
Chapter 11

Human Health

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11 HUMAN HEALTH

11.1 Introduction

This chapter of the Environmental Impact Assessment Report (EIAR) addresses the potential human health impacts relating to the construction and operation of the N2 Slane Bypass and Public Realm Enhancement Scheme, referred to hereafter as the ‘Proposed Scheme’.

The Proposed Scheme represents a key opportunity for improving population health outcomes for the people of Slane and those visiting the area. This aligns with the Healthy Ireland policy position to improve people’s health and wellbeing (Department of Health, 2013). It also aligns with the National Planning Framework (NPF) section 6.2 on healthy communities and section 9.4 on creating a clean environment for a healthy society (Department of Housing, 2019). The NPF states:

“Our health and our environment are inextricably linked. Specific health risks that can be influenced by spatial planning include heart disease, respiratory disease, mental health, obesity and injuries. By taking a whole-system approach to addressing the many factors that impact on health and wellbeing and which contribute to health inequalities, and by empowering and enabling individuals and communities to make healthier choices, it will be possible to improve health outcomes, particularly for the next generation of citizens.”

Key features of the Proposed Scheme that support population health are the bypass providing improved road safety, amenity and environmental quality in Slane. The Proposed Scheme, including the public realm enhancements, also improves the road transport infrastructure and active travel routes, with wider social and economic benefits.

The chapter follows guidance and good practice, giving the public health perspective of impacts. In so doing, the chapter:

- Takes a population health approach to assessing physical and mental health outcomes;
- Considers the wider determinants of health, that may be significantly affected directly or indirectly;
- Assesses the potential for health inequalities to vulnerable groups; and
- Considers opportunities to improve the Proposed Scheme to further benefit population health.

The potential for the Proposed Scheme to change population health outcomes may arise from various health pathways. The effects on physical and mental health link to impacts discussed throughout this EIAR. In particular, the health assessment draws inputs from the following chapters:

- **Chapter 4 – Description of the Proposed Scheme**
- **Chapter 5 – Description of the Construction Phase**
- **Chapter 6 – Consultation**
- **Chapter 7 – Traffic and Transport**
- **Chapter 8 – Population**
- **Chapter 9 – Noise and Vibration**
- **Chapter 10 – Air Quality**
- **Chapter 12 – Landscape and Visual**
- **Chapter 13 – Archaeological and Cultural Heritage**
- **Chapter 15 – Biodiversity: Terrestrial Ecology**
- **Chapter 16 – Biodiversity: Aquatic Ecology**
- **Chapter 17 – Water**
- **Chapter 18 – Land, Soils, Geology and Hydrogeology**
- **Chapter 19 – Climate**
- **Chapter 20 – Material Assets: Agricultural Properties**
- **Chapter 21 – Material Assets: Non-agricultural Properties**
- **Chapter 24 – Risks of Major Accidents and/or Disasters**
- **Chapter 25 – Cumulative Effects**
- **Chapter 26 – Interaction between the Environmental Factors**

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The health assessment takes as its input the residual effect conclusions of the EIAR Technical Chapters listed above'. In this regard the health assessment relies on the mitigation measures set out in those chapters and does not repeat them. This avoids duplication and keeps the assessment proportionate.

11.2 Methodology

11.2.1 Legislation, Policy and Guidance

11.2.1.1 Legislation

The following legislation in **Table 11-1** is relevant to the assessment of the effects on human health.

Table 11-1: Health Legislation

Legislation	Description
The EIA Regulations 2018 (Government of Ireland, 2018)	Sets the requirement to consider the likely significant effects on human health
The Roads Act, 1993, Section 50(2) as amended by the (Environmental Impact Assessment) (Amendment) Regulations 2019 (S.I. No. 279 of 2019). (Law Reform Commission, 2021)	Sets the general provisions for an environmental impact assessment report. Section 2(1) of the amended act defines EIA, including the inclusion of human health.
The Safety, Health and Welfare at Work etc Act 2005 (as amended) (Government of Ireland, 2005)	Sets out general duties on employers, including ensuring, so far as is reasonably practicable, that employees and individuals at the place of work who are not employees are not exposed to risks to their safety, health or welfare.
The Environmental Protection Agency Act 1992 (as amended) (Government of Ireland, 1992)	Governs environmental exposures, including provisions in relation to nuisance.
The Air Quality Standards Regulations 2011 (Government of Ireland, 2011)	Sets the regulatory thresholds for air quality. These are the standards considered acceptable in terms of public health protection in the Republic of Ireland.
Environmental Noise Regulations 2018 (as amended) (Government of Ireland, 2018)	Sets a common approach to avoid, prevent or reduce on a prioritised basis the harmful effects, including annoyance, due to exposure to environmental noise.

11.2.1.2 Policy

The preparation of this chapter has had regard to a number of relevant policies. These include the following key national and local policies:

- Ireland 2040 – National Planning Framework (NPF), Department of Housing, Local Government and Heritage (DHLGH, 2021);
- Healthy Ireland Framework (HIF) 2019-2025, Department of Health (Doha, 2019);
- Roadmap for Social Inclusion 2020-2025, Department of Social protection (DSP, May 2023); and
- Healthy Meath Plan 2019-2021, Meath County Council (MCC, 2019).

Refer to **Appendix 11.1 – Health Policy Context** for further details on these policies.

11.2.1.3 Guidance

The following guidance in **Table 11-2** has informed the assessment.

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Table 11-2: Health Guidance

Guidance	Description
Institute of Public Health (IPH), Guidance, Standalone Health Impact Assessment and health in environmental assessment, 2021 (Institute of Public Health, 2021).	Sets current good practice for the assessment of human health in EIA, including assessment methods. This updates the 2009 guidance from the IPH.
Institute of Environmental Management and Assessment (IEMA) 2022 guidance on health in EIA series, effective scoping (Pyper, et al., 2022a) and determining significance (Pyper, et al., 2022b).	EIA practitioner guidance on assessing human health, applicable to Republic of Ireland and Northern Ireland. Guidance sets out principles and methods of assessment.
International Association for Impact Assessment (IAIA) and European Public Health Association. A reference paper on addressing Human Health in EIA (Human health: Ensuring a high level of protection. A reference paper on addressing Human Health in Environmental Impact Assessment as per EU Directive 2011/92/EU amended by 2014/52/EU., 2020), and academic discussion of the same (Cave, Pyper, Fischer-Bonde, Humboldt-Dachroeden, & Martin-Olmedo, 2021).	This international consensus piece informed the IPH 2021 guidance. The publication explains EIA for public health stakeholders and sets out transparent assessment approaches adopted by the IPH.
International Association for Impact Assessment. Health Impact Assessment International Best Practice Principles, 2021 (Winkler, et al., 2021).	Confirms the relationship between HIA and EIA. Confirms the application of HIA principles when undertaking health in EIA.
Environmental Protection Agency. Guidelines on the information to be contained in Environmental Impact Assessment Reports, 2022 (Environmental Protection Agency, 2022).	The EPA present a health protection position statement on the coverage of health in EIA. The wider public health remit is covered by the IPH 2021 guidance.

The conceptual models/tools of the IPH 2021 guidance informed the health assessment, specifically Part 4, Figures T09 (sensitivity), T11 (magnitude) and T12 (significance, including importance and acceptability). This is a robust best practice approach that can be applied consistently and transparently to all determinants of health.

11.2.2 Zone of Influence

The following study areas are used in the assessment:

- The 'site-specific' area is the electoral division (ED) areas of Slane and Painestown where the Proposed Scheme works are located (illustrated in **Figure 11.1**). It is noted that small area deprivation statistics show particular disadvantage in Small Area ID 167081003 which is in the northern area of Slane ED.
- The 'local' area is the local authority area of County Meath.
- The 'regional' area is the province of Leinster.
- The 'national' area is Republic of Ireland (and beyond for international travel and transboundary effects).

As study areas do not necessarily define the boundaries of potential health effects, particularly mental health effects, the health chapter uses study areas to broadly define representative population groups, including in relation to sensitivity, rather than to set boundaries on the extent of potential effects.

The health assessment has regard to the zones of influence defined by other EIAR chapters that are inter-related technical disciplines for the health assessment. Those chapters provide data inputs to the health assessment. Those zones of influence are relevant and inform the health chapter's consideration of effect magnitude.

11.2.3 Sources of Information to inform the Assessment

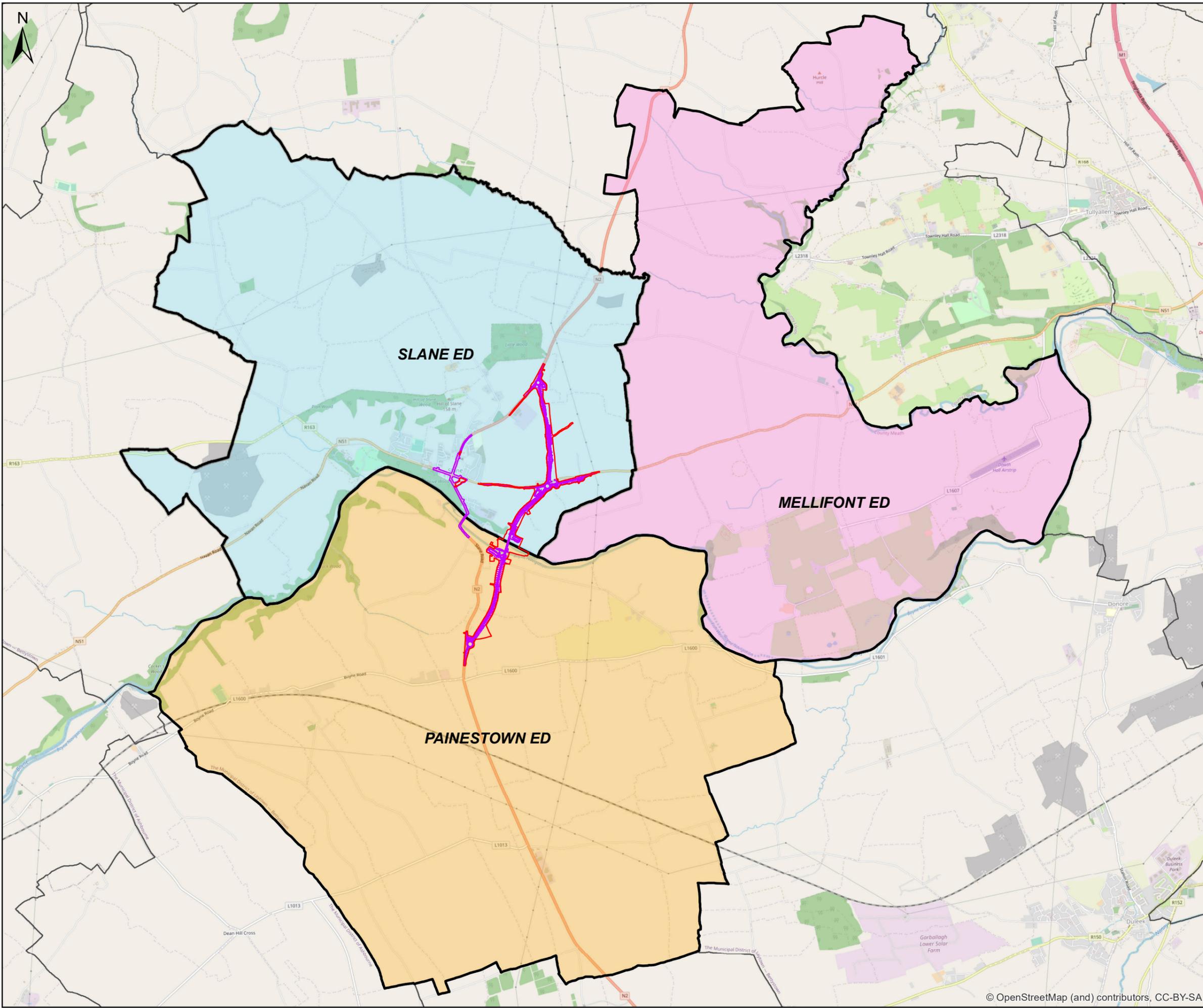
Data from the inter-related technical disciplines have been used to inform the health assessment. This data informs the health assessment by identifying potential receptors and community assets for these disciplines, such as schools, residential properties, walking and cycling routes, as well as tourism and recreational

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amenities. No separate health specific data collection surveys have been undertaken. The health analysis is informed by scheme-wide consultation.

The following data sources have informed the health baseline assessment:

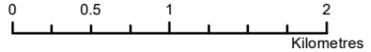
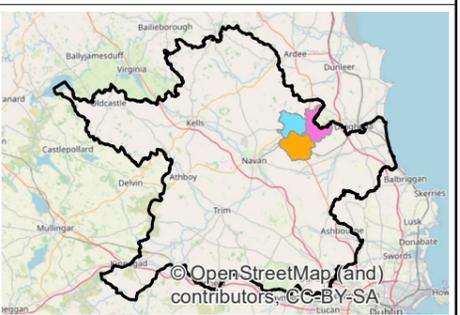
- CSO (CSO) Small Area Population Statistics (SAPS) Interactive Mapping Tool (CSO, 2016);
- CSO StatBank (CSO, n.d.);
- Pobal HP Deprivation Index (Pobal, 2016); and
- Google Earth Pro 2021 aerial and street level photography.



Legend

-  Proposed Scheme
-  Proposed Scheme Boundary
- Electoral Division (2016)**
-  Mellifont
-  Painestown
-  Slane

Data Source: CSO Electoral Divisions and County Boundaries 2016

Client **Meath County Council**

N2 Slane Bypass and Public Realm Enhancement Scheme

Title

Figure 11.1

Zone of Influence for Human Health

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11.2.4 Key Parameters for Assessment

A proportionate and evidence-based approach to the EIA health chapter scoping has been undertaken. Scoping has followed the IPH list of determinants of health and population groups (Institute of Public Health, 2021).

This chapter covers the following issues:

- **Health inequalities:** Consideration is given to the distribution of changes in population health outcomes in terms of its influence on health inequalities. The assessment does this by reaching conclusions for both the general population and for the sub-population who may be more vulnerable, e.g. due to age, poor health, low incomes or geographic location.
- **Healthy lifestyles:** The effects of the public realm enhancements and other elements of the Proposed Scheme on active travel and physical activity are considered. This includes any disruption to active travel routes during construction; as well as the enhancements that support physical activity from the finished scheme. Supporting people to be active, and the amenity value of the routes or facilities, is an important determinant of physical and mental health.
- **Safe and cohesive communities:** Changes in local transport nature and flow rates are considered, particularly in relation to the schemes benefits to road safety. Other considerations include the influence on journey times that may affect routine or emergency healthcare access. The potential for benefits to community cohesion and social capital within Slane from reduced dominance of road traffic in public spaces are considered. Community identity is a determinant of wellbeing and is influenced by aesthetic elements of the landscape and townscape, including the setting of sites of cultural significance. There is potential for a range of effects due to the Proposed Scheme's changes and the subjective nature of people responses to such changes. Community identity in Slane itself may be enhanced by the road network changes not only reducing traffic, but also making it a deliberate destination rather than a place passed through on a major transport route. The public realm enhancements are also likely to improve community identity.
- **Socio-economic conditions:** Good quality employment and levels of income are strong predictors of health, including for dependants. Dependants include vulnerable groups such as children, the frail elderly and people with long-term health conditions that require high levels of care. The assessment considers how the Proposed Scheme affects direct, indirect and induced employment opportunities during construction, and what influence this may have on population health.

Under '**Environmental conditions**', the following are considered:

- Changes to local air quality (road traffic emissions and potential dust nuisance) are discussed, including both potential for adverse effects during construction and redistributed effects during operation. For example, the potential for benefits of less traffic, including HGVs, and less congestion that may improve air quality in the areas of higher population density, i.e. within Slane.
- Changes in noise exposure are discussed, particularly night-time noise that may be detrimental to population health where sleep is disturbed to a high degree. Changes in the distribution of day-time noise are also considered. The latter may include the potential to change levels of traffic noise near to schools, where educational outcomes for young people are considered.
- Radon exposure pathways are considered. Radon is a naturally occurring gas harmful to health when it builds up in inhabited confined spaces. Radon originates from rock formations. It is noted that there are pockets of high radon risk as mapped by the EPA in the environs of Slane village and the surrounding area i.e. an area where it is predicted that one-in-five homes is likely to have high radon levels. Potential for road construction to facilitate diffusion of radon from underlying bedrock/ fault lines is considered. The assessment considers how any change in pathways affects risk. The assessment has regard to peoples understanding of such risks also being an influence on mental wellbeing.

11.2.5 Assessment Criteria and Significance

11.2.5.1 General approach

This section sets out the methods for assessment of any likely significant population health effects of the Proposed Scheme.

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The generic scheme-wide approach to the assessment methodology is set out in **Section 1.3.3 in Chapter 1 – Introduction**. Here it is explained how the generic approach is refined to address the specific needs of the EIA health assessment. Namely criteria for sensitivity, magnitude and significance that inform a professional judgment and reasoned conclusion as to the public health implications of the Proposed Scheme.

Regard has been had to the EPA (2022) Guidelines on the Information to be Contained in Environmental Impact Assessment Reports. The guidelines provide generic definitions for significance, but also note that when more specific definitions exist within a specialised factor or topic, these should be used in preference to the generalised definitions. In the case of Human Health, specific definitions are set out by IPH (2021). This assessment follows the IPH (2021) definitions and approach relevant to determining health sensitivity, health magnitude and health significance in an EIA context.

The methodology outlined in this section follows the IEMA 2022 and IPH 2021 guidance, which sets out best practice for the consideration of health in EIA. The IPH guidance was informed by the international consensus publication between impact assessment and public health practitioners, the IAIA/EUPHA Reference Paper 2020.

Where significant adverse population health effects are identified, including for vulnerable groups, then mitigation has been proposed to avoid or reduce the effects. Mitigation is secured as part of the Proposed Scheme design or development consent. In line with good practice the Proposed Scheme takes a proportionate approach to identifying opportunities to enhance beneficial population health effects, including for vulnerable groups.

Cumulative effects are considered, including inter-related effects of the Proposed Scheme. This analysis considers how the same geographic or vulnerable group populations may be affected by more than one change in relevant health determinants, for example the combined effects of changes in air quality and noise on population health outcomes.

Where proportionate, the need for monitoring has been considered, including relevant governance.

11.2.5.2 Determinants of health, risk factors and health outcomes

The chapter uses the World Health Organization (WHO) definition of health, which states that health is a “*state of complete physical, mental and social wellbeing and not merely the absence of disease or infirmity*”.¹

The chapter also uses the WHO definition for mental health, which is a “*state in which every individual realises his or her own potential, can cope with the normal stresses of life, can work productively and fruitfully, and is able to make a contribution to her or his community*”.²

In this chapter the terms health, health and wellbeing and population health are used interchangeably.

Health and wellbeing are influenced by a range of factors, termed the ‘wider determinants of health’. Determinants of health span environmental, social, behavioural, economic and institutional factors. Determinants therefore reflect a mix of influences from society and environment on population and individual health.

Impacts of the Proposed Scheme that result in a change in determinants have the potential to cause beneficial or adverse effects on health, either directly or indirectly. The degree to which these determinants influence health varies, given the degree of personal choice, location, mobility and exposure.

A change in a determinant of health affects does not equate directly to a change in population health. Rather the change in a determinant alters risk factors for certain health outcomes. The assessment considers the degree and distribution of change in these pathways. The analysis of health pathways focuses on the risk factors and health outcomes that are most relevant to the determinants of health affected by the Proposed Scheme. As there are both complex and wide-ranging links between determinants of health, risk factors and health outcomes, it would not be proportionate or informative for an assessment to consider every interaction.

¹ World Health Organization. Preamble to the Constitution of the World Health Organization; signed on 22 July 1946 by the representatives of 61 States and entered into force on 7 April 1948. New York, 1948. Available at: <http://bit.ly/1cgnJ3S>

² World Health Organization. Mental health: strengthening mental health promotion. 2007. Available at: <http://mindyourmindproject.org/wp-content/uploads/2014/11/WHO-Statement-on-Mental-Health-Promotion.pdf>

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Typically, the change in a risk factor may need to be large, sustained and widespread within a population for there to be a significant influence on public health outcomes.

11.2.5.3 Population health approach and vulnerable groups

In line with IPH guidance a population health approach has been taken, informed by discussion of receptors within the other technical chapters of the EIAR.

For each determinant of health, the human health chapter identifies relevant inequalities through consideration of the differential effect to the 'general population' of the relevant study area and effects to the 'vulnerable population group' of that study area. The vulnerable population group being comprised of relevant sensitivities for that determinant of health. The following population groups have been considered:

- The 'general population' including residents, visitors, workers, service providers, and service users; and
- The 'vulnerable group population'.

The methods draw on the list of vulnerable population groups set out in IPH Part 3, Table 09. The following six broad population groups are used to inform a consistent narrative on potential health inequalities across the assessment, people falling into more than one group may be especially sensitive:

- **Young age:** Children and young people (including pregnant women and unborn children).
- **Old age:** Older people (particularly frail elderly).
- **Low income:** People on low income, who are economically inactive or unemployed/workless.
- **Poor health:** People with existing poor health; those with existing long-term physical or mental health conditions or disability that substantially affects their ability to carry out normal day-to-day activities.
- **Social disadvantage:** People who suffer discrimination or other social disadvantage, including relevant protected characteristics under the Irish Human Rights and Equality Commission Act 2014³ or groups who may experience low social status or social isolation for other reasons.
- **Access and geographical factors:** People experiencing barriers in access to services, amenities and facilities and people living in areas known to exhibit high deprivation or poor economic and/or health indicators.

The following general characterisations of how the 'general population' may differ from 'vulnerable group populations' were considered when scoring sensitivity. These statements are not duplicated in each assessment and apply (as relevant) to the issues discussed for both construction and operation.

- In terms of life stage, the general population can be characterised as including a high proportion of people who are independent, as well as those who are providing some care. By contrast, the vulnerable group population can be characterised as including a high proportion of people who are providing a lot of care, as well as those who are dependant.
- The general population can be characterised as experiencing low deprivation. However, the professional judgment is that the vulnerable group population experiences high deprivation (including where this is due to pockets of higher deprivation within low deprivation areas).
- The general population can be characterised as broadly comprised of people with good health status. Vulnerable groups, however, tend to include those parts of the population reporting bad or very bad health status.
- The general population tends to include a large majority of people who characterise their day-to-day activities as not limited. The vulnerable group population tends to represent those who rate their day-to-day activities as limited a little or limited a lot.
- Based on a professional judgement the general population's resilience (capacity to adapt to change) can be characterised as high whilst the vulnerable group population can be characterised as having limited resilience.

³ For example, disadvantage by reference to the following factors: gender; civil status; family status; sexual orientation; religious belief; age; disability; race, including colour, nationality, ethnic or national origin; or membership of the Traveller community.

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- Regarding the usage of affected infrastructure or facilities, the professional judgement is that the general population are more likely to have many alternatives to resources shared with the Proposed Scheme (e.g. shared routes or community assets). For the vulnerable group population, the professional judgement is that they are more likely to have a reliance on shared resources.
- The general population includes the proportion of the community whose outlook on the Proposed Scheme includes support and ambivalence. The vulnerable group population includes the proportion of the community who are uncertain or concerned about the Proposed Scheme.

11.2.5.4 Temporal Scope

The temporal scope of the assessment is consistent with the period over which the Proposed Scheme will be carried out and therefore covers the construction and operational periods. It is anticipated that construction will take place over an approximate 36 month period. The assessment does not place an end date on the operations of the Proposed Scheme.

Where relevant EIAR chapters define specific assessment years, the health chapter assessment uses the same assessment years (e.g. opening year 2026 and design year 2041). The following temporal scope definitions set out in the EPA (2022) guidelines provide consistency of terminology:

- Momentary Effects are those lasting from seconds to minutes;
- Brief Effects are those lasting less than a day;
- Temporary Effects are those lasting less than a year;
- Short-term Effects are those lasting one to seven years;
- Medium-term Effects are those lasting seven to fifteen years;
- Long-term Effects are those lasting fifteen to sixty years; and
- Permanent Effects are those lasting over sixty years.

11.2.5.5 Determining Effect Significance

The assessment of EIA health significance is an informed expert judgement about what is important, desirable or acceptable for public health with regards to changes triggered by the Proposed Scheme. These judgements are value-dependant (underpinned by scientific data, but also informed by professional perspectives); and are context-dependent (judgements reflect relevant social, economic and political factors for the population).⁴

The determination of significance has two stages:

- Firstly, the sensitivity of the receptor affected, and the magnitude of the effect upon it are characterised. This establishes whether there is a relevant population and a relevant change to consider; and
- Secondly, a professional judgement is made as to whether the expected change in a population's health outcomes would be significant in public health terms. This judgement is explained using an evidence-based narrative setting out reasoned conclusions.

Table 11-3,

Table 11-4, Table 11-5 and Table 11-6 together summarise the assessment methodology that has been adopted. This approach shows how the general EIA methods of using sensitivity and magnitude to inform a judgement of significance, are applied for human health. The approach uses professional judgement, drawing on consistent and transparent criteria for sensitivity and magnitude. It also references relevant contextual evidence to explain what significance means for human health in public health terms.

The EIA human health assessment uses qualitative analysis following the IPH (2021) guidance approach. This draws on qualitative and quantitative inputs from other EIAR topic chapters. This reflects the consensus position amongst public health and impact assessment practitioners that qualitative analysis is the most appropriate methodology for assessing wider determinants of health proportionately, consistently and

⁴ European Commission. 2017. Environmental Impact Assessment of Projects: Guidance on Scoping (Directive 2011/92/EU as amended by 2014/52/EU). European Union. Luxembourg. http://ec.europa.eu/environment/eia/pdf/EIA_guidance_Scoping_final.pdf

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transparently. The IPH 2021 approach is presented in a tabulated format for consistency with other EIA topics.

The EIA health chapter conclusions are both EIA scores, such as major, moderate, minor or negligible, and a narrative explaining this score with reference to evidence, local context and any inequalities.

Terms in bold in **Table 11-3**,

Table 11-4 and **Table 11-6** indicate terms that qualitatively describe levels within criteria that are discussed across the scoring options. For example, high, moderate, low or very low levels of deprivation. These are the terms from the guidance that are used within the assessment narrative.

Table 11-3: Health Sensitivity Methodology Criteria

Category/ Score	Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories) <i>The narrative explains that the population or sub-population's sensitivity is driven by (select as appropriate):</i>
High	High levels of deprivation (including pockets of deprivation); reliance on resources shared (between the population and the project); existing wide inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or concern ; people who are prevented from undertaking daily activities; dependants ; people with very poor health status; and/or people with a very low capacity to adapt.
Medium	Moderate levels of deprivation; few alternatives to shared resources; existing widening inequalities between the most and least healthy; a community whose outlook is predominantly uncertainty with some concern; people who are highly limited from undertaking daily activities; people providing or requiring a lot of care ; people with poor health status; and/or people with a limited capacity to adapt.
Low	Low levels of deprivation; many alternatives to shared resources; existing narrowing inequalities between the most and least healthy; a community whose outlook is predominantly ambivalence with some concern; people who are slightly limited from undertaking daily activities; people providing or requiring some care ; people with fair health status; and/or people with a high capacity to adapt.
Very low	Very low levels of deprivation; no shared resources; existing narrow inequalities between the most and least healthy; a community whose outlook is predominantly support with some concern; people who are not limited from undertaking daily activities; people who are independent (not a carer or dependant); people with good health status; and/or people with a very high capacity to adapt.

Table 11-4: Health Magnitude Methodology Criteria

Category/ Score	Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories) <i>The narrative explains that the change due to the project has (select as appropriate):</i>
High	High exposure or scale; long-term duration; continuous frequency; severity predominantly related to mortality or changes in morbidity (physical or mental health) for very severe illness/injury outcomes; majority of population affected; permanent change; substantial service quality implications.
Medium	Low exposure or medium scale; medium-term duration; frequent events; severity predominantly related to moderate changes in morbidity or major change in quality-of-life; large minority of population affected; gradual reversal; small service quality implications.
Low	Very low exposure or small scale; short-term duration; occasional events; severity predominantly related to minor change in morbidity or moderate change in quality-of-life; small minority of population affected; rapid reversal; slight service quality implications.
Negligible	Negligible exposure or scale; very short-term duration; one-off frequency; severity predominantly relates to a minor change in quality-of-life ; very few people affected; immediate reversal once activity complete; no service quality implication.

Table 11-5: Assessment Matrix (Indicative)

		Sensitivity			
		High	Medium	Low	Very low
Magnitude of Impact	High	Major	Moderate or major	Moderate or minor	Minor or negligible
	Medium	Moderate or major	Moderate	Minor	Minor or negligible
	Low	Moderate or minor	Minor	Minor	Negligible
	Negligible	Minor or negligible	Minor or negligible	Negligible	Negligible

Where the matrix offers more than one significance option, professional judgement is used to decide which option is most appropriate.

Table 11-6: Health Significance Methodology Criteria

Category/ Score	Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories)
Major (significant)	<p>The narrative explains that this is significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> Changes, due to the project, have a substantial effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by referencing relevant policy and effect size (magnitude and sensitivity scores), and as informed by consultation themes among stakeholders, particularly public health stakeholders, that show consensus on the importance of the effect. Change, due to the project, could result in a regulatory threshold or statutory standard being crossed (if applicable). There is likely to be a substantial change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a causal relationship between changes that would result from the project and changes to health outcomes. In addition, health priorities for the relevant study area are of specific relevance to the determinant of health or population group affected by the project.
Moderate (significant)	<p>The narrative explains that this is significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> Changes, due to the project, have an influential effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by referencing relevant policy and effect size, and as informed by consultation themes among stakeholders, which may show mixed views. Change, due to the project, could result in a regulatory threshold or statutory standard being approached (if applicable). There is likely to be a small change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a clear relationship between changes that would result from the project and changes to health outcomes. In addition, health priorities for the relevant study area are of general relevance to the determinant of health or population group affected by the project.
Minor (not significant)	<p>The narrative explains that this is not significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> Changes, due to the project, have a marginal effect on the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by effect size of limited policy influence and/or that no relevant consultation themes emerge among stakeholders. Change, due to the project, would be well within a regulatory threshold or statutory standard (if applicable); but could result in a guideline being crossed (if applicable). There is likely to be a slight change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is only a suggestive relationship between changes that would result from the project and changes to health outcomes. In addition, health priorities for the relevant study area are of low relevance to the determinant of health or population group affected by the project.
Negligible (not significant)	<p>The narrative explains that this is not significant for public health because (select as appropriate):</p>

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Category/ Score	Indicative criteria (judgment based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories)
	<ul style="list-style-type: none"> • Changes, due to the project, are not related to the ability to deliver current health policy and/or the ability to narrow health inequalities, including as evidenced by effect size or lack of relevant policy, and as informed by the project having no responses on this issue among stakeholders. • Change, due to the project, would not affect a regulatory threshold, statutory standard or guideline (if applicable). • There is likely to be a very limited change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is an unsupported relationship between changes that would result from the project and changes to health outcomes. • In addition, health priorities for the relevant study area are not relevant to the determinant of health or population group affected by the project.

Population health effects that are scored major or moderate are considered significant.

Ultimately a likely significant health effect is one that should be brought to the attention of the competent authority, as the effect of the Proposed Scheme is judged to provide, or be contrary to providing, a high level of protection to population health. This may include reasoned conclusions in relation to health protection, health improvement and/or improving services.

Where significant adverse effects are identified, mitigation is considered to reduce the significance of such effects. Similarly, enhancements are considered where significant and proportionate opportunities to benefit population health are identified.

11.2.5.6 Evidence Assumptions and Limitations

This assessment is based on publicly available statistics and evidence sources. No new primary research or bespoke analysis of non-public data was undertaken for the assessment.

11.2.6 Data Limitations

This assessment is based on publicly available statistics and evidence sources. No new primary research or bespoke analysis of non-public data was undertaken for the assessment.

Health and wellbeing data provided by the Institute of Public Health Community Profile Tool has been unavailable throughout 2022 due to ongoing updates to their database. Available statistics from other sources have been collected and presented.

Such limitations do not affect the robustness of the assessment for EIA purposes.

11.3 Description of Existing Environment (Baseline Scenario)

11.3.1 Current Baseline Environment

Different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstances.

The aim of the following information, which summarises the more detailed health and wellbeing baseline information provided in **Appendix 11.2**, is primarily to put into context the local health circumstances of the communities surrounding the village of Slane, drawing from available statistics⁵. Where possible, data has been collected for the Slane ED and Painestown ED, to compare against the national (Ireland) average. Where ED data is not available, data for County Meath has been used to compare with the national average.

⁵ Please note health and wellbeing data provided by the Institute of Public Health Community Profile Tool is currently unavailable due to ongoing updates to the database. Available statistics from other sources have been collected, but there are gaps in some physical health (morbidity) indicators as well as mental health and lifestyle indicators.

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This is then applied as the foundation to the assessment and aids in identifying, informing and refining healthy urban design features tailored to support local community health needs, and the delivery of public health objectives/priorities.

It should be noted that the description of the whole population, and the populations within the local and wider study area, does not exclude the probability that there will be some individuals or groups of people who do not conform to the overall profile.

Physical Health

Overall, currently available physical health statistics for Slane ED and County Meath perform better than national averages. There is a higher proportion of people reporting good health, and mortality rates for all causes, cancer, circulatory diseases, and respiratory diseases are all consistently lower than national levels. Further detail can be found in **Appendix 11.2**.

Mental Health, Lifestyle and Behavioural Risk Factors

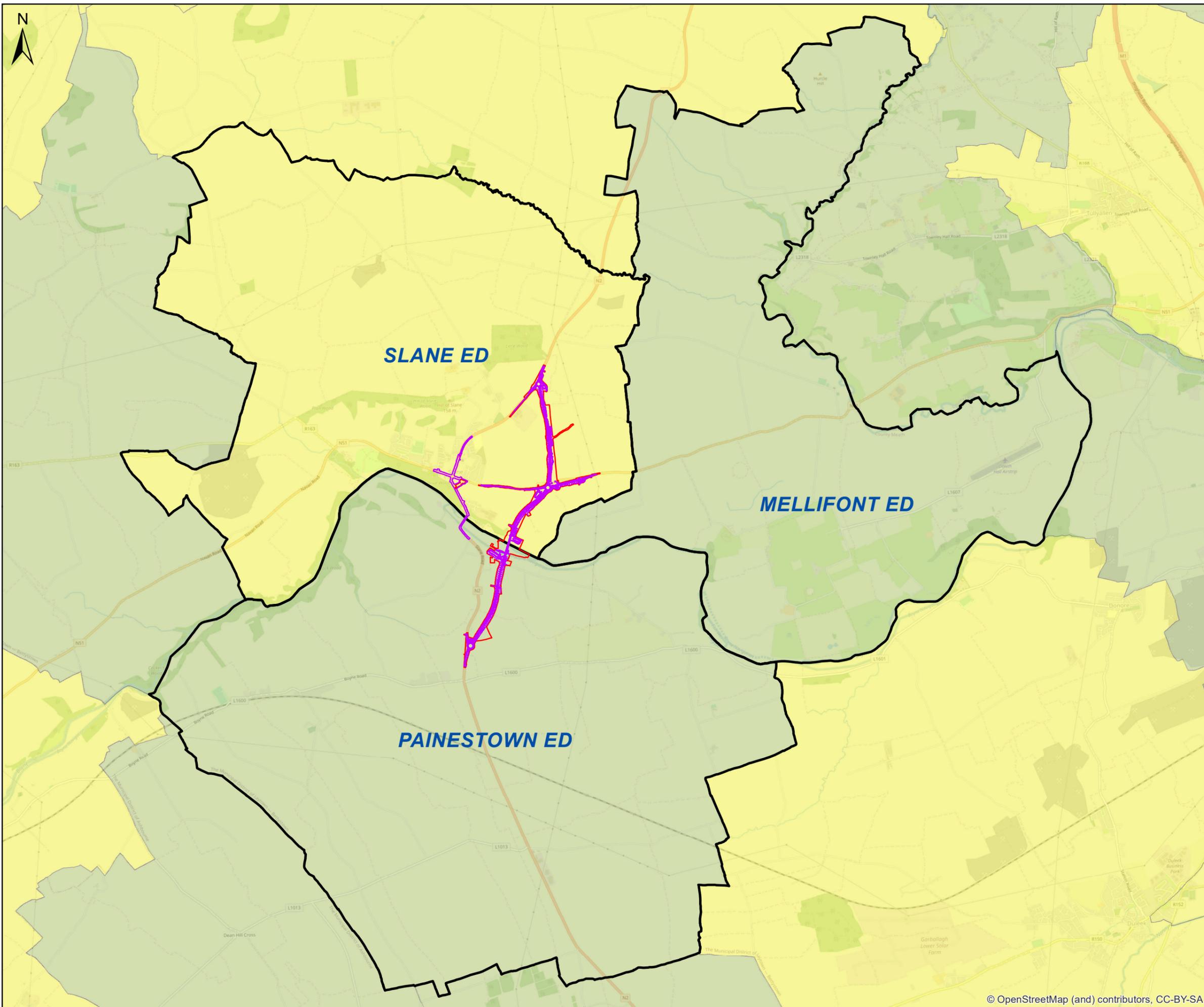
Currently, the only mental health statistic available is suicide rate (reported by the CSO at county level for County Meath), which has fluctuated over the years but is currently showing a decreasing trend and is lower than the national average. This indicator is included as a surrogate for other mental health conditions for which indicators are not currently available, e.g. relating to anxiety and depression.

Deprivation

Deprivation levels in the study area are relatively low, with 5 out of the 7 Small Areas which make up the Slane ED being classified as "Marginally Above Average". However, one Small Area (ID 167081003), located in the southeast of the Slane ED, is classified as "Disadvantaged", and the overall deprivation of Slane ED is therefore classified as "Marginally Below Average". All Small Areas making up the Painestown ED are classified as "Marginally Above Average" except one, which is classified as "Marginally Below Average", and the overall deprivation of Painestown ED is classified as "Marginally Above Average". Deprivation at ED level is shown in **Figure 11.2**, however further detail on Small Area deprivation is detailed and illustrated in **Appendix 11.2**.

Healthcare facilities

The HSE Slane Health Centre is located along the existing N2 within Slane village.



Legend

- Proposed Scheme
- Proposed Scheme Boundary

Pobal Deprivation 2016 By ED

- Very affluent
- Affluent
- Marginally above average
- Marginally below average
- Disadvantaged
- Very disadvantaged
- Extremely disadvantaged

Data Source: CSO Electoral Divisions and County Boundaries 2016 Pobal Deprivation Model 2016

0 0.5 1 2
Kilometres

Client
Meath County Council

N2 Slane Bypass and Public Realm Enhancement Scheme

Title
Figure 11.2

Pobal Deprivation Index 2016

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Issue Details

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Approved: NO'N	Projection: ITM	

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11.3.2 Evolution of the Environment in the Absence of the Proposed Scheme

Longer term trends and interventions in population health may influence the future baseline. Health and social care, public health initiatives and government policies aim to reduce inequalities and improve quality of life. The historic success of such interventions is increasingly challenged by national trends, such as an aging population, rising levels of obesity, the COVID-19 pandemic, cost-of-living crisis and climate change. The implications of these pressures for public health will take years to be reflected within statistical data releases, but it is expected that they will exacerbate public health challenges. These factors disproportionately affected vulnerable groups, including due to age and ill-health.

Climate change may exacerbate physical and mental health risk factors, particularly around flooding, extremes of temperature and uncertainty for future generations. The baseline indicates that the population of Slane village is relatively affluent and would be expected to therefore be relatively resilient to climate change stresses. Typically, low resource groups, e.g. in areas of high deprivation, are most sensitive to the adverse health effects of climate change.

To reflect these trends the assessment scores all vulnerable groups as having high sensitivity for all determinants of health. This appropriately captures any increase in sensitivity within the future baseline.

It would not be proportionate (or consistent with the qualitative assessment approach taken) to quantitatively model the population's future health. This reflects the complexities of interactions between the wider determinants of health, as well as the potential for macro-economic changes in the next decade that are hard to predict. Any prediction would have such wide error margins that it would greatly limit the value of the exercise.

11.4 Description of Likely Significant Effects

Sections 11.4.1 and 11.4.2 provide a description of the likely significant effects of the Proposed Scheme on human health in cumulation with other existing development in the area. A description of the likely significant effects in cumulation with other approved development, i.e. development not yet built, is presented in **Section 11.4.3** based on the detailed methodology for the CIA included in **Chapter 25**.

The impact interactions between human health and other environmental factors are identified and described in **Chapter 26** and assessed throughout **Sections 11.4.1 to 11.4.3**.

11.4.1 Construction Phase

11.4.1.1 Healthy lifestyles

This section considers the effects on active travel and physical activity due to any disruption to active travel routes during construction. Supporting people to be active is an important determinant of physical and mental health.

This section has been informed by **Chapter 5 – Description of the Construction Phase**, **Chapter 7 – Traffic and Transport** and **Chapter 8 – Population**, which set out relevant assessment findings and mitigation measures that have been considered.

The potential health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is potential construction disruption and disturbance to the public footpaths, cycle routes, open spaces, sports and leisure facilities.
- The pathway is behavioural change in levels of physical activity.
- Receptors are residents in the local communities near the construction activities.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane; and
- The sub-population vulnerable due to:

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- Young age, specifically children who are overweight or who have low physical activity levels;
- Older age, specifically the elderly for whom familiar routes with appropriate mobility considerations play a part in regular exercise;
- Low income, specifically people with limited access to alternative physical activity opportunities or means of transport;
- Poor health, specifically conditions where physical activity would be beneficial to physical or mental health; and
- Access and geographical factors, specifically the population who have limited access to natural green space accessed by the routes affected by the Proposed Scheme.

The assessment covers these populations within two groups. The general population for the geographic area, notably Slane residents, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

Active travel health effects may relate to physical health (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety or depression) associated with obesity and levels of physical activity.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been considered and are listed in **Section 11.2.5.3** of this report. The general population comprise those members of the community in good physical and mental health and with greater resources to respond to change. Most residents are unlikely to make regular use of the public footpaths, open spaces and sports or leisure facilities affected by the Proposed Scheme and would likely have a high capacity to adapt by selecting alternative routes or physical activity opportunities to avoid any temporary disruption or disturbance.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of dependants, both children, elderly and those receiving care due to poor health. This sub-population may have fewer resources and less capacity to adapt to changes. The population may therefore be more reliant on the affected routes, open spaces and sports or leisure facilities with greater likelihood that any disruption or disturbance could affect physical activity behaviours.

The magnitude of change due to the Proposed Scheme is **low**. As reported in **Chapter 5, Section 5.5.2 Construction Traffic Impact**, the proposed public realm improvements within Slane Village will require works to reconfigure existing roads and footways. However, all works will occur after the proposed bypass is operational, and any temporary road closures will be at night with local diversions in place. Most of the construction will be offline, and earthworks and materials haulage will be along specific haulage routes and not permitted through the village.

Furthermore, there would be construction management practices, including a Construction Traffic Management Plan that will be developed by the contractor (**Chapter 5, Section 5.5.1 Traffic Management During Construction**), which will contain measures to reduce disturbance and adverse effects on surrounding amenity during the construction works. Mitigation within **Chapter 8 – Population** states that a Communications Plan will be developed by the contractor, who will also appoint a Community Liaison Officer to ensure good communication lines with the public (see **Chapter 8, Section 8.5.1.1 General Measures** for these details). The scale of change is therefore considered *small* and *short-term*. Only *minor* changes in morbidity for cardiovascular and mental health outcomes would be expected for a *small minority* of the population due to the temporary disruption during construction works. Most adverse effects on health behaviours and outcomes would be temporary and would be expected to *reverse* on completion of the construction works.

The significance of the population health effect for this determinant of health is **minor adverse (not significant)**. The professional judgment is that there would, at most, be a very *slight* adverse change in the health baseline for the site-specific populations. This conclusion reflects that physical activity is a public health priority and the scientific literature on the benefits of physical activity to health is well established. However, the level of change due to the Proposed Scheme is small and is appropriately mitigated by standard good practice measures that minimise disruption and disturbance. The change is unlikely to result in significant differential or disproportionate effects between the general population (low sensitivity) and the vulnerable sub-population (high sensitivity). Consequently, no widening of health inequalities would be expected, and no influence is expected on the ability to deliver local or national health policy.

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11.4.1.2 Socio-economic conditions

Good quality employment and levels of income are strong predictors of health, including for dependants. Dependants include vulnerable groups such as children, the frail elderly and people with long-term health conditions that require high levels of care. The assessment considers how the Proposed Scheme affects direct, indirect and induced employment opportunities, and what influence this may have on population health.

While the assessment has given regard to wider population level and community health concerns that play a role in people's health (for example, potential links between deprivation and environmental conditions (EEA, 2018)), the focus of the health assessment is the likely significant effects of the Proposed Scheme. Importantly, this includes positive impacts of moving road traffic and HGV numbers away from the majority of receptors (Slane village), thus improving air quality for the majority of the Slane community.

This section has been informed by **Chapter 8 – Population**, which set out relevant assessment findings and mitigation measures that have been considered.

Employment is an important determinant of health and well-being both directly and indirectly by making health-promoting resources available to an employee and any dependants. The socio-economic benefits associated with employment are improved living conditions and the potential to make healthier choices, e.g. eating a healthier diet and undertaking more physical activity. If members of the community are employed, this can also generate indirect economic activity.

The potential health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- Source: Direct and indirect job creation and economic activity;
- Pathway: Level of income and employment linked to spend on health supporting resources; and
- Receptor: People of working age (and their dependants).

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population Slane;
- The 'local' population County Meath; and
- The sub-population vulnerable due to:
 - Young age vulnerability (young adults as employees or apprentices, and children and young people as dependants);
 - Old age vulnerability (older people as dependants);
 - Poor health vulnerability (people with existing poor physical or mental health, including as dependants); and
 - Low-income vulnerability (people living in deprivation, including those on low incomes for who good quality employment may be particularly beneficial).

The assessment covers these populations within two groups. The general population for the geographic area, notably Slane residents, and the vulnerable sub-population for this area. The latter is a comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The scientific literature indicates that there is a clear association between employment opportunities and health and wellbeing outcomes. The literature does not identify thresholds for effects. The assessment has had regard to the population groups identified in the literature that may be particularly sensitive. For example, those who are unemployed, on low incomes or have low job security, including where children are consequently socioeconomically deprived.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been considered and are listed in **Section 11.2.5.3** of this report. This reflects that most people would already be within stable employment that would be unaffected by the Proposed Scheme (or being a dependant of such a person).

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The sensitivity of the vulnerable sub-population is **high**. The health of vulnerable groups is particularly sensitive to employment. Vulnerability in this case relates to people and their dependants who are on low incomes or who are unemployed. Young people, including leaving education or early in their careers may have the most to gain from an increase in good quality job opportunities. Future young or older people may also come to rely on those employed.

The magnitude of change due to the Proposed Scheme is **low**. As stated in **Chapter 8 – Population**, construction of the Proposed Scheme will result in temporary additional employment in the area. There may also be a temporary disruption to passing trade within Slane and nearby tourist attractions, most notably the Francis Ledwidge Museum and Slane Castle, however this is anticipated by **Chapter 8** to be an imperceptible economic effect. The scale of change is considered to be *small* and predominantly relates in maintaining people in existing construction related jobs over the short-term. The benefits of good quality employment contribute to quality-of-life, as well as being protective against adverse changes in morbidity (i.e. avoiding economic hardship or unemployment which are associated with poor physical and mental health outcomes). Effects are likely to relate to *minor* changes that would be experienced by a *small minority* of the local population (including through indirect benefits to dependants). Whilst the benefits may gradually diminish or *reverse* after construction is completed, the experience and upskilling during this time is likely to lead to a continuity of employment that would maintain the health benefits. This would be important particularly for young adults starting their careers, including those on apprentice schemes. Whilst construction activities have inherent occupational risks, the operation of appropriate health and safety practices means that it is unlikely that there would be an impact on healthcare services.

The significance of the population health effect for this determinant of health is **minor beneficial (not significant)**. The professional judgment is that there would be a slight beneficial change in the health baseline for the local population. This conclusion reflects that the scientific literature establishes a *clear* relationship between good quality employment and factors that promote health or are protective against poor health, particularly mental health. The scale and nature of employment is not expected to widen existing health inequalities.

11.4.1.3 Environmental conditions

11.4.1.3.1 Air quality

This section discusses changes to air quality during construction of the Proposed Scheme, and related effects on human health. Construction of the Proposed Scheme has the potential to result in dust effects from construction activities and construction compounds, as well as vehicle emissions from construction traffic.

This section has been informed by **Chapter 10 – Air Quality**, which sets out relevant assessment findings and mitigation measures that have been taken into account.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is air pollutants (particularly NO₂, PM_{2.5} and PM₁₀ from construction emissions);
- The pathway is diffusion through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane; and
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people);
 - Old age vulnerability (older people);
 - Poor health vulnerability (people with existing poor respiratory or cardiovascular health); and
 - Access and geographical vulnerability (people for whom close proximity to Proposed Scheme change increases sensitivity).

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The assessment covers these populations within two groups: The general population for the geographic area, notably residents of Slane, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

Chapter 10 – Air Quality finds that the residual effects from construction traffic will be moderate adverse at a small number of individual properties adjacent to the haul route. The predicted increases in traffic along haul routes will be 10% of existing traffic, and levels of NO₂ and PM_{2.5} along the haul routes will be well below statutory limits set to be protective of human health. It is noted that baseline PM_{2.5} levels at a single worst affected property are above the WHO guidelines, meaning the property is experiencing poor air quality with and without the Proposed Scheme. The change as a result of the Scheme is relatively small, and at a population level, this is not anticipated to result in significant health effects.

Construction activities that produce dust relate to the coarser fractions of PM₁₀ and potential nuisance from dust deposition on property. The great majority of anthropogenic PM_{2.5} health effects relate to combustion related processes, particularly changes in transport patterns, solid fuel burning from space heating or industrial processes that use fossil fuels. These have limited relevance to construction activities but are nevertheless taken into account in the air quality assessment.

Whilst the focus of discussion in this health chapter differentiates between coarse PM during construction and fine PM during operation, the health outcomes of PM₁₀ and PM_{2.5} are not distinguished in this assessment. This reflects that both are typically present (though the relative proportions change) and that the evidence base does not consistently distinguish their effects particularly given that PM_{2.5} is a subset of PM₁₀. However, generally, elevated concentrations of PM_{2.5} are considered of greater concern due to their greater potential to interact within the body therefore, where relevant, PM_{2.5} levels are used to be conservative.

For construction dusts, the main health outcomes are likely to relate to exacerbation of existing conditions, such as asthma or chronic obstructive pulmonary disease (COPD) (i.e. airway inflammation by coarse PM) and to reductions in wellbeing associated with annoyance or reduced amenity. Whilst other outcomes (e.g. cardiovascular events) may be relevant in the event of brief high concentrations, such elevated exposures are expected to be avoided though the embedded standard good practice mitigation discussed in **Chapter 10 – Air Quality, Section 10.5**.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3** of this report. The general population comprise those members of the community who live, work and study at a distance where high levels of dispersion and deposition would greatly limit the effects any change in exposure due to the Proposed Scheme. Furthermore, most people enjoy *good* respiratory health (e.g. are not asthmatic) and are not at a life stage (e.g. infant or frail elderly) with particular sensitivity to air quality.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. For example, existing respiratory conditions including asthma and chronic obstructive pulmonary disease (COPD) and type 2 diabetes would increase sensitivity. People likely to be most affected by the Proposed Scheme are those either living close to mainline N2/N51 works or the construction compounds (see receptors listed in **Chapter 10 – Air Quality**).

The magnitude of change due to the Proposed Scheme is **low**. As reported in **Chapter 10 – Air Quality**, construction activity and construction compound dust impacts on the identified sensitive receptors are predicted to be of local spatial extent, short term duration, intermittent and high reversibility. Furthermore, a comprehensive set of mitigation measures, including a Traffic Management Plan and dust monitoring will be implemented during the construction phase, to further minimise construction traffic and dust impacts. Occasionally, weather conditions may coincide with construction activities to generate higher levels of dust. This can cause temporary annoyance, and for people with existing poor health, higher levels of coarse dust in the air it can exacerbate some conditions (e.g. asthma). Coarse PM is larger and heavier and so it is deposited more quickly. This means that the concentration of coarse PM in the air reduces rapidly as it gets further from the source. The potential for nuisance-type dust effects is therefore expected to be occasional and limited in extent. Deposition rates are slower for finer PM and affect a wider area and thus, potentially, a greater number of people. However, exposure is expected to be very low due to the finer PM being typically a relatively small component of construction dusts and the effects of dispersion would reduce concentrations over distance. At these levels it is unlikely that there would be discernible changes in the risk of developing a new health condition or of exacerbating an existing condition. Such changes would be *short-term*, with a *very*

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minor influence on *quality of life* and/or *morbidity* risk for respiratory and cardiovascular conditions for a *very few* people. Most effects would *rapidly* reverse, with *no* discernible influence for healthcare services.

For the health assessment, the construction air quality effects are considered **minor adverse (not significant)**. This assessment conclusion reflects that whilst the scientific literature establishes a *causal* effect relationship between changes in air quality and health outcomes, the changes would result in a *very limited* effect in the health baseline of the local population. This finding takes into account non-threshold effects of PM particularly on the vulnerable sub-population. The temporary and slight reduction in air quality is not expected to affect health inequalities.

11.4.1.3.2 Noise

This section discusses changes in noise exposure during construction of the Proposed Scheme, particularly night-time noise that may be detrimental to population health where sleep is disturbed to a high degree. Changes in the distribution of day-time noise are also considered. The latter may include the potential to change levels of traffic noise near to schools, where educational outcomes for young people are considered.

This section has been informed by **Chapter 9 – Noise and Vibration**, which sets out relevant assessment findings and mitigation measures that have been taken into account.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is noise generated by construction activities;
- The pathway is pressure waves through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane; and
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people);
 - Old age vulnerability (older people);
 - Poor health vulnerability (people with existing poor physical or mental health);
 - Low-income vulnerability (people living in deprivation, including those on low incomes may have fewer resources to adapt, e.g. seek respite or install insulation furthermore, those who are economically inactive may spend more time in affected dwellings); and
 - Access and geographical vulnerability (people for whom close proximity to the proposed changes increases sensitivity).

The assessment covers these populations within two groups. The general population for the geographic area, notably Slane residents, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

During construction, there is potential for noise to temporarily arise from construction works, road works and movement of construction related vehicles.

The literature highlights cardiovascular effects, annoyance and sleep disturbance (and consequences arising from inadequate rest) as being the main pathways by which population health may be affected. The literature also notes the potential for chronic noise to have a detrimental effect on learning outcomes (e.g. noise distracting and affecting communication within classrooms). Whilst the literature supports there being thresholds at which effects (such as annoyance and sleep disturbance) are likely, it also acknowledges the subjective nature of responses to noise. In this regard noise effects can be considered to have non-threshold effects, with characteristics other than sound levels also determining the influence on health outcomes. The assessment had regard to the population groups identified in the literature that may be particularly sensitive. For example, children, the elderly, the chronically ill, people with a hearing impairment, shift-workers and people with mental illness (e.g. schizophrenia or autism).

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The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3** of this report. The general population comprise those members of the community in *good* physical and mental health and with resources that enable a *high* capacity to adapt to change. Additionally, most people live, work or study at a distance from the affected parts of the local road network where construction noise and vibration would be unlikely to be a source of concern.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. This sub-population may experience existing *widening* inequalities due to living in areas with increasing noise and *moderate* deprivation, with *limited* capacity to adapt to changes. Vulnerability particularly relates to those living close to the construction activities and construction compounds, including those spending more time in affected dwellings, e.g. due to low economic activity, shift work or *poor* health. People who are *concerned* or have high degrees of *uncertainty* about construction noise and its effect on their wellbeing may be more sensitive to changes in noise.

As reported in **Chapter 9 – Noise and Vibration**, construction of the Proposed Scheme will involve activities that are mobile (i.e. not taking place in location permanently), such as rock extraction and road formation; and activities that are static such as earthworks and demolition works. Mobile works will impact receptors for short periods of time, whereas static works will last longer, which will be mitigated through noise screening. Construction noise is predicted to be within limits set to be protective of health and the environment in most cases. However, **Chapter 9** identifies the is potential for construction noise to exceed limits at a small number of individual receptors (residential properties) that are located closest to the construction compounds and mainline N2/N51 works, resulting in temporary significant adverse effects. These changes will be mitigated as set out in **Chapter 9 section 9.5.1**, which includes potential for targeted noise insulation and offering residents the option of temporary rehousing. The residual effects reported in **Chapter 9** are not anticipated to result in significant changes in population health outcomes.

Noise and vibration impacts from construction traffic will be mitigated through the use of appropriate construction hours and best practice measures detailed in **Chapter 4 – Description of the Proposed Scheme** and the Environmental Operating Plan (EOP).

The magnitude of change due to the proposed construction works is **low**. In terms of population health, the *small* scale of change in noise levels is likely to predominantly relate to a *minor* change in quality of life for a *large minority* of the community and a *very minor* change in cardiovascular and mental wellbeing morbidity for the *small minority* of the community closest to construction activities. The changes would be of *short-term* duration and relate to *frequent* construction related noise exposures. Prolonged periods of construction noise at night or daytime disruption of educational activities at schools are not anticipated. **Chapter 9 – Noise & Vibration** sets out mitigation including noise barriers and /or giving people the option of temporary rehousing (if deemed necessary) that reduces the potential for large magnitude effects.

Construction noise impacts of the Proposed Scheme are considered to result in a **minor adverse (not significant)** effect on population health. This assessment conclusion reflects that although the scientific literature indicates a *clear association* between elevated and sustained noise disturbance and reduced health outcome, the changes would result in a very limited effect in the health baseline of the site-specific populations. The temporary and localised construction noise effects are not expected to affect health inequalities.

11.4.1.3.3 Radon

Radon is a naturally occurring carcinogenic gas that is of concern where it builds up to harmful concentrations (above 200 Bq/m³). It is the second highest cause of lung cancer in Ireland.

Changes to radon exposure are discussed to consider any public health risk due to construction activities altering the pathways by which naturally occurring radon gas is released from underlying rock formations. The construction activities have the potential to create new pathways, e.g. where bedrock is fractured.

The realise of radon is normal and is managed in areas of high radon through building design and monitoring. The potential for a risk to the public relates to circumstances where construction activities that could fracture bedrock are undertaken in close proximity to dwellings. In such circumstances there is the potential for radon to newly build up within enclosed spaces that lack adequate ventilation.

The potential health effect is considered plausible based on the following source-pathway-receptor relationship:

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- Sources: naturally occurring radon gas release in underlying rock formations;
- Pathway: gas migration to the surface along new pathways that end in enclosed spaces of dwellings or community buildings; and
- Receptors: residents and long-term occupiers of nearby properties and community buildings.

However, the potential effect is not probable as highly unusual conditions are required for the source-pathway-receptor linkage to occur. Such conditions are unlikely because the intrusive ground works for the proposed bypass are not in close proximity to the community, so it is unlikely that any new pathways for radon would result in new population level exposures to radon. Furthermore, the proposed public realm enhancements are unlikely to affect ground radon pathways. Construction would be undertaken in line with standard good practice.

On the basis that a public health effect is unlikely, there could not be a likely significant effect for population health and therefore this issue is not assessed further. Risks of major accidents and/or disasters are covered in **Chapter 24**.

11.4.2 Operational Phase

11.4.2.1 Healthy lifestyles

This section considers the effects of the public realm enhancements and other elements of the Proposed Scheme on active travel that support physical activity from the finished scheme. Supporting people to be active, and the amenity value of the routes or facilities, is an important determinant of physical and mental health.

This section has been informed by **Chapter 7 – Traffic and Transport**, and it sets out relevant assessment findings, public realm enhancements and mitigation measures that have been taken into account.

Key features of the Proposed Scheme that are expected to improve physical activity within Slane are: the new bypass reducing traffic flows within the village, particularly north-south; traffic calming measures; pedestrian crossings; reallocation of road space to shared walking/cycling, including the proposed pedestrian/cyclist facility extending from the village centre to St Patrick's National School in the north; the proposed shared pedestrian/cyclist facilities along the proposed bypass and connecting the towpath/Rampart's walk. These are described in greater detail in **Chapter 4 – Description of the Proposed Scheme**.

Health effects may relate to physical health (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety or depression) associated with obesity and levels of physical activity. **Chapter 7** finds that the proposed improvements in Slane included in the Proposed Scheme will have a very positive outcome in terms of promoting active travel and recreational benefit in the area. The potential positive effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is reduced vehicle volumes on the road network and enhancements to active travel infrastructure;
- The pathway is changes in journey time and route quality and amenity for pedestrians and cyclists; and
- Receptors are local road and route users, including pedestrians and cyclists.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane; and
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people as active travel route users, including travelling to and from school);
 - Old age vulnerability (older people as benefiting from remaining physically active);
 - Low-income vulnerability (people living in deprivation, including those on low incomes for who travel costs or alternatives may be limiting);

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- Poor health vulnerability (people with existing poor physical and mental health in relation to health trip journey times); and
- Access and geographical vulnerability (people who experience existing access barriers).

The assessment covers these populations within two groups. The general population for the geographic area, notably Slane residents, and the vulnerable group population for the area. The latter is a sub-population comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3**. The general population comprise those members of the community in *good* physical and mental health, including due to established active travel and physical activity behaviours. This group includes those who already have *many alternative* active travel routes and therefore less reliance on the routes affected by the Proposed Scheme.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. People on low incomes, including in *moderately* deprived areas of Slane, may experience *wider* baseline inequalities and are more likely to be *reliant* on active travel routes as a primary mode of transport. Older adults and people in poor health may be *limited a lot* in their day-to-day activities and mobility constraints may make them more sensitive to the quality of active travel infrastructure, including even surfaces, separation from traffic, priority crossing points and dropped kerbs.

The magnitude of change due to the Proposed Scheme is **medium**. This reflects the *long-term* availability of improved active travel infrastructure that is expected to be used *frequently*. The new routes and public realm enhancements represent a *medium* scale of change compared to the baseline provision. These benefits are expected to be realised by a *large minority* of the people of Slane, with potential for a *moderate* risk reduction in cardiovascular and mental wellbeing *morbidity* where regular active travel behavioural change is sustained. In this regard the links to St Patrick's National School and the towpath along the River Boyne are considered particularly beneficial. Over time there may be reduced demand on local healthcare capacity.

The significance of the population health effect is **moderate beneficial (significant)**. The professional judgment is that there would be a *small* improvement in the health baseline for the population. The change may be *influential* within this population in delivering health policy that aims to increase physical activity, promote mental health and reduce obesity. This also relates to the *specific* local health priority on 'Healthy Lifestyle'. The likelihood of change is supported by a strong evidence base in the scientific literature for a *causal* relationship between physical activity and good physical and mental health.

11.4.2.2 Safe and cohesive communities

11.4.2.2.1 Transport

This section considers changes in local transport nature and flow rates, particularly in relation to the schemes benefits to road safety. Other considerations include the influence on journey times that may affect routine or emergency healthcare access.

This section has been informed by **Chapter 7 – Traffic and Transport**, which sets out relevant assessment findings and mitigation measures that have been taken into account.

There are the wider transport network benefits of the bypass improving the journey time of those currently passing through Slane. This includes people accessing routine and emergency healthcare in the wider County Meath area. Within Slane there is also a reduction in journey times due to reduced overall traffic and congestion. The benefits on the north-south route are particularly large in magnitude, with much less traffic over the existing Slane bridge, including a ban on HGVs (other than local public transport). The east-west N51 connection is more nuanced, as on the east side of Slane there would be increased traffic flows compared to the baseline due to the rerouting of traffic previously passing over Slane Bridge. The change in traffic patterns is however considered overall to be beneficial, including for road safety. **Chapter 7** describes measures to change the priority of junctions and the inclusion of crossing points for pedestrians.

For road safety, health effects may be associated with the severity or frequency of road traffic incidents. For accessibility, health effects may be associated with emergency response times or non-emergency treatment outcomes associated with delays or non-attendance.

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The potential effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is vehicles on the road network;
- The pathway is changes in driver delay and accidents and safety. These factors also influence emergency response times; and
- Receptors are local road users, including those using motor vehicles as well as pedestrians and cyclists, as well as emergency services using the road network.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane;
- The 'local' population of County Meath; and
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people as potentially more vulnerable road users);
 - Old age vulnerability (older people as potentially more vulnerable road users);
 - Poor health vulnerability (people with existing poor physical and mental health in relation to health trip journey times); and
 - Access and geographical vulnerability (people who experience existing access barriers or who rely on the affected routes, including healthcare and other amenities).

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Slane, and the vulnerable group population for the area. The latter is a sub-population comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3**. This reflects that most people in the local area (County Meath) would only make occasional use of the affected section of the road network. It also includes those for whom the road network affords *alternative* routes. The general population comprise those members of the community with a *high* capacity to adapt to changes in access, including changes in healthcare access, for example due to greater resources and good physical and mental health.

The sensitivity of the vulnerable group population is **high**. Vulnerability in this case is linked to mode of travel, including pedestrians and cyclists being more sensitive to road safety changes; age (young people and older people) being more vulnerable to accident severity; those *reliant* on services accessed on affected sections of the road network (e.g. traveling to schools); and those in areas of *moderate* deprivation. Deprived populations may already face more access barriers compared to general population and therefore be more sensitive to access changes. Low incomes may compound access barriers by *limiting* adaptive response. Vulnerability also includes those accessing health services (emergency or non-emergency) at times and locations affected by congestion. Ambulance services (and the recipients of their care) are particularly sensitive to delays in response times (time taken to arrive and stabilise the patient). Ambulances are generally less affected by congestion due to the priority given to them travelling under blue lights, but journey times may benefit from the road improvements. People in *poor or very poor* health may be more frequent users of healthcare service and therefore be more sensitive to access changes.

The magnitude of change due to the Proposed Scheme is **small**. This reflects that:

- In relation to road safety the scale of reduction in accident risk would be moderate, with such events remaining occasional. However, the benefit would be expected to accrue over the long-term with fewer incidents, e.g. at Slane Bridge. Severity relates to a minor change in risk of injury or mortality (though with outcome reversal gradual or permanent). The new dual carriage way provides a safer route compared to the existing constrained highway through Slane. Very few people would be affected, with no or slight implications for healthcare services; and
- In relation to journey time, the change for those undertaking long distance travel on the N2 is relatively *small* scale. However, within Slane the effect on shorter more frequent journeys is greater and considered of *medium* scale. Such reductions in journey time are expected to continue over the long-

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term. Where the change relates to healthcare access the change is likely to result in a *minor* change in risk for morbidity or mortality associated with time critical treatment. The frequency with which health related journeys may be affected is likely to be occasional, with very few people affected and only slight implications for healthcare services.

The significance of the population health effect for this determinant of health is **minor beneficial (not significant)**. The conclusion reflects what whilst the benefits to road safety and health related journey times are noteworthy, they are on a scale that is likely to only have a *marginal* influence on the delivery of local health policy to improve local road safety and healthcare access. The change may contribute to a *slight* improvement in the population health baseline.

11.4.2.2.2 Community identity and society

This section considers the potential for benefits to community cohesion and social capital within Slane from reduced dominance of road traffic in public spaces. Community identity is a determinant of wellbeing and is influenced by aesthetic elements of the landscape and townscape, including the setting of sites of cultural significance. There is potential for a range of effects. Community identity in Slane itself may be enhanced by the road network changes not only by reducing traffic, but also making it a deliberate destination rather than a place passed through on a major transport route.

This section has been informed by **Chapter 12 – Landscape and Visual** and **Chapter 8 – Population**, which sets out relevant assessment findings and mitigation measures that have been taken into account.

The potential effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is environmental change due to the new bypass, associated road works, the public realm enhancements and the changes in traffic dominance within Slane;
- The pathways are cues, visual or auditory, and economic opportunities that contribute to behaviour and a sense of identity, as well as a greater proportion of social interactions due to a more conducive environment; and
- Receptors are communities in the site-specific population, notably Slane residents but also visitors.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane;
- The sub-population vulnerable due to:
 - Young age, specifically children and young people using central areas of Slane for social networking or those with strong views about the future identity of Slane.
 - Old age, specifically long-term residents who may hold strong views about the past, present and future identity of Slane.
 - Social disadvantage, specifically those experiencing social isolation for whom a less traffic dominated centre may enhance connectivity and opportunities to build social networks.
 - Low income, specifically those who are reliant on visitor revenues to Slane.
 - Access and geographical factors, specifically those closest to the new and existing roads that experience the greatest changes in traffic flows.

The assessment covers these populations within two groups. The general population for the geographic area, notably Slane residents, and the vulnerable group population for the area. The latter is a sub-population comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

Health effects may be associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion. The scientific literature broadly indicates that favourable psychosocial environments (environments about which people feel positive and which support social interactions) are associated with better health and that unfavourable psychosocial environments are associated with poorer health. The literature does not identify particular thresholds for effects.

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The sensitivity of the general population is **medium**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3**. Slane is a prominent natural, cultural and economic feature of the area, on account of its ecological and historic heritage, and concerts held at Slane Castle. The general population of Slane are therefore likely to have an interest in, and awareness of, the Proposed Scheme, with potential for many people to feel *uncertain* as to the impacts. Most residents of Slane are likely to have a *reliance* on, or few alternatives to, the resources affected, including the road networks themselves and the community assets whose setting is affected by the new bypass.

The sensitivity of the vulnerable group population is **high**. Vulnerability in this case is particularly linked to the proportion of people who have strong expectations that their community or way of life would be changed to a large degree by the Proposed Scheme. Outlooks may range from *support* to *concern*. People living in homes with direct views of the new bypass, or adjacent to roads that experience a large change in traffic flows, may be particularly sensitive, with *very low* capacity to adapt. Some of those who are reliant on visitor related incomes may also have *limited* capacity to adapt, e.g. to Slane as a destination rather than passing trade. Those reliant on Slane centre for social networking, particularly those with risk of social isolation, may be more sensitive to a more favourable psychosocial environment.

The magnitude of change due to the Proposed Scheme is **medium**. **Chapter 12** describes wide ranging effects on views from representative vantage points, with some locations experiencing large adverse changes. **Chapter 8** describes significant positive influences of the Proposed Scheme on residential amenity, journey amenity, severance, accessibility and economic activity. For population health the scale of change is considered to be *medium*, as one of many influences of community identity. The effects are *long-term* with effects experienced *frequently* or *continuously*. The expectation is that the benefits to community identity and wellbeing will persist, whilst adverse influences *gradually* decline as there is adaptation to views and increased screening as planting matures. The benefits are expected for the majority of the community of Slane. Adverse effects are expected for a small minority. In both cases the changes relate to minor effects on mental health related morbidity and quality of life.

The conclusion of the assessment for human health is that the significance of the effect would range from **minor adverse (not significant)**, through to negligible and up to **moderate beneficial (significant)**. The improvements to the psychosocial environment within Slane and economic opportunities of Slane as a destination are likely to positively influence community identity with long-term benefits to community cohesion and mental health. Where the setting of homes or culturally or ecologically significant community assets is affected, this has the potential for some adverse influence. The inclusion of both adverse and beneficial scores reflects that the population response would be highly subjective and is likely to encompass a range of views. Some people may focus on the economic and travel benefits of the new bypass. Other people may focus on the reduction in landscape amenity inherent to the proposed bypass. The overall change in the health baseline is likely to be small and driven by the beneficial influences. These changes are supportive of healthy planning policy and relate *generally* to local health priorities, including on 'Community Connectivity'.

11.4.2.3 Environmental conditions

11.4.2.3.1 Air quality

This section discusses changes to local air quality during operation of the Proposed Scheme, and related effects on human health. Operation of the Proposed Scheme has the potential to result in redistributed effects, for example, the potential for benefits of less traffic, including HGVs, and less congestion that may improve air quality in the areas of higher population density, i.e. within Slane.

This section has been informed by **Chapter 10 – Air Quality**, which sets out relevant assessment findings and mitigation measures that have been taken into account. The **Chapter 10** assessment indicates, with reference to regulatory standards and baseline conditions, that the operation of the Proposed Scheme would result in a net benefit for air quality, but any localised impacts (both beneficial and adverse) at individual properties is considered negligible to substantial adverse. **Chapter 10** and this chapter have had regard to the WHO 2021 advisory guidelines (WHO, 2021).

Potential effects (beneficial and adverse) on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is air pollutants (particularly Nitrogen Dioxide (NO₂) and particulate matter (PM₁₀ and PM_{2.5}) from road traffic emissions;

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- The pathway is diffusion through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The 'site-specific' geographic population of Slane; and
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people);
 - Old age vulnerability (older people);
 - Poor health vulnerability (people with existing poor respiratory or cardiovascular health); and
 - Access and geographical vulnerability (people for whom close proximity to Proposed Scheme change increases sensitivity).

The assessment covers these populations within two groups. The general population of Slane, and the vulnerable sub-population for this area. The latter is comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The scientific literature indicates that there is an association between air quality emissions and health and wellbeing effects. The link is primarily between particulate matter and health effects (particularly for PM_{2.5}). Exposures relating to NO₂ are also relevant. Whilst the literature supports there being thresholds set for health protection purposes, it also acknowledges that for PM and NO₂ there are non-threshold health effects (i.e. when there is no known exposure threshold level below which adverse health effects may not occur). The assessment has identified population groups that may be particularly sensitive to air quality effects. For example, young children are particularly susceptible to air pollution because of their developing lungs, high breathing rates per bodyweight, and amount of time spent exercising outdoors. Other vulnerable groups include the sick (e.g. people with type 2 diabetes), the elderly, and pregnant women.

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3**. The general population comprise those members of the community who live, work and study at a distance where high levels of dispersion and deposition would greatly limit the effects any change in exposure due to the Proposed Scheme. Furthermore, most people enjoy *good* respiratory health (e.g. are not asthmatic) and are not at a life stage (e.g. infant or frail elderly) with particular sensitivity to air quality.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. For example, existing respiratory conditions including asthma and chronic obstructive pulmonary disease (COPD) and type 2 diabetes would increase sensitivity. People likely to be most affected due to their proximity to the Proposed Scheme's influences are those either living on roads within Slane that will experience reduced traffic flow (sensitive to beneficial changes), or residents of dwellings closer to the new bypass who may experience increased traffic emissions (sensitive to adverse changes).

The magnitude of change due to the Proposed Scheme is **small**. As reported in **Chapter 10**, the level of exposure to NO₂ and PM₁₀ at even the worst-case receptors analysed would be very low compared to baseline levels. However, a small improvement in average air pollutant exposure would be experienced over the *long-term* for the *majority* of the population in Slane.

In terms of adverse effects, **Chapter 10** identifies that baseline levels of PM_{2.5} in the area are above WHO guidelines, therefore any increases (even slight) due to the Proposed Scheme is considered, under the **Chapter 10** methodology, a significant adverse impact. For the health assessment, it is noted that the Proposed Scheme results in a decrease in PM_{2.5} levels for the *majority* of people within Slane, however, a *small minority* will experience a *small* scale of increase in PM_{2.5} levels due to traffic moving closer to them. Such changes would also be *long-term*, with a *very minor* influence on *morbidity* risk for respiratory and cardiovascular conditions for a *very few* people. Such adverse effects are not expected to affect population health. Although permanent, the magnitude of the changes are **low** and are not anticipated to result in any material change in health outcomes (such as respiratory disease morbidity or mortality), beneficial or adverse, at the population level. *No* health service implications are expected.

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For the health assessment, the overall redistribution of air quality away from the local population centre of Slane is considered **minor beneficial (not significant)**. This assessment conclusion reflects that whilst the scientific literature establishes a *causal* effect relationship between changes in air quality and health outcomes, all air quality changes are predicted to be *well within* statutory standards set for health protection. The changes would over time be expected to result in a *slight* beneficial effect in the health baseline of the local population. This finding takes into account non-threshold effects of NO₂ and PM_{2.5}, particularly on the vulnerable sub-population. It is noted that non-threshold effects take account of effects to population health outcomes even below the WHO 2021 advisory guidelines (WHO, 2021). The slight improvement in air quality within Slane may have a *marginal* effect on reducing inequalities, driven by people in deprived areas of Slane being exposed to less air pollution. These changes are supportive of delivering health-related planning policy and relate *generally* to local health priorities, including on ‘Healthy Planning and Living Environment’.

11.4.2.3.2 Noise

This section discusses changes in noise exposure during operation of the Proposed Scheme; particularly night-time noise that may be detrimental to population health where sleep is disturbed to a high degree. Changes in the distribution of day-time noise are also considered. The latter may include the potential to change levels of traffic noise near to schools, where educational outcomes for young people are considered.

This section has been informed by **Chapter 9 – Noise and Vibration**, which sets out relevant assessment findings and mitigation measures that have been taken into account.

Potential effects on human health are considered likely because there is a plausible source-pathway-receptor relationship:

- The source is noise generated by additional road traffic, as well as reduced noise levels due to reduction of traffic travelling through Slane village;
- The pathway is pressure waves through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

Furthermore, the potential effect is probable as no highly unusual conditions are required for the source-pathway-receptor linkage.

The population groups relevant to this assessment are:

- The ‘site-specific’ geographic population of Slane
- The sub-population vulnerable due to:
 - Young age vulnerability (children and young people);
 - Old age vulnerability (older people);
 - Poor health vulnerability (people with existing poor physical or mental health); and
 - Low income vulnerability (people living in deprivation, including those on low incomes may have fewer resources to adapt, e.g. seek respite or install insulation; furthermore, those who are economically inactive may spend more time in affected dwellings); and
 - Access and geographical vulnerability (people for whom close proximity to Proposed Scheme change increases sensitivity).

The assessment covers these populations within two groups. The general population for the geographic area, notably residents of Slane, and the vulnerable group population for the area. The latter is a sub-population comprised of the vulnerabilities listed above. The differentiation of these two groups, allows a discussion of any potentially significant health inequalities and the targeting of any mitigation.

The scientific literature indicates that there is an association between noise disturbance and health and wellbeing outcomes. Regard has also been had to WHO advisory guidelines (WHO, 2009) and (WHO, 2018) including the supporting systematic review (Basner & McGuire, 2018). The literature highlights cardiovascular effects, annoyance and sleep disturbance (and consequences arising from inadequate rest) as being the main pathways by which population health may be affected. The literature also notes the potential for chronic noise to have a detrimental effect on learning outcomes (e.g. noise distracting and affecting communication within classrooms). Whilst the literature supports there being thresholds at which effects (such as annoyance and sleep disturbance) are likely, it also acknowledges the subjective nature of responses to noise. In this regard noise effects can be considered to have non-threshold effects, with

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characteristics other than sound levels also determining the influence on health outcomes. The assessment had regard to the population groups identified in the literature that may be particularly sensitive. For example, children, the elderly, the chronically ill, people with a hearing impairment, shift-workers and people with mental illness (e.g., schizophrenia or autism).

The sensitivity of the general population is **low**. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in **Section 11.2.5.3**. The general population comprise those members of the community in *good* physical and mental health and with resources that enable a *high* capacity to adapt to change. Additionally, most people live, work or study at a distance from the affected parts of the local road network where changes in transport noise are unlikely to be a source of concern.

The sensitivity of the vulnerable group population is **high**. This reflects that the sub-population includes a high representation of *dependants*, both children, elderly and those receiving care due to poor health. This sub-population may experience existing *widening* inequalities due to living in areas with increasing transport noise and *moderate* deprivation, with *limited* capacity to adapt to changes. Vulnerability particularly relates to those living close to the affected roads, including those spending more time in affected dwellings, e.g. due to low economic activity, shift work or *poor* health. People who are *concerned* or have high degrees of *uncertainty* about transport noise and its effect on their wellbeing may be more sensitive to changes in noise.

As reported in **Chapter 9 – Noise and Vibration**, exposure to noise levels above 60 dB will reduce at the majority of receptors, due to road traffic on the N2 being diverted away from Slane village via the proposed bypass. However, a few receptors that are currently not near a road will experience increased noise levels due to the Proposed Scheme bringing traffic closer to them. In terms of night-time noise, following mitigation and considering relevant impact ratings, an overall positive residual impact is predicted. As stated in **Chapter 9** of the EIA, following mitigation, predicted increases in noise are within statutory thresholds set to be protective of health and the environment at most receptors, however four receptors are anticipated to experience a significant change in noise.

The magnitude of change due to the Proposed Scheme is **low**. In terms of population health, the *small* change in noise levels is likely to predominantly relate to a *very minor* change in cardiovascular and mental wellbeing morbidity for a *large minority* of the population of Slane. The changes would be of *long-term* duration and relate to *frequent* transport related noise exposures. In terms of adverse effects, **Chapter 9** identifies that ten residential receptors are anticipated to experience a significant change in noise due to traffic moving closer to them. Such changes would also be *long-term*, with a *minor* influence on morbidity risk for a *very few* people. Such adverse effects are not expected to affect population health, and individual level effects are likely to be reduced through the targeting of noise insulation mitigation. *No* health service implications are expected.

Operational noise impacts of the Proposed Scheme are considered to result in a **minor beneficial (not significant)** effect on population health. This reflects a *slight* beneficial change in the health baseline for the local population given that the scientific literature indicates a *clear association* between long-term exposure to transport noise and health outcomes. The redistribution of noise may have a *marginal* effect on reducing inequalities, driven by people in deprived areas of Slane experiencing reduced traffic noise. These changes are supportive of delivering health-related planning policy and relate *generally* to local health priorities, including on 'Healthy Planning and Living Environment'.

11.4.3 Cumulative Impact

A cumulative impact assessment (CIA) has been undertaken to consider potential for cumulative impact of the Proposed Scheme with other approved development. The detailed methodology for the CIA is described in **Chapter 25 – Cumulative Effects**. The assessment has considered cumulative sources and impact pathways which could impact on human health.

The projects listed in **Appendix 25.2** have been assessed. Each project has been considered on a case-by-case basis for screening in or out of this chapter's assessment based upon data confidence, effect-receptor pathways and the spatial/ temporal scales involved.

It should be noted that a CIA has been undertaken for noise and vibration (see **Chapter 9, Section 9.4.3**) and air quality (see **Chapter 10, Section 10.4.3**), which are considered the main pathways of impact that are of relevance to human health.

The Slane village community has the potential to experience a combination of impacts such as construction dust and noise, where vulnerable populations will be at higher risk. However, given the nature, duration and

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magnitude of both construction and operational impacts detailed in this EIA, any resulting cumulative effects on human health are not expected to alter the significance conclusions reached for the individual effects.

As set out in **Appendix 25.2**, there are existing permissions within the vicinity of the Proposed Scheme for a number of residential developments which have potential to increase the local population. Any new community members arising from these potential developments will be affected by the construction and operational phases as set out above for the general existing resident community. However, none of the individual potential additional dwellings themselves will result in significant impacts on the local community or human health, and accordingly have no potential to give rise to any significant cumulative effects on human health.

11.5 Mitigation Measures

11.5.1 Construction Phase

11.5.1.1 Healthy Lifestyles

No further mitigation is proposed.

11.5.1.2 Socio-economic Conditions

No further mitigation is proposed.

11.5.1.3 Environmental Conditions

Air Quality

No further mitigation is proposed.

Noise

No further mitigation is proposed; refer to **Chapter 9 – Noise and Vibration** for specific details of the noise mitigation.

11.5.2 Operational Phase

11.5.2.1 Healthy Lifestyles

No further mitigation is proposed.

The following enhancement is a recommendation that would support maximising the public health opportunity: Implementation by MCC of the active travel routes within Slane, including to the school, could be accompanied by a health promotion launch initiative to encourage behavioural change to active travel modes. This could be coordinated, and detail developed, with local public health stakeholders and the school. The Proposed Scheme could support planning and providing information boards. Vulnerable groups could be targeted by the initiative, including school children.

11.5.2.2 Safe and Cohesive Communities

Transport

No further mitigation is proposed, though regular review of any unintended accident hotspots would be a routine monitoring activity of the local authority and would underpin any need for further action.

Community Identity and society

No further mitigation is proposed.

11.5.2.3 Environmental Conditions

Air Quality

No further mitigation is proposed.

Noise

No further mitigation is proposed; refer to **Chapter 9 – Noise and Vibration** for specific details of the noise mitigation.

11.6 Residual Impacts

11.6.1 Construction Phase

As identified in **Section 11.4.1**, a range of positive and adverse effects are anticipated during construction of the Proposed Scheme. This includes **minor adverse** (not significant) effects relating to healthy lifestyles and environmental conditions (such as exposure to air pollution and noise), and **minor beneficial** (not significant) effects relating to socio-economic conditions.

11.6.2 Operational Phase

As identified in **Section 11.4.2**, a range of positive and adverse effects are anticipated during operation of the Proposed Scheme. This includes **moderate beneficial** (significant) effects relating to healthy lifestyles (e.g. improved physical activity through the uptake of active travel); **minor adverse** (not significant) to **moderate beneficial** (significant) effects relating to safe and cohesive communities, and **minor beneficial** (not significant) effects relating to environmental conditions (e.g. exposure to air pollution and noise). Overall, operation of the Proposed Scheme has a net positive effect on health outcomes.

For noise, it is noted that the mitigation relates to individual level effects rather than population level effects. This is good practice and supports equity and does not change the assessment conclusions for population health.

11.7 Monitoring

11.7.1 Construction Phase

No monitoring is proposed for the construction phase.

11.7.2 Operational Phase

No monitoring is proposed for the operational phase.

11.8 Chapter References

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