Partners in UK offshore wind

MONA OFFSHORE WIND PROJECT

Preliminary Environmental Information Report

Volume 4, chapter 30: Human health

Image of an offshore wind farm

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FINAL

Document status

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Acronyms

Acronym	Description
HIA	Health impact assessment
IAIA	International Association for Impact Assessment
IEMA	Institute of Environmental Management and Assessment
LSOA	Lower super output area
NEET	Not in education employment or training
NPS	National Policy Statement
NSIPs	Nationally Significant Infrastructure Projects
OHID	Department of Health and Social Care's Office for Health Improvement and Disparities
PHE	Public Health England
PHW	Public Health Wales
PPW	Planning Policy Wales
PRoW	Public Rights of Way
TAN	Technical Advice Note
UKHSA	United Kingdom Health Security Agency
WHIASU	Wales Health Impact Assessment Support Unit
WHO	World Health Organisation

30 Human Health

30.1 Introduction

30.1.1 Overview

30.1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the assessment of the potential impact of the Mona Offshore Wind Project on Human Health. Specifically, this chapter considers the potential impact of Mona Offshore Wind Project during the construction, operations and maintenance, and decommissioning phases.

30.1.1.2 Human health is a broad topic. The assessment considers how the Mona Offshore Wind Project affects different aspects of the environment that influence population health. This includes changes to the social, economic and bio-physical environment, as well as how the electricity generated by the windfarm is a resource that supports society.

30.1.1.3 This chapter also assesses the cumulative effects of Mona Offshore Wind Project on human health.

30.1.1.4 The Mona Offshore Wind Project has taken the approach to focus on the 'source' of the impact, which is consistent with the broader approach of the Mona Offshore Wind Project to separate offshore and onshore effects:

- Offshore: if physical infrastructure and civil works are located offshore, any resulting impacts are categorised as offshore
- Onshore: if physical infrastructure and civil works are located onshore, any resulting impacts are categorised as onshore. Where there are marine activities close to the coast that are associated with onshore infrastructure and civil works, (e.g. vessels supporting landfall, the health chapter includes these within the onshore assessment and terms these nearshore activities).

30.1.1.5 The assessment presented is informed by the following technical chapters:

- Volume 2, chapter 6: Physical processes of the PEIR
- Volume 2, chapter 7: Benthic subtidal ecology of the PEIR
- Volume 2, chapter 11: Commercial fisheries of the PEIR
- Volume 2, chapter 12: Shipping and navigation of the PEIR
- Volume 2, chapter 14: Other sea users of the PEIR
- Volume 3, chapter 16: Geology, hydrogeology and ground conditions of the PEIR
- Volume 3, chapter 17: Hydrology and flood risk of the PEIR
- Volume 3, chapter 20: Land use and recreation of the PEIR
- Volume 3, chapter 21: Traffic and transport of the PEIR
- Volume 3, chapter 22: Noise and vibration of the PEIR
- Volume 3, chapter 23: Air quality of the PEIR
- Volume 4, chapter 26: Seascape, Landscape and Visual Resources of the PEIR
- Volume 4, chapter 28: Climate change of the PEIR
- Volume 4, chapter 29: Socio-economics and community of the PEIR.

30.1.2 Purpose of chapter

30.1.2.1 The primary purpose of the PEIR is outlined in volume 1, chapter 1: Introduction of the PEIR. In summary, the primary purpose of an Environmental Statement is to support the Development Consent Order (DCO) application for Mona Offshore Wind Project under the Planning Act 2008 (the 2008 Act). The PEIR constitutes the Preliminary Environmental Information for Mona Offshore Wind Project and sets out the findings of the EIA to date to support the pre-application consultation activities required under the 2008 Act. The EIA will be finalised following completion of pre-application consultation and the Environmental Statement will accompany the application to the Secretary of State for Development Consent.

30.1.2.2 The PEIR forms the basis for statutory consultation which will last for 47 days and conclude on 04 June 2023 as outlined in volume 1, chapter 2: Policy and legislation of the PEIR. At this point, comments received on the PEIR will be reviewed and incorporated (where appropriate) into the Environmental Statement, which will be submitted in support of the application for Development Consent scheduled for quarter one of 2024.

30.1.2.3 In particular, this PEIR chapter:

- Presents the existing population health baseline established from desk studies
- Identifies any assumptions and limitations encountered in compiling the environmental information
- Presents the potential environmental effects on human health arising from the Mona Offshore Wind Project, based on the information gathered and the analysis and assessments undertaken
- Highlights any necessary monitoring and/or mitigation measures which could prevent, minimise, reduce or offset the possible environmental effects of the Mona Offshore Wind Project on human health

30.1.3 Study area

30.1.3.1 The Mona Offshore Wind Project array boundary is located in the Irish sea, 28.2km from the north coast of Wales, 39.9km from the northwest coast of England, and 42.3km from the Isle of Man. The offshore generation and transmission assets are thus remote from the nearest mainland receptor population. Onshore transmission assets are located in North Wales. The Mona Proposed Onshore Development Area is located within Conwy and Denbighshire and comprises the area in which the Landfall, Onshore Cable Corridor, Onshore Substation, mitigation areas, temporary construction facilities and the connection to National Grid infrastructure will be located.

30.1.3.2 For most offshore determinants of health there is therefore not a localised population impact around which a study area can be defined. The closest population is on the north coast of Wales. As discussed later in this chapter the sea transport connections between the mainland and the Isle of Man are of interest, as are coastal communities

associated with commercial fisheries. Local populations in Wales are relevant for onshore/nearshore activities associated with the Mona Offshore Wind Project including employment and educational opportunities, transport disruption and recreation and leisure. Wider impacts of the project are relevant to national public health and climate change related effects extend to the global population. To be proportionate the Human Health study area for PEIR is therefore comprised of:

- The site specific population for landfall near Abergele, the sensitivity of which is based on the most deprived lower super output area (LSOA) within close proximity (Abergele Pensarn 2 (W01001928)). See sections 30.9.3, 30.9.5, 30.9.7 and 30.9.8.
- The site specific population for the onshore cable corridor between Abergele and St Asaph, the sensitivity of which is based on the most deprived LSOA within close proximity (Gele 1 (W01000140)). See sections 30.9.3, 30.9.5, 30.9.7 and 30.9.8.
- The site specific population for the onshore substations near St Asaph, the sensitivity of which is based on the most deprived LSOA within close proximity (St Asaph West (W01000246)). See sections 30.9.3, 30.9.5, 30.9.7 and 30.9.8.
- The local populations of Isle of Man (offshore access and visual impacts, see sections 30.9.2 and 30.9.4) and Welsh local authorities of Conwy (landfall and onshore cable corridor impacts) and Denbighshire (onshore cable corridor and substation impacts). For Conwy and Denbighshire see sections 30.9.3, 30.9.5, 30.9.7 and 30.9.8.
- The regional populations of Northwest England and North Wales (offshore visual impacts, see section 30.9.4).
- The national populations of Wales, England and the United Kingdom (offshore asset electricity generation impacts and climate change). See sections 30.9.9 and 30.9.10.
- The global populations, particularly low- and middle-income countries (LMIC) (offshore asset climate change impacts). See section 30.9.9.

30.1.3.3 The human health study area is used to define representative population groups, including in relation to sensitivity, rather than to set localised boundaries on the extent of potential effects. The broader areas are designed to encompass all effects, including fishing communities outside of Northwest England and North Wales.

30.1.3.4 The health assessment has regard to the topic specific study areas defined by other PEIR chapters listed in paragraph 30.1.1.5. Those chapters inform the consideration of impact magnitude, including the extent of effects in the health chapter.

30.1.3.5 The chapter considers appropriate actions to avoid or mitigate health risks and promote health opportunities including targeting measures to respond to health inequalities for vulnerable groups.

30.1.3.6 In this chapter the terms health and wellbeing are used interchangeably, and parity is given to considering both physical and mental health outcomes.

Table 30.1: Impacts scoped into the assessment for human health.

Health determinant	Summary
Social environment	
Transport modes, access and connections	Construction, Operations and maintenance and Decommissioning phases • Offshore: The potential impact of changes in shipping access to the Isle of Man is scoped in. Disruption of routine and or emergency access has the potential to affect the availability of goods and services that support health promotion, health protection and healthcare services. • Onshore: There is the potential that construction works (construction site activities as well as vehicle traffic associated with construction activities) may disrupt local vehicle traffic (private and public transport) as well as active travel (pedestrians and cyclists). Effects to active travel from any temporary diversions are scoped in.
Community identity, culture, resilience and influence	Operations and maintenance phase • Offshore: The visual impact of the Mona Offshore Wind Project is scoped in to consider the potential for visual change in the seascape, which may affect community wellbeing. This takes into account a context that includes other windfarm projects.
Open space, leisure and play	Construction and Decommissioning phases • Onshore: works may lead to temporary disruption of public open spaces (including beaches) and Public Rights of Way (PRoW), potentially affecting recreational activities. Consideration has also been given to the influences on nearshore recreation, e.g. bathing, sailing and other water sports. Temporary construction disruption of accesses to green and blue open space is scoped in. This includes considering the need for any temporary or permanent provision for alternative space or access.
Economic environment	
Employment and income	Construction, Operations and maintenance and Decommissioning phases • Offshore: Health effects from wider indirect economic impacts are considered. Any potential unemployment or adverse economic implications are scoped in. • Onshore: As for offshore.
Bio-physical environment	
Climate change and adaptation	Operations and maintenance phase • Offshore: Health effects of climate change are scoped in. The generating assets of the project would be a part of a wider energy sector transition that reduces the severity of climate change. The benefits to population health are discussed.
Noise and vibration	Construction and decommissioning phases • Onshore: The noise effects from onshore and nearshore activities, albeit temporary and transient at any given location, are scoped in. The health chapter is informed by the noise and vibration assessment of changes to daytime and night-time noise. Consideration is given to population health effects, for example related to annoyance and sleep disturbance. Operations and maintenance phases • Onshore: The potential operational noise effects of the Onshore Substations are scoped in to consider the potential for a population health effect.
Radiation	Operations and maintenance phases • Onshore: For onshore electrical infrastructure, the 'actual EMF' risks are scoped out on the basis that the project would adopt the International Commission on Non-ionizing Radiation Protection (ICNIRP) guidelines (ICNIRP, 1998) and Government voluntary Code of Practice on EMF public exposure (Department of Energy & Climate Change, 2012). Public understanding of risk in relation to operational EMF are scoped in.

Health determinant	Summary
Institutional and built environment	
Wider societal infrastructure and resources	Operations and maintenance phase • Offshore: During operation, the generating aspects of the project would be part of a wider societal contribution to supporting public health. The project would provide energy infrastructure that supports many aspects of public health. A reliable supply of electricity is required in relation to factors including, population food safety, thermal comfort, healthcare, learning, income generation and social networking.

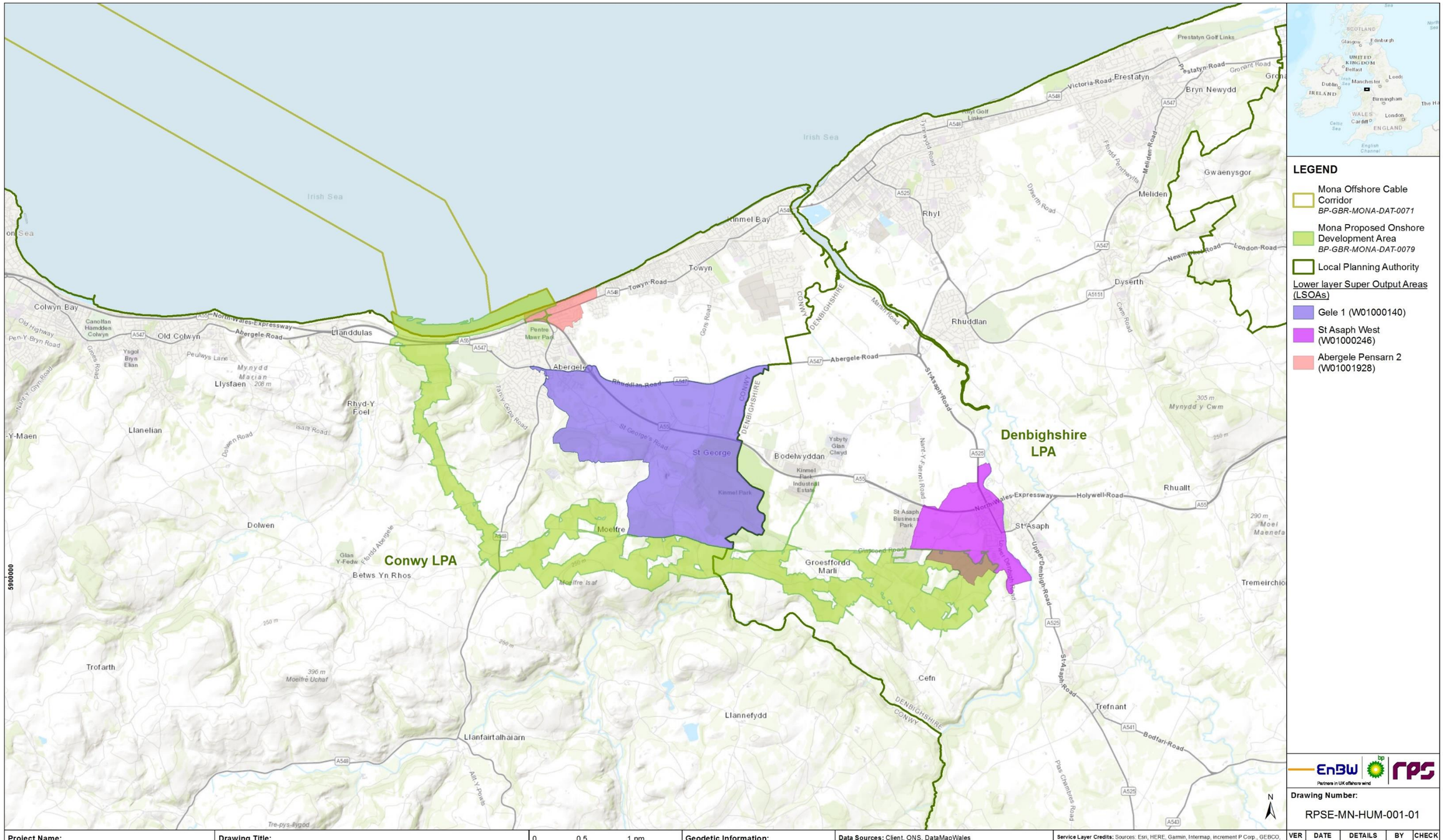
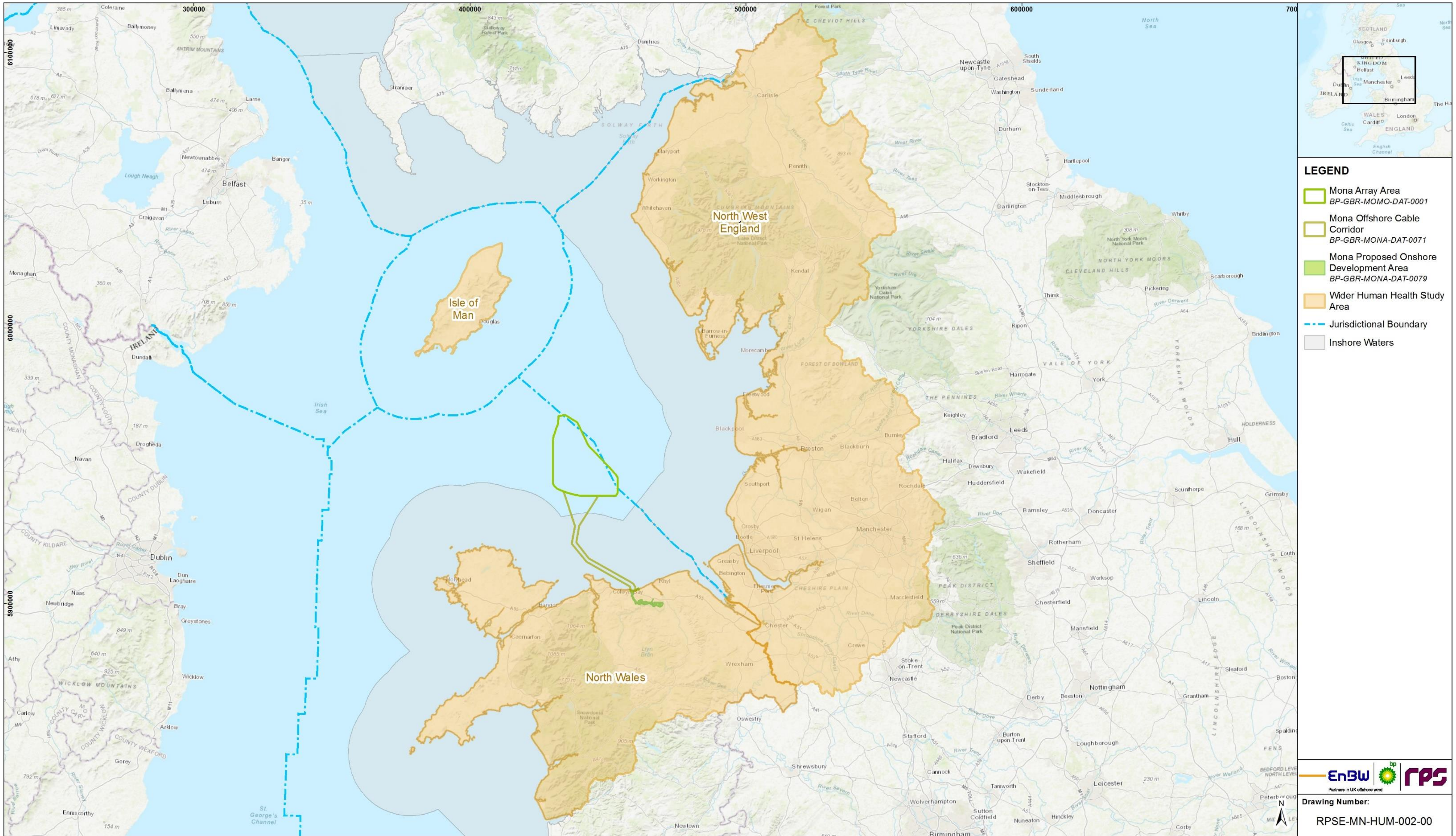


Figure 30.1: Human Health study area (selected LSOAs reflect higher levels of deprivation and inform wider area sensitivity) – onshore activities



Project Name:	Drawing Title:	Scale	Geodetic Information:	Data Sources:	Service Layer Credits:
MONA OFFSHORE WIND PROJECT	HUMAN HEALTH STUDY AREA	0 5 10 20 nm; 0 10 20 40 km	Datum: ETRS 1989 Projection: ETRS 1989 UTM Zone 30N Scale@379mmx231mm: 1:1,400,000	Client, ONS, DataMapWales	Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), (c) OpenStreetMap contributors, and the GIS User Community

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Figure 30.2: Human health study area – offshore activities

30.2 Policy context

30.2.1 National Policy Statements

30.2.1.1 Planning policy on renewable energy infrastructure is presented in volume 1, chapter 2: policy and legislation of the PEIR. Planning policy on offshore renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to human health, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1) (DECC, 2011a) and the NPS for Electricity Networks Infrastructure (EN-5, DECC, 2011b).

30.2.1.2 The NPS for renewable energy infrastructure EN-3 (DECC, 2011b) has been reviewed and it is not considered that there are relevant policy positions in relation to human health that need to be taken into account.

30.2.1.3 NPS EN-1 includes guidance on what matters are to be considered in the assessment. These are summarised in Table 30.2 below. NPS EN-1 also highlights a number of factors relating to the determination of an application and in relation to mitigation. These are summarised in Table 30.3 below. Table 30.4 sets out relevant provisions from the NPS on electricity networks infrastructure EN-5 (DECC, 2011c).

30.2.1.4 This section refers to the current NPSs, specifically NPS EN-1 and NPS EN-5. If the NPSs are updated prior to the application for Development Consent, the revised NPSs will be fully considered in relation to human health within the Environmental Statement.

Table 30.2: Summary of the NPS EN-1 provisions relevant to human health.

Summary of NPS EN-1 provision	How and where considered in the PEIR
To consider the potential effects, including benefits, of a proposal for a project, the Secretary of State will find it helpful if the applicant sets out information on the likely significant social and economic effects of the development, and shows how any likely significant negative effects would be avoided or mitigated. This information could include matters such as employment, equality, community cohesion and well-being. (paragraph 4.2.2 of NPS EN-1)	The potential for employment effects is covered in section 30.9.6. The potential for effects relating to healthy lifestyles and safe and cohesive communities are covered in Section 30.7.2. Effects on wellbeing and equality are inherent to all the assessments in Section 30.9.
Energy production has the potential to impact on the health and well-being ("health") of the population. Access to energy is clearly beneficial to society and to our health as a whole. However, the production, distribution and use of energy may have negative impacts on some people's health. … where the proposed project has an effect on human beings, the Environmental Statement should assess these effects for each element of the project, identifying any adverse health impacts, and identifying measures to avoid, reduce or compensate for these impacts as appropriate. The impacts of more than one development may affect people simultaneously, so the applicant and the Secretary of State should consider the cumulative impact on health. The direct impacts on health may include increased traffic, air or water pollution, dust, odour, hazardous waste and substances, noise, exposure to radiation, and increases in pests. (paragraphs 4.13.2 and 4.13.3 of NPS EN-1)	The effects to population health are considered in Section 30.9. For example, benefits of access to energy are covered in Section 30.9.10. The potential for adverse effects is covered in Sections 30.9.2, 30.9.3 and 30.9.6. Cumulative effects to population health are considered in Section 30.11.
New energy infrastructure may also affect the composition, size and proximity of the local population, and in doing so have indirect health impacts, for example if it in some way affects access to key public services, transport or the use of open space for recreation and physical activity. (paragraph 4.13.4 of NPS EN-1)	Given the Mona Offshore Wind Project is remote to human health receptors the main pathway is potential effects to health and other services on the Isle of Man should water-based transport be disrupted. This is considered within this chapter (Section 30.9.2), informed by volume 2, chapter 12: Shipping and navigation and volume 4, chapter 29: Socio-economics and community of the PEIR. Onshore transport effects are assessed in section 30.9.3. Effects on use of open space are assessed in section 30.9.5.
During the construction, operation and decommissioning phases, developments can lead to … increased risk of spills and leaks of pollutants to the water environment. These effects could lead to adverse impacts on health. (paragraph 5.15.1 of NPS EN-1)	Potential health effects relating to water are considered in Section 30.7.2 and informed by volume 2, chapter 7: benthic subtidal ecology of the PEIR (relating to offshore conditions) and volume 3, chapter 17: hydrology and flood risk of the PEIR (relating to onshore conditions).

Table 30.3: Summary of NPS EN-1 policy on decision making relevant to human health.

Summary of NPS EN-1 provision	How and where considered in the PEIR
:Generally, those aspects of energy infrastructure which are most likely to have a significantly detrimental impact on health are subject to separate regulation (for example air pollution) which will constitute effective mitigation of them, so that it is unlikely that health concerns will either constitute a reason to refuse consents or require specific mitigation under the Planning Act 2008. However, the Secretary of State will want to take account of health concerns when setting requirements relating to a range of impacts such as noise. (paragraph 4.13.5 of NPS EN-1)	Impacts that are governed by separate regulation (for example air pollution) have been considered. Where appropriate issues have been scoped out, see section 30.7.2.

Table 30.4: Summary of the NPS EN-5 provisions relevant to human health.

Summary of NPS EN-5 provision	How and where considered in the PEIR
"*EMFs can have both direct and indirect effects on human health."*	This chapter considers public understanding of EMF exposure in terms of mental health outcomes associated with concern, acknowledging that actual risks are unlikely to be significant for public health. See section 30.9.8.
"The balance of scientific evidence over several decades of research has not proven a causal link between EMFs and cancer or any other disease." (paragraphs 2.10.2 and 2.10.6 of NPS EN-5)	
"*To prevent these known effects, the International Commission on Non-Ionizing Radiation Protection (ICNIRP) developed health protection guidelines in 1998 for both public and occupational exposure*…" (paragraph 2.10.3 of NPS N-5)	The Mona Offshore Wind Project will adopt ICNIRP guidelines. See Table 30.18.
"The levels of EMFs produced by power lines in normal operation are usually considerably lower than the ICNIRP 1998 reference levels. For electricity substations, the EMFs close to the sites tend to be dictated by the overhead lines and cables entering the installation, not the equipment within the site." (paragraph 2.10.4 of NPS EN-5)	This chapter notes the importance of given the public relevant non-technical information such as this in order to mitigate against levels of concern about EMF, which could affect mental health. See section 30.9.8.
"…*Government policy is that exposure of the public should comply with the ICNIRP (1998) guidelines …."* (paragraph 2.10.5 of NPS EN-5)	The Mona Offshore Wind Project will adopt the ICNIRP guidelines. See Table 30.18.
"Government has developed with the electricity industry a Code of Practice, "Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice" … that specifies the evidence acceptable to show compliance with ICNIRP (1998)…" (paragraph 2.10.5 of NPS EN-5)	The Mona Offshore Wind Project will adopt the Power Lines: Demonstrating compliance with EMF public exposure guidelines – a voluntary Code of Practice. See Table 30.18.

30.2.2 Wales national planning policy context

30.2.2.1 Planning Policy Wales (PPW), Edition 11 published February 2021 (Welsh Government, 2021a); Future Wales - the National Plan 2040, published February 2021 (Welsh Government, 2021b) and the Technical Advice Notes (TANs) set out the national planning policies of the Welsh Government. Following the publication of Future Wales, TAN 8: Planning for Renewable Energy has been revoked and there is no longer an energy-specific TAN.

Planning Policy Wales (PPW)

30.2.2.2 Paragraph 3.19 states that the '*built and natural environment is a key determinant of health and well-being. The planning system has an important role in shaping the social, economic, environmental and cultural factors which determine health, and which promote or impact on well-being in line with the Healthier Wales goal*.'

30.2.2.3 Paragraph 3.20 advises that '*disadvantaged and deprived communities tend to be disproportionately affected by health problems. … The planning system should identify proactive and preventative measures to reduce health inequalities. This will include enabling opportunities for outdoor activity and recreation, reducing exposure of populations to air and noise pollution, promoting active travel options and seeking environmental and physical improvements, particularly in the built environment*.'

Well-being Future Generations Act 2015

30.2.2.4 The Well-being Act gives a legally-binding common purpose – the seven well-being goals – for national government, local government, local health boards and other specified public bodies.

30.2.2.5 There are many determinants of health that derive from our environment, society and economy. This includes poor air quality, nutrition, access to green space and income. The well-being goals can be used to understand these connections and find sustainable solutions.

A healthier Wales is described as "a society in which people's physical and mental well-being is maximised and in which choices and behaviours that benefit future health are understood."

30.2.3 Welsh National Marine Plan

30.2.3.1 The assessment of potential changes to human health has also been made with consideration to the specific policies set out in the Welsh National Marine Plan (Welsh Government, 2019a). Key provisions are set out in Table 30.5 along with details as to how these have been addressed within the assessment.

Table 30.5: Welsh National Marine Plan policies of relevance to human health.

Policy	Key provisions	How and where considered in the PEIR
SOC_01	Policy SOC_01 aims to contribute towards sustainable development by helping to support the health and well-being of coastal communities and safeguarding access to the recreational and well-being benefits associated with the marine environment.	Offshore access is discussed in section 30.9.2. Onshore access, including any relevant nearshore activities, is discussed in section 30.9.3. Leisure and recreation are discussed in section 30.9.5.
SOC_06	Policy SOC_06 recognises that resilient, diverse, multifunctional landscapes supported by sustainable management practices can provide a range of services and opportunities with the potential to contribute to the achievement of social objectives and improve health and well-being as well as delivering economic benefit.	Issues of landscape influencing community identity are discussed in section 30.9.4. Economic effects are discussed in section 30.9.6.
SOC_07	The strong sense of place and unique character that is typical of coastal environments makes an important contribution to Welsh national health and well-being.	Issues of seascape influencing community identity are discussed in section 30.9.4.

Policy	Key provisions	How and where considered in the PEIR
SOC_10	Climate change poses a series of challenges to the marine environment and the communities and businesses that rely on it. This includes impacts on health and well-being.	Climate change is discussed in section 30.9.9.
ENV_06	This policy recognises that adverse impacts on air or water quality can have knock on impacts on health and well-being and other interests such as tourism and recreation.	Air and water quality effects have been scoped out, see section 30.7.2.

30.2.4 North West Inshore and North West Offshore Marine Plans

30.2.4.1 The assessment of potential changes to human health has also been made with consideration to the specific policies set out in the North West Inshore and North West Offshore Marine Plans (Marine Management Organisation, 2021). Key provisions are set out in Table 30.6 along with details as to how these have been addressed within the assessment.

Table 30.6: North West Inshore and North West Offshore Marine Plan policies of relevance to human health.

Policy	Key provisions	How and where considered in the PEIR
Objectives of the North West Marine Plan	Objectives include: infrastructure to support and promote safe, profitable and efficient marine businesses; marine businesses respect environmental limits and are socially responsible; the use of the marine environment is benefiting society as a whole… contributing to physical and mental wellbeing; the coast, seas, oceans and their resources are safe to use; there is equitable access for those who want to use and enjoy the coast, seas and their wide range of resources and assets and recognition that for some island and peripheral communities the sea plays a significant role in their community.	The effects on seascape, landscape and visual resources are considered in section 30.9.3. Access by other sea users is considered in section 30.7.2 Equitable access to health determinants is considered throughout the assessment in section 30.9.
NW-WQ-1	Proposals that protect, enhance and restore water quality will be supported.	The water quality effects of the Mona Offshore Wind Project to population health are discussed in section 30.7.2.
NW-FISH-2	Proposals that may have significant adverse impacts on access for fishing activities must demonstrate that they will, in order of preference: a) avoid; b) minimise; c) mitigate adverse impacts so they are no longer significant.	Economic effects that could influence population health area discussed in section 30.9.6.
NW-CO-1	Proposals that may have significant adverse impacts on, or displace, existing activities must demonstrate that they will, in order of preference: a) avoid; b) minimise; c) mitigate adverse impacts so they are no longer significant.	Sea transport access between the Isle of Man and the mainland that could affect population health is discussed in section 30.9.2.
NW-REN-1 NW-AIR-1	Proposals that enable the provision of renewable energy technologies and associated supply chains, will be supported. Clean air is essential for life, health, the environment and the economy. Air pollution and greenhouse gas emissions must be reduced to protect health, habitats and species and reduce the impacts of climate change.	The renewable energy benefits of the Mona Offshore Wind Project to population health are discussed in section 30.9.10. The population health benefits of renewable energy for reduction of greenhouse gas emissions is discussed in section 30.9.7.
NW-SOC-1	Those bringing forward proposals should consider and demonstrate how their development shall enhance public knowledge, understanding, appreciation and enjoyment of the marine environment as part of (the design of) the proposal.	Public information sharing is discussed as part of mitigation in section 30.9.2 and section 30.9.3.
NW-TR-1	Proposals that promote or facilitate sustainable tourism and recreation activities.	Economic effects that could influence population health are discussed in section 30.9.2 (in relation to access) and section 30.9.6 (in relation to any adverse economic impacts).

30.2.5 Local policy context

30.2.5.1 The assessment of potential changes to human health has also been made with consideration to the specific policies set out in Adopted Local Development Plans (LDPs) of Conwy County Borough Council (CCBC) (adopted in October 2013) and Denbighshire County Council (DCC) (adopted in June 2013). Replacement LDPs are currently being drafted by CCBC and DCC and will be considered upon publication. Key provisions are set out in Table 30.7 along with details as to how these have been addressed within the assessment.

Table 30.7: Local Planning Policy of relevant to human health

Policy	Key provisions	How and where considered in the PEIR
Conwy County Borough Council: Adopted Local Development Plan (October 2013)		
Spatial objective SO11	…the promotion of renewable energy developments where they have prospects of being economically attractive and environmentally and socially acceptable.	Economic effects that could influence population health area discussed in section 30.9.6.
Spatial objective SO13	To protect and improve accessibility to essential services and facilities, including open space, allotments, health, education and leisure.	Economic effects that could influence population health are discussed in section 30.9.2 (in relation to access) and section 30.9.6 (in relation to any adverse economic impacts).
Denbighshire County Council: Adopted Local Development Plan (June 2013)		
Policy VOE 10 Renewable energy technologies	Development proposals which promote the provision of renewable energy technologies may be supported providing they are located so as to minimise visual, noise and amenity impacts and demonstrate no unacceptable impact upon the interests of nature conservation, wildlife, natural and cultural heritage, landscape, public health and residential amenity.	The population health benefits of renewable energy for reduction of greenhouse gas emissions is discussed in section 30.9.7

30.3 Consultation

30.3.1.1 A summary of the key issues raised during consultation activities undertaken to date specific to human health is presented in Table 30.8 below, together with how these issues have been considered in the production of this PEIR chapter.

Table 30.8: Summary of key consultation issues raised during consultation activities undertaken for the Mona Offshore Wind Project relevant to human health.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
May 2022	Public Health Wales, Scoping Opinion Appendix	Risk assessing the health of individuals and/or populations is a complex process due to the variety of interactions with different determinants of health including but not limited to lifestyle and social, deprivation, cultural, economic and environmental factors. This public health risk assessment is based on the documentation provided and should be considered in the broadest possible sense to avoid human health harms – both physical and mental.	Noted. This assessment is set out in section 30.930.9.
		It is noted that the combined environmental effects on populations will be considered, taking into consideration potential for cumulative effects to occur as a result of other projects or activities within and outside the Mona Array Area. We encourage all environmental hazards and impacts on sensitive human receptors to be considered simultaneously throughout all stages of the proposed development, as well as in conjunction with any other developments planned in the nearby area.	Cumulative impacts are assessed in section 30.11.
		It is stated that EMF considerations will be scoped out. We encourage adequate assessment of possible impacts to receptors is carried out before scoping out of the ES.	Justification for scoping out the actual public health risks of EMF effects is provided in Table 30.18. The good practice assessment of public understanding of operational EMF risk is set out in section 30.9.
May 2022	UK Health & Security Agency Environmental Hazards and Emergencies Department, Scoping Opinion Appendix	The health of an individual or a population is the result of a complex interaction of a wide range of different determinants of health, from an individual's genetic make-up to lifestyles and behaviours, and the communities, local economy, built and natural environments to global ecosystem trends. All developments will have some effect on the determinants of health, which in turn will influence the health and wellbeing of the general population, vulnerable groups and individual people. Although assessing impacts on health beyond direct effects from for example emissions to air or road traffic incidents is complex, there is a need to ensure a proportionate assessment focused on an application's significant effects.	Noted. This assessment is set out in section 30.9
		We understand that the promoter will wish to avoid unnecessary duplication and that many issues including air quality, emissions to water, waste, contaminated land etc. will be covered elsewhere in the Environmental Statement (ES). It is noted that population and human health will be considered within a technical appendix and not form a separate chapter within the ES. Given the current knowledge of the scheme and potential impacts this appears to be a proportionate approach.	This assessment is set out in section 30.9.
		In terms of the level of detail to be included in an ES, we recognise that the differing nature of projects is such that their impacts will vary. UKHSA predecessor organisation Public Health England produced an advice document Advice on the content of Environmental Statements accompanying an application under the NSIP Regime', setting out aspects to be addressed within the Environmental Statement. This advice document and its recommendations are still valid and should be considered when preparing an ES. Please note that where impacts relating to health and/or further assessments are scoped out, promoters should fully explain and justify this within the submitted documentation.	The PHE NSIP advice note has been referenced in section 30.6.1.
		We are content with the promoter's rationale in identifying and scoping out certain environmental aspects due to their insignificance of impact.	Noted.
		It should be noted that Public Health Wales is the national public health agency in Wales who will take the lead in health and wellbeing considerations.	Noted.
		Recommendation The current proposals do not appear to consider possible health impacts of Electric and Magnetic Fields (EMF). We request that the Environmental Statement clarifies this and if necessary, the proposer should confirm either that the proposed development does not impact any receptors from potential sources of EMF; or ensure that an adequate assessment of the possible impacts is undertaken and included in the ES.	Justification for scoping out the actual public health risks of EMF effects is provided in Table 30.18. The good practice assessment of public understanding of operational EMF risk is set out in section 30.9.
		However, the scoping report does not consider any cumulative effects from neighbouring off- shore energy developments. Consideration should be given to the co-ordinated use of shared landfall and cable export routes to reduce environmental impact.	Cumulative impacts are assessed in section 30.11.

Date	Consultee and type of response	Issues raised	Response to issue raised and/or where considered in this chapter
June 2022	The Planning Inspectorate Scoping Opinion	The Applicant proposes to scope out a standalone aspect chapter on Human health on the basis that potential impacts on human health will be assessed within other aspect chapters of the Environmental Statement and an overall conclusion of the significance of effects on human health will be included within a technical appendix. The Inspectorate is content that Human health does not need to be considered as a standalone aspect chapter. The Scoping Report states that potential impacts on health arising from the generation assets would be considered in the following Environmental Statement topics: • Physical processes • Commercial fisheries • Shipping and navigation • Socio-economics and community • Other sea users. However, there are no references to assessing impacts on human health within these chapters and no further details provided in Part 2, Section 7.2.1. As such, the Inspectorate is unclear what the Applicant proposes to assess. The Applicant should seek to agree the scope of the assessment of impacts on health with relevant consultees.	A human health chapter is provided in alignment with the November 2022 guidance on human health in EIA by IEMA. This assessment is set out in section 30.9.
June 2022	The Planning Inspectorate Scoping Opinion	Human health – heat. (Transmission assets) The Inspectorate agrees that the transmission assets are unlikely to produce levels of heat likely to generate significant effects on human health and agrees that this matter can be scoped out.	Noted.
		Human health – radiation. (Transmission assets) Radiation (electro-magnetic fields (EMF)) is proposed to be scoped out on the basis that the perimeter fence of the substation provides screening of the electric field. However, the Proposed Development also involves up to 12 onshore export cables up to 275kV and up to 12 grid connection export cables up to 400kV, the proposed cable corridors of which are yet to be confirmed. Furthermore, paragraph 2.4.5.1 states that there is the potential requirement for a 400kV link to connect the new proposed substation to the existing National Grid Bodelwyddan substation. In line with relevant guidance (DECC Power Lines: Demonstrating compliance with EMF public exposure guidelines, A Voluntary Code of Practice 2012), above and below ground cables above 132kV have potential to cause EMF effects. In the absence of information, including the location of the cable corridor and sensitive receptors, the Inspectorate is not in a position to agree to scope out this matter at this stage. The Environmental Statement should demonstrate the design measures take to avoid the potential for EMF effects on receptors from all onshore components, including overhead and buried cables and the substation.	This assessment is set out in section 30.9.

30.4 Baseline environment

30.4.1 Methodology to inform baseline

Desktop study

30.4.1.1 Information on human health within the human health study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 30.9 below.

30.4.1.2 The following data sources have informed the health baseline assessment:

- Public Health Wales Public Health Outcomes Framework (Public Health Wales, 2022)
- Stats Wales: Catalogue (Welsh Government, 2022)
- Welsh Index of Multiple Deprivation (WIMD) 2019 (Welsh Government, 2019b)
- Stats Wales: WIMD 2019 (Welsh Government, 2019c).
- Office for Health Improvement and Disparities. Fingertips Public Health Data. Public Health Outcomes Framework. (OHID, 2022)
- Isle of Man Cabinet Office. Public Health Outcomes Framework. (Isle of Man Cabinet Office, 2018)
- Google Earth Pro 2021 aerial and street level photography review.

Table 30.9: Summary of key desktop reports.

Title	Source	Year	Author
Public Health Outcomes Framework, England	Fingertip's resource	2011 - 2022	Office of Health Improvement and Disparities (OHID)
Public Health Outcomes Framework, Wales	The Public Health Wales Observatory	2011 - 2020	Welsh Government
Public Health Outcomes Framework, Isle of Man	Health Intelligence	2016 - 2021	Isle of Man Cabinet Office

30.4.2 Site specific surveys

30.4.2.1 No site-specific surveys have been undertaken to inform the EIA for human health. This is because relevant population health data is publicly available and further data collection would not be proportionate.

30.5 Baseline environment

30.5.1 Wales

30.5.1.1 Recent public health data indicates similar health outcomes in Denbighshire, Conwy and Wales. These are summarised in Table 30.10 .

30.5.1.2 Overall health can be informed by life expectancy indicators. Healthy life expectancy is the number of years a person can expect to live without illness or disabling injury. For males, compared to the average for Wales (61.5 years), healthy life expectancy is better in Denbighshire (63.3 years) and Conwy (63.4). Similarly, for females, compared to the average for Wales (62.4 years), healthy life expectancy is better in Denbighshire (65.8 years) and Conwy (66 years).

30.5.1.3 Welsh data provide indicators of mental well-being. The percentage of people who reported a sense of community is higher in Denbighshire (75.9%) than Conwy (68%) and Wales (69.3%). The percentage of people feeling lonely was similarly low in Denbighshire (10%), Conwy (12%) and Wales (12.6%). Life satisfaction among working age adults was highest in Conwy (81%) compared to Denbighshire (74.1%) and Wales (76.9%).

Table 30.10: Selection of public health outcomes – Wales (Public Health Wales, 2022)

Indicator	Sex	Period	Denbighshire	Conwy	Wales
Healthy life expectancy at birth (years)	Male	2018 - 20	63.3	63.4	61.5
Healthy life expectancy at birth (years)	Female	2018 - 20	65.8	66	62.4
Adults meeting physical activity guidelines (age-standardised percentage)	Persons	2020-21	43.4	50.2	55.5
Adults eating five fruit or vegetable portions a day (age-standardised percentage)	Persons	2020-21	44.7	23.4	30.7
Working age adults of healthy weight (age-specific percentage)	Persons	2020-21	41.4	37.6	36.7
Working age adults in good health (age-specific percentage)	Persons	2020-21	75.5	80.5	79.6
Working age adults free from limiting long term illness (age-specific percentage)	Persons	2020-21	55.4	64.8	60.1
Hip fractures among older people (age-standardised rate per 100,000)	Persons	2021/22	731.6	463.3	576.4
A sense of community (age-standardised percentage)	Persons	2020-21	75.9	68	69.3
People feeling lonely (age-standardised percentage)	Persons	2020-21	10	12	12.6
Life satisfaction among working age adults (age-specific percentage)	Persons	2020-21	74.1	81	76.9
Older people free from limiting long term illness (age-specific percentage)	Persons	2020-21	40.5	55	33.3
Older people of healthy weight (age-specific percentage)	Persons	2020-21	43.3	39.2	38.2
Older people in good health (age-specific percentage)	Persons	2020-21	68.1	70.9	66.6

Indicator	Sex	Period	Denbighshire	Conwy	Wales
Premature deaths from key non communicable diseases (age standardised rate per 100,000)	Male	2019-21	378.2	389.8	370.9
Premature deaths from key non communicable diseases (age standardised rate per 100,000)	Female	2019-21	279.4	257	254.1
Deaths from injuries (age standardised rate per 100,000)	Persons	2019-21	50.2	35.7	39.7
Deaths from road traffic injuries (age standardised rate per 100,000)	Persons	2012-21	3.9	3.9	3.1
Suicides (age standardised rate per 100,000)	Persons	2017-21	12.9	10.7	12.2

30.5.1.4 Using deprivation as a health resilience indicator, the lower layer super output area (LSOA) of St Asaph West (W01000246) (Welsh Government, 2019b) has been used, as this is the LSOA within which the onshore substations will be located. Local authority data for Conwy (W06000003) has been used with regards to the proposed location for the cable landfall and proposed onshore development area, and Denbighshire (W06000004) data has been used with regards to the proposed location for the proposed onshore development area. The sub-domains for 2019 deprivation data is as follows:

- Sub-domains of deprivation where less deprived than national average:
  - Overall St Asaph West is ranked 1,020 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived
  - For housing St Asaph West is ranked 1,177 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived
  - For community safety St Asaph West is ranked 1,255 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived
  - For access to services St Asaph West is ranked 1770 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived

30.5.1.5 For physical environment St Asaph West is ranked 1,138 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived

- Sub-domains of deprivation where more deprived than national average:
  - For income St Asaph West is ranked 919 out of 1,909 LSOAs in Wales, which places it among the 30-50% most deprived
  - For employment St Asaph West is ranked 849 out of 1,909 LSOAs in Wales, which places it among the 30-50% most deprived
  - For health St Asaph West is ranked 725 out of 1,909 LSOAs in Wales, which places it among the 30-50% most deprived
  - For education St Asaph West is ranked 571 out of 1,909 LSOAs in Wales, which places it among the 20-30% most deprived
  - For physical environment St Asaph West is ranked 1,138 out of 1,909 LSOAs in Wales, which places it among the 50% least deprived
  - Overall, the Denbighshire Local Authority contains 7 of the 10% most deprived LSOAs in Wales
  - Overall, the Conwy Local Authority contains 4 of the 10% most deprived LSOAs in Wales.

30.5.1.6 The proposed landfall location of Mona Offshore Wind Project is near areas of employment deprivation in Wales, including: Glyn (Colwyn) 2 (W01000144) which is ranked 2 of 1,909 LSOAs in Wales, which makes it the 2nd most deprived LSOA in Wales; and Abergele Pensarn 2 (W01001928) ranked 5 of 1,909 LSOAs in Wales, making it the 5th most deprived LSOA in Wales for employment.

30.5.1.7 The proposed landfall location of Mona Offshore Wind Project is near areas of education deprivation in Wales, including: Glyn (Colwyn) 2 (W01000144) which is among the 10-20% most deprived; Llysfaen 1 (W01000163) which is among the 10-20% most deprived; and Kinmel Bay 1 (W01000149) which is among the 10% most deprived.

30.5.2 Isle of Man

30.5.2.1 Public health data as recent as 2018 demonstrate slightly poorer health outcomes on the Isle of Man compared to England averages. These are summarised in Table 30.11. Healthy life expectancy at birth is similar to England for males (63.8 years vs 63.4 years) but slightly lower for females compared to England (57.9 years vs 63.8 years). Excess weight in children (4-5 years old) is slightly higher than the England average (25.2% vs 22.4%). Mortality rates from all causes considered preventable are higher than in England (206.4 per 100,000 v. 181.5 per 100,000). Infant mortality and excess winter deaths (all ages) rates are very low on the Isle of Man. Emergency hospital admissions for intentional self-harm (a mental health indictor), shows higher rates for the Isle of Man compared to England (206.5 per 100,000 v. 185.5 per 100,000).

Table 30.11: **Selection of public health outcomes – Isle of Man (Isle of Man Cabinet Office, 2018).**

Description	Sex	Period	Unit	Isle of Man	England
Healthy Life Expectancy at birth	Male	2015-2017	Years	63.8	63.4
Healthy Life Expectancy at birth	Female	2015-2017	Years	57.9	63.8
Child Excess weight - 4-5 year olds	All	2017/18	%	25.2	22.4
Infant mortality	All	2015-2017	per 1000	0.9	3.9
Mortality rate from causes considered preventable	All	2015-17	per 100,000	206.4	181.5
Under 75 mortality rate from all cardiovascular diseases considered preventable	All	2015-17	per 100,000	54.3	45.9
Under 75 mortality rate from cancer considered preventable	All	2015-17	per 100,000	86.1	78.0
Under 75 mortality rate from liver disease considered preventable	All	2015-17	per 100,000	11.5	16.3

Description	Sex	Period	Unit	Isle of Man	England
Under 75 mortality rate from respiratory disease considered preventable	All	2015-17	per 100,000	13.7	18.9
Excess Winter Deaths Index (single year, all ages)	All	2016/17	%	14.4	21.6
Emergency Hospital Admissions for Intentional Self-Harm	All	2017/18	per 100,000	206.5	185.5

30.5.3 North west England

30.5.3.1 Recent public health data indicates poorer health outcomes in the North West region than the rest of England. These are summarised in Table 30.12. Healthy life expectancy is lower compared to the rest of England.

30.5.3.2 Socio-economic conditions and other health determinants are typically worse in the north west compared to all of England. There is a higher percentage of children in relative and absolute low-income families compared to the England average. The percentage of people in employment is lower than the England average, however, there is a slightly lower percentage of 16 to 17 year olds not in education, employment or training (NEET) compared to England. Fuel poverty also affects a higher percentage of the north west population (14.4% compared to 13.2% national average).

Table 30.12: Selection of public health outcomes – north west region England (OHID, 2022).

Indicator	Sex	Period	North West	England
A01a - Healthy life expectancy at birth	Male	2018 - 20	61.53	63.14
A01a - Healthy life expectancy at birth	Female	2018 - 20	62.43	63.87
B01b - Children in absolute low income families (under 16s)	Persons	2020/21	16.60	15.10
B05 - 16 to 17 year olds not in education, employment or training (NEET) or whose activity is not known	Persons	2020	5.28	5.48
B10 - Killed and seriously injured (KSI) casualties on England's roads	Persons	2020	79.53	86.08
B12b - Violent crime - violence offences per 1,000 population	Persons	2021/22	43.91	34.95
B14a - The rate of complaints about noise	Persons	2019/20	3.75	6.37
B14b - The percentage of the population exposed to road, rail and air transport noise of 65dB(A) or more, during the daytime	Persons	2016	5.51	5.50
B14c - The percentage of the population exposed to road, rail and air transport noise of 55 dB(A) or more during the night-time	Persons	2016	9.37	8.48
B15a - Homelessness: households owed a duty under the Homelessness Reduction Act	N/A	2020/21	11.93	11.34
B15c - Homelessness: households in temporary accommodation	N/A	2020/21	1.64	4.03
B16 - Utilisation of outdoor space for exercise/health reasons (over 16s)	Persons	Mar 2015 - Feb 2016	17.55	17.92
B17 - Fuel poverty (low income, low energy efficiency methodology)	N/A	2020	14.43	13.23
1.01i - Children in low income families (all dependent children under 20)	Persons	2016	18.10	17.00
C09a - Reception: Prevalence of overweight (including obesity)	Persons	2021/22	23.28	22.25
C09b - Year 6: Prevalence of overweight (including obesity)	Persons	2021/22	39.05	37.76
C10 - Percentage of physically active children and young people	Persons	2020/21	44.02	44.63
C15 - Proportion of the population meeting the recommended '5-a-day' on a 'usual day' (adults)	Persons	2019/20	51.17	55.43
C16 - Percentage of adults (aged 18+) classified as overweight or obese	Persons	2020/21	65.92	63.45
C17a - Percentage of physically active adults	Persons	2020/21	64.47	65.94
C17b - Percentage of physically inactive adults	Persons	2020/21	24.95	23.38
C22 - Estimated diabetes diagnosis rate	Persons	2018	81.15	77.95
C27 - Percentage reporting a long-term Musculoskeletal (MSK) problem	Persons	2021	19.35	17.01
C28d - Self reported wellbeing: people with a high anxiety score	Persons	2020/21	25.73	24.15
D01 - Fraction of mortality attributable to particulate air pollution (new method)	Persons	2020	5.00	5.64
D02b - New STI diagnoses (excluding chlamydia aged under 25) per 100,000	Persons	2021	322.04	394.47
E01 - Infant mortality rate	Persons	2018 - 20	4.33	3.90
E03 - Under 75 mortality rate from causes considered preventable (2019 definition)	Persons	2017 - 19	176.86	142.25
E04b - Under 75 mortality rate from cardiovascular diseases considered preventable (2019 definition)	Persons	2017 - 19	34.91	28.06
E05b - Under 75 mortality rate from cancer considered preventable (2019 definition)	Persons	2017 - 19	65.34	54.06
E06b - Under 75 mortality rate from liver disease considered preventable (2019 definition)	Persons	2017 - 19	22.65	16.65
E07b - Under 75 mortality rate from respiratory disease considered preventable (2019 definition)	Persons	2017 - 19	27.10	20.22
E14 - Excess winter deaths index	Persons	Aug 2019 - Jul 2020	19.50	17.40

30.5.4 Future baseline scenario

30.5.4.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) requires that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline

scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the Environmental Statement. In the event that Mona Offshore Wind Project does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

30.5.4.2 Population health data presents a snapshot at a particular time. It is well recognised that population health is subject to continuing influences, both at the individual and community level. Influences may be environmental, such as seasonal variation in wellbeing and communicable diseases, they may also respond to socio-economic factors, such as migration and the availability of jobs.

30.5.4.3 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 and the COVID-19 pandemic. The implications of COVID-19 for public health will take years to be reflected within statistical data releases, but it is expected that the pandemic will have exacerbated public health challenges. The pandemic disproportionately affected vulnerable groups, including due to age and ill-health (Welsh Government, 2021).

30.5.4.4 For assessment purposes, the current health baseline is considered a suitable proxy of the future baseline. The current baseline used in this assessment includes appropriate health indicators to reflect the types of health outcomes that that would also be relevant for the future population (e.g. in relation to age and long-term conditions). The assessment methodology includes a categorisation of vulnerable population groups, which, for example, allows for the effects of ‘older people’ and ‘people with existing poor health’ to be distinguished from the general population. The assessment sensitivity score for each vulnerable group is independent of the population size within that group, which would be the main change between the current and future baseline. The sensitivity scores within the assessment therefore account for both current and future population characteristics.

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 predication would have such wide error margins that it would greatly limit the value of the exercise. Annual national population health trend forecasting is undertaken as a government public health activity (Welsh Government, 2021) and has been taken into account by the assessment.

30.5.5 Data limitations

30.5.5.1 This assessment is based on publicly available statistics and evidence sources. No new primary research or bespoke analysis of non-public data was considered necessary and therefore none has been undertaken for the assessment.

30.5.5.2 The health assessment partially draws from and builds upon, the technical outputs from inter-related technical disciplines set out in paragraph 30.1.1.3.

30.5.5.3 As a consequence, the assumptions and limitations of those assessments also apply to any information used in this chapter. It is, however, considered that the information available provides a suitable basis for assessment.

30.5.5.4 Reducing uncertainty is a key element of impact assessment. Whilst not all uncertainty can be removed, the following steps have been taken to allow confidence in the health assessment conclusions:

- Methods are used that triangulate evidence sources and professional perspectives
- The scientific literature reviews undertaken give priority to high quality study design, such as systematic reviews and meta-analysis, and strength of evidence
- Quantitative inputs for other assessments have been used, which included model validation, as described in inter-related technical disciplines set out in paragraph 30.1.1.3
- The health assessment has been cautious, with conservative assessments, for example in taking account of non-threshold effects and vulnerable group findings
- The need for monitoring and adaptive management has been considered
- The health assessment has been transparent in its analysis and follows good practice as set out in guidance referenced in section 30.6.1.

30.5.5.5 It is also noted that a number of assumptions have been made on the required workforce of the Mona Offshore Wind Project which are detailed in volume 4, chapter 29: socio-economics and community of the PEIR.

30.5.5.6 It is considered that these limitations and assumptions do not affect the robustness of the assessment and that the evidence available is sufficient to reach conclusions as to the likely significant effects of the project on population health.

30.6 Impact assessment methodology

30.6.1 Overview

30.6.1.1 The human health impact assessment has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR. Specific to the human health impact assessment, the following guidance documents have also been considered:

- 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)
- Institute of Public Health (IPH), Guidance, Standalone Health Impact Assessment and health in environmental assessment, 2021 (Institute of Public Health, 2021)
- International Association for Impact Assessment (IAIA) and European Public Health Association. A reference paper on addressing Human Health in EIA (IAIA, 2020) and academic discussion of the same (Cave, Pyper, Fischer-Bonde, Humboldt-Dachroeden, & Martin-Olmedo, 2021)
- Wales Health Impact Assessment Support Unit. Health Impact Assessment: A practical guide (WHIASU, 2012)

- Public Health England, Advice on the content of Environmental Statements accompanying an application under the Nationally Significant Infrastructure Planning (NSIP) Regime (PHE, 2021)
- Public Health England, Health Impact Assessment in spatial planning (Public Health England, 2020)
- World Health Organisation (WHO) guidelines on air quality and noise (Berglund, Lindval, Schwela, & Organization, 1999; WHO, 2009; WHO, 2018; WHO, 2021).

30.6.1.2 In addition, the human health impact assessment has considered the legislative framework as defined by:

- The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 set out the topics to be assessed within the EIA process, including: 'The EIA must identify, describe and assess in an appropriate manner, in light of each individual case, the direct and indirect significant effects of the proposed development on the following factors –population and human health…'
- The Air Quality Standards Regulations 2010 (HM Government, 2010) set out statutory health protection standards on ambient air quality
- The Environment Act 1995 sets provisions for protecting certain environmental conditions of relevance to health in the UK (HM Government, 1995). Part II covers contaminated land and Part IV covers air quality
- The Environmental Protection Act 1990 (as amended), Part IIA covers contaminated land and Part III manages the control of emissions (including dust, noise and light) that may be prejudicial to health or a nuisance (HM Government, 1990)
- The Health and Safety at Work etc Act 1974 (HM Government, 1974a) places duties on employers to ensure, 'so far as is reasonably practicable': the health, safety and welfare at work of all their employees; and that persons not in their employment are not exposed to risks to their health or safety as a result of the activities undertaken
- Control of Pollution Act 1974 (HM Government, 1974b) makes provisions in relation to waste disposal, water pollution, noise, atmospheric pollution and public health. It describes licencing of certain activities to avoid danger to public health or serious detriment to the amenity of the locality affected. It also covers control of, and consent for, noise on construction sites (sections 60 and 61), including defining 'best practicable means' (section 72)
- International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 Regulations are aimed at preventing and minimising, both accidental and operational, pollution from ships are included in the MARPOL (International Maritime Organisation, 1973).
- The Well-being Act (Welsh Government, 2015) gives a legally-binding common purpose – the seven well-being goals – for national government, local government, local health boards and other specified public bodies.
- The Active Travel (Wales) Act 2013 requires local authorities to continuously improve facilities and routes for pedestrians and cyclists and to prepare maps identifying current and potential future routes for their use.
- The Environment (Wales) Act 2016 enables Wales' resources to be managed in a more proactive, sustainable and joined-up way. The Act provides powers to put in place statutory emission reduction targets.

30.6.2 Impact assessment criteria

30.6.2.1 The criteria for determining the significance of effects involves a two-stage process of defining the magnitude of the impacts and the sensitivity of the receptors. This section describes the criteria applied in this chapter to assign values to the magnitude of potential impacts and the sensitivity of the receptors. The terms used to define magnitude and sensitivity are based on those which are described in further detail in volume 1, chapter 5: EIA methodology of the PEIR.

30.6.2.2 Judgments are based on most relevant criteria in Table 30.13, Table 30.14 and Table 30.16. It is likely in any given analysis that some criteria will span score categories. These are as set out by guidance (IEMA, 2022).

30.6.2.3 The criteria for defining magnitude in this chapter are outlined in Table 30.13 below.

Table 30.13: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition
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.

30.6.2.4 The criteria for defining sensitivity in this chapter are outlined in Table 30.14 below.

Table 30.14: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition
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.

Sensitivity	Definition
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.

30.6.2.5 The significance of the effect upon human health is determined by correlating the magnitude of the impact and the sensitivity of the receptor. The particular method employed for this assessment is presented in Table 30.15. Where a range of significance of effect is presented in Table 30.15, the final assessment for each effect is based upon expert judgement.

30.6.2.6 For the purposes of this assessment, any effects with a significance level of minor or less have been concluded to be not significant in terms of The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017.

Table 30.15: Matrix used for the assessment of the significance of the effect.

Sensitivity of receptor	Magnitude of impact			
	Negligible	**Low**	**Medium**	**High**
Very Low	Negligible	Negligible	Negligible or Minor	Minor
Low	Negligible	Minor	Minor	Minor or Moderate
Medium	Negligible or Minor	Minor	Moderate	Moderate or Major
High	Minor or Negligible	Minor or Moderate	Moderate or Major	Major

30.6.2.7 The IEMA 2022 guidance requires that the conclusions, reached using sensitivity and magnitude, are then explained for the public health audience with a suitable concise narrative. The narrative summarises key considerations and supporting evidence. The guidance sets out the criteria for doing so, see Table 30.16.

Table 30.16: Explanation of Population Health Significance.

Category/Score	Indicative criteria
Major (significant)	The narrative explains that this is significant for public health because: • 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)	The narrative explains that this is significant for public health because: • 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)	The narrative explains that this is not significant for public health because: • 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.

Category/Score	Indicative criteria
Negligible (not significant)	The narrative explains that this is not significant for public health because: • 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.

30.6.2.8 The temporal scope of this chapter used the following summary terms:

- 'Very short term' relates to effects measured in hours, days or weeks
- 'Short term' relates to effects measured in months, (up to 24 months duration)
- 'Medium term' relates to effects measured in years
- 'Long term' relates to effects measured in decades.

30.6.2.9 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*" (World Health Organization, 1948).

30.6.2.10 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*" (World Health Organization, 2022).

30.6.2.11 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.

30.6.2.12 Impacts of the Mona Offshore Wind Project 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.

30.6.2.13 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 Mona Offshore Wind Project. 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.

30.6.2.14 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.

30.6.3 Vulnerable groups

30.6.3.1 Of the vulnerable population groups identified in guidance, the following relevant groups are considered within 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 Equality Act 2010 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.

30.6.3.2 The following characterisations of how the general population may differ from vulnerable group populations were considered when scoring sensitivity:

- 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; experiencing low deprivation; comprising people with good health status; rating their day-to-day activities as not limited; having a high capacity to adapt to change (high resilience); less likely to rely on resources shared with the Mona Offshore Wind Project.
- 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; experiencing high deprivation (including where this is due to pockets of higher deprivation within low deprivation areas); reporting bad or very bad health status; rating their day-to-day activities as limited; having a low capacity to adapt to change (limited resilience); more likely to rely on resources shared with the Mona Offshore Wind Project

30.6.3.3 Heightened vulnerability is rarely due to a single cause and people may experience multiple forms of vulnerability due to intersecting social processes that result in inequalities (e.g. socioeconomic status and income).

30.6.3.4 As all development has the potential for adverse effects to some particularly vulnerable individuals, the role of EIA significance conclusions are not to set a threshold of 'no harm' from development, but to show where, at a population level, the harm should weigh strongly in the balance alongside the development's benefits for health and other outcomes.

30.6.3.5 In some situations, an effect may only be relevant to a few individuals, indicating that a population health effect would not occur. As stated by guidance: "*Where the effect*

is best characterised as only affecting a few individuals, this may indicate that a population health effect would not occur. Such individuals should still be the subject of mitigation and discussion, but in EIA and public health terms the effect may not be a significant population health change." (Pyper, et al., 2022b) paragraph 8.18.

30.7 Key parameters for assessment

30.7.1 Maximum design scenario

30.7.1.1 The health assessment does not duplicate the maximum design scenarios (MDS) described in the inter-related technical disciplines set out in paragraph 30.1.1.3.

30.7.1.2 The MDS identified in Table 30.17 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. These scenarios have been selected from the Project Design Envelope provided in volume 1, chapter 3: Project description of the PEIR. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different infrastructure layout), to that assessed here be taken forward in the final design scheme.

Table 30.17: Maximum design scenario considered for the assessment of potential impacts on human health.

[a] C=construction, O=operational and maintenance, D=decommissioning

Potential impact	Phasea			Maximum Design Scenario	Justification
	C	O	D		
Transport modes, access and connections	✓	✓	✓	MDS is in relation to disruption to commercial operators including strategic routes and lifeline ferries (as stated in volume 2, chapter 12: Shipping and navigation of the PEIR) and traffic and transport disruption associated with onshore construction activities (as stated in volume **3**, chapter 21: Traffic and **t**ransport of the PEIR).	The greatest level of disruption in access, transport and traffic.
Community identity, culture, resilience and influence	x	✓	x	MDS is in relation to visual impact of the wind turbines. The relevant MDS is as stated in volume 4, chapter 2**6**: Seascape, Landscape and Visual Resources of the PEIR.	The greatest visual impact of the wind farm.
Open space, leisure and play	✓	✓	✓	MDS is in relation to displacement of offshore/nearshore recreational activities, disruption to onshore recreational activities and increased sediment concentrations in recreational areas (as stated in volume 2, chapter 14: Other sea users of the PEIR and volume 3, chapter 20: Land use and recreation of the PEIR).	The greatest amount of disruption in recreational activities.
Employment and income, adverse	✓	✓	✓	MDS is in relation to loss or restricted access to commercial fishing grounds (as stated in volume 2, chapter 11: Commercial fisheries of the PEIR).	The greatest unemployment or adverse economic implications.
Noise and vibration	✓	✓	✓	MDS is in relation to construction associated noise and vibration effects, and operations and maintenance noise effects of the substations (as stated in volume 3, chapter 22: Noise and Vibration of the PEIR).	The greatest noise and vibration effects.
Radiation	x	✓	x	MDS is in relation to renewable energy generation and the perceived risk of subsequent EMF generation associated with the Mona Onshore Transmission Infrastructure (as stated in volume 1, chapter 3: Project description of the PEIR).	The greatest output of EMF generation onshore.
Climate change and adaptation	x	✓	x	MDS is in relation to renewable energy generation and subsequent reduced greenhouse gas emissions (as stated in volume 4, chapter 28: Climate change of the PEIR).	The smallest output contribution to renewable energy generation.
Wider societal infrastructure and resources	x	✓	x	MDS is in relation to renewable energy generation (as stated in volume 1, chapter 3: Project description of the PEIR).	The smallest output contribution to renewable energy generation.

30.7.2 Impacts scoped out of the assessment

30.7.2.1 On the basis of the baseline environment and the description of development outlined in volume 1, chapter 3: project description of the PEIR, a number of impacts are proposed to be scoped out of the assessment for human health. These impacts are outlined, together with a justification for scoping them out, in Table 30.18.

30.7.2.2 Table 30.18 follows the list of issues set out in guidance (IEMA, 2022).

Table 30.18: Impacts scoped out of the assessment for human health.

Potential impact	Justification
Health related behaviours	
Physical activity	Construction and Decommissioning phases • Offshore: Health promotion within the Mona Offshore Wind Project workforces will be considered as a good practice enhancement measure but is otherwise scoped out. Community physical activity is not affected by offshore works or port operations. Operational and maintenance phase • Offshore: Health promotion within the Mona Offshore Wind Project workforces will be considered as a good practice enhancement measure but is otherwise scoped out. Community physical activity is not affected by offshore works or port operations.
Risk taking behaviour	Construction and Decommissioning phases • Offshore: Issues of community health behaviours being detrimentally affected by the presence of a temporary workforce are scoped out. The issue of communicable illness, including in relation to COVID-19 is noted but scoped out. The Mona Offshore Wind Project will operate appropriate measures to safeguard the Mona Offshore Wind Project workforce and the public in line with Government guidance of the day, including in relation to vessel crews. Risks are similar to other routine construction and shipping activities. • Onshore: Issues of community health behaviours being detrimentally affected by the presence of the workforce are scoped out. This reflects a workforce of professionals who are assumed to return to their usual place of residence during periods of leave. The workforce is unlikely to be sufficiently large in number to affect local markets, (e.g. for alcohol, cigarettes or gambling, to an extent which could significantly affect community health). Operational and maintenance phase • Offshore: The same conclusions are reached for the operational workforce as for the construction workforce. This issue is therefore scoped out. • Onshore: Minimal operational workforce numbers are anticipated to check and maintain the onshore infrastructure. There is not considered to be the potential for a likely significant population health effect, this issue is therefore scoped out.
Diet and nutrition	Construction and Decommissioning phases • Offshore: Activities are neither expected to require agricultural land take, nor disrupt food related production or transport. Effects on diet due to impacts to commercial fisheries (notably shellfish harvesting) have been considered, see section 30.9.6 for economic implications, but are scoped out in relation to diet. There are no anticipated effects on the availability or price of food. • Onshore: Construction may require some temporary reduction in availability or quality of agricultural land. This is however not considered to be on a scale that could change population diet or food prices and therefore significantly affect population health. This issue is therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: No effects on diet and nutrition are expected from operation of the onshore infrastructure, as there would be no, or minimal, further disturbance of agricultural lands. This issue is therefore scoped out.
Social environment	
Housing	Construction and Decommissioning phases • Offshore: Housing related issues are scoped out. No new housing is proposed associated with the Mona Offshore Wind Project. The workforce will have housing requirements, but it is expected that a high proportion will be resident in the regional area or would be based aboard their vessels unless traveling to their usual place of residence. Any temporary accommodation requirements would be met through usual capacity for such activities around ports. There is not considered to be the potential for a likely significant population health effect associated with changes in the availability of housing. • Onshore: The majority of workers are assumed to be based in the regional area, returning to their usual place of residence when not working. Where temporary accommodation is required, this would be existing B&B/hotel bed spaces, as is typical for the construction industry. It is not expected that use of temporary accommodation would be on a scale to significantly displace local residents; adversely affect seasonal tourism; or otherwise affect housing availability. There is not expected to be a loss of residential housing or permanent loss of outdoor spaces associated with dwellings. Housing effects are scoped out. Operational and maintenance phase • Offshore: The same conclusions are reached for the operational workforce as for the construction workforce. The workforce is expected to be smaller in number than for construction and decommissioning and more locally resident. The onshore infrastructure, including the substations, is relatively low impact in terms of its built form, limiting the potential for any widespread adverse effect on housing value or affordability. This issue is therefore scoped out. • Onshore: Minimal operational workforce numbers are anticipated to check and maintain the onshore infrastructure. There is not considered to be the potential for a likely significant population health effect, this issue is therefore scoped out.
Relocation	Construction and Decommissioning phases • Offshore: Neither offshore works nor port activities would involve compulsory land purchases of homes or community facilities. This issue is therefore scoped out. • Onshore: Onshore works would not involve compulsory purchases of homes or community facilities. This issue is therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: As for construction and decommissioning.

Potential impact	Justification
Open space, leisure and play	Construction and Decommissioning phases • Offshore: Offshore and port activities are not expected to affect access to areas of open space that could significantly affect population health. This reflects use of existing port areas and designated shipping routes near ports. Furthermore, offshore activities would be a considerable distance from land, so have limited potential to effect marine leisure on a scale that could be influential to public health. This issue is therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Permanent land take for onshore infrastructure, including the substations, is not within, or adjoining, land that is publicly accessible. Therefore, the project change is unlikely to significantly affect physical, mental or social health aspects of community recreation. This issue is therefore scoped out.
Transport modes, access and connections	Construction and Decommissioning phases • Offshore: Vehicle transport is expected to predominantly relate to the movement of goods, materials, people and plant to and from a port location associated with the offshore works. Although a project port has not been determined, the road infrastructure to ports in general is good. It is considered reasonable to assume that an existing major port would be selected with appropriate existing consents that have taken transport impacts into account. Port expansion is not part of the scheme being proposed. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: The onshore infrastructure is expected to have minimal implications for road transport, with activity limited to checks and maintenance. It is unlikely that there would be the potential for significant population health effects due to changes in: routine or emergency health related journey travel times; access to health promoting goods and services; community severance; or road safety.
Community safety	Construction and Decommissioning phases • Offshore: There are not anticipated to be community safety or security issues associated with worker behaviour in ports or communities. The Mona Offshore Wind Project will have appropriate safeguarding and modern slavery policies. The potential for widespread actual or perceived crime that could affect population health is unlikely. This issue is therefore scoped out. • Onshore: Where surface excavations are undertaken these would be within controlled work areas, including use of appropriate fencing and notifications as required. Best practice measures would be secured through suitable management plans. The risk to the public from accidental injury, (e.g. falls or drowning is scoped out). There are not anticipated to be community safety or security issues associated with worker behaviour in ports or communities. The project will have appropriate safeguarding and modern slavery policies. The potential for widespread actual or perceived crime that could affect population health is unlikely. Electrical risks to the public would be avoided though the design, including fencing of above ground electrical infrastructure. These issues are therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: As for construction and decommissioning.
Community identity, culture, resilience and influence	Construction and Decommissioning phases • Offshore: Demographic changes that could affect community identity are not anticipated, as there would not be a large in-migration or out-migration of workers to local communities. Visual impacts of offshore activities are expected to be limited due to their distance offshore. Temporary employment opportunities are not expected to have a strong influence on community identity. These issues are therefore scoped out. • Onshore: Transient effects along the onshore cable corridor, including due to temporary lighting and temporary changes in views, are not expected to influence community identity or disrupt community gatherings to an extent that could affect population health. This issue is therefore scoped out. Operational and maintenance phases • Onshore: Visual impacts of onshore infrastructure, including the onshore substations, are not expected to be of a scale that could affect population health outcomes. This issue is therefore scoped out.
Social participation, interaction and support	Construction and Decommissioning phases • Offshore: The Mona Offshore Wind Project will not directly affect land used for community interaction (e.g. meeting places, village greens, community centres, etc. that promote community voluntary, social, cultural or spiritual participation). This issue is therefore scoped out. Whilst project wide consultation for the Mona Offshore Wind Project are likely to support community empowerment and voice, this is not considered to be of a scale that would result in significant population health effects. This issue is therefore scoped out. • Onshore: As for offshore. These issues are therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: As for construction and decommissioning.
Economic environment	
Education and training	Construction and Decommissioning phases • Offshore: Whilst the project could support upskilling and career development in relation to its workforces, this is not on a scale with the potential for significant population level effects. Consideration has been given to how benefits, including for local and vulnerable groups, could be enhanced. At this stage there is not sufficient information or certainty of such measures being offered to warrant an assessment. This issue is therefore scoped out. • A large influx for workers, including those bringing families, is not expected, so changes to educational capacity or quality are unlikely and are scoped out. • Onshore: The potential to adversely affect access to schools is limited by the use of trenchless techniques for major road crossings. A large influx for workers, including those bringing families, is not expected, so changes to educational capacity or quality are unlikely and are scoped out. Operations and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Operational education and training opportunities associated with the onshore infrastructure are not expected to be on a scale that could influence population health, even with benefits targeted to vulnerable groups. No effects on educational outcomes are expected due to noise. This issue is therefore scoped out.

Potential impact	Justification
Employment and income	Construction, Operations and maintenance and Decommissioning phases • Offshore: Whilst the project provides opportunities for good quality employment, which are noted as beneficial for health, these are not on a scale with the potential for significant population level effects. Consideration has been given to how benefits, including for local and vulnerable groups, could be enhanced. At this stage there is not sufficient information or certainty of such measures being offered to warrant an assessment. This issue is therefore scoped out. • Onshore: As for offshore. Construction and Decommissioning phases • Offshore: The project would operate appropriate employment policies in relation to equality, health and safety. Project activities are not expected to differ from industry norms, therefore there is no expected change to community or familial relations. These issues are therefore scoped out. • Onshore: As for offshore. These issues are therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Operational employment associated with the onshore infrastructure is not expected to be on a scale that could influence population health, even with benefits targeted to vulnerable groups. The effects on tourism have been assessed within Volume 4, chapter 29: socio-economics and have been determined to be not significant. These issues are therefore scoped out.
Bio-physical environment	
Climate change and adaptation	Construction and Decommissioning phases • Offshore: Embodied carbon and climate altering pollutant emissions are not of a scale to have the potential for population level effects associated with climate change. This issue therefore is scoped out. • Onshore: As for offshore. Operations and maintenance phase • Onshore: The onshore electrical infrastructure facilitates the benefits accrued from the renewable energy generating assets. This issue is addressed under 'Offshore climate change and adaptation'. To avoid double counting this is not separately assessed and is scoped out.
Air quality	Construction and Decommissioning phases • Offshore: Consistent with the Scoping Opinion offshore air quality effects on all phases to human health are scoped out. See Volume 3, chapter 23: Air quality of the PEIR. • Onshore: Dust emissions generated by onsite construction and decommissioning activities has been assessed in volume 3, chapter 23: Air quality for the PEIR as having negligible significance with standard mitigation strategies. This issue would therefore not be expected to affect population health. This issue is therefore scoped out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Operational nearshore and onshore air quality effects (e.g. maintenance vehicle emissions) are not anticipated to be of a scale, even accounting for non-threshold effects, that could affect population health. This issue is therefore scoped out.
Water quality or availability	Construction and Decommissioning phases • Offshore: Offshore pollutant spills have potential to affect coastal bathing water quality, which can result in toxin exposures through dermal contact and ingestion. However, as stated in volume 2, chapter 7: benthic subtidal ecology of the PEIR, these risks are managed through development of, and adherence to, an Environmental Management Plan including a Marine Pollution Contingency Plan (MPCP) which will include planning for accidental spills. It will also set out industry good practice and OSPAR (Oslo-Paris), International Maritime Organisation (IMO) and MARPOL (International Convention for the Prevention of Pollution from Ships) guidelines for preventing pollution at sea. This issue is therefore scoped out on the basis of the anticipated effectiveness of such measures • Onshore: Bathing water quality may be temporarily affected by landfall works that create or mobilise pollutants, including potential toxin exposures through dermal contact or ingestion. Onshore pollution of surface water or groundwater bodies used as potable sources could affect the quality or availability of drinking water. The onshore cable corridor is predominately through agricultural land and food safety could also be compromised by contamination of agricultural water sources. However, as stated in volume 3, chapter 17 – hydrology and flood risk, both onshore and nearshore the project would adopt standard best practice spill avoidance and response measures including the production of an Outline Code of Construction Practice (CoCP) that would be secured through the detailed design process or as a requirement of the DCO. Based on the effectiveness of such measures pollution risk issues are scoped out. Temporary increases in non-harmful suspended sediments are scoped out. Effects to public drinking water infrastructure is scoped out on the basis that disruption of the existing water utilities network would be avoided, including through diversions if appropriate, see discussion under 'built environment'. Operations and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: As for construction and decommissioning.
Land quality	Construction and Decommissioning phases • Offshore: Offshore works would not affect land quality. Port activities are unlikely to result in public exposures to contaminated soils. Any new or historic contamination that may be mobilised by activities will be managed by existing port consents and standard best practice contamination avoidance and response measures. This issue is therefore scoped out. • Onshore: Ground condition and soil effects are scoped out. Risks of new or historic pollutant mobilisation, including direct exposure and food contamination, are highly likely to be addressed by standard good practice mitigation measures that would be secured through management plans (as stated in volume 3, chapter 16: geology, hydrogeology and ground conditions of the PEIR). Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Operations and maintenance activities are unlikely to require excavations or result in land quality related risks to public health. Any risks would be managed through standard best practice contamination avoidance and response measures that would be secured through management plans. This issue is therefore scoped out.

Potential impact	Justification
Noise and vibration	Construction and Decommissioning phases • Offshore: Consistent with the section 3.15 of the Scoping Opinion, the offshore airborne noise effects to human health are scoped out. Port activities would generate noise but this is not expected to be of a scale, timing or character that differs from existing operational port levels. This issue is therefore scoped out. See Volume 3, chapter 22: Noise and Vibration of the PEIR. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: Checks and maintenance activities are not expected to result in noise and vibration levels that could affect population health. This issue is therefore scoped out.
Radiation	Construction and Decommissioning phases • Offshore: Non-ionising electro-magnetic field (EMF) effects are scoped out. Offshore electrical infrastructure, including offshore substations, are not located in proximity to communities. Relevant occupational safeguards would be followed. No EMF risk is therefore likely for offshore aspects of the Mona Offshore Wind Project. No ionising radiation sources are proposed. These issues are scope out. • Onshore: Works would not include using, or making changes to, active major electrical infrastructure producing EMF. Relevant public and occupational safeguards, secured through management plans, would be followed for the temporary electrical equipment used. Electric and magnetic fields strengths reduce rapidly with distance, often requiring only a few meters separation between the source and receptor, to reach background levels. No ionising radiation sources are proposed. These issues are scope out. Operational and maintenance phase • Offshore: As for construction and decommissioning. • Onshore: For onshore electrical infrastructure, the 'actual EMF' risks are scoped out on the basis that the project would adopt the International Commission on Non-ionizing Radiation Protection (ICNIRP) guidelines and Government voluntary Code of Practice on EMF public exposure. Such considerations are inherent to the detailed engineering considerations of cable specification and routing. Relevant public EMF exposure guideline limits are noted in NPS EN-5 and would be complied with by the project. These guidelines are long standing and have a high safety margin. The levels of exposure that they require would not pose a risk to public health.

Institutional and built environment

Potential impact	Justification
Health and social care services	Construction and Decommissioning phases • Offshore: Effects on health and social care are scoped out. The Mona Offshore Wind Project workforce is assumed to include a high proportion of people who are resident in the regional area. The UK workforce would have NHS entitlement irrespective of place of residence. UK workers away from their usual place of residence for a prolonged period would be able to register with local primary healthcare on a temporary basis. This would facilitate NHS funding for their care. The expectation is that the great majority of healthcare needs of the offshore workforce will be met either by occupational provision aboard their vessel or by their usual healthcare provider when they return to their usual place of residence during rotation. Any multinational workforce are assumed to be covered by health insurance provisions that would allow the NHS to recoup costs to an extent that avoided any significant adverse effect on healthcare services. This is routine practice across industries and sectors. The Mona Offshore Wind Project programme and workforce assumptions are set out in volume 4, chapter 29: socio-economics and community of the PEIR. It is not expected that a high proportion of workers would move to the area with dependants requiring social care. Health protection measures such as screening and immunisations are expected to continue from the workers' usual place of residence. Similarly routine dental appointments are assumed to be with the worker's dental practice close to their usual place of residence. Other health services are not expected to be affected as no largescale in-migration is expected and the workforce of skilled technical roles would return to their usual places of residence when ashore. This issue is therefore scoped out. • Onshore: As for offshore. Operational and maintenance phase • Offshore: The same conclusions are reached for the operational workforce. The workforce is expected to be smaller in number and more locally resident. This issue is therefore scoped out. • Onshore: Minimal operational workforce numbers are anticipated to operate and maintain the onshore infrastructure. There is not considered to be the potential for a likely significant population health effect, this issue is therefore scoped out.
Built environment	Construction and Decommissioning phases • Offshore: Offshore utilities disruption is unlikely and any crossing of existing power or communications cables would be managed to avoid interruption. Appropriate waste management practices would be used, including regard to the MARPOL regulations on waste at sea. Significant population health implications are not anticipated and are scoped out. • Onshore: The potential for the project to affect existing features of the built environment that are supportive of population health has been considered and scoped out. The project would have a relatively low impact, including due to the use of trenchless techniques to avoid surface disruption at road crossings. Similarly, the position of existing services, such as water and sewer systems will be taken into account in planning the export cable corridor and techniques used. Appropriate diversions would occur to avoid disruption to such services. This issue is therefore scoped out. Operational and maintenance phase • Offshore: The distance offshore means there is very limited direct impacts on human receptors from new elements in the built environment. Port or offshore operational activities are not considered to have waste management, land use or infrastructure use implications on a scale that could affect population health. These issues are therefore scoped out. • Onshore: The project's onshore infrastructure would have a very limited long-term impact on land use patterns, with the main change relating to the substations. Appropriate buffer zones would be maintained between infrastructure and communities and the design is resilient to accidents and disasters. These issues are therefore scoped out.

Potential impact	Justification
Wider societal infrastructure and resources	Construction and Decommissioning phases • Offshore: The Mona Offshore Wind Project energy infrastructure would not generate public health benefits at this stage. This issue is therefore scoped out. • Nearshore/onshore: As for offshore. This issue is therefore scoped out. Operational and maintenance phase • Onshore: The onshore electrical infrastructure facilitates the benefits accrued from the renewable energy generating assets. This issue is assessed under 'Offshore operational and maintenance phase wider societal infrastructure and resources'. To avoid double counting this is not separately assessed and is scoped out.

30.8 Measures adopted as part of the Mona Offshore Wind Project

30.8.1.1 For the purposes of the EIA process, the term 'measures adopted as part of the project' is used to include the following measures (adapted from (IEMA, 2016)):

- Measures included as part of the project design. These include modifications to the location or design of the Mona Offshore Wind Project which are integrated into the application for consent. These measures are secured through the consent itself through the description of the development and the parameters secured in the DCO and/or marine licences (referred to as primary mitigation in (IEMA, 2016))
- Measures required to meet legislative requirements, or actions that are generally standard practice used to manage commonly occurring environmental effects and are secured through the DCO requirements and/or the conditions of the marine licences (referred to as tertiary mitigation in (IEMA, 2016)).

30.8.1.2 A number of measures (primary and tertiary) have been adopted as part of the Mona Offshore Wind Project to reduce the potential effects that are relevant to impacts on human health. As there is a commitment to implementing these measures, they are considered inherently part of the design of the Mona Offshore Wind Project and have therefore been considered in the assessment presented in section 30.9 below (i.e. the determination of magnitude and therefore significance assumes implementation of these measures).

30.8.1.3 This human health chapter takes as its input the residual effect conclusions of the inter-related technical disciplines set out at paragraph 30.1.1.3. In this regard the health assessment relies on the measures adopted as part of the Mona Offshore Wind Project set out in those chapters and does not repeat them. This avoids duplication and keeps the assessment proportionate.

Table 30.19: Measures adopted as part of the Mona Offshore Wind Project.

Measures adopted as part of the Mona Offshore Wind Project	Justification	How the measure will be secured
Tertiary measures: Measures required to meet legislative requirements, or adopted standard industry practice		
ACode of Construction Practice (CoCP) to ensure effective management of environmental risk during the construction phase of onshore transmission assets and supporting infrastructure. The CoCP shall include regulatory guidance and industry best practice guidance	To minimise construction impacts on the public and the environment	These measures would be secured through a requirement of the DCO
The Mona Offshore Wind Project will adopt and implement relevant design guidelines of the ICNIRP and UK Government voluntary code of practice	To avoid EMF risks	These measures would follow industry best practice.

30.8.1.4 Where significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA 2016) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in section 30.9 below.

30.8.1.5 Where significant effects have been identified, further mitigation measures (referred to as secondary mitigation in IEMA 2016) have been identified to reduce the significance of effect to acceptable levels following the initial assessment. These are measures that could further prevent, reduce and, where possible, offset any adverse effects on the environment. These measures are set out, where relevant, in section 30.9 below.

30.9 Assessment of significant effects

30.9.1 Overview

30.9.1.1 The potential impacts arising from the construction, operations and maintenance and decommissioning phases of the Mona Offshore Wind Project have been assessed for human health. These are listed in Table 30.17 along with the MDS against which each impact has been assessed.

30.9.1.2 A description of the potential effect on human health receptors caused by each identified impact is given below.

30.9.2 Transport modes, access and connections – Offshore

30.9.2.1 The construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project may lead to disruption of routine and or emergency shipping access to the Isle of Man. This has the potential to affect the availability of goods and services that support health promotion, health protection and healthcare services. The MDS is represented by the greatest level of disruption in access and is summarised in Table 30.17.

30.9.2.2 This section has been informed by volume 2, chapter 12: shipping and navigation of the PEIR, which sets out relevant assessment findings and mitigation measures that have been taken into account. Volume 2, chapter 12: shipping and navigation of the PEIR concludes:

- A potential impact on recognised sea lanes essential to international navigation is a minor adverse effect.
- The potential impact to commercial operators including strategic routes and lifeline ferries is considered to be a minor adverse effect.
- Potential impacts on adverse weather routing is a moderate adverse effect. During adverse weather, some sailings are delayed or inevitably cancelled irrespective of the presence of the Mona Array Area. However, with the presence of the Mona Array Area, where sailings are safe to take place, they may be required to route a greater distance and duration. Over the course of a day, the aggregation of these delays would result in the potential for additional sailings to be cancelled. Such effects are already experienced by operators but the presence of the Mona Offshore Wind Project may exacerbate this. The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors and the significant effects that have been identified as part of the individual and cumulative shipping and navigation assessment. These will be tested and applied as part of the assessment post PEIR and included in the Environmental Statement which will be submitted for the DCO application.
- Impact on access to ports and harbours is deemed a minor adverse effect.

30.9.2.3 On the basis of these four issues a potential population health effect is considered likely because there is a plausible source-pathway-receptor relationship:

- The source is disruption by vessels and restricted areas
- The pathway is a change in access to goods and services that support health directly and indirectly
- Receptors are residents and visitors to the Isle of Man.

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

30.9.2.5 The population groups relevant to this assessment are:

- The ‘local’ population of the Isle of Man.
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Construction, Operations and Maintenance, and Decommissioning

Magnitude of impact

30.9.2.6 The scale of change is considered *small*, with potential for *occasional* disruption. For commercial operators including strategic routes and lifeline ferries changes in access would result in possible minor delays. During adverse weather conditions, more substantial delays could occur potentially resulting in cancellations in some services. The duration would be *short-term*. Outcome reversal may be *rapid* once services are reinstated, with slight service quality implications. There is the potential for *minor* adverse changes in *morbidity* for a *large minority* of the population.

30.9.2.7 It is predicted that the impact will affect the receptor directly and indirectly. The magnitude is therefore considered to be **low**.

Sensitivity of receptor

30.9.2.8 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 30.6.3.

30.9.2.9 The general population of residents and visitors to the Isle of Man are likely to be in good general health and make limited use of healthcare services affected by any disruption to shipping. Most people are also likely to have access to alterative goods, amenities and services that have a health promotion or health protection function, (e.g. that facilitate active lifestyles or reduce risks of social isolation).

30.9.2.10 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 them having greater resources and good physical and mental health.

30.9.2.11 The sensitivity of the general population is therefore considered to be **low**.

30.9.2.12 The vulnerable group 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 goods and services with greater likelihood that any disruption could affect health outcomes.

30.9.2.13 Deprived populations may already face more access barriers compared to the general population and therefore be more sensitive to access changes. Issues of access are particularly relevant in island contexts, such as the Isle of Man, where alternative access to goods and services is limited. Low incomes may compound access barriers by limiting adaptive response.

30.9.2.14 Vulnerability also includes those accessing health services (emergency or non-emergency) at locations in the UK. Ambulance services (and the recipients of their care) are particularly sensitive to delays in response times (time taken to arrive and stabilise the patient). The Isle of Man Air Ambulance Service is not expected to be affected by the Mona Offshore Wind Project.

30.9.2.15 There may be some disruption during adverse weather to the Isle of Man Steam Packet Company vessels, and other vessels, that provide lifeline and essential deliveries, including of people to NHS care in the UK. Such impacts on commercial operators has been deemed moderate adverse (volume 2, chapter 12: shipping and

navigation of the PEIR). People in poor or very poor health may be more frequent users of healthcare service and therefore be more sensitive to access changes.

30.9.2.16 The sensitivity of the vulnerable group population is therefore, considered to be **high**.

Significance of effect

30.9.2.17 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high**.

30.9.2.18 Access to health supporting goods and services is a *specific* public health priority for the Isle of Man community and the scientific literature is well established on the *causal* association between physical and mental health outcomes and access to resources that support health and healthcare services. However, the overall potential access disruption is on a scale that could have only *slight* implication for the population health baseline of the Isle of Man. This conclusion takes into account that a scarcity of resources or access opportunities may result in differential or disproportionate effects experienced by those who are most vulnerable, including due to low incomes and existing poor health. Even accounting for this, there is considered only a *marginal* impact on the ability to deliver health policies, including related to the supply of essential goods and services, as well as in relation to narrowing health inequalities.

30.9.2.19 The effect would, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Further mitigation and residual effects

30.9.2.20 The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors and the significant effects that have been identified as part of the individual and cumulative shipping and navigation assessment. These will be tested and applied as part of the assessment post PEIR and included in the Environmental Statement which will be submitted for the DCO application. It is expected that the further mitigation to enable a conclusion of a **negligible** residual effect for population health will be confirmed in the Environmental Statement.

30.9.2.21 The anticipation of such measure being secured as part of the final design should mean that mental health and wellbeing effects from concern over the potential impact to access on the Isle of Man, including cumulatively with other projects, should be avoided. It should also mean that the actual effect should be fully mitigated, including any adverse effect on health inequalities.

30.9.2.22 To reduce the potential for community concern, a clear statement that the final project design will allow appropriate access to the Isle of Man is included in the PEIR non-technical summary. This is in itself a form of mitigation and aligns with good practice.

30.9.3 Transport modes, access and connections – Onshore

30.9.3.1 There is the potential that construction works may disrupt local vehicle traffic (private and public transport) as well as active travel (pedestrians and cyclists). This includes road works, temporary diversions and traffic volumes required due to the onshore cable corridor construction or in relation to the construction of the onshore substations. This has the potential to affect active travel and physical activity. The MDS represents the greatest disruption from construction works and is represented in Table 30.17.

30.9.3.2 Active travel has many beneficial health effects for physical health (e.g. cardiovascular health) and mental wellbeing (e.g. reduced stress and anxiety). Certain population groups may be particularly sensitive to road safety and access. For example, children, and cyclists are generally more vulnerable in terms of road safety. People with lower socio-economic status typically face more transportation barriers.

30.9.3.3 This section has been informed by volume 3, chapter 21: traffic and Transport which set out relevant assessment findings and mitigation measures that have been considered.

30.9.3.4 Volume 7, chapter 21: traffic and transport concludes:

- The impact on driver delay caused by construction works or construction traffic is a negligible adverse effect.
- The impact on pedestrian delay caused by construction works for construction traffic is a negligible adverse effect.
- The impact on pedestrian amenity (pleasantness of the journey) is minor adverse.
- The impact on community severance caused by construction works or construction traffic is negligible adverse.
- The impact of construction traffic on accidents and safety in minor adverse.

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

- The source is disruption and disturbance to roads, cycle routes and footpaths.
- The pathway is behavioural change in physical activity, transport delay, and road accidents and safety.
- Receptors are coastal and inland residents and visitors.

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

30.9.3.7 The population groups relevant to this assessment are:

- The ‘site specific’ populations near landfall (close to Abergele), the cable corridor (between Abergele and St Asaph) and near the substations (close to St Asaph).
- The ‘local’ populations of Conwy and Denbighshire.
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Construction and decommissioning

Magnitude of impact

30.9.3.8 As reported in volume 7, chapter 21: traffic and transport of the PEIR, a construction traffic management plan (CTMP) would be developed and secured through the Development Consent Order. The CTMP will maintain access and provide early notice of any route changes.

30.9.3.9 Any scale of change in accidents would be *small to negligible*. The frequency of any incidents would be *one-off* or *occasional*, with severity related to a *very minor* change

in risk of injury or mortality. The expectation is that very few people would be affected, with no or slight implications for healthcare services.

30.9.3.10 In relation to health-related travel times and accessibility the scale of change in delays is expected to be *low*. The frequency with which health related journeys may be affected is likely to be *occasional* for most people though for a few people, severity could relate to a small change in risk for morbidity or mortality. Ambulance services (and the recipients of their care) are particularly sensitive to delays in response times (time taken to arrive and stabilise the patient). Even with the delays described in volume 7, chapter 21: traffic and transport, the priority given to ambulances travelling under blue lights would be expected to reduce any changes in journey times. Mitigation in terms of early and ongoing information sharing with emergency and healthcare services is secured within construction traffic management plans. The temporary nature of the work and ability for people to adapt to known planned diversions or delays means there is unlikely to be a significant change to population health outcomes associated with access to social infrastructure such as shops, employment and educational facilities.

30.9.3.11 The scale of change is therefore considered *small*, and *medium-term*, though there would be limited duration at any given location due to the transitory nature of construction works to lay cables. There is the potential for *minor* adverse changes in *morbidity* for a *small minority* of the population. Most adverse effects on health behaviours and outcomes would be expected to *reverse* on completion of the construction works. Outcome reversal may be *rapid* once services are reinstated, with slight service quality implications.

30.9.3.12 It is predicted that the impact will affect the receptor directly and indirectly. The magnitude is therefore considered to be **low**.

Sensitivity of receptor

30.9.3.13 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 30.6.3.

30.9.3.14 Most residents are unlikely to make regular use of footpaths and cycle routes affected by the Mona Offshore Wind Project 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 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.

30.9.3.15 The sensitivity of the general population is therefore considered to be **low**.

30.9.3.16 The vulnerable 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 with greater likelihood that any disruption or disturbance could affect physical activity behaviours. Vulnerability is linked to mode of travel, including pedestrians and cyclists being more sensitive to road safety changes. It also relates to age (young people and older people) being more vulnerable to accident severity, as well as to those who are reliant on services accessed on affected sections of the road network (e.g. traveling to schools). Vulnerability may be increased in areas of moderate deprivation. Deprived populations may already face more access barriers compared to the 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.

30.9.3.17 The sensitivity of the vulnerable group population is considered to be **high.**

Significance of effect

30.9.3.18 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high.**

30.9.3.19 The professional judgment is that there would, at most, be a *slight adverse* change in health. This conclusion reflects that physical activity is a *specific* public health priority and there is *causal association* of the benefits of physical activity to health that is supported by the scientific literature. However, the level of change due to the Project, whether sequential or concurrent, 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.

30.9.3.20 The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

30.9.4 Community identity, culture, resilience and influence

30.9.4.1 The operations and maintenance of the Mona Offshore Wind Project offshore activities may lead to effects on visual impact and community identity. The MDS is represented by the greatest visual impact of the Mona Offshore Wind Project and is summarised in Table 30.17.

30.9.4.2 Impact will result from visibility of both moving and static project components occupying Mona Array Area (e.g. rotating wind turbines and service vessels/aircraft) which have the potential to affect peoples' appreciation of the surrounding seascape/landscape.

30.9.4.3 Community identity as a determinant of health has a strong subjective dimension that varies between individuals. The visibility of the windfarm can be interpreted differently and includes beneficial effects such as reminding people that the economy supports employment opportunities and renewable electricity generation, as well as potential adverse effects where people feel the coastal setting is adversely affected. Health effects may be associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community identity and wellbeing.

30.9.4.4 This section has been informed by volume 4, chapter 26: Seascape, landscape and visual impact assessment of the PEIR which sets out relevant assessment findings and mitigation measures that have been taken into account. Volume 4, chapter 26: Seascape, landscape and visual impact assessment concludes:

- No significant effects are predicted during construction, operations and maintenance and decommissioning of the Mona Offshore Wind Project on recognised, national and local, seascape and marine character areas in the SLVIA study area when considered as a whole.
- A moderate to major significant adverse effect on seascape character is predicted during construction, operations and maintenance and decommissioning for the area of sea occupied by Mona Array Area.
- No significant effects are predicted during construction, operations and maintenance and decommissioning of the offshore generation assets of the Mona Offshore Wind Project on landscape character areas in the SLVIA study area.
- No significant effects are predicted during construction, operations and maintenance and decommissioning of Mona Offshore Wind Project on nationally designated landscapes in the SLVIA study area.
- A moderate adverse effect is predicted during construction, operations and maintenance and decommissioning for people onboard the Liverpool to Dublin and Liverpool to Douglas ferries when passing Mona Array Area.
- No significant visual effects are predicted to occur for: national trails; national cycle networks; key coastal roads and railways; land access including land within National Parks and AONB; country parks; national parks; and other key ferry routes.

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

- The source is visual change associated with the operational windfarm and perceived benefits of the Mona Offshore Wind Project which influence community identity
- The pathway is factors that contribute to behaviour and a sense of identity, including: changes in visual environmental cues; and economic and prosperity cues that influence social status
- Receptors are residents in the coastal communities.

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

30.9.4.7 The population groups relevant to this assessment are:

- The ‘regional’ population of coastal communities in northwest England and North Wales
- The vulnerable sub-populations including young and old people, people with low incomes, people with poor health, and people experiencing social disadvantage.

Operations and maintenance

Magnitude of impact

30.9.4.8 The impact is predicted to be of regional spatial extent, *long-term* duration, continuous and low reversibility. However, the scale of visual change of the Mona Offshore Wind Project 28.2km from the north coast of Wales, 39.9km from the northwest coast of England, and 42.3km from the Isle of Man would be *small* with *frequent* views during clear weather conditions. Views from Isle of Man are noted as very distant. The change is likely to have a very *minor* influence on quality of life and morbidity risk factors linked to wellbeing for a *small minority* of the population. *No* healthcare services implications are anticipated. The assessment gives weight to the context of their being other windfarm views within the seascape, which limits the extent to which the Mona Offshore Wind Project represents a change in existing community identity.

30.9.4.9 It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

30.9.4.10 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 30.6.3. This reflects that for most people in the regional area the Mona Offshore Wind Project would not be a strong driver of community identity given many other influences on the social, economic and environmental landscape. For most people there would be no regular views of the windfarm.

30.9.4.11 The sensitivity of the general population is therefore, considered to be **low**.

30.9.4.12 Vulnerability in this case is linked to the proportion of people who have expectations that their community or way of life would be changed to a large degree, positively or negatively, by visual change caused by the Mona Offshore Wind Project, and is within the context of other existing operational windfarms in the area

30.9.4.13 The sensitivity of the vulnerable group population is therefore, considered to be **high**.

Significance of effect

30.9.4.14 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable population group is considered to be **high.**

30.9.4.15 The effect is characterised as being both *beneficial* and *adverse* in direction, reflecting the subjective nature of community identity. The level of change in sense of place and community cohesion is *unlikely to influence health policy* delivery or inequalities. Any change to the population health baseline would be *slight* and comprised of both beneficial and adverse influences.

30.9.4.16 Across both the general population and vulnerable group population there are expected to be both **minor adverse** and **minor beneficial** effects, which is **not significant** in EIA terms. The inclusion of both positive and negative outcomes from the same impact reflects the likelihood of a range of subjective responses to the visual change.

30.9.5 Open space, leisure and play

30.9.5.1 There is the potential that onshore works associated with construction for the Mona Offshore Wind Project may lead to temporary disruption of public open spaces (including beaches) and public rights of way (PRoW), potentially affecting recreational activities. This may include disturbance or disruption in nearshore recreation (e.g. bathing, sailing and other water sports). The MDS represents the greatest disruption from construction works and is represented in Table 30.17.

30.9.5.2 The health benefits of recreation and leisure include physical activity as well as mental wellbeing. Health outcomes include physical health (e.g. cardiovascular health) and mental health (e.g. decreased stress, anxiety or depression). Use of places of recreation may be affected by not only physical barriers but also changes in the amenity or setting of the destination.

30.9.5.3 This section has been informed by volume 2, chapter 12: shipping and navigation; volume 2, chapter 14: other sea users, volume 4, chapter 25: seascape, landscape and visual impact assessment; and volume 3, chapter 20: land use and recreation of the PEIR, which set out relevant assessment findings and mitigation measures that have been taken into account.

30.9.5.4 Volume 2, chapter 12: shipping and navigation of the PEIR concludes:

- Analysis of vessel traffic demonstrates that there are few recreational movements through the shipping and navigation study area. Inshore, during cable laying operations, there may be short term and localised impacts on recreational movements, however there is clear searoom for recreational craft to avoid the cable layer. The effect will, therefore, be minor adverse.

30.9.5.5 Volume 2, chapter 14: Other sea users concludes:

- There is low to medium recreational vessel activity in the nearshore area of the Mona Offshore Cable Corridor, with a general boating area and water sports clubs in the vicinity. Recreation vessels can alter their routes with regards to the advising of construction works. The effect will be minor adverse.
- There is potential that sediment plumes from resuspended sediment could impact recreational areas (including dive sites) through changes to water quality. It is anticipated that any deposited fine sediments would be subject to redistribution under the prevailing coastal processes. The effect is considered minor adverse for construction and decommissioning, and negligible for operations and maintenance.

30.9.5.6 Volume 4, chapter 26: Seascape, landscape and visual impact assessment concludes there will be some moderate adverse effects in relation to users of footpaths, walking routes and local roads near the onshore substations (as stated in section 30.9.4).

30.9.5.7 Volume 3, chapter 20: Land use and recreation concludes:

- Landfall construction works may require an area of beach in the land use and recreation study area to be secured temporarily from public access. The temporary effect on recreational access to the coast is assessed to be of minor adverse effect.
- There is potential for the installation of the landfall and onshore cable route to result in temporary disruption of a number of recreational resources (e.g. caravan parks and golf course) that lie in or adjacent to the land use and recreation study area during the construction period. For recreational resources the potential for disruption to recreational assets identified during the construction period is assessed to be a moderate adverse effect.
- The Wales Coast Path and NCR 5 are national trails that run along the coast and may be located in close proximity to the construction works at the landfall and onshore export cable route. Disruption to these trails during construction is judged to be minor adverse.
- A series of PRoW cross the land use and recreation study area and there are other tracks and local lanes that are also used as recreational routes that may be affected within this area. Disruptions to recreational paths during construction is judged to be minor adverse.

30.9.5.8 These impacts across relevant input chapters have been considered in terms of both their individual and collective potential to affect population health.

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

- The source is disruption and disturbance including to PRoW and nearshore spaces.
- The pathway is behavioural change in use of leisure and recreational activities affecting physical activity and mental wellbeing.
- Receptors are coastal and inland residents and visitors.

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

30.9.5.11 The population groups relevant to this assessment are:

- The ‘site specific’ populations near landfall (close to Abergele), the cable corridor (between Abergele and St Asaph) and near the substations (close to St Asaph).
- The ‘local’ populations of Conwy and Denbighshire
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Construction and decommissioning

Magnitude of impact

30.9.5.12 There is likely to be a *small* scale of change over the *medium-term* from construction activities, including shipping movements and land access, affecting marine, nearshore and onshore recreational and leisure activities. Any such effect is likely to be characterised as an *occasional* effect on opportunities to be active at a given location, (e.g. due to transitory cable laying). It is likely there would be *rapid* reversal of any effect once the given construction activity concluded, with limited potential to cause lasting behavioural change. The outcome is likely to be a minor change in quality of life and/or cardiovascular related morbidity for a small minority of the affected population. No effect on healthcare services would be expected.

30.9.5.13 The magnitude of change due to the Project is therefore considered to be **low**.

Sensitivity of receptor

30.9.5.14 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 30.6.3. Most people in the local area would only make occasional use of the affected marine, coastal and inland recreational and leisure opportunities. The general population also includes those with access to many alternatives that are not affected. The general population comprise those members of the community with a high capacity to adapt to changes, for example due to greater resources and good physical and mental health.

30.9.5.15 The sensitivity of the general population is considered to be **low**.

30.9.5.16 Vulnerability in this case is linked to having fewer resources and less capacity to adapt to changes. The population may be more reliant on the affected recreational and leisure opportunities with greater likelihood that any additional disruption or disturbance could affect use and behaviours.

30.9.5.17 The sensitivity of the vulnerable group population is therefore considered to be **high**.

Significance of effect

30.9.5.18 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high.**

30.9.5.19 The effect is characterised as being *adverse* in direction, *temporary* and *indirect*. Although the scientific literature supports a *clear* association between recreational and leisure activities and health outcomes, there is likely to be at most a *slight* change in the population health baseline. This would have at most a *marginal* effect on health policy delivery and is not expected to change population health inequalities.

30.9.5.20 The effect will, therefore, be of **minor adverse** significance, which is **not significant** in EIA terms.

30.9.6 Employment and income

30.9.6.1 The spacing of wind turbines within the Mona Array Area may lead to changes in access to commercial shellfish harvesting grounds. The MDS is represented by the greatest adverse economic implications and is summarised in Table 30.17.

30.9.6.2 Changes in direct and indirect employment opportunities have socio-economic effects that impact upon health and mental well-being.

30.9.6.3 This section has been informed by volume 2, chapter 11: Commercial fisheries of the PEIR, which sets out relevant assessment findings and mitigation measures that have been taken into account. Volume 2, chapter 11: Commercial fisheries of the PEIR concludes:

- Restricted access to fishing grounds during construction of the Mona Offshore Wind Project is considered negligible or minor adverse effect.
- During operations, the loss or restricted access to fishing grounds is considered negligible for most receptors. A moderate adverse effect is predicted for Scottish west coast scallop vessels. With further mitigation, such as increasing the minimum distance between wind turbines, this could reduce to minor adverse.
- The construction, operations maintenance, and decommissioning phases may lead to displacement of fishing activity into other areas, as a result of loss or restricted access to fishing grounds. The impact is judged to be negligible to minor adverse for all receptor groups during construction and decommissioning. During operational and maintenance phases the impact is negligible to minor adverse for most receptors. A moderate adverse effect is predicted for the Scottish west coast scallop vessels. Implementation of further mitigation measures could reduce this to a minor adverse effect.
- The construction, operations and maintenance and decommissioning phases may lead to interference with fishing activity, as a result of increased vessel traffic caused by vessels associated with the Mona Offshore Wind Project or changes to shipping routes. The impact is judged to be negligible or minor adverse for all receptor groups.

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

- The source is changes in direct and indirect jobs and economic activity
- The pathway is good quality employment and income providing more health supporting resources
- Receptors are people of working age (and their dependants).

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

30.9.6.6 The population groups relevant to this assessment are:

- The ‘regional’ populations of northwest England and Scotland (for communities strongly associated with Scottish west coast scallop vessels). Consideration has also been given to potential effects on the Isle of Man.
- The vulnerable sub-populations including young and old people, people with low incomes, people with poor health or disabilities, and people experiencing social disadvantage or access and geographical factors.

Construction, Operations and Maintenance and Decommissioning

Magnitude of impact

30.9.6.7 Changes in fishing access would be *continuous* and of *long-term* duration, though reversible following decommissioning. The effects are judged to relate to a *small* scale of change given access to alternative fishing grounds for most employers. A *frequent* or *continuous* effect on employment and/or income may occur to a very *small minority* of the population associated with Scottish west coast scallop vessels. This is likely to relate to *minor* changes in physical and mental health morbidity associated with job insecurity. At most there may be *slight* healthcare service implications. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

30.9.6.8 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 30.6.3. This reflects that most people would already be within stable employment that

would be unaffected by the Mona Offshore Wind Project (or being a dependant of such a person).

30.9.6.9 The sensitivity of the general population is therefore, considered to be **low**.

30.9.6.10 Vulnerability in this case relates to people and their dependants who are in affected commercial fisheries related employment, on low incomes, have poor job security, poor working conditions or who are unemployed. Future young or older people may also come to rely on those employed.

30.9.6.11 The sensitivity of the vulnerable group population is therefore, considered to be **high**.

Significance of effect

30.9.6.12 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable population group is considered to be **high**.

30.9.6.13 The changes to employment and income associated with some commercial fishing activities being unable to operate within the Mona Array Area would have adverse physical and mental health effects (including to dependants). This conclusion is supported by a *clear* association between employment and health in the scientific literature. Consequently, there may be a small adverse change in localised health baselines where coastal community employment is strongly linked to Scottish west coast scallop vessels. This could be associated with a marginal increase in health inequalities. More generally the regional and national health baseline effects would, at most, be slight; with limited potential to affect the delivery of health policy.

30.9.6.14 The effect will, therefore, be of **minor adverse** significance, which is **not significant** in EIA terms.

30.9.7 Noise and Vibration

30.9.7.1 There is the potential for noise and vibration effects from landfall and onshore activities. Construction activities may result in changes to noise during the day and at night. Some specific activities such as concrete pouring require periods of night-time working, however the majority of works would occur during normal daytime construction working hours. There is also the potential for operational noise effects associated with the substations. The MDS represents the greatest changes in noise and vibration levels and is represented in Table 30.17.

30.9.7.2 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 by noise and vibration. 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 health assessment has 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).

30.9.7.3 This section has been informed by volume 3, chapter 22: Noise and vibration of the PIER, which sets out relevant assessment findings and mitigation measures that have been taken into account. Volume 3, chapter 22: Noise and vibration concludes:

- Noise impacts due to construction of the onshore export cable at Landfall will be of moderate or major adverse significance. Noise impacts due to the Onshore Cable Corridor landward of MHWS will be minor adverse. Construction noise mitigation will be applied as best is reasonably practicable. Noise impacts from construction activities may be reduced via the implementation of a construction noise management plan. Temporary acoustic barriers, quieter equipment, and minimising the amount of night-time work required are possible measures which may reduce noise impacts.
- Vibration impacts due to construction of the onshore export cable at Landfall will be minor adverse. This reflects that the nearest receptors are residential. Construction noise mitigation will be applied as best reasonably practicable. Possible measures include undertaking piling activities when the static caravans are not occupied and prior communication with residents to inform them of the works required.
- Noise impacts due to the operations and maintenance of the Onshore Substations will be minor adverse. This reflects that the nearest receptors are residential. It is likely that much of the plant will be housed internally, either in one or multiple buildings. Plant noise may be controlled through robust façade sound insulation in the building design, acoustic barriers around the plant and/or site perimeter, and through the use of bespoke acoustic enclosures where each is appropriate.

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

- The source is noise and vibration generated by construction activities and vehicle movements and noise generated by operation of the substations.
- The pathway is pressure waves through the air and ground vibrations.
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

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

30.9.7.6 The population groups relevant to this assessment are:

- The ‘site specific’ populations near landfall (close to Abergele), the Onshore Cable Corridor (between Abergele and St Asaph) and near the substations (close to St Asaph).
- The ‘local’ population of Conwy and Denbighshire (in relation to transport noise)
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Construction, Operations, Maintenance and Decommissioning

Magnitude of impact

30.9.7.7 As reported in volume 3, chapter 22: Noise and vibration, construction along the Onshore Cable Corridor would involve activities that are mobile (i.e. only temporarily taking place at a given location during the construction period), such as trenching for cable laying; and activities that are static such as construction of the onshore substations. Noise associated with operations and maintenance of the substations would be static. Mobile works will impact receptors for short periods of time, whereas static works will last longer.

30.9.7.8 In terms of population health, the *small* scale of change in noise and vibration levels is likely to predominantly relate to a *minor* change in quality of life and/or cardiovascular and mental wellbeing morbidity for a small minority of the community populations along the new onshore cable corridor and near the substations. The changes would be *medium-term* duration in relation to frequent construction related noise exposures, and *long-term* for noises from the substations. The greatest potential for effects is likely for the few people close to either the landfall or the onshore substations. Prolonged periods of construction noise at night or daytime disruption of educational activities at schools are not anticipated.

30.9.7.9 The magnitude of change due to the proposed construction works is therefore considered to be **low.**

Sensitivity of receptor

30.9.7.10 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 30.6.3. 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 onshore transmission works and substations where noise and vibration would be unlikely to be a source of concern.

30.9.7.11 The sensitivity of the general population is considered to be **low**.

30.9.7.12 The sub-population more sensitive to noise includes children, elderly and those receiving care due to poor health. This sub-population may experience existing widening inequalities due to living in areas with increased noise and elevated deprivation, with limited capacity to adapt to changes. Vulnerability particularly relates to those living close to the construction activities and substations, 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 noise and its effect on their wellbeing may be more sensitive to changes in noise. The small population living at the coastal edge may experience nearshore noise (noise can travel longer distances across water than land) as well as night-time landfall noise. Occupants of dwellings with less acoustic insulation, such as caravans, may be more sensitive to noise effects.

30.9.7.13 The sensitivity of the vulnerable group population is **high**.

Significance of effect

30.9.7.14 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable population group is considered to be **high**.

30.9.7.15 Noise and vibration impacts from construction activities and construction traffic will be mitigated through the use of appropriate construction hours and best practice measures agreed through the Construction Noise Management Plan, as detailed in volume 3, chapter 22: Noise and vibration.

30.9.7.16 Noise impacts from operations and maintenance of the substations will be mitigated through Best Practicable Means implemented through design of the onshore substations, as detailed in volume 3, chapter 22: Noise and vibration.

30.9.7.17 Based on these mitigation measures, the effect is characterised as being *adverse* in direction, temporary to long-term and direct. Although the scientific literature indicates a clear association between elevated and sustained noise and vibration disturbance and reduced health outcomes, the changes would result in a very *limited* effect in the health baseline of the population. The distribution of effects is not expected to affect health inequalities. The level of effect is not expected to affect the ability to deliver local or national health policy.

30.9.7.18 The effects are considered to be of **minor adverse** significance, which is not significant in EIA terms.

30.9.8 Radiation

30.9.8.1 This section considers the potential onshore operational population health effect due to electro-magnetic fields (EMF) exposure associated with the Mona Offshore Wind Project. The MDS is represented by the largest output of EMF associated with energy generation and is summarised in Table 30.17.

30.9.8.2 All electrical systems, including natural processes and living organisms generate EMF. EMF effects diminish rapidly with distance, often requiring only a few metres, or less, to reach background levels.

30.9.8.3 In line with good practice, public understanding of risk in relation to operational EMF is assessed. This includes considering how mental health effects can be avoided or reduced through provisions of timely and non-technical information explaining how actual health risks are mitigated.

30.9.8.4 As noted in Table 30.18, Mona Offshore Wind Project will adopt and implement relevant design guidelines of the ICNIRP and UK Government voluntary code of practice. Such guidelines are deemed sufficient for avoiding actual EMF risk. The focus of this assessment section is therefore not on the actual risk, which is considered appropriately mitigated, but on people's understanding of risks (risk perception). This relates to the potential for community concern about their proximity to the electrical infrastructure, including buried cables and onshore substations, to affect mental health, even where relevant public EMF exposure guideline limits are met.

30.9.8.5 The potential health effect has a plausible source-pathway-receptor relationship:

- Source: electrical equipment introduced by the onshore transmission assets
- Pathway: concern about EMF exposure, affecting mental health

- Receptor: residents in the local community, particularly those living in close proximity to new electrical infrastructure.

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

30.9.8.7 The population groups relevant to this assessment are:

- The 'site specific' population near landfall (close to Abergele), the cable corridor (between Abergele and St Asaph) and at near the substations (close to St Asaph).
- The 'local' population of Conwy and Denbighshire (reflecting potential for wider community concern)
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Operations and maintenance

Magnitude of impact

30.9.8.8 The severity of health outcome relates to concern about risks of EMF, as no actual risks are anticipated. These relate predominantly to a minor change in mental health related morbidity for a very few people within the population. Such individual level effects are unlikely to have implications for health service capacity. For many people there is likely to be a rapid reversal of effects should their concerns be responded to and resolved to their satisfaction.

30.9.8.9 The level of actual exposure is negligible, however the scale of change that may contribute to community concern about EMF is *medium*, *continuous* and *long-term*. The magnitude of change due to the project is therefore **low**.

Sensitivity of receptor

30.9.8.10 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 30.6.3. Most people in the study area live, work or travel at a separation distance from the Project's electrical infrastructure where they would not be concerned about the potential for EMF risks. This group also includes that portion of the population who are ambivalent or not concerned about EMF as a risk factor.

30.9.8.11 The sensitivity of the general population is therefore **low**.

30.9.8.12 The sub-population includes people who may be uncertain or concerned about EMF and this may exacerbate existing mental health conditions or be a source of stress and anxiety in itself. This may particularly be the case for people with near views and/or who live in close proximity to the onshore substations.

30.9.8.13 The sensitivity of the vulnerable sub-population is **high**.

Significance of effect

30.9.8.14 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable population group is considered to be **high**.

30.9.8.15 The professional judgment is that there could be a slight adverse change in the health baseline for the local population if concerns are widespread. This conclusion reflects scientific understanding of the impact of uncertainty or concern about environmental risks on mental health. It also reflects that the actual risks would be well within regulatory standards for EMF and that most members of the public would expect this to be the case. The context that electrical transmission infrastructure and substations are relatively common features would also be expected to inform population risk perception.

30.9.8.16 The significance of the population health effect is therefore **minor adverse** which is not significant in EIA terms.

30.9.9 Climate change and adaptation

30.9.9.1 The Mona Offshore Wind Project contribute towards wider energy sector transition to renewable energy which reduces the severity of climate change. The MDS is represented by the smallest output contribution to renewable energy generation and is summarised in Table 30.17.

30.9.9.2 Renewable energy generation and subsequent reduced greenhouse gas emissions supports avoiding adverse health effects associated with climate change. These include extreme temperature and climatic effects related to infectious diseases occurrence, food insecurity, injury and death (Costello, et al., 2009). These effects are relevant to the UK population, but also the global population, particularly deprived populations in low- and middle-income countries.

30.9.9.3 There are important global inequalities in the effects of climate change, with the greatest adverse effects on health expected in the some of the poorest and least economically developed populations. In contrast, populations that benefit from rapid social and economic development are expected to experience reduced (but not eliminated) adverse effects to health from climate change. Changes in health outcomes related to climate change are therefore expected to be relatively small in the UK. When considering health and well-being, there is a global responsibility to reduce the effect of climate-altering pollutants that are expected to reduce health outcomes in low- and middle-income countries. The Intergovernmental Panel on Climate Change (IPCC) states that there are opportunities to achieve co-benefits from actions that reduce emissions of climate altering pollutants and at the same time improve health (IPCC, 2014).

30.9.9.4 Key health outcomes (globally) relate to heat-related disorders (e.g. heat stress and lower work capacity), respiratory disorders (e.g. worsened asthma), infectious diseases, population displacement, water and food insecurity (e.g. lower crop yields) and injury, death and mental stress associated with natural disasters.

30.9.9.5 This section has been informed by volume 4, chapter 28: climate change of the PEIR which sets out relevant assessment findings and mitigation measures that have been taken into account. Volume 4, chapter 28: climate change of the PEIR concludes that despite greenhouse gas emissions resulting from stages in the project lifecycle, the magnitude of avoided emissions during the operations and maintenance phase of the Mona Offshore Wind Project would result in a beneficial effect.

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

- Source: renewable energy created during the operation of the wind farm
- Pathway: reduction in climate-altering pollutants that contribute to climate change, which is associated with global changes in temperature, crop yields, productivity and disease prevalence
- Receptor: international global population, particularly vulnerable populations in low- and middle-income countries.

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

30.9.9.8 The population groups relevant to this assessment are:

- The 'national' populations of England, Wales and the wider UK
- The 'international' population globally
- The sub-population vulnerable due to less capacity to adapt to climate change including young and old people, people with low incomes, people with poor health (physical and mental), people experiencing social disadvantage including gender disparities and people with access and geographical vulnerability (such that they may be unable to adopt climate change mitigation strategies).

Operations and maintenance

Magnitude of impact

30.9.9.9 Whilst the scale of change would be very small within the national energy sector emissions context, it would be continuous and long-term. The health effect likely represents a minor change in the risk of mortality and morbidity linked to a range of health determinants influenced by a changing climate for a large minority of the global population and a small minority of the national population. Relevant effects include population displacement, food insecurity, infectious disease occurrence and exposure to extreme climatic events.

30.9.9.10 The impact is predicted to be of national and international spatial extent with the impact affecting the receptor directly and indirectly. The magnitude is therefore, considered to be **low**.

Sensitivity of receptor

30.9.9.11 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 30.6.3. This reflects that UK is a developed economy and has comparatively high resilience and capacity to adapt, so in general the national population can be considered to be of low sensitivity.

30.9.9.12 The sensitivity of the general population is therefore, considered to be **low**.

30.9.9.13 Adverse effects would be disproportionately experienced by the most vulnerable members and regions of society (globally). Such effects are likely to widen health inequalities. Although the general population in UK are likely able to get support to cope with the effects of climate change, some vulnerable population groups are at greater risk (e.g. people with socio economic disadvantage or old age making it harder to cope with heatwaves or flooding).

30.9.9.14 The sensitivity of the vulnerable group population is therefore, considered to be **high**.

Significance of effect

30.9.9.15 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable population group is considered to be **high**.

30.9.9.16 The scientific literature (Al-Delaimy, Ramanathan, & Sánchez Sorondo, 2020) supports a *causal* relationship between climate altering pollutants, climate change and population health outcomes. Although the change due to the Mona Offshore Wind Project would have a *very limited* effect on the global or national health baseline even accounting for long-term inter-generational effects; the Mona Offshore Wind Project makes an *influential* contribution to delivering national climate change policy, including public health related climate policies.

30.9.9.17 The effect will, therefore, be of **minor beneficial** significance, which is **not significant** in EIA terms.

30.9.10 Wider societal infrastructure and resources

30.9.10.1 The electricity produced by the Mona Offshore Wind Project would enable many aspects of everyday life that either protect or promote good health. The MDS is represented by the smallest output contribution to renewable energy generation (1.5 GW) and is summarised in Table 30.17.

30.9.10.2 UK energy security is important for maintaining continuous and affordable electricity which supports many aspects of public health. This includes power to safely cook and refrigerate food, regulate the temperature and lighting of homes and schools, operate health and social care services, maintain economic productivity and employment, and operate technologies that improve quality of life and social support. Sustained interruption of supply or rapid increases in costs would both be expected to result in reductions in health and well-being outcomes. Increases in the cost of electricity, particularly in the context of rising costs of living, can cause some people to prioritise essential costs (e.g. food, shelter) over electricity demands (e.g. heating a home).

30.9.10.3 Energy insecurity is a public health concern particularly for vulnerable populations (low-income, children, elderly). It is associated with hazardous exposures, heat stress, cold stress, asthma, chronic disease, poor mental health, parental fear and stigma, family disruption and residential instability (Hernández, 2016). In children, energy insecurity has been shown to affect development, hospitalisation and overall child health (Cook, et al., 2008).

30.9.10.4 This section has been informed by volume 4, chapter 28: climate change which sets out relevant assessment findings and mitigation measures that have been taken into account.

30.9.10.5 Volume 4, chapter 28: climate change of the PEIR concludes that the Mona Offshore Wind Project contributes to reductions in greenhouse gas emissions.

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

- Source: renewable electricity generation;
- Pathway: energy security whilst avoiding climate altering emissions;
- Receptor: population connected to the national power grid.

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

30.9.10.8 The population groups relevant to this assessment are:

- The 'national' populations of England, Wales and the wider UK
- The vulnerable sub-populations including young and old people, people with low income and their dependants, people with poor health or disabilities, people experiencing social disadvantage and people with access and geographical vulnerability.

Operations and maintenance

Magnitude of impact

30.9.10.9 Project generation of renewable electricity would have *continuous* public health benefits to energy security (subject to weather conditions and maintenance), despite the scale of contribution being relatively small within the national energy generation context. The effects are likely to provide a minor reduction in risks for population mortality (e.g. reducing excess winter deaths) and morbidity of physical and mental health outcomes related to standard of living and access to health supporting infrastructure. Such an effect may extend via the national grid to a large minority of the national population. Such effects may bring small benefits to healthcare service quality by reducing capacity burdens.

30.9.10.10 The impact is predicted to be of national spatial extent, with direct and indirect effects to population health. The magnitude is therefore, considered to be **medium**.

Sensitivity of receptor

30.9.10.11 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 30.6.3. The general population comprise those members of the community in good physical and mental health and with greater resources to respond to the costs of energy or to interruptions in supply.

30.9.10.12 The sensitivity of the general population is therefore, considered to be **low**.

30.9.10.13 The sub-population on low incomes, for whom energy security and interruption of energy supplies are more sensitive, pose a greater risk. This is particularly the case for dependants at risk during temperature extremes, including heatwaves and cold weather, as well as people in poor health, including when accessing healthcare.

30.9.10.14 The sensitivity of the vulnerable group population is therefore, considered to be **high**.

Significance of effect

30.9.10.15 Overall, the magnitude of the impact is deemed to be **medium** and the sensitivity of the vulnerable population group is considered to be **high**.

30.9.10.16 The Mona Offshore Wind Project provide a protective effect on the health baseline and that this would be important for public health. This conclusion reflects the scientific literature which establishes a *clear* association between energy security and health outcomes. The Mona Offshore Wind Project are likely to be *influential* to delivering health policy, including in narrowing inequalities that are at risk of widening due to reduced national energy security and rising costs of living.

30.9.10.17 The effect will, therefore, be of **moderate beneficial** significance, which is **significant** in EIA terms.

30.10 Cumulative effect assessment methodology

30.10.1 Methodology

30.10.1.1 The Cumulative Effects Assessment (CEA) takes into account the impact associated with the Mona Offshore Wind Project together with other projects and plans. The projects and plans selected as relevant to the CEA presented within this chapter are based upon the results of a screening exercise (see volume 5, annex 5.1: CEA screening matrix). 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.

30.10.1.2 The human health CEA methodology has followed the methodology set out in volume 1, chapter 5: EIA methodology of the PEIR. As part of the assessment, all projects and plans considered alongside the Mona Offshore Wind Project have been allocated into 'tiers' reflecting their current stage within the planning and development process, these are listed below.

30.10.1.3 A tiered approach to the assessment has been adopted, as follows:

- Tier 1
  - Under construction
  - Permitted application
  - Submitted application
  - Those currently operational that were not operational when baseline data were collected, and/or those that are operational but have an ongoing impact
- Tier 2
  - Scoping report has been submitted and is in the public domain
- Tier 3
  - Scoping report has not been submitted
  - Identified in the relevant Development Plan
  - Identified in other plans and programmes.

30.10.1.4 This tiered approach is adopted to provide a clear assessment of the Mona Offshore Wind Project alongside other projects, plans and activities.

30.10.1.5 The projects, plans and activities scoped into the CEA are informed by those considered within the CEA of:

- Volume 2, chapter 11: Commercial fisheries of the PEIR
- Volume 2, chapter 12: Shipping and navigation of the PEIR
- Volume 2, chapter 14: Other sea users of the PEIR

- Volume 3, chapter 20: Land use and recreation of the PEIR
- Volume 3, chapter 21: Traffic and transport of the PEIR
- Volume 3, chapter 22: Noise and vibration of the PEIR
- Volume 4, chapter 25: Seascape, Landscape and Visual Resources of the PEIR
- Volume 4, chapter 28: Climate change of the PEIR
- Volume 4, chapter 29: Socio-economics and community of the PEIR.

30.10.2 Maximum design scenario

30.10.2.1 The MDS is informed by the cumulative MDS provided in:

- Volume 2, chapter 11: Commercial fisheries of the PEIR
- Volume 2, chapter 12: Shipping and navigation of the PEIR
- Volume 2, chapter 14: Other sea users of the PEIR
- Volume 3, chapter 20: Land use and recreation of the PEIR
- Volume 3, chapter 21: Traffic and transport of the PEIR
- Volume 3, chapter 22: Noise and vibration of the PEIR
- Volume 4, chapter 25: Seascape, Landscape and Visual Resources of the PEIR
- Volume 4, chapter 28: Climate change of the PEIR
- Volume 4, chapter 29: Socio-economics and community of the PEIR.

30.10.2.2 The MDS identified in Table 30.17 have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group. The cumulative effects presented and assessed in this section have been selected from the Project Design Envelope provided in volume 1, chapter 5: project description of the PEIR as well as the information available on other projects and plans, in order to inform a 'MDS'. Effects of greater adverse significance are not predicted to arise should any other development scenario, based on details within the Project Design Envelope (e.g. different wind turbine layout), to that assessed here, be taken forward in the final design scheme.

30.10.2.3 National Grid Electricity Transmission (NGET) are proposing to undertake upgrades to their Bodelwyddan substation; to facilitate the connection of multiple projects (e.g. Awel Y Mor). The upgrades will comprise works to the existing substation, an extension to the substation and associated works and infrastructure (e.g. new overhead gantries).

30.10.2.4 It is understood that works to the existing substation will be undertaken via NGET's permitted development rights. The proposed extension to Bodelwyddan substation will require planning consent. At the time of writing, an application had not been submitted to Denbighshire County Council but the anticipated timeframe is early 2024. Given that an application has not been submitted, the potential cumulative impacts of the Bodelwyddan upgrade have not been assessed within the PEIR. This will be re-visited in the application for consent for the Mona Offshore Wind Project should further information become available.

30.11 Cumulative effects assessment

30.11.1.1 A description of the significance of cumulative effects upon population health arising from each identified impact is given below.

30.11.1.2 Cumulative health assessment extends the analysis of each determinant of health. This means for each determinant of health the relevant reasonably foreseeable cumulative projects are listed and a professional judgement is made as to the combined level of effect and its implications for public health. Following IEMA 2022 guidance, sensitivity of the relevant populations is unchanged from the main assessment in section 30.9. Magnitude is however appraised in light of the combined effect of multiple projects.

30.11.1.3 As set out in IEMA 2022 guidance for human health, a combined public health effect is most likely where a population is affected by multiple determinants of health and a large proportion of the same individuals within that population experience the combination of effects.

30.11.1.4 A high degree of spatial proximity is required for there to be the potential for cumulative effects for localised changes in determinants of health, (e.g., dust from a construction site). In contrast, where there are more far-reaching effects in a determinant of health, (e.g., job creation or noise along shared transport corridors, there is greater opportunity for cumulative interactions between projects).

30.11.1.5 For each of the determinants in the main assessment the cumulative assessment considers the potential for pathways to the same population from other large-scale developments that are similar in location and timing. The assessment is qualitative, following the approach set out in section 30.6, and considers the potential for combined magnitudes of effect to the same populations.

30.11.1.6 This chapter is informed by cumulative assessment conclusions set out in other chapters (as listed in section 30.1). The health assessment does not duplicate detail set out in those chapters. Distinctions between Tier 1 and Tier 2 projects follow other assessment chapters. Tier 1 being those projects where levels of uncertainty are lower, due to being more advanced in the planning process.

30.11.1.7 Offshore effects focus on the interaction of the Mona Offshore Wind Project with Morgan Generation Assets, Awel-y-Mor Offshore Wind Farm and Morecambe Offshore Wind Farm generation assets. These projects collectively have the potential for a greater magnitude of impact across the offshore health assessments.

30.11.1.8 Onshore effects at this stage note the potential for an interaction with the Awel y Môr Offshore Windfarm (Onshore Infrastructure). For example, the potential for such an effect is noted in Volume 3, chapter 22: Noise and vibration of the PEIR, but concluded by that assessment to be at most minor adverse.

30.11.1.9 Due to Mona making landfall in North Wales and Morgan and Morecambe Transmission Assets making landfall in northeast England there is limited potential for cumulative onshore effects from these projects, so combined onshore effects with Morgan and Morecambe Transmission Assets has been discounted.

30.11.1.10 In terms of other onshore projects, there is currently insufficient information from relevant onshore inter-related assessments for the health assessment to complete a CEA at PEIR. For example, Volume 3, chapter 21: Traffic and transport of the PEIR explains that at this stage the full extent of the highway network to be assessed has

not yet been fully confirmed. The health assessment will therefore follow the approach set out in other relevant chapters in stating that the onshore CEA will be set out within the Environmental Statement health chapter submitted in support of the application for Development Consent.

30.11.1.11 The following sections provide a CEA on issues with sufficient information and the potential for likely significant population health cumulative effects.

30.11.2 Transport modes, access and connections – Offshore

Tier 1 and Tier 2

Construction, Operations and Maintenance, and Decommissioning

30.11.2.1 This section has been informed by volume 2, chapter 12: shipping and navigation of the PEIR, which sets out relevant cumulative assessment findings and mitigation measures that have been taken into account. Volume 2, chapter 12: shipping and navigation of the PEIR concludes:

- The potential for minor adverse cumulative effect for recognised sea lanes essential to international navigation.
- The potential for moderate adverse cumulative impacts to commercial operators including strategic routes and lifeline ferries.
- The potential for moderate adverse cumulative impacts on adverse weather routeing.
- The potential for a minor adverse impact on access to ports and harbours.
- The potential for major adverse cumulative impacts to vessel collision risk.
- The potential for moderate adverse cumulative impacts on allision (contact) risk to vessels.

30.11.2.2 Volume 2, chapter 12: Shipping and navigation of the PEIR notes that there is ongoing work to avoid or reduce the cumulative effects. This includes activities reviewing the array boundary, site layout design and construction scheduling, as well as continued engagement. Volume 2, chapter 12: Shipping and navigation of the PEIR does not provide a residual effect conclusion at the PEIR stage for cumulative effects, but it is the expectation of the health assessment that ultimately these issues will be satisfactorily resolved. Until that situation is confirmed the health assessment takes the reasonable worst case and assesses the unmitigated effects as reported in volume 2, chapter 12: Shipping and navigation of the PEIR.

30.11.2.3 The population groups relevant to the cumulative health assessment are:

- The ‘local’ population of the Isle of Man.
- The ‘regional’ populations of North West England and North Wales.
- The sub-population vulnerable due to young age, old age, low income, poor health, social disadvantage or access and geographical factors.

Magnitude of impact

30.11.2.4 The cumulative effect is predicted to be similar in the majority of its characteristics to the individual level magnitude described in section 30.9.2. The combined effect of the projects means the scale of change is considered to be medium rather than small, with more frequent disruptions and greater combined risks. Disruption is still likely to be occasional, but more frequent than the individual level effect.

30.11.2.5 It is predicted that the impact will affect the receptor directly and indirectly. The magnitude is therefore considered to be **medium**.

Sensitivity of the receptor

30.11.2.6 The sensitivity of the general and of the vulnerable group populations are unchanged in the cumulative assessment. As set out in section 30.9.2, the sensitivity of the general population is **low** and the sensitivity of the vulnerable group population is **high**.

Significance of effect

30.11.2.7 Overall, the magnitude of the impact is deemed to be **medium** and the sensitivity of the vulnerable group population is considered to be **high**. The effect will, therefore, be of **moderate** adverse significance, which is significant in EIA terms.

30.11.2.8 The reasons this is significant for public health are as set out in section 30.9.2, with the difference being that the cumulative effect has the potential to result in a *small* rather than slight change to the population health baseline of the Isle of Man. Such a change would be driven by ongoing and more frequent disruption in access to essential goods and services and increased shipping risk. This is likely to be *influential* in widening health inequalities, with those least able to adapt being most affected.

Further mitigation and residual effect

30.11.2.9 As noted in volume 2, chapter 12: Shipping and navigation of the PEIR the residual effect is expected to be not significant in EIA terms. This includes collaborative efforts with other projects that are also seeking solutions on this issue.

30.11.2.10 It is expected that the further mitigation will enable a conclusion of a **negligible to minor adverse** (**not significant**) residual cumulative effect for population health. This will be confirmed in the Environmental Statement.

30.11.2.11 As set out in section 30.9.2, the health assessment notes the importance of clear communication with the public to avoid levels of concern that could in themselves result in mental health and wellbeing effects. The PEIR non-technical summary provides appropriate mitigation by explaining how the final design will allow appropriate and safe access to the Isle of Man.

30.11.3 Transport modes, access and connections – Onshore

30.11.3.1 As noted in Volume 3, chapter 21: Traffic and transport of the PEIR a CEA will be reported in the Environmental Statement. No health assessment CEA of onshore transport related effects is therefore provided at PEIR.

30.11.4 Community identity, culture, resilience and influence

Tier 1 and Tier 2

Operations and maintenance

30.11.4.1 This section has been informed by volume 4, chapter 26 - seascape, landscape and visual impact assessment of the PEIR which sets out relevant cumulative assessment findings and mitigation measures that have been taken into account. Volume 4, chapter 25: seascape, landscape and visual impact assessment of the PEIR concludes:

- No cumulative significant effects are predicted during operations of the Mona Offshore Wind Project on recognised, national and local, seascape and marine character areas in the SLVIA study area when considered as a whole.
- A cumulative moderate to major significant adverse effect on seascape character is predicted during operations and maintenance for the area of sea occupied by Mona Array Area.
- No cumulative significant effects are predicted during operations and maintenance of the offshore generation assets of the Mona Offshore Wind Project on landscape character areas in the SLVIA study area.
- No cumulative significant effects are predicted during operations and maintenance of Mona Offshore Wind Project on nationally designated landscapes in the SLVIA study area.
- A cumulative moderate adverse effect is predicted during operations and maintenance for people onboard the Liverpool to Dublin and Liverpool to Douglas ferries when passing Mona Array Area.
- No cumulative significant visual effects are predicted to occur for: national trails; national cycle networks; key coastal roads and railways; land access including land within National Parks and AONB; country parks; national parks; and other key ferry routes.

30.11.4.2 The population groups relevant to this assessment are:

- The ‘regional’ population of coastal communities in northwest England and North Wales
- The vulnerable sub-populations including young and old people, people with low incomes, people with poor health, and people experiencing social disadvantage.

Magnitude of impact

30.11.4.3 The cumulative effect is predicted to be similar in the majority of its characteristics to the individual level magnitude described in section 30.9.4. The combined effect of the projects means the scale of change would be *small* with *frequent* views during clear weather conditions. The change is likely to have a very *minor* influence on quality of life and morbidity risk factors linked to wellbeing for a *small minority* of the population. *No* healthcare services implications are anticipated.

30.11.4.4 It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **low**.

Sensitivity of the receptor

30.11.4.5 The sensitivity of the general and of the vulnerable group populations are unchanged in the cumulative assessment. As set out in section 30.9.4 the sensitivity of the general population is **low** and the sensitivity of the vulnerable group population is **high**.

Significance of effect

30.11.4.6 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high**. The effect will, therefore, be of **minor adverse** and **minor beneficial** significance, which is not significant in EIA terms.

30.11.5 Open space, leisure and play

30.11.5.1 There is considered limited potential for cumulative project effects to influence use of outdoor space. This reflects the different landfall locations of other offshore windfarm projects, which would limit the nearshore and onshore disruption that could influence population behaviour.

30.11.5.2 This section has been informed by volume 2, chapter 12: shipping and navigation; volume 2, chapter 14: other sea users, and volume 3, chapter 20: land use and recreation of the PEIR, which set out relevant assessment findings and mitigation measures that have been taken into account

30.11.5.3 Volume 2, chapter 12: shipping and navigation of the PEIR concludes:

- The cumulative impact on recreational craft passengers will be minor adverse for all project phases.

30.11.5.4 Volume 2, chapter 14: other sea users concludes:

- The cumulative effect on displacement of recreational activities will be minor adverse during all project phases.
- There is potential that sediment plumes from resuspended sediment could impact recreational areas (bathing and diving sites) through changes to water quality. The cumulative effect is judged to be minor adverse during construction and decommissioning and negligible during operations and maintenance.

30.11.5.5 Volume 3, chapter 20: Land use and recreation concludes:

- The cumulative effect on PRoW during construction is assessed to be of minor adverse significance. No operations or maintenance cumulative effects are identified.

Magnitude of impact

30.11.5.6 The cumulative effect is predicted to be similar in the majority of its characteristics to the individual level magnitude described in section 30.9.5. There is likely to be a *small* scale of change over the *medium-term* from construction activities, including shipping movements and land access, affecting marine, nearshore and onshore recreational and leisure activities. Any such effect is likely to be characterised as an *occasional* effect on opportunities to be active at a given location, (e.g. due to transitory cable laying). It is likely there would be *rapid* reversal of any effect once the given construction activity concluded, with limited potential to cause lasting behavioural

change. The outcome is likely to be a minor change in quality of life and/or cardiovascular related morbidity for a small minority of the affected population. No effect on healthcare services would be expected.

30.11.5.7 The magnitude of change due to the Mona Offshore Wind Project is therefore considered to be **low**.

Sensitivity of the receptor

30.11.5.8 The sensitivity of the general and of the vulnerable group populations are unchanged in the cumulative assessment. As set out in section 30.9.5 the sensitivity of the general population is **low** and the sensitivity of the vulnerable group population is **high**.

Significance of effect

30.11.5.9 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

30.11.6 Employment and income

Tier 1 and Tier 2

Construction, Operations and maintenance and Decommissioning

30.11.6.1 This section has been informed by volume 2, chapter 11: Commercial fisheries of the PEIR, which sets out relevant cumulative assessment findings and mitigation measures that have been taken into account. Volume 2, chapter 11: Commercial fisheries concludes: there is the potential for a moderate adverse effect during operations and maintenance, but only a minor adverse effect during construction. The effects both relate to Scottish west coast scallop vessels.

30.11.6.2 The population groups relevant to the cumulative health assessment are:

- The 'regional' populations of Northwest England and Scotland (for communities strongly associated with Scottish west coast scallop vessels). Consideration has also been given to potential effects on the Isle of Man.
- The vulnerable sub-populations including young and old people, people with low incomes, people with poor health or disabilities, and people experiencing social disadvantage or access and geographical factors.

Magnitude of impact

30.11.6.3 The cumulative effect is predicted to be similar in the majority of its characteristics to the individual level magnitude described in section 30.9.6. The combined effect of the projects means a larger area of fishing grounds would have reduced access, with a medium scale of change for affected fishing communities (notably Scottish west coast scallop vessels).

30.11.6.4 It is noted that Morecambe offshore windfarm generation assets may not affect the same parts of the commercial fishing fleet, so may not contribute to cumulative effects relating to Scottish west coast scallop vessels. This will be confirmed in the Environmental Statement. At this stage it is assumed the combined effect is driven by the interaction of the Morgan and Mona projects, with Awel y Môr Offshore Wind Farm also contributing to a lesser degree due to spatial overlap in the south limits of the scallop fishery for Scottish west coast scallop vessels.

30.11.6.5 Whilst there is the potential for a combined effect from the projects, it is also likely that the effect would be distributed across a large regional area, rather than the projects having overlapping localised effects to the same communities. On this basis the impact is not considered to be of greater than the individual level effect. The magnitude is therefore considered to be **low**.

Sensitivity of the receptor

30.11.6.6 The sensitivity of the general and of the vulnerable group populations are unchanged in the cumulative assessment. As set out in section 30.9.6 the sensitivity of the general population is **low** and the sensitivity of the vulnerable group population is **high**.

Significance of effect

30.11.6.7 Overall, the magnitude of the impact is deemed to be **low** and the sensitivity of the vulnerable group population is considered to be **high**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Further mitigation and residual effect

30.11.6.8 The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors and the significant effects that have been identified as part of the individual and cumulative shipping and navigation assessment. These will be tested and applied as part of the assessment post PEIR and included in the Environmental Statement which will be submitted for the DCO application.

30.11.6.9 As noted in volume 2, chapter 12: shipping and navigation of the PEIR following mitigation, that would be reported in the Environmental Statement, which would include additional controls, the residual effect is expected to be negligible (not significant). This includes collaborative efforts with other projects that are also seeking solutions on this issue.

30.11.6.10 It is expected that the further mitigation will enable a conclusion of a **negligible** (**not significant**) residual cumulative effect for population health. This will be confirmed in the Environmental Statement.

30.11.7 Noise and Vibration

30.11.7.1 This section has been informed by volume 3, chapter 22: Noise and vibration of the PEIR, which sets out relevant cumulative assessment findings and mitigation measures that have been taken into account. Volume 3, chapter 22: Noise and vibration of the PEIR concludes that:

- The cumulative effect for noise impacts due to construction of the onshore cable corridor landward of the MHWS and concurrent construction with Awel y Mor is deemed to be major adverse.
- The cumulative effect for noise impacts due to construction of the onshore cable corridor landward of the MHWS and concurrent construction with the proposed 198 bed Registered Care Home is deemed to be minor adverse.

- Construction noise will be managed via the implementation of a CoCP and best practicable means in the form of mitigation and a noise management plan. Enhanced acoustic mitigation (e.g. enclosures) around continuously operating items such as pumps and generators will reduce the noise impacts at the source. If such measures are implemented, the effect may be reduced to minor adverse, which is not significant in EIA terms.
- The cumulative effect for noise impacts due to the Mona Onshore Substation during all project phases is deemed to be minor adverse.

30.11.7.2 As no significant cumulative effects are identified in volume 3, chapter 22: noise and vibration of the PEIR, the cumulative effect is predicted to be similar to the individual level effect described in section 30.9.7. As such, no further health assessment CEA is undertaken at PEIR. The potential for cumulative effects will be kept under review and further reported in the Environmental Statement health chapter.

30.11.8 Radiation (EMF)

30.11.8.1 Cable corridor overlaps in proximity to places where people spend extended periods of time are not expected. Cumulative effects in terms of actual risks or public understandings of risk are not expected. Effects in terms of understanding of risk are similarly not expected to be cumulatively greater than the individual effects of each project as effects would relate to localised visual or auditory cues. The potential for cumulative effects, (e.g. between the Mona and Awel y Môr Offshore Wind Farm onshore cable corridors and substations will be kept under review and further reported in the Environmental Statement health chapter).

30.11.9 Climate change and adaptation

30.11.9.1 The Mona Offshore Wind Project in combination with Morgan Generation Assets, Awel-y-Mor Offshore Wind Farm and Morecambe Offshore Wind Farm generation assets will all contribute towards wider energy sector transition to renewable energy which reduces the severity of climate change. Cumulatively these projects have a greater magnitude of effect. In the context of effects on global atmospheric conditions, rather than localised effects, the cumulative effect is arguably inclusive of all energy projects currently being consented, and likely much broader than just this one sector. Such a broad cumulative assessment is not within the scope of project level EIA. On this basis the cumulative effect is noted as greater, but for this subset of Tier 1 and Tier 2 projects the effect is conservatively considered to remain minor beneficial. The potential for cumulative effects will be kept under review and further reported in the Environmental Statement health chapter.

30.11.10 Wider societal infrastructure and resources

30.11.10.1 In combination with Morgan Generation Assets, Awel-y-Mor Offshore Wind Farm and Morecambe Offshore Windfarm generation assets, the Mona Offshore Wind Project will provide enhanced energy security. The national context of such energy security has been considered and the individual effects are not expected to be collectively greater. Sensitivity of the population remains unchanged as does the overall magnitude. On this basis the cumulative effect would remain **moderate beneficial**, which is significant in EIA terms.

30.11.11 Future monitoring

30.11.11.1 No further monitoring is proposed.

30.12 Transboundary effects

30.12.1.1 A screening of transboundary impacts has been carried out and has identified that there was no potential for significant transboundary effects with regard human health from the Mona Offshore Wind Project upon the interests of other states. Effects to the Isle of Man are discussed within the main assessment in section 30.9.

30.13 Inter-related effects

30.13.1.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the Mona Offshore Wind Project on the same receptor. These are considered to be:

- Project lifetime effects: Assessment of the scope for effects that occur throughout more than one phase of the Mona Offshore Wind Project (construction, operations and maintenance, and decommissioning), to interact to potentially create a more significant effect on a receptor than if just assessed in isolation in these three phases (e.g. subsea noise effects from piling, operational wind turbines, vessels and decommissioning)
- Receptor led effects: Assessment of the scope for all effects to interact, spatially and temporally, to create inter-related effects on a receptor. As an example, all effects on human health, such as changes in access, changes in community identity, changes in employment and benefits from renewable energy security, may interact to produce a different, or greater effect on a given population than when the effects are considered in isolation. Receptor-led effects may be short term, temporary or transient effects, or incorporate longer term effects.

30.13.1.2 A description of the likely interactive effects arising from the Mona Offshore Wind Project on human health is provided in volume 3, chapter 25: Inter-related effects of the PEIR.

30.13.1.3 The population health effects identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between effects for a given geographic population are presented in Table 30.20. Vulnerable group effects are expected across all geographic populations, so are not listed separately.

30.13.1.4 lists the inter-related effects (project lifetime effects) that are predicted to arise during the construction, operational and maintenance and decommissioning phases of the Mona Offshore Wind Project, and also the inter-related effects (receptor-led effects that are predicted to arise for human health receptors).

Table 30.20: Interaction between health determinants by geographic populations.

	Site specific			Local		Regional		National	International
	Landfall	Cable corridor	Substations	Isle of Man	Conwy and Denbighshire	North Wales	North West England	UK	Global
Transport (access – offshore)				✓					
Transport (access – onshore)	✓	✓	✓		✓				
Community identity						✓	✓		
Open space, leisure and play	✓	✓	✓		✓				
Employment (adverse)							✓		
Noise and vibration	✓	✓	✓		✓				
Radiation (EMF risk perception)	✓	✓	✓		✓				
Climate change	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	✓	✓
Wider societal resources	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	(✓)	✓	

Key:	Positive (green)	Positive as a component within wider area assessment (light green)	Negative (blue)	Positive and negative (orange)

Table 30.21: Summary of likely significant inter-related effects on the environment for individual effects occurring across the construction, operational and maintenance and decommissioning phases of the Mona Offshore Wind Project and from multiple effects interacting across all phases (receptor-led effects).

Description of impact	Phase[a]			Likely significant inter-related effects	Significance
	C	O	D		
Combined Transport access effects across project phases.	✓	✓	✓	Effects relating to ongoing disruption to access across construction, operations and maintenance and decommissioning are already taken into account by the health assessment, including where effects are characterised as 'long-term'.	No change.
Receptor-led effects					
Potential reduction is use of open spaces for recreation, leisure and play due to a combination of reduced access to such spaces or connecting active travel routes (including PRoW) and additional noise disturbance and concern about EMF.	✓	✓	✓	Changes in access to open space (e.g. at landfall) are not expected to overlap with issues of any active travel disruption (e.g. along the cable corridor) or with issues of noise and EMF concern (e.g. close to the substation). This issue will be kept under review and further reported in the Environmental Statement. Construction noise and any disruption active travel routes or open space are all transitory and short-term at any given location, this limits the potential for effects, even in combination to be significant public health effects.	No change.
Combination of reduced transport access and effects on community identity locally on the population of the Isle of Man.		✓		A small minority of the population of the Isle of Man may experience views of the wind farm (adversely affecting community identity health outcomes) and adverse impacts affecting health due to shipping route disruption. Combined effects are considered likely during the operational phase, once the windfarm is a feature of the seascape. The combined effects may particularly affect vulnerable groups with existing poor mental health. At a population level it is not expected that the combination of effects would interact in a way that would significantly reinforce health outcomes. No greater effect is therefore likely.	No change.
Combined national population benefits relating to climate change and wider societal resources		✓		Nationally the population would benefit both from a reduction in the severity of health effects associated with climate change and from the benefits to public health of energy security. Effects would be greatest for vulnerable groups, particularly those on low incomes less able to adapt or afford alternatives. As the effects associated with climate change are expected to be driven by the benefit to deprived populations globally, the combined effect in the UK of these health determinants is not expected to be greater than the individual effects.	No change.

30.14 Summary of impacts, mitigation measures and monitoring

30.14.1.1 Information on human health within the human health study area was informed by a review of relevant public health evidence sources, including scientific literature, baseline data, health policy, local health priorities and health protection standards with reference to corresponding chapters as set out in paragraph 30.1.1.3.

30.14.1.2 This chapter finds that Mona Offshore Wind Project as proposed for PEIR will have beneficial and adverse health effects. These are summarised in Table 30.22. The chapter concludes that:

- As set out in section 30.9.2, transport modes, access and connections in relation to commercial operators including strategic routes and lifeline ferries to the Isle of Man will have a minor adverse effect for population health, which is not significant in EIA terms. Following mitigation, that would be reported in the Environmental Statement, which would include additional controls (see Volume 2, chapter 12: Shipping and navigation of the PEIR) the residual effect is expected to be negligible (not significant).
- As set out in section 30.9.3 transport modes, access and connections in relation to construction works may disrupt local vehicle traffic and active travel. The effects of this are minor adverse significance, which is not significant in EIA terms.

- As set out in section 30.9.4, community identity, culture, resilience and influence in relation to visual impacts of the wind turbines will have a minor adverse and minor beneficial effect which is not significant in EIA terms.
- As set out in section 30.9.5, open space, leisure and play, offshore and onshore construction works leading to disruption of recreation and leisure will have a minor adverse effect which is not significant in EIA terms.
- As set out in section 30.9.6, employment and income in relation to loss or restricted access to commercial fishing grounds will have a minor adverse effect for population health, which is not significant in EIA terms.
- As set out in section 30.9.7, noise and vibration related to construction, operations, maintenance and decommissioning of the Mona Offshore Wind Project will have a minor adverse effect (not significant).
- As set out in section 30.9.8, radiation in relation to risk perception of EMF is expected to produce a minor adverse (not significant) effect. Following adoption of mitigation strategies for communication with local communities about EMF regulatory standards and risks of the Mona Offshore Wind Project, the residual effect is expected to be negligible (not significant).
- As set out in section 30.9.9 climate change and adaptation in relation to renewable energy generation and subsequent reduced greenhouse gas emissions will have a minor beneficial effect for population health, which is not significant in EIA.
- As set out in section 30.9.10, wider societal infrastructure and resources in relation to renewable energy generation will have a moderate beneficial effect for population health, which is significant in EIA terms.
- Table 30.22 presents a summary of the potential impacts, mitigation measures and residual effects. Overall, it is concluded that there will be no significant adverse effects arising from the Mona Offshore Wind Project during the construction, operations and maintenance or decommissioning phases. Significant public health benefits in relation to energy security are expected for population health in the operational phase.
- Table 30.23 presents a summary of the potential cumulative impacts, mitigation measures and residual effects. The cumulative impacts assessed include combined effects on access to the Isle of Man and in relation to commercial fisheries. Overall it is concluded that there will be the following significant cumulative effects from the Mona Offshore Wind Project alongside other projects:
- As set out in section 30.11.2, transport modes, access and connections in relation to commercial operators including strategic routes and lifeline ferries to the Isle of Man will have a cumulative moderate adverse effect for population health, which is significant in EIA terms. Following mitigation, that would be reported in the Environmental Statement, which would include additional controls (see Volume 2, chapter 12: Shipping and navigation of the PEIR) the residual effect is expected to be minor adverse (not significant).
- As set out in section 30.11.10, wider societal infrastructure and resources in relation to renewable energy generation will have a moderate beneficial effect for population health, which is significant in EIA terms.
- No potential transboundary impacts have been identified in regard to effects of the Mona Offshore Wind Project.

Table 30.22: Summary of potential environmental effects, mitigation and monitoring.

[a] C=construction, O=operational and maintenance, D=decommissioning

Description of impact	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Transport modes, access and connectivity - offshore	✓	✓	✓	Tertiary measures	C: low O: low D: low	C: high O: high D: high	Minor adverse (not significant)	The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors. Non-technical communication with the public that the Environmental Statement is expected to confirm that the impact is mitigated. This would reduce the risk of adverse health effects associated with concern on this issue.	Not assessed for PEIR as additional risk controls are to be further considered and included as for of the DCO application.	
Transport modes, access and connectivity - onshore	✓		✓	Tertiary measures	C: low D: low	C: high D: high	Minor adverse (not significant)	Mitigation in terms of early and ongoing information sharing with emergency and healthcare services is secured within construction management plans.	negligible (not significant)	
Community identity, culture, resilience and influence		✓		Tertiary measures	O: low	O: high	Minor adverse and minor beneficial (not significant)	No further mitigation required.	unchanged	
Open space, leisure and play	✓		✓	Tertiary measures	C: low D: low	C: high D: high	Minor adverse (not significant)	No further mitigation required.	unchanged	
Employment and income	✓	✓	✓	Tertiary measures	C: low O: low D: low	C: high O: high D: high	Minor adverse (not significant)	The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors. Non-technical communication with the public that the Environmental Statement is expected to confirm that the impact is mitigated. This would reduce the risk of adverse health effects associated with concern on this issue.	Not assessed for PEIR as additional risk controls are to be further considered and included as for of the DCO application.	
Noise and Vibration	✓	✓	✓	Tertiary measures	C: low O: low D: low	C: high O: high D: high	Minor adverse (not significant)	No further mitigation required.	unchanged	
Radiation (EMF risk perception)		✓		Tertiary measures	O: low	O: high	Minor adverse (not significant)	Non-technical communication with the public that actual EMF risks are within standards set for health protection.	negligible (not significant)	
Climate change and adaptation		✓		Tertiary measures	O: low	O: high	Minor beneficial (not significant)	No further mitigation required.	unchanged	
Wider societal infrastructure and resources		✓		Tertiary measures	O: medium	O: high	Moderate beneficial (significant)	No further mitigation required.	unchanged	

Table 30.23: Summary of potential cumulative environmental effects, mitigation and monitoring.

[a] C=construction, O=operational and maintenance, D=decommissioning

Description of effect	Phase[a]			Measures adopted as part of the project	Magnitude of impact	Sensitivity of the receptor	Significance of effect	Further mitigation	Residual effect	Proposed monitoring
	C	O	D							
Tier 1 & 2										
Transport modes, access and connectivity - offshore	✓	✓	✓	Tertiary measures	C: medium O: medium D: medium	C: high O: high D: high	Moderate adverse (significant)	The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors. Non-technical communication with the public that the Environmental Statement is expected to confirm that the impact is mitigated. This would reduce the risk of adverse health effects associated with concern on this issue.	Not assessed for PEIR as additional risk controls are to be further considered and included as for of the DCO application.	
Community identity, culture, resilience and influence		✓		Tertiary measures	O: low	O: high	Minor adverse and minor beneficial (not significant)	No further mitigation required.	unchanged	
Open space, leisure and play	✓		✓	Tertiary measures	C: low D: low	C: high D: high	Minor adverse (not significant)	No further mitigation required.	unchanged	
Employment and income	✓	✓	✓	Tertiary measures	C: low O: low D: low	C: high O: high D: high	Minor adverse (not significant)	The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors. Non-technical communication with the public that the Environmental Statement is expected to confirm that the impact is mitigated. This would reduce the risk of adverse health effects associated with concern on this issue.	Not assessed for PEIR as additional risk controls are to be further considered and included as for of the DCO application.	
Wider societal infrastructure and resources		✓		Tertiary measures	O: medium	O: high	Moderate beneficial (significant)	No further mitigation required.	unchanged	

30.15 Next steps

30.15.1.1 The Applicant has made firm commitments to reducing the potential impacts on shipping and navigation receptors and the significant effects that have been identified as part of the individual and cumulative shipping and navigation assessment. These will be tested and applied as part of the assessment post PEIR and included in the Environmental Statement which will be submitted for the DCO application. The conclusions provided in this chapter will be reviewed with regards to such measures. Further discussion with public health stakeholders will also be undertaken. Further consultation will be offered with Public Health Wales to discuss the PEIR health chapter findings. Opportunities to target socio-economic benefits to vulnerable groups will continue to be explored.

30.16 References

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