
55-60	835	916	+81
60-65	721	542	-179
65-70	207	143	-64
70-75	23	7	-16
Key	Lower than the Do Minimum scenario		
	Higher than the Do Minimum Scenario		

Table 4.4: Change in Noise Levels (L_{night}) at Residential Properties

Noise Level Range dB(A)	Do Minimum	Do Something (with Mitigation)	Change
<45	1197	1382	+185
45-50	770	837	+67
50-55	593	478	-115
55-60	353	251	-102
60-65	69	34	-35
Key	Lower than the Do Minimum scenario		
	Higher than the Do Minimum Scenario		

4.43 Importantly from a health perspective, the most significant change in residential noise exposure is the reduction of higher magnitude exposures (i.e. 60-75 L_{den} and 50-65 L_{night}), of which are associated with risk ratios of Hypertension, Ischaemic Heart Disease (IHD), Acute Myocardial Infarction (AMI), Stroke and all-cause mortality, over and above what can be achieved with the Do Minimum scenario.

4.44 In contrast, the increase in residential noise exposure is within the ranges of <55-60 L_{den} and <45-50 L_{night} along the new southern section, while potentially perceptible, this presents a far lower relative risk, and in some cases does not even fall within the exposure range sufficient to apply the noise exposure response metrics (**Table 4.5**) to quantify risk.

Table 4.5: Noise Exposure-Response Metrics

Health outcome	Relative risk (95% CI)	Per increase (dB)	Exposure range (dB)*	Source
Hypertension incidence	1.07 (1.02 – 1.12)	10	47 – 77	(van Kempen & Babisch, 2012)
IHD incidence	1.08 (1.04 – 1.13)	10	52 – 77	(Babisch, 2014)
AMI incidence	Cubic function: 1.629657 – 0.000613 x [noise]^2 + 0.000007356834623455 x [noise]^3	Non-linear	>60	(Babisch, 2006)
Stroke incidence and mortality** (a)	1.04 (1.00 – 1.09)	10	>50	(Houthuijis, et al., 2014)
Stroke hospital admissions (b)	1.04 (1.02 – 1.07)	Within range shown	55 – 60	(Halonen, et al., 2015)
	1.05 (1.02 – 1.09)		>60	
All-cause mortality	1.03 (1.01 – 1.05)		55 – 60	
	1.04 (1.00 – 1.07)		>60	

***** The metrics apply to noise expressed using the Lden, Ldn and LAeq,16hr averaging periods. For the purpose of this assessment, these have all been treated as equivalent and obtained using a -2.2 dB correction from the noise model results in LA10,18hr (Scott, 03 December 2015).

****** This is derived from an "ad hoc analysis" of mixed studies of incidence and mortality, including aircraft and road noise. The studies assessing mortality specifically used aircraft noise rather than road nose exposure. Therefore this metric has been applied only to stroke incidence (hospital admissions), not mortality, both to avoid double-counting and because the mortality evidence is weaker

4.45 On the above basis the proposed road project will facilitate both a net reduction in residential noise exposure, and importantly, reduces existing community exposure to higher magnitude exposures (associated with cardiovascular health risk) over and above what can be achieved through the Do Minimum scenario.

Health Impact from Changes in Community Traffic Flows

4.46 Potential health pathways associated with changes in road traffic movements include increased risk of road traffic accident and injury, community severance and exposure to vehicle exhaust and noise emissions. The latter two are addressed in the preceding sections.

Risk of Road Accident and Injury

4.47 The major and most obvious hazard of road transport is human injury as a result of collision. Statistically, roads designed to motorway standards have the lowest accident rates per vehicle kilometre travelled. The existing N28 has a poor collision record. Between 2009 and 2013 there have been 33 collisions, 4 of which were fatal. Collision clusters are noted at/adjacent to the Rochestown Road junction, at/adjacent to Shannonpark roundabout and at Raffeen Bridge.

4.48 A description of the accidents are as follows:

- The accidents at the Rochestown Road junction comprised single vehicle collisions, rear end straight collision and a collision between a car and cyclist on the roundabout;
- South of the Rochestown Road, a taxi collided with a pedestrian in dark conditions, there was a rear end straight collision and accidents involving vehicles carrying out U-Turns;
- Recorded accidents on the single carriageway section between Rochestown and Shannonpark included a single vehicle collision and a rear end straight collision;
- At the Shannonpark roundabout one of the collisions was a rear end straight and two of the collisions were between cars and cyclists on the roundabout who often struggle in high traffic flow conditions; and
- At Raffeen Bridge, there were three angle right turn collisions and a head on collision which can be attributed to the lack of opportunity for turning right from the N28 onto the R610.

4.49 A large majority of these accidents can be attributed to the combination of heavy traffic flows, a significant proportion of HGVs and an inconsistent quality of route. The proposed road project is inherently designed to address these problems through :

- Prohibiting walking, cycling and high risk manoeuvres such as U-turns; and
- Diverting traffic away from the existing N28 onto the proposed M28 road, creating lower volumes of traffic along the N28 and higher volumes using the motorway.

4.50 And more specifically:

- Traffic light control on Rochestown Road between Clarke's Hill and the merge junction with the N28, including a dedicated right turn lane from the R610 Rochestown Road to Clarke's Hill;
- The development of a new motorway will eliminate the risk of U-turn accidents and will not permit pedestrian movement limiting community exposure to traffic;
- Reduce the amount of drivers becoming frustrated through having trouble accessing the N28 from side roads and as a result, exhibiting risk taking behaviours;
- Reduction of traffic volumes at Shannonpark roundabout; and
- Improved operation of the junction at Raffeen Bridge.

4.51 Additionally, by taking traffic off the N28, there is an increased capacity and improved safety for cyclists and walkers which will help improve health and wellbeing by removing barriers to active transport.

4.52 On the above basis, the proposed road project is inherently designed to address existing road safety issues, and will improve safety above and beyond what can be achieved through the Do Minimum scenario.

Community Severance

4.53 As a result of the proposed road project, there is predicted to be significant decreases in traffic especially between Shannonpark and Carr's Hill, and Shannonpark and Ringaskiddy where the existing N28 route directly cuts through Shanbally and Ringaskiddy villages.

4.54 The reductions in Section 2 (refer to **Figure 2.1**) of the proposed road project range from -2.0% to -92.3%, and there are only 2 instances of increased traffic flows at the N28 Shanbally–Shannonpark Section (westbound 9-10am) and N28 Roundabout Ringaskiddy–Shanbally Section (eastbound 8-9am).

4.55 The reduction of traffic flow through these villages due to diverting typical traffic onto the proposed road project is particularly important as it will result in the removal of negative effects the N28 has on community severance within these villages.

4.56 The proposed road project will pass south-west of the Brothers of Charity accommodation site at Shannonpark. This presents a significant change in environmental setting for a particularly sensitive receptor, and may also impinge on the facilities ability to expand.

Access and Accessibility

4.57 As a direct result of the proposed road project, there will be improved opportunities for walking and cycling along the existing N28, as a consequence of diverting large volumes of traffic from the current N28 onto the new route. This is considered particularly beneficial to the villages of Shanbally and Ringaskiddy which the N28 currently cuts through.

4.58 Additionally, the proposed road project will provide cycle and walking connectivity at numerous locations between Cork City and Ringaskiddy to align with existing and future plans and initiatives including:

- Cork Cycle Network Plan (Cork County Council and Cork City Council);
- Greenway Link from Ringaskiddy and Shanbally to the Cork Harbour Greenway at Raffeen for connectivity to Carrigaline, Crosshaven, Passage West and Cork City; and
- Verge areas and suitable side roads for walking and cycling provision.

4.59 This presents increased opportunities for physical activity and active transport, with associated respiratory and cardiovascular benefits (Sustrans, 2008).

5 Health Assessment; Summary and Conclusions

Construction

5.1 Construction of the proposed road project presents a number of potential health pathways. However, taking into account the level of emissions (air and noise) generated on-site, their intermittent nature/duration and minimal opportunity for community exposure, the risk to community health is not of a level to quantify any meaningful adverse health outcome, and would be further managed through the mitigation measures set out in the EIA approval process.

Operation

5.2 Once operational, the proposed road project is inherently designed to address a range of existing environmental and safety issues along the existing road network; will improve capacity and reduce congestion, and more importantly from a health perspective, will reduce residential exposure to air quality and noise over and above what can be achieved through the Do Minimum scenario.

5.3 In addition, the proposed road project is central to improving connectivity between residential areas and strategic employment areas, and is key to the sustainable development of both, while further displacing existing and forecasted traffic away from residential areas, thereby creating indirect opportunities for urban renewal and improvement.

5.4 A review of the EIS demonstrates that the proposed project is designed to address existing hazards, offering a net reduction in community exposure from emissions to air and noise and improving road safety over and above what can be achieved through the alternative of no change to the road. In addition, the proposed road project seeks to address congestion, improve connectivity between residential and employment areas, while further displacing traffic and supporting sustainable development.

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RPS

Contact

Tara Barratt
Assistant Environmental Consultant
RPS Planning & Development
6-7 Lovers Walk
Brighton
East Sussex
BN1 6AH
T: +44 (0) 1273 546 800
j.jones@rpsgroup.com