

CITY AIRPORT DEVELOPMENT PROGRAMME  
(CADP1) S73 APPLICATION

# ENVIRONMENTAL STATEMENT

VOLUME 1: MAIN ES

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# Pell Frischmann

City Airport Development  
Programme (CADP1) S73  
Application

Volume 1: Environmental Statement  
Chapter 12: Public Health and well-  
being

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## 12 Public Health and Wellbeing

### 12.1 Introduction

12.1.1 This chapter of the ES has been prepared by RPS and identifies the likely significant population health effects of the proposed development. In particular this chapter:

- Sets out the health policy and baseline conditions established from desk studies and consultation with stakeholders;
- Describes the methodology used, referencing relevant guidance and good practice;
- Assesses the likely significant population health effects arising from the proposed development, and whether these conclusions introduce new or materially different conclusions from those reached by the 2015 Health Impact assessment (HIA) (hereafter referred to the 2015 HIA) undertaken alongside the 2015 Updated Environmental Statement (UES);
- Highlights any necessary monitoring and/or mitigation measures that could prevent, minimise, reduce or offset likely significant adverse effects or enhance possible beneficial effects identified in the EIA process; and
- Assesses potential in-combination and cumulative effects.

12.1.2 In this chapter the terms human health, health and wellbeing are used interchangeably. Key definitions are set out in the methods Section at 12.3.

12.1.3 Health in EIA takes a public health approach, meaning it reaches conclusions on the health outcomes to defined populations, rather than the health outcomes of individuals. Guidance explaining that this is the correct approach is set out in Section 12.1.6.

12.1.4 This chapter should be read in conjunction with the following appendices:

- Appendix 12.1 – Health Policy;
- Appendix 12.2 – Health Methods; and
- Appendix 12.3 – Health Baseline Data.

12.1.5 The health assessment considers the public health implications of the conclusions of the other technical assessments.

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

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

12.1.7 The potential for the proposed development to change population health outcomes may arise from various health pathways. In particular, the health assessment draws inputs from the following chapters to form the basis of the assessment for population health and wellbeing:

- **Chapter 7** – Socio-economics;
- **Chapter 8** – Noise;
- **Chapter 9** – Air Quality;
- **Chapter 10** – Surface Access;
- **Chapter 11** – Climate Change; and
- **Chapter 14** – Cumulative Effects.

12.1.8 This chapter does not seek to repeat text or replicate data from these inter-related technical disciplines. The health assessment takes the residual effect conclusions of these other EIA technical topic chapters as its

input. In this regard the health assessment also relies on the mitigation measures set out in those chapters and does not repeat them. This avoids duplication and keeps the assessment proportionate.

12.1.9 In addition to the findings of the other technical assessment, it is also of relevance that LCY fosters good health for its staff and the local population through existing employment and training opportunities and other community initiatives, as summarised in Chapter 7: Socio Economics. The assessment considers opportunities for continuing and extending these enhancement initiatives where: necessary; relevant; enforceable; precise; and reasonable in all other respects.

12.1.10 The 2015 HIA was undertaken prior to the updated EIA Regulations requiring consideration of the likely significant effects to human health as part of an ES; however it fulfilled an equivalent planning role. The 2015 HIA concluded that:

*“CADP1 does not constitute a significant risk to local community health, on the basis that all regulatory environmental standards set to protect health are predicted to be achieved, and the relative effects of the predicted minor changes in air quality, noise and transport upon existing burdens of health are not sufficient to quantify any significant adverse health outcome. Moreover, when accounting for the underlying factors defining local influences on poor health in and surrounding the area (largely socio-economic and lifestyle related), and the direct, indirect and induced socio-economic benefits from CADP1, coupled with the committed and ongoing community support and employment initiatives managed by the Airport to optimise local health benefit uptake, CADP1 is considered to represent a net health benefit.”*

## 12.2 Legislative and Policy Context

12.2.1 This section summaries the legislation and policy context relevant to the health assessment. See Appendix 12.1 for further relevant policy context. Additional legislation and policies are set out within the other ES chapters on which this chapter draws.

### Legislation

12.2.2 The following legislation is relevant to the assessment of the effects on human health.

12.2.3 The Environment Act 2021 (HM Government, 2021) established The Office for Environmental Protection (OEP) as a public body in England and Northern Ireland. The OEP sets targets and takes enforcement action to prevent, or mitigate, serious damage to the natural environment or to human health. This includes reducing adverse impacts on public health. The OEP objective (OEP, 2022) is for environmental law (including EIA legalisation) and its implementation to be well designed and delivered, so that positive outcomes for the environment and people’s health and wellbeing are achieved.

12.2.4 The EIA Regulations 2017 (HM Government, 2017) set out, at Regulation 4(2) and Schedule 4, the topics to be assessed within the EIA process, including:

- ‘(2) 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 –
- (a) population and human health;...’ (Regulation 4(2))

12.2.5 The Civil Aviation Act 2012 (HM Government, 2012a) gives the Civil Aviation Authority a role in promoting better public information about the environmental effects of civil aviation in the UK, their impact on human health and safety, and measures taken to mitigate adverse impacts.

12.2.6 The Air Quality Standards Regulations 2010 (HM Government, 2010) set out statutory health protection standards on ambient air quality.

12.2.7 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.

12.2.8 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).

12.2.9 The Public Health (Control of Disease) Act 1984 (as amended) (HM Government, 1984), relates to disease control and establishing of 'port health' authorities. Port health authorities carry out a range of health controls at the UK borders. These include checks on imported food, inspecting aircraft for food safety and infectious disease control, as well as general public and environmental health checks (HM Government, 2012b).

12.2.10 Public Health (Aircraft) Regulations 1979 (as amended) (HM Government, 1979), reflect the International Health Regulations 2005 requirement (adopted by the WHO) that port health is notified of any cases or symptoms of infectious disease aboard an aircraft before it arrives in port.

12.2.11 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.

12.2.12 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).

## National Policy

12.2.13 The National Planning Policy Framework (NPPF) (Ministry of Housing Communities & Local Government, 2019) is relevant to the proposed development. This sets the national policy context for planning in general, including expectations for how development and planning decisions should take health into account.

12.2.14 The NPPF states:

*"Planning policies and decisions should aim to achieve **healthy, inclusive and safe places** which... **promote social interaction**... are **safe and accessible**... and enable and **support healthy lifestyles**, especially where this would address identified **local health and well-being needs**...." [paragraph 92, emphasis added]*

*"Planning policies and decisions should also ensure that new development is appropriate for its location **taking into account the likely effects (including cumulative effects) of pollution on health, living conditions and the natural environment**... In doing so they should: mitigate and reduce to a minimum potential adverse impacts resulting from noise from new development, **avoid noise giving rise to significant adverse impacts on health and the quality of life**; identify and protect tranquil areas which have remained relatively undisturbed by noise and are prized for their recreational and amenity value for this reason..." [paragraph 185, emphasis added]*

*"Planning policies and decisions should sustain and **contribute towards compliance with relevant limit values or national objectives for pollutants**... Opportunities to improve air quality or mitigate impacts should be identified, such as through traffic and travel management, and green infrastructure provision and enhancement. **So far as possible these opportunities should be considered at the plan-making stage**, to ensure a strategic approach and limit the need for issues to be reconsidered when determining individual applications". [paragraph 186]*

12.2.15 Aviation Policy Framework (HM Government, 2013) sets out the government's policy to allow the aviation sector to continue to make a significant contribution to economic growth across the country. Economic prosperity is an important positive determinant of health. The points included here are noted in relation to health:

“The aviation sector is a **major contributor to the economy** and [the Government] support its growth within a framework which maintains a **balance between the benefits of aviation and its costs**, particularly its contribution to climate change and noise...” [paragraph 5, emphasis added].

“For aviation’s other local environmental impacts, such as air pollution, our overall objective is to ensure **appropriate health protection by focusing on meeting relevant legal obligations**”. [paragraph 19, emphasis added]

“Emissions ... at airports, contribute to air pollution. EU legislation sets **legally binding air quality limits for the protection of human health**. The Government is committed to achieving full compliance with European air quality standards”. [paragraph 3.47, emphasis added]

“The Government’s overall policy on aviation noise is to limit and, **where possible, reduce the number of people in the UK significantly affected by aircraft noise**, as part of a policy of sharing benefits of noise reduction with industry”. [paragraph 3.12, emphasis added]

“This is consistent with the Government’s Noise Policy, as set out in the Noise Policy Statement for England (NPSE) which aims to avoid significant adverse impacts on health and quality of life”. [paragraph 3.13, emphasis added]

“We want to **strike a fair balance between the negative impacts of noise (on health, amenity (quality of life) and productivity) and the positive economic impacts of flights**. As a general principle, the Government therefore expects that future growth in aviation should ensure that **benefits are shared between the aviation industry and local communities**. This means that the industry must continue to **reduce and mitigate noise as airport capacity grows**. As noise levels fall with technology improvements the aviation industry should be expected to share the benefits from these improvements”. [paragraph 3.3, emphasis added]

“The NPPF expects **local planning policies and decisions to ensure that new development is appropriate for its location and the effects of pollution – including noise – on health...** In the same way that **some people consider themselves annoyed by aircraft noise even though they live some distance from an airport ...**, other people living closer to an airport seem to be tolerant of aircraft noise and may choose to live closer to the Airport to be near to employment or to benefit from the travel opportunities”. [paragraph 3.21, emphasis added]

“The Government recognises that the **costs on local communities are higher from aircraft noise during the night**, particularly the health costs associated with sleep disturbance. Noise from aircraft at night is therefore widely regarded as the least acceptable aspect of aircraft operations. However, we also recognise the importance to the UK economy of certain types of flights... which may only be viable if they operate at night”. [paragraph 3.34, emphasis added]

“Whilst our policy is to give particular weight to the management and mitigation of noise in the immediate vicinity of airports, there **may be instances where prioritising noise creates unacceptable costs in terms of local air pollution**. ... For this reason, **the impacts of any proposals which change noise or emissions levels should be carefully assessed to allow these costs and benefits to be weighed up**”. [paragraph 3.52, emphasis added]

## Regional Policy

12.2.16 The London Plan 2021 (Mayor of London, 2021), is the spatial development strategy for Greater London.

Policy GG3: “To improve Londoners’ health and reduce health inequalities, those involved in planning and development must:

- A. ensure that the **wider determinants of health are addressed in an integrated and co-ordinated way**, taking a systematic approach to improving the mental and physical health of all Londoners and **reducing health inequalities**
- B. promote **more active and healthy lives** for all Londoners and enable them to make healthy choices
- C. use the Healthy Streets Approach to prioritise health in all planning decisions

- D. assess the potential impacts of development proposals and Development Plans on the **mental and physical health and wellbeing of communities**, in order to **mitigate any potential negative impacts, maximise potential positive impacts**, and help **reduce health inequalities**, for example through the **use of Health Impact Assessments**
- E. plan for appropriate health and care infrastructure to address the needs of London's changing and growing population
- F. seek to **improve London's air quality, reduce public exposure to poor air quality and minimise inequalities in levels of exposure to air pollution**
- G. plan for **improved access to and quality of green spaces**, the provision of new green infrastructure, and spaces for play, recreation and sports
- H. ensure that new buildings are well-insulated and sufficiently ventilated to avoid the health problems associated with damp, heat and cold
- I. seek to create a healthy food environment, increasing the availability of healthy food and restricting unhealthy options". [emphasis added]

Policy T8: "The Mayor supports the role of the Airports serving London in enhancing the city's spatial growth... The environmental and **health impacts of aviation must be fully acknowledged** and **aviation-related development proposals should include mitigation measures** that fully meet their external and environmental costs, particularly in respect of noise, air quality and climate change. **Any airport expansion scheme must be appropriately assessed ...**". [emphasis added]

## Local Policy

12.2.17 The LBN Local Plan 2018 (London Borough of Newham, 2018), sets the local basis for planning application determinations:

Policy SC5: "The Council supports health care partners' efforts to **promote healthy lifestyles and reduce health inequalities** and recognises the **role of planning** in doing so through the **creation of healthy neighbourhoods and places**. In Newham, this will be achieved through: ...

- ii. The need to ... **reduce exposure to airborne pollutants ... having regard to national and international obligations ...**;
- iii. The need to **improve employment levels and reduce poverty**, whilst attending to the **environmental impacts of economic development** including community/public safety, noise, vibrations and odour ...;
- iv. The importance of **facilitating and promoting walking and cycling** to increase people's activity rates ...;
- vii. The need for **new or improved inclusive open space** and sports facilities, including **good quality, secure and stimulating play space** and informal recreation provision for young people and accessible natural greenspace and bluespace to **encourage greater participation in physical activity ...**". [emphasis added]

Policy SP2: "[Furthermore,] the requirement for major development proposals to be accompanied by a **health impact assessment** detailing how they respond to the above contributors to health and well-being, including **details of ongoing management** or mitigation of issues where necessary." [emphasis added]

Policy J3: "More **Newham residents will share in the increasing wealth** associated with the expanding local and London-wide economy through ... **Promotion of local labour agreements and procurement** in the construction and operation of new development". [emphasis added]

Policy SP8: "All development is expected to achieve good neighbourliness and fairness from the outset by **avoiding negative and maximising positive social, environmental and design impacts** for neighbours on and off the site". [emphasis added]

"**Compliance with the standards** and due regard to the importance of the technical guidance in Table 4 where they are relevant to development proposals, will be expected to promote neighbourliness in addressing the need to: ... **Avoid unacceptable exposure** to light (including light spillage), odour, dust, **noise**, disturbance, vibration, radiation and other amenity or **health impacting pollutants** in accordance with policy SP2". [emphasis added]

*“All development should be **at least Air Quality Neutral**, supporting a net decrease in specified pollutants and making design, access, energy, and management decisions that minimise air pollution generation and exposure at demolition, construction, and operation stage ...”. [emphasis added].*

## Other Guidance

12.2.18 This health assessment report was conducted in accordance with EIA and HIA industry guidance.

12.2.19 Planning Practice Guidance (PPG) on health and wellbeing (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government., 2014) applies and was taken into account when preparing this chapter (see Appendix 12.1). PPG on Environmental Impact Assessment (Ministry of Housing, Communities & Local Government, 2014) also explains the requirements of the EIA Regulations. However, neither PPG provides additional information in relation to defining, scoping or assessing ‘human health’. Regard has therefore been given to the following, with further detail and citations being provided in Appendix 12.1.

- 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 (Cave, et al., 2020).
- International Association for Impact Assessment. Health Impact Assessment International Best Practice Principles, 2021 (Winkler, et al., 2021).
- Public Health England, Health Impact Assessment in spatial planning 2020 (Public Health England, 2020).

## 12.3 Assessment Methodology

12.3.1 This section summarises the assessment methods. Further detail is set out in Appendix 12.2.

### Consultation

12.3.2 The assessment has been informed by project-wide consultation with the LBN and other stakeholders. Consultation focusing on public health issues is summarised in Table 12.1. No public health-related issues were raised by any other statutory consultees (points related to precursors to health outcomes are covered in the relevant technical chapters listed in paragraph 12.1.7).

**Table 12.1: Consultation Responses Relevant to this Chapter**

Consultee	Issues Raised	How/ Where Addressed
LBN	When gathering the baseline conditions, if any further sensitive human receptors are identified, these should also be considered within the HIA (PHW1)	Noted and agreed. Baseline is set out in Section 12.4 and vulnerable group set out in Appendix 12.2. The baseline confirmed the appropriateness of vulnerable groups set out by guidance.
LBN	Clarity is required regarding how the health effects of air pollution will be assessed (PHW 2).	Meetings attended by the LCY health assessment team, the LBN deputy director of public health and LBN advisors from Air Pollution Services, were held on 14 Sep 2022 and 20 Sep 2022. The latter session focused on explaining and discussing the health assessment methods, as set out in guidance. The methods are set out in Section 12.3 and Appendix 12.2.
LBN	The Public Health and Well Being chapter should assess against the 2021 WHO Air Quality Guidelines which are based on the most recent synthesis of the medical evidence (PHW3).	The health assessment includes a comparison against the 2021 WHO Air Quality Guidelines, see Table 12.11.

LBN	The HIA is narrow in its approach to consideration of Air Quality. The Applicant should consider the full range of risks to health including exposure of the future users within the airport boundary (PHW4).	As set out in Section 12.15, the health assessment of air quality sets out a proportionate geographic scope, population scope, temporal scope and technical scope. The scope includes considering future users within the airport boundary.
LBN	For the HIA, full considerations of all locations where people may be exposed to air pollution over different averaging periods should be considered (PHW5).	As set out in Section 12.15, the health assessment of air quality includes proportionate and appropriate consideration of the locations where people may be exposed to short-term and long-term changes in air quality.
LBN	The Applicant should provide quantitative information on air pollution in relation to WHO guidelines in the Air Quality Assessment to allow the HIA to fully assess the health effects (PHW6).	The health assessment includes a comparison against the 2021 WHO Air Quality Guidelines, see Table 12.11. This is informed by quantitative analysis from the Chapter 9 air quality assessment.
LBN	There is no information on the methodology for going from the air quality impact at individual receptors to the impact on populations. This needs to be provided (PHW7).	Meetings attended by the LCY health assessment team, the LBN deputy director of public health and LBN advisors from Air Pollution Services, were held on 14 Sep 2022 and 20 Sep 2022. The latter session focused on explaining and discussing the health assessment methods, as set out in guidance. The methods are set out in Section 12.3 and Appendix 12.2.
LBN	The Applicant should provide an assessment of UFP in the Air Quality Assessment to allow the health assessment to fully assess the health effects of this pollutant (PHW8).	As set out in Section 12.16, the health assessment includes a section on UFP. This provides a proportionate population health assessment based on the current state of scientific knowledge about the severity and causality of UFP health pathways. This is informed by discussion of UFP in the Chapter 9 air quality assessment and its appendices.
LBN	The determination of significance in relation to air quality should be related to the health outcomes rather than a breach of statutory standards (PHW9).	The health assessment methods follow guidance in determining the likely significant population health effects of a project. This includes identifying relevant health outcomes. It also includes using a range of public health evidence sources, including regulatory standards to evidence the conclusion reached on EIA significance. It is clear in guidance and national policy that weight should be given to regulatory standards as an appropriate health protection standard when determining population health significance. The assessment follows good practice in also considering non-threshold health outcomes below regulatory standards when reaching a judgement on significance. This is explained in the Section 12.15 air quality assessment, and the methods are set out in Section 12.3 and Appendix 12.2.
LBN	The Applicant has stated that the health chapter conclusions will be presented in both EIA categories of significance, such as major, moderate, minor or negligible; and a narrative explaining this 'score' with reference to evidence, local context and any inequalities. The details of the 'score' methodology should be clearly outlined in the ES (PHW10).	Agreed. The methods are set out in Section 12.3. These follow the most recent guidance by the Institute of Environmental Management and Assessment 2022. The guidance has been produced by a working group that includes the UK Health Security Agency and the Department of Health and Social Care Office for Health Improvement and Disparities.

## Scope of the Assessment

### Technical Scope

12.3.3 The health assessment considers the operational effects of the proposed development following its completion. Construction effects are not included as there are no proposed changes to the approved buildings or infrastructure as part of this application, see paragraph 12.7.1 for further details.

12.3.4 The health assessment considers the public health implications of the conclusions of the other technical assessments. Further details on the scope are provided in Appendix 12.2, but broadly the health assessment considers whether there are likely to be significant population health effects linked to changes in:

- Use of public areas of green space, affecting physical activity and mental health;
- Community identity, affecting community cohesion and social isolation;
- Road safety and travel mode, affecting injury risk or walking and cycling behaviour;
- Employment, affecting standards of living and spend on health promoting activities;
- Upskilling and training, affecting socio-economic position and earning capacity;
- Noise disturbance, affecting psychological and physiological health responses;
- Air quality, affecting respiratory, cardiovascular and overall mortality outcomes;
- Climate change, affecting diverse health outcomes and global inequalities; and
- Health service demand or capacity, affecting quality of care locally.

### Study Area

12.3.5 The health assessment has regard to the zones of influence defined by other EIA chapters.

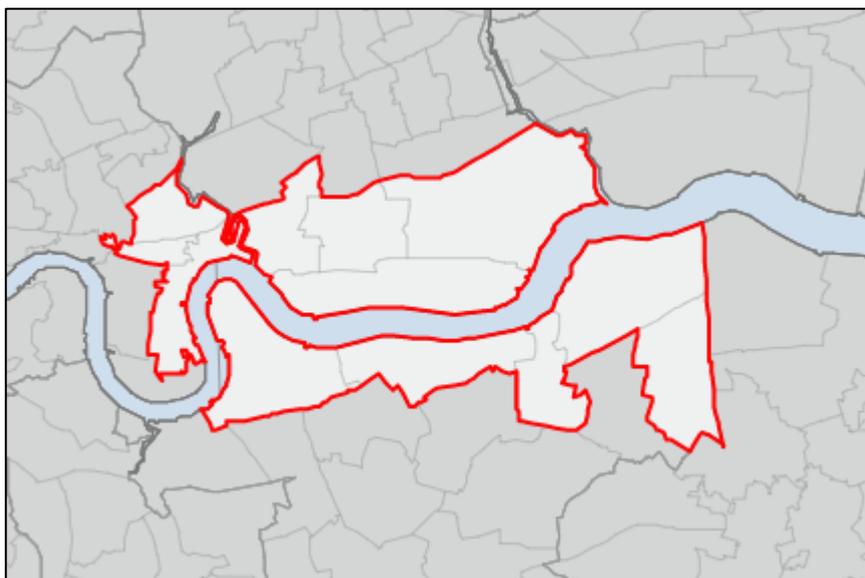
12.3.6 The following study areas are used in the assessment:

- The 'site-specific' population (see below);
- The 'local' population is defined using the local authority areas of Newham, Greenwich and Tower Hamlets (as appropriate to the determinant of health assessment);
- The 'regional' population is defined using the area of Greater London;
- The 'national' population is defined with reference to England; and
- The 'international' population is defined with reference to global effects relevant to international travel and transboundary effects.

12.3.7 The site-specific population, unless defined within the assessment with reference to the zone of influence set out in other ES chapters, is defined for the health assessment using the 12 area wards of: Royal Docks, E05000491; Custom House, E05000479; Beckton, E05000475; Thamesmead Moorings, E05000228; Abbey Wood, E05000214; Glyndon, E05000221; Woolwich Riverside, E05000230; Peninsula, E05000225; Blackwall & Cubitt Town, E05009318; Poplar, E05009328; Lansbury, E05009325; and Canning Town South, E05000478.

12.3.8 These site-specific wards have been selected on the basis of proximity to the airport and areas of higher deprivation. The area covered by the 12 wards is shown in **Error! Reference source not found..**

**Figure 12.1: Site-specific population area (Local Health (OHID, 2022b))**



12.3.9 For the purposes of baseline data collection, the following sub-set of site-specific wards have also been selected to reflect an appropriate range of areas with the highest levels of deprivation. These wards provide a realistic worst-case basis for determining population sensitivity for site-specific populations.

- Royal Docks, E05000491 (the airport site);
- Custom House, E05000479 (an area of higher deprivation to the north and west); and
- Abbey Wood, E05000214 (an area of higher deprivation to the south and east).

### Assessment Scenarios

12.3.10 The assessment of health effects considers the following scenarios and assessment years:

- 2019 Baseline Year;
- Do Minimum (DM) Scenario in the principal year of assessment, 2031; and
- Development Case (DC) Scenario in the principal year of assessment, 2031.

12.3.11 Other intervening assessment years, e.g. 2025 and 2029, are considered as appropriate where these are assessed by other technical chapters listed in paragraph 12.1.7.

12.3.12 The assessment also considered the two sensitivity tests, as set out in Chapters 3 and 4 of the ES, which reflect growth in passengers being faster or slower than in the core DC Scenario. Under the Faster Growth Scenario 9mppa is forecast to be reached in 2029. Under the Slower Growth Scenario 9mppa is forecast to be reached in 2033. The assessment considers if there would be new or materially different conclusions between the core DC Scenario and the Faster Growth and Slower Growth Scenarios.

12.3.13 Finally, the assessment considers if there would be new or materially different conclusions from those reached by the 2015 HIA. Where there are comparable assessments, these provide informative point of comparison as part of a qualitative professional judgment.

### Baseline Characterisation

12.3.14 The approach to defining the baseline involved collation and interpretation of published demographic, socio-economic and existing public health and healthcare capacity data.

12.3.15 The baseline was established through a desk-based study to gather relevant up-to-date health indicator data at the ward, local authority, regional and national level.

12.3.16 The health baseline is reported in Appendix 12.3, as well as indicators relevant to a particular issue being discussed within the assessment section of this chapter.

12.3.17 The following data sources have been used:

- Office of Health Improvement and Disparities (OHID) Fingertips: Local Authority Health Profiles (OHID, 2022a) and Local Health (OHID, 2022b);
- Office of National Statistics (ONS) and official labour market statistics (NOMIS) statistics. If available, 2021 census data has been included (NOMIS, 2022);
- Indices of deprivation mapping 2019, including 'Index of multiple deprivation' and individual sub-domains (Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government, 2019);
- Google Earth Pro 2021 aerial and street level photography review; and
- Local Joint Strategic Needs Assessment (JSNA) and Health and Wellbeing Strategy (HWS) reports have been analysed to provide additional context on local health circumstances, inequalities and public health priorities as appropriate.

12.3.18 Different communities have varying susceptibility to health and wellbeing effects (both adverse and beneficial) as a result of social and demographic structure, behaviour and relative economic circumstances.

12.3.19 These baseline data have been used to better understand local health and socio-economic circumstances. This understanding supports bespoke mitigation and community support initiatives tailored to local circumstances and need, where appropriate.

## General Approach

12.3.20 The health assessment methodology uses best practice, as published by IEMA 2022 Guidance on Health in EIA series, effective scoping (Pyper, et al., 2022a) and determining significance (Pyper, et al., 2022b). This guidance references out to further information in:

- IPH Health Impact Assessment Guidance, Standalone HIA and health in environmental assessment (Institute of Public Health, 2021); and
- IAIA and EUPHA 'Human Health: Ensuring a high level of protection', a reference paper on addressing Human Health in EIA (2020) (International Association for Impact Assessment and European Public Health Association, 2020).

12.3.21 The human health assessment is a qualitative analysis, following the IEMA 2022 guidance approach, which draws on qualitative and quantitative inputs from other EIA topic chapters. This is considered the most appropriate methodology for assessing wider determinants of health proportionately, consistently and transparently.

12.3.22 As set out in guidance the assessment methods allow a consideration of the effect on population health outcomes and what this means for public health, drawing on, as relevant, the: scientific literature; health baseline change; local health priorities; health policy context; compliance with regulatory or statutory standards; and consultation.

12.3.23 The approach taken ensures that HIA is embedded within the EIA in line with good practice (London Borough of Newham, 2018; Public Health England, 2020).

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

## Significance Criteria

12.3.25 The methodology for assessing the significance of health effects follows the IEMA 2022 Guidance, which sets out best practice for the consideration of health in EIA.

12.3.26 The assessment conclusions are presented in both EIA categories of significance, such as major, moderate, minor or negligible; and a narrative explaining this 'score' with reference to evidence, local context and any inequalities. The IEMA guidance sets out the criteria and indicative levels that support the professional judgement in 'scoring' and presenting a narrative.

12.3.27 The subsequent tables together summarise the assessment criteria adopted. The approach uses professional judgement, drawing on consistent and transparent criteria for determining the sensitivity of the population or sub-population group and the magnitude of the impact. It also references relevant contextual evidence to explain what significance means for human health in public health terms. While a judgment is made based on most relevant criteria, it is likely in any given analysis that some criteria will span score categories.

**Table 12.2: Population or Sub-population Sensitivity Criteria**

Category/ Score	Indicative criteria
High	<b>High</b> levels of deprivation (including pockets of deprivation); <b>reliance</b> on resources shared (between the population and the proposed development); existing <b>wide</b> inequalities between the most and least healthy; a community whose outlook is predominantly anxiety or <b>concern</b> ; people who are <b>prevented</b> from undertaking daily activities; <b>dependants</b> ; people with <b>very poor</b> health status; and/or people with a <b>very low</b> capacity to adapt.
Medium	<b>moderate</b> levels of deprivation; <b>few alternatives</b> to shared resources; existing <b>widening</b> inequalities between the most and least healthy; a community whose outlook is predominantly <b>uncertainty</b> with some concern; people who are <b>highly limited</b> from undertaking daily activities; people providing or requiring <b>a lot of care</b> ; people with <b>poor</b> health status; and/or people with a <b>limited</b> capacity to adapt.
Low	<b>low</b> levels of deprivation; <b>many alternatives</b> to shared resources; existing <b>narrowing</b> inequalities between the most and least healthy; a community whose outlook is predominantly <b>ambivalence</b> with some concern; people who are <b>slightly limited</b> from undertaking daily activities; people providing or requiring <b>some care</b> ; people with <b>fair</b> health status; and/or people with a <b>high</b> capacity to adapt.
Very low	<b>very low</b> levels of deprivation; <b>no</b> shared resources; existing <b>narrow</b> inequalities between the most and least healthy; a community whose outlook is predominantly <b>support</b> with some concern; people who are <b>not limited</b> from undertaking daily activities; people who are independent (not a carer or dependant); people with <b>good</b> health status; and/or people with a <b>very high</b> capacity to adapt.

**Table 12.3: Health Magnitude of Impact Criteria**

Category/ Score	Indicative criteria
High	<b>High</b> exposure or scale; <b>long-term</b> duration; <b>continuous</b> frequency; severity predominantly related to <b>mortality</b> or changes in morbidity (physical or mental health) for very severe illness/injury outcomes; <b>majority</b> of population affected; <b>permanent</b> change; <b>substantial</b> service quality implications.
Medium	<b>Low</b> exposure or <b>medium</b> scale; <b>medium-term</b> duration; <b>frequent</b> events; severity predominantly related to moderate changes in <b>morbidity</b> or major change in quality-of-life; <b>large minority</b> of population affected; <b>gradual</b> reversal; <b>small</b> service quality implications.
Low	<b>Very low</b> exposure or <b>small</b> scale; <b>short-term</b> duration; <b>occasional</b> events; severity predominantly related to minor change in <b>morbidity</b> or moderate change in quality-of-life; <b>small minority</b> of population affected; <b>rapid</b> reversal; <b>slight</b> service quality implications.
Negligible	<b>Negligible</b> exposure or scale; <b>very short-term</b> duration; <b>one-off</b> frequency; severity predominantly relates to a minor change in <b>quality-of-life</b> ; <b>very few</b> people affected; <b>immediate</b> reversal once activity complete; <b>no</b> service quality implication.

12.3.28 The assessment of significance is informed by the indicative assessment matrix set out in Table 12.4.

**Table 12.4: Indicative Significance of Effect Assessment Matrix**

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

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

12.3.30 Effects of moderate and above are considered significant in terms of the EIA Regulations.

**Table 12.5: Health Significance of Effect Criteria**

Category/ Score	Indicative criteria
Major (significant)	<p>The narrative explains that this is significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> <li>➤ Changes, due to the proposed development, have a <b>substantial</b> 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 <b>consensus</b> on the importance of the effect.</li> <li>➤ Change, due to the proposed development, could result in a regulatory threshold or statutory standard being <b>crossed</b> (if applicable).</li> <li>➤ There is likely to be a <b>substantial</b> change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a <b>causal</b> relationship between changes that would result from the proposed development and changes to health outcomes.</li> <li>➤ In addition, health priorities for the relevant study area are of <b>specific</b> relevance to the determinant of health or population group affected by the proposed development.</li> </ul>
Moderate (significant)	<p>The narrative explains that this is significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> <li>➤ Changes, due to the proposed development, have an <b>influential</b> 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 <b>mixed views</b>.</li> <li>➤ Change, due to the proposed development, could result in a regulatory threshold or statutory standard being <b>approached</b> (if applicable).</li> <li>➤ There is likely to be a <b>small</b> change in the health baseline of the population, including as evidenced by the effect size and scientific literature showing there is a <b>clear</b> relationship between changes that would result from the proposed development and changes to health outcomes.</li> <li>➤ In addition, health priorities for the relevant study area are of <b>general</b> relevance to the determinant of health or population group affected by the proposed development.</li> </ul>
Minor (not significant)	<p>The narrative explains that this is not significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> <li>➤ Changes, due to the proposed development, have a <b>marginal</b> 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 <b>no</b> relevant consultation themes emerge among stakeholders.</li> <li>➤ Change, due to the proposed development, would be <b>well within</b> a regulatory threshold or statutory standard (if applicable); but could result in a guideline being crossed (if applicable).</li> <li>➤ There is likely to be a <b>slight</b> change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is only a <b>suggestive</b> relationship between changes that would result from the proposed development and changes to health outcomes.</li> <li>➤ In addition, health priorities for the relevant study area are of <b>low</b> relevance to the determinant of health or population group affected by the proposed development.</li> </ul>
Negligible (not significant)	<p>The narrative explains that this is not significant for public health because (select as appropriate):</p> <ul style="list-style-type: none"> <li>➤ Changes, due to the proposed development, are <b>not related</b> 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 <b>no responses</b> on this issue among stakeholders.</li> <li>➤ Change, due to the proposed development, would <b>not affect</b> a regulatory threshold, statutory standard or guideline (if applicable).</li> <li>➤ There is likely to be a <b>very limited</b> change in the health baseline of the population, including as evidenced by the effect size and/or scientific literature showing there is an <b>unsupported</b> relationship between changes that would result from the proposed development and changes to health outcomes.</li> <li>➤ In addition, health priorities for the relevant study area are <b>not</b> relevant to the determinant of health or population group affected by the proposed development.</li> </ul>

## Assumptions and Limitations

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

12.3.32 Baseline data includes indicators where the available public data is pre-Covid-19, or that have yet to show the full impacts of the pandemic for public health. The baseline has also been prepared at a time when census 2011 data is gradually being updated by releases of 2021 data. The baseline is however considered sufficient and robust in evidencing that there are vulnerable population groups with high sensitivity in the study area. New data would be unlikely to change that conclusion as a 'high' sensitivity is already assigned to vulnerable groups, and any new data would not change this.

12.3.33 The health and wellbeing assessment partially draws from and builds upon, the technical outputs from the other technical chapters of the ES, namely: Chapter 7 – Socio-economics; Chapter 8 – Noise and Vibration; Chapter 9 – Air Quality; Chapter 10 – Surface Access; Chapter 11 – Climate Change; and Chapter 14 – Cumulative Effects.

12.3.34 As a consequence, the assumptions and limitations of those assessments also apply to any information used in this chapter (e.g. for modelling work undertaken). It is, however, considered that the information available provides a suitable basis for assessment.

## 12.4 Baseline Conditions

12.4.1 This section summaries the health baseline. Additional baseline information, including small area ward level data, which has been taken into account by the assessment, is set out in Appendix 12.3.

12.4.2 Different communities have varying susceptibilities to health impacts and benefits as a result of social and demographic structure, behaviour and relative economic circumstances. This section sets out relevant health baseline information. Chapter 7 – Socio-economics also includes data on issues such as ethnicity, labour market indicators and deprivation that have been taken into account.

12.4.3 The aim of the following information is primarily to put into context the local health circumstances of the communities within the local and wider study area. It should be noted that the description of the whole population, and the populations within the local and wider study area, does not exclude the probability that there will be some individuals or groups of people who do not conform to the overall profile.

### Existing Baseline

12.4.4 This section focuses on local area public health indicators for the wards immediately around the airport. The section starts with summary statistics for an aggregate of 12 ward areas around the airport (see paragraph 12.3.7). This characterises the size and key health attributes of the population immediately around the airport. For the purpose of proportionately determining sensitivity with more detailed health statistics, three of these wards (see paragraph 12.3.9) are selected and individually described in greater detail within Appendix 12.3. The 3 wards reflect the closest and most deprived areas and are therefore indicative of a realistic worst-case basis for assessment. The 12 and 3 ward approaches confirm that high sensitivity is appropriate for vulnerable groups. Finally wider local area statistics are referenced.

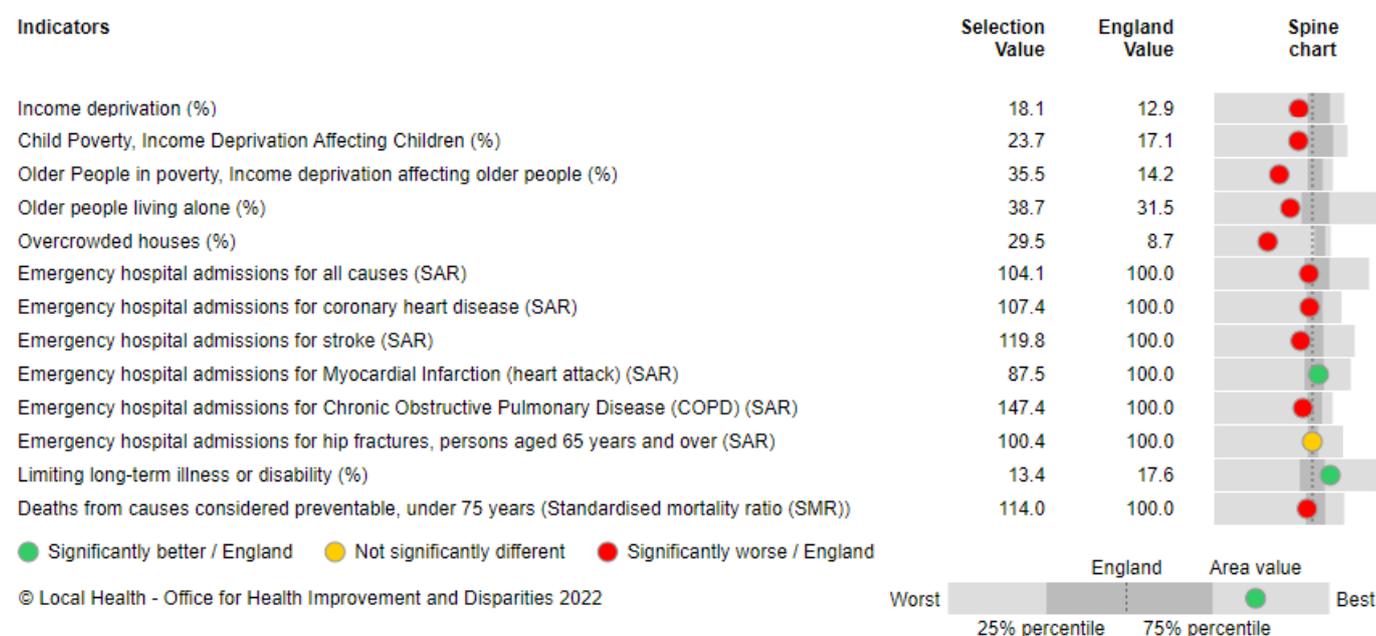
12.4.5 The 12 wards have a total estimated population of 224,206 people (2021). The age structure is shown in **Table 12.6**. The 0 to 15 year of age category is indicative of the sub-population vulnerable due to young age (22% of the population, which is slightly above the national average). The 65 years and over category is indicative of the sub-population vulnerable due to older age (6.5% of the population, which is well below the national average).

**Table 12.6: Site-specific population age structure (Local Health (OHID, 2022b))**

Indicators	12 Wards	England
Percentage of the total residential population who are 0 to 15 years of age, 2020 (%)	22.2	19.2
Percentage of the total residential population who are 16 to 24 years of age, 2020 (%)	10.9	10.5
Percentage of the total residential population who are 25 to 64 years of age, 2020 (%)	60.2	51.8
Percentage of the total residential population who are 65 and over, 2020 (%)	6.6	18.5
Total population, Mid 2020	224,206	56,550,138

12.4.6 Key health indicators that support characterising the sensitivity of the 12 ward population are set out in **Table 12.7**. The data shows that the population is particularly sensitive to socio-economic conditions, with above average income deprivation and poverty for both older and younger groups. The population also includes those who are vulnerable due to poor health, including in relation to chronic obstructive pulmonary disease, stroke and coronary heart disease. This indicates increased sensitivity for vulnerable groups to cardiovascular and respiratory effects. Despite this trend, on some measures the population shows better than average health outcomes, for example hospital admissions for heart attack. Notably, and consistent with having fewer older people than average, the proportion of people with limiting long-term illness or disability (13.4%) is lower than the national average.

**Table 12.7: 12 ward population representative health indicators (Local Health (OHID, 2022b))**



12.4.7 Trends are similar for the 3 ward statistics set out in Appendix 12.3. Whilst indicators for the population closest to the airport (Royal Docks ward) suggest lower sensitivity across most measures; in the neighbouring deprived wards, particularly Custom House but also Abbey Wood, higher sensitivity is evident. The higher sensitivity has been used as the basis for assessment.

12.4.8 Local area population data has also been collected for the Newham, Greenwich and Tower Hamlets local authorities (LAs), which together make up the local study area. Where ward level data is not available, data for these local authorities has been collected as a representative alternative geography. This reflects that as the spatial resolution increases the number of available public health indicators increases. Some local authority level data is therefore also relevant in determining the sensitivity of the site-specific population. Regional (London) and national (England) averages have been used as relevant comparators.

12.4.9 The following summarises relevant health issues in the Local study area.

12.4.10 The health of people in in the Local study area is varied compared with the England average. The presence of vulnerable groups and pockets of deprivation is noted. All of these local authorities have lower layer super output areas<sup>1</sup> (LSOAs) within the 20% most deprived districts/unitary authorities in England and about 20% of children live in low-income families. Between 25% and 28% of children in year 6 are classified as obese. There are issues of adult physical activity, excess weight and cardiovascular risk. Compared to the England average, the rates of under 75 mortality from cardiovascular diseases are worse in Newham and Tower Hamlets, but similar to the England average in Greenwich. In Newham and Greenwich, the rates of people killed and seriously injured on roads are better than the England average, whilst in Tower Hamlets the rates are worse than the England average.

12.4.11 Newham and Tower Hamlets have particularly high rates of mortality attributable to air quality. Baseline sensitivity on this issue is taken into account in the assessment.

### Port Health

12.4.12 The existing airport has 63 staff members who are trained to provide first aid with an additional 33 Fire Service personnel on site. In addition, there is a total of 7 Automated External Defibrillators (AEDs) located within the airport with a further 13 due to be installed. The airport is therefore prepared to respond, treat, and if required call for emergency assistance from the London Ambulance Service NHS Trust.

12.4.13 Port Health services are provided by the London Port Health Authority. Port Health undertakes the following statutory activities, which are scaled with increased passenger growth: imported food and feed controls; infectious disease controls; food safety and hygiene, including water quality; environmental controls, including noise, refuse, and industrial emissions; and a 24-hour standby service for infectious disease control available every day of the year. The London Port Health Authority works with the UKHSA and LBN as required.

### Future Baseline (DM Scenario)

12.4.14 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.

12.4.15 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.

12.4.16 Climate change may also exacerbate physical and mental health risk factors, particularly around flooding and extremes of temperature. The baseline indicates that the populations of Newham, Greenwich and Tower Hamlets include both those who are relatively affluent and would therefore be expected to be relatively resilient to climate change stresses; it also includes more deprived communities who would be most sensitive to the adverse health effects of climate change.

The DM Scenario is discussed in more detail in the assessment that follows from section 12.6.

## 12.5 Embedded Mitigation and Existing Controls

12.5.1 The health assessment accounts for embedded mitigation including those required under the existing planning conditions attached to the CADP1 planning permission and S106 Agreement obligations. These measures are set out in other EIA topic chapters and are not repeated here (see Chapter 7 – Socio-economics,

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<sup>1</sup> Lower Layer Super Output Areas (LSOA) are a geographic hierarchy designed to improve the reporting of small area statistics in England and Wales.

section 7.5; Chapter 8 – Noise and Vibration, section 8.5; Chapter 9 – Air Quality, section 9.5; Chapter 10 – Surface Access, section 10.5; and Chapter 11 – Climate Change, section 11.5). For example, Chapter 8 discusses the Sound Insulation Scheme and Chapter 9 discusses the Air Quality Action Plan (2020-2022) approved by LBN.

12.5.2 To avoid double counting the benefits of existing mitigation and controls, the health assessment input is the residual effect conclusions of these chapters.

12.5.3 Positive health outcomes to airport staff and the wider local population are expected to be derived from existing and proposed initiatives described in **Chapter 7 – Socio-Economics**. In particular, as part of this S73 application, the following mitigation is proposed in the DC scenario (these will be confirmed and secured via the S106 agreement):

- A Community Fund of £3.85 million which could be used to fund a variety of community interventions that improve the lives of those living under the flight path.
- An Employment and Education contribution of up to £1.9m to LBN.
- Continued and expanded existing employment and training initiatives.

12.5.4 The 2015 HIA included a Health Action Plan. The measures within that plan remain relevant and, in some areas, will be improved upon as part of the proposed development. The measures will form part of a new S106 or amended conditions as appropriate. In summary, the Health Action Plan notes that the airport already provides noise mitigation that surpasses Government recommendations and operates an array of community support initiatives and on-going engagement that target the underlying factors defining local burdens of poor health and inequality. Key measures within the plan include:

- The Construction Environmental Management Plan (CEMP) (as approved under Condition 88 of the CADP1 consent) will be supported through a committed engagement strategy building from LCY's on-going engagement with stakeholders and local communities before and during work on site. Engagement will be applied to both inform local communities as to planned and potentially disruptive works, but also to record community concerns and complaints. This will help inform, refine and enhance the construction process and the proposed mitigation, where appropriate;
- In relation to air noise management, LCY operates a comprehensive and leading UK airport air noise management programme. It will continue to operate existing mitigation schemes, and, where appropriate, seek to improve the various noise mitigation measures in place at the airport that have successfully ensured that noise effects to the local community have been, and will continue to be, controlled to acceptable levels;
- LCY's Noise Monitoring and Mitigation Strategy (NOMMS) sets out a framework to provide a more robust system of noise control, reporting and mitigation. This includes the measurement and monitoring of ground based sources as well as airborne noise;
- Under the proposed development, LCY will continue to operate the Sound Insulation Scheme. For further details see Chapter 8 Noise and Vibration, and Chapter 15 Mitigation;
- Any eligible properties that fall within the 69 dB LAeq,16h noise contour will receive an offer from LCY to purchase the property at the open market value within 6 months of the owner/occupier making an application for the Airport to do so. To date, no properties fall within this noise contour;
- CADP1 includes the provision of new and enhanced cycle and pedestrian ways to increase the modal split of walking, cycling and use of the east London river crossings for staff and passengers alike. Additional secure cycle parking and appropriate staff facilities are also included to further enhance the uptake of active transport. Such provision not only improves permeability of the airport and for existing communities for pedestrians by reducing the walk distance from areas to the east, but also improves safety, by further segregating pedestrian and cycle paths from roads;
- LCY already operates a comprehensive engagement programme with local communities and stakeholders alike. For example, the London City Airport Consultative Committee, The 'Inside E16' community newsletter and London City Airport's Air Transport Forum. These were used to engage and discuss CADP1. LCY will utilise such communication channels/forums to continue to raise awareness as to the

programme for CADP1 construction activities, emerging employment opportunities, and complaint contact details and procedures to address community concerns;

- LCY will continue to support education attainment and employment through the London City Airport's Education Excellence Programme. The programme helps young people and adults develop the skills and attributes required for future employment, either at the Airport or elsewhere. The projects delivered within the programme focus on basic skills, raising aspirations and attitude for employment;
- LCY already supports local education and employment through a series of interlinked initiatives. The 'Take off into work' employment programme with East London Business Alliance comprises a two week employability training course and then a two week work placement at the Airport within departments such as customer service, retail and car hire. The programme takes place five times per year, with up to 15 candidates and is open for applications from all Newham residents over 16 who are not in employment or education;
- LCY will also continue to advertise training, education and employment opportunities through its newsletter and to work with local employment agencies and training institutes to maximise the uptake of employments locally; and
- The existing LCY Health and Wellbeing programme is intended to support staff and neighbouring communities to engage in healthy activities.

## 12.6 Assessment of Effects

12.6.1 The assessment section provides commentary on the construction phase (Section 12.7) and detailed analysis of the operational phase from Section 12.8. The operational phase covers the following health determinants:

- Section 12.9 Environmental Effects: Noise
- Section 12.10 Healthy Lifestyles: Use of Open Space
- Section 12.11 Safe and Cohesive Communities: Community Identity
- Section 12.12 Safe and Cohesive Communities: Transport
- Section 12.13 Socio Economic Effects: Good Quality Employment
- Section 12.14 Socio Economic Effects: Training Opportunities
- Section 12.15 Environmental Effects: Air Quality
- Section 12.16 Environmental Effects: Air Quality - Ultra Fine Particles
- Section 12.17 Environmental Effects: Climate Change
- Section 12.18 Health and Social Care Services: NHS Routine Service Planning

## 12.7 Construction Phase Effects

12.7.1 There are no proposed changes to the approved buildings or infrastructure as part of this application and therefore no additional construction activity associated with the proposed development beyond what has previously been assessed and approved. Construction related effects are therefore as assessed in the 2015 UES and 2015 HIA.

12.7.2 The 2015 HIA concluded:

*"Taking into account the likely level of emissions generated on-site during construction, their intermittent nature/duration and minimal opportunity for community exposure, the risk to community health is not of a level to quantify any meaningful adverse health outcome"*

12.7.3 Minor physical changes such as the provision of new pedestrian crossing facilities at Hartmann Road as part of the forecourt layout to improve pedestrian connections to the airport are not considered to be a scale of construction activity that would warrant assessment.

12.7.4 Similarly, as set out in other ES chapters, the revised construction programme is not expected to result in any new or materially different effects to those assessed as part of the 2015 UES. Such changes are therefore not assessed further in this health assessment. For further details see Chapter 7 – Socio-economics;

Chapter 8 – Noise and Vibration; Chapter 9 – Air Quality; Chapter 10 – Surface Access; and Chapter 11 – Climate Change.

12.7.5 The construction programme is set out in Chapter 6 of this ES. Construction traffic associated with the proposed development is incorporated into the predicted traffic flows for each operational assessment year between 2025 and 2031, due to the overlap between the construction phase and operational years. Accordingly, the traffic model, and the technical assessments which are based upon it (surface access, air quality, noise and climate change) all inherently assess the impacts associated with construction traffic as part of the assessment. As these assessments feed into this health assessment, the health assessment too inherently assesses impacts associated with construction traffic.

## 12.8 Operational Phase Effects

12.8.1 As a S73 application the findings of the original CADP1 application are a relevant reference point. For this ES chapter that reference point is the 2015 HIA. The following bullets summarise its scope and key conclusions. Items in bold are determinants of health that are assessed by both the 2015 HIA and this ES Chapter. This shows that the current assessment covers a broader range of issues.

12.8.2 The 2015 HIA assessed:

- Changes in local road **transport** nature and flow rates, finding the change “is not predicted to impact upon local road capacity, materially impact upon road safety or adversely impact upon community severance”;
- Direct, indirect and induced income **employment** opportunities, finding “significant socio-economic health benefits at a regional and local level”;
- Changes in **noise** exposure, finding the change: “[in air noise] will not impact upon sleep disturbance [and is] not of a level to quantify any impact upon academic performance[; ground noise levels] “are not of a level to quantify any measurable adverse health outcome”[; and traffic noise is] “not significant ”; and
- Changes to local **air quality** (emissions to air), finding “the relative change in concentration exposure are not of an order to quantify any meaningful adverse health outcome”.

12.8.3 This ES health chapter assesses:

- Healthy lifestyles: Use of open space;
- Safe and cohesive communities: Community Identity; and **Transport**;
- Socio Economic Effects: Good quality **employment**; and Training Opportunities;
- Environmental Effects: **Noise**; **Air quality**; Ultra Fine Particulates; and Climate Change; and
- Health and Social Care Services: NHS Routine Service Planning.

## 12.9 Environmental Effects: Noise

12.9.1 This section considers the population health implications of changes in day-time and night-time noise from aviation (both air noise and ground noise), as well as from surface access.

12.9.2 As explained in **Chapter 8**, the primary metric for quantifying community effects of aircraft noise in the UK are  $L_{Aeq,16h}$ , which is an average noise metric covering the daytime period and  $L_{Aeq,8h}$  covering the night-time period from 23:00 to 07:00. Other supplementary metrics reported in Chapter 8 are also taken into account by the health assessment to reflect how aircraft noise may be experienced. These include:

- Single mode contours ( $L_{Aeq,16h}$ ), westerly and easterly;
- Number of people likely to be highly annoyed;
- Number of people likely to be highly sleep disturbed;
- Day, evening, night contours ( $L_{den}$ );
- Night noise contours ( $L_{night}$ ); and
- $N_x$  and  $L_{Amax}$  noise contours.

12.9.3 **Chapter 8** explains the thresholds applied to the  $L_{Aeq,16h}$  and  $L_{Aeq,8h}$  primary metrics. The most relevant for the health assessment are the Significant Observed Adverse Effect Level (SOAEL) and Lowest Observed Adverse Effect Level (LOAEL). The levels for SOAEL and LOAEL and the relative changes in noise levels taken into account in this assessment are set out in **Chapter 8**.

12.9.4 Noise effects relating to day-time amenity of public open spaces, has been covered in the section on 'Healthy lifetimes, use of open space'. To avoid double counting such effects are not considered in this section. This section covers other outcomes from noise, such as cardio-metabolic, sleep disturbance and annoyance outcomes.

12.9.5 Noise is an important public health issue. It has negative impacts on human health and well-being and is a growing concern (WHO, 2018). Noise is pervasive in everyday life and can cause both auditory and non-auditory health effects (Basner, et al., 2014). Noise is linked to health outcomes such as annoyance, sleep disturbance, cardiovascular and metabolic disease, and cognitive impairment in schoolchildren (Peris & Fenech, 2020). Physiologically, noise leads to oxidative stress, vascular dysfunction, autonomic imbalance, and metabolic abnormalities (Münzel, et al., 2018).

12.9.6 In terms of mental health, wellbeing and quality of life evidence from UK studies is mixed. The national Survey of Noise Attitudes 2014 failed to find associations between aircraft noise and self-reported health or the Warwick Edinburgh Mental Wellbeing Scale. A UK study using census data for people living around 17 airports and a measure of wellbeing, found that day-time aircraft noise was associated with wellbeing, but no association was found between night-time aircraft noise exposure and wellbeing. Another study from the United Kingdom using census data from around Belfast Airport failed to find an association between aircraft noise and self-reported mental health (Clark, Crumpler, & Notley, 2020).

12.9.7 The context of how noise is associated with health outcomes is also important. A WHO systematic review (Basner & McGuire, 2018) found that when individuals were asked whether road, rail, or aircraft noise affected sleep a significant increase in the odds of being highly sleep disturbed was found for a 10 dBA increase in outdoor noise levels for all sources. However, no significant increase was found when the noise source was not mentioned in the question. This suggests that for self-reported measures it is annoyance or attitude to the noise that may be driving the increase of reported disturbance. 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 and the higher sensitivity and vulnerability of subsets of the population. 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. Such issues, such as frequency, tone and character has been taken into account, e.g. the sound characteristics of the A220 aircraft. The following points from the WHO systematic review on noise are also noted as they give context to any change in noise levels:

- Noise is only one reason for sleep disturbance. There are many other external (e.g., temperature, humidity, light levels) and internal (e.g., sleep disorders, health conditions, bad dreams) causes;
- Whether or not noise will disturb sleep also depends on situational (e.g., depth of sleep phase, background noise level) and individual (e.g., noise sensitivity) moderators; and
- It is normal for a healthy adult to briefly awakens approximately 20 times during an 8 h bed period (most of these awakenings are too short to be remembered the next morning).

12.9.8 The WHO 2009 night noise guidelines (WHO, 2009) find that where a population is exposed to average annual night-time noise above 55dB (the SOAEL used in this assessment) "*The situation is considered increasingly dangerous for public health. Adverse health effects occur frequently, a sizeable proportion of the population is highly annoyed and sleep-disturbed. There is evidence that the risk of cardiovascular disease increases*". Such conclusions are a clear indication that where the SOAEL is experienced across the whole or great majority of a population (which is not the case here), this would be significant for public health. The WHO noise guidelines (WHO, 2018) also confirms on a composite day-evening-night metric ( $L_{den}$ ) that the evidence for changes in cardiovascular health outcomes is limited, particularly where changes are much smaller than 10dB (which is the case here):

- there is “very low quality” evidence for a change in the relative risk of ischaemic heart disease incidence (RR of 1.09, 95% CI: 1.04–1.15, per 10dB increase above 47dB).
- there is “low quality” evidence for a change in the relative risk of hypertension incidence (RR of 1.0 (i.e. no risk change), 95% CI: 0.77–1.30 per 10dB increase).

12.9.9 Effects related to annoyance are likely to be the dominant health outcome. Effects may also relate to sleep disturbance and educational outcomes (WHO Environmental Noise Guidelines 2018, Section 3.3, Tables 29 and 31).

12.9.10 In terms of vulnerable groups, the results from sleep studies in children have suggested that they are less likely to awaken to noise events than adults, with a difference in sensitivity of approximately 10 dBA. However, despite being less sensitive, children are still considered a vulnerable group due to their developmental state and also because of the difference in their sleep patterns. Children have earlier bedtimes and longer sleep durations than adults, which may overlap with periods not accounted for by night-time metrics (Basner & McGuire, 2018). Children are also more vulnerable for cognitive effects of noise. They are not per se more vulnerable as a group, but more at risk because of less-developed coping strategies, and they are in a sensitive developmental period. This is indicative of a life phase effect rather than an age effect. Children seem to be less vulnerable for awakenings due to noise but more vulnerable for physiological effects during sleep and related motility (van Kamp & Davies, 2013). Evidence does not indicate that the elderly are more vulnerable to noise in terms of annoyance and sleep disturbance. Age-specific comparisons rather show an inverted U-shaped relation and indicate that both young and older people are less at risk as far as annoyance and disturbance are concerned. But possibly, the elderly are more vulnerable regarding cardiovascular effects, and this may be a combined effect of air pollution and noise (van Kamp & Davies, 2013).

12.9.11 The health assessment highlights any instances where the change in noise results in widespread new exposures, or reductions in exposures, across a population which are above thresholds defined in the Chapter 8 noise assessment as being significant (i.e. above SOAEL). In such cases, populations are defined in relation to the relevant geographic extent for the source of exposure, with a focus on small area populations rather than the full local authority or regional population. Within these populations, vulnerabilities to noise are considered including where day-time rest is important due to poor health or age. Any widespread changes in noise below the thresholds of noise assessment significance are also considered in relation to the public health implication (i.e. between LOAEL and SOAEL).

12.9.12 The key health outcomes relevant to this determinant of health are cardiovascular and cardio-metabolic, as well as mental health outcomes (e.g. stress, anxiety or depression relating to annoyance). Sleep disturbance, particularly associated with changes to night-time noise levels, has the potential to affect day-time functioning, physical health and mental health. Cognitive performance in children, particularly at school is also a potential outcome.

12.9.13 The proposed development has implications for aircraft type and flight scheduling. For example, with the proposed development there would be an increase from 6 to 9 flights between 06:30 and 06:59, which forms part of the  $L_{Aeq,8h}$  noise metric night-time period (but not part of the 8 hour night-time 22:30-06:30 respite period). There is also the extension of operating hours on Saturday for cleaner, quieter, new generation aircraft. Flight scheduling and passenger numbers also have implication for passenger travel to and from the Airport, so influence surface access noise.

12.9.14 This section has been informed by Chapter 8 – Noise, which sets out relevant assessment findings and mitigation measures that have been taken into account.

12.9.15 **Chapter 8** concludes for air noise: that in 2025 there is a negligible to minor adverse effect, primarily due to an increase in night noise in the DC scenario. Night noise continues to be higher for the DC scenario than 2019 or the DM scenario, but the increase compared to DM in 2027 and 2031 has been rated as a negligible effect. The daytime and weekend effects comparing DM and DC are less than for night. For 2027 and 2031 the air noise daytime and weekend impacts have been rated as a negligible effect, and the night-time

negligible to minor adverse. Chapter 8 concludes that effects related to ground noise are negligible to minor adverse and road traffic noise effects are negligible.

12.9.16 Consistent with the quantitative analysis discussed in Chapter 8, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario. Regard is also given to effects in 2025 and 2027 to discuss situations where effects are greater than in 2031. Reference to the 2019 baseline is also provided to give context to the experience of changes relative to pre-Covid pandemic levels.

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

- The source is aviation (ground noise and air noise) and surface access (road traffic noise);
- The pathway is pressure waves through the air; and
- Receptors are residents in the local communities near the Airport and its flightpaths.

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

12.9.19 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 8 air noise zone of influence based on the extent of the contours corresponding to the LOAEL (see Chapter 8 Figure 8.3.2), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 12.3.7;
- The 'site-specific' geographic population of communities in the Chapter 8 ground noise zone of influence, the health sensitivity of which is indicatively based on representative wards close to the airport, as set out above;
- The 'site-specific' geographic population of communities in the **Chapter 8** surface access noise zone of influence, the health sensitivity of which is indicatively based on representative wards close to the airport, as set out above;
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people including for educational disturbance);
  - Old age vulnerability (older people may spend more time in affected dwellings);
  - Low-income vulnerability (people living in deprivation, including those on low incomes may have fewer resources to adapt, e.g. seek respite or install insulation; furthermore, those who are economically inactive may spend more time in affected dwellings);
  - Poor health vulnerability (people with existing poor physical and mental health may spend more time in affected dwellings); and
  - Access and geographical vulnerability (people for whom close proximity to project change increases sensitivity).

12.9.20 The sensitivity of the general population is considered to be medium. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. The classification of medium reflects that existing noise stressors affect a wide area and the population is likely to have heightened sensitivity to aviation noise as an issue. Existing proximity to the baseline noise conditions of the Airport and its flightpaths, as well as local road network suggests the affected population already has a level of exposure to transport noise that affects cardio-metabolic, annoyance, educational and sleep disturbance outcomes.

12.9.21 The sensitivity of the vulnerable sub-population is considered high. This reflects the presence of populations who are likely to spend extended periods near to the Airport, its flightpaths within the **Chapter 8** zone of influence for LOAEL, or parts of the local transport network that are expected to experience additional movements. Vulnerability in this case is particularly linked to: living close to sources of noise; age (both young people and older people); existing poor health (e.g. long-term illness); spending more time in affected dwellings (e.g. due to low economic activity, shift work or ill health); vulnerability due to deprivation or health inequalities (including potential for more deprived communities to live in areas of high noise disturbance); or having strong

views or high degrees of uncertainty about the project (which may be associated with health effects even below thresholds that are generally considered acceptable).

12.9.22 In relation to the sensitivity of the affected populations, it is noted that even within the sub-population who experience increased noise and who are potentially more sensitive to its effects, only a proportion would experience a change in risk factors; and of those, only a further sub-proportion may experience a change in health outcomes. This small minority<sup>2</sup> is further reduced by those who experience the greatest effects being eligible for the enhanced Sound Insulation Scheme that accompanies the Proposed Development (see **Chapter 8** for further details).

12.9.23 Also relevant to the sensitivity of population affected is that neither the flight paths nor total number of consented aircraft per year are changing as part of this S73 application. Consequently, for those affected, the change is within the context of similar overflights. This is relevant as the literature (Basner, 2018) notes that whilst evidence is limited and habituation is not complete, “*subjects exposed to noise usually habituate*”. For example, “*exposure-response relationships derived in the field (where subjects have often been exposed to the noise for many years) are usually much shallower than those derived in laboratory settings...*”.

12.9.24 Based on the findings presented in the Chapter 8 noise assessment effects primarily relate to a small but permanent change in noise levels distributed across a large area.

12.9.25 In 2025 and 2031 the Proposed Development will result in an increase in the number of people exposed to air noise. Three issues are discussed for day-time, night-time and weekend effects above the LOAEL and above the SOAEL. Whilst other points are discussed in Chapter 8, including beneficial air noise changes in other assessment years and ground noise and road transport noise, the adverse air noise issues are considered the most relevant for public health and represent a conservative assessment. Day-time and night-time noise exposure are considered to be of equal importance. The following analysis does not discuss assessment years or levels of change where there are not adverse changes in the numbers above LOAEL or SOAEL.

12.9.26 Key air noise data summarised from Chapter 8 is set out in Table 12.8 (daytime), Table 12.9 (night-time) and Table 12.10 (daytime weekend).

**Table 12.8: Health noise analysis – Daytime air noise (including new permitted housing developments)**

Assessment year		2025		2027		2031	
Noise threshold		Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL
LOAEL 51dB LAeq,16h and SOAEL 63dB LAeq,16h							
Daytime	DM scenario number of people	347,800	13,600	348,700	14,150	287,700	7,600
	DC scenario number of people	342,500	12,650	277,400	7,350	293,650	8,600
	Change in number of people comparing DM and DC scenarios	-5,300	-950	-71,300	-6,800	<b>5,950</b>	<b>1,000</b>

12.9.27 In 2025 and 2027 there are notable reduction with the Proposed Development in the numbers of people exposed between the LOAEL and SOAEL and above the SOAEL. This is driven by faster adoption of quieter new generation aircraft compared to the DM scenario. In 2031, 5,950 people are newly exposed between the LOAEL and SOAL due to the changes. In 2031, 1,000 people are also newly exposed above the SOAEL due to the changes. In both cases the change is no greater than 2dB.

<sup>2</sup> ‘Small minority’ is a term used to qualitatively describe population extent by EIA health guidance, see paragraph 12.3.20 and Table 12.3.

12.9.28 The number of people experiencing noise effects at or above the SOAEL is a guide for the health assessment as to the potential for health effects within a population. If the SOAEL is experienced by all, or the majority, of a population the potential for a significant adverse population health effect is high. If, as is the case here, the SOAEL is experienced by a small minority of a population the potential for a significant adverse population health effect is more limited. In these circumstances additional context is informative, for example the degree of change experienced. In this case a change of no greater than 2dB suggests that the additional noise would not be noticed by most people and so has limited potential to affect population health. To treat the SOAEL as a hard threshold where population health effects become significant with a minority of the population experiencing exceedances would not reflect the actual change in population health outcomes that would be expected.

12.9.29 The changes in exposure between the LOAEL and SOAEL are noted, as chronic noise exposure across all or the great majority of the population may also contribute to adverse population health outcomes. Again, the degree of change is also relevant and in this case is very small, no greater than 2dB. Such a change has very limited potential to affect population health.

12.9.30 For daytime air noise the assessment concludes that there is a *very low* change in exposure, albeit over the *long-term* and experienced *frequently*. The change in exposure corresponds to a *minor* change in risk factors for cardio-metabolic and annoyance related morbidity and quality of life, with any health effect from this change in risk factors affecting a *small minority* of the study area population. There are not expected to be quantifiable healthcare service implications. The change in daytime noise is considered to be of low magnitude for public health. This takes into account the measures designed to lower noise exposure set out in Chapter 8, Sections 8.5 and 8.7.

**Table 12.9: Health noise analysis – Night-time air noise (including new permitted housing developments)**

Assessment year		2025		2027		2031	
Noise threshold		Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL
LOAEL 45dB L <sub>Aeq,16h</sub> and SOAEL 55dB L <sub>Aeq,16h</sub>							
Night-time	DM scenario number of people	46,250	0	46,250	0	56,200	0
	DC scenario number of people	78,600	0	50,300	0	55,130	70
	Change in number of people comparing DM and DC scenarios	<b>32,350</b>	0	<b>4,050</b>	0	-1,070	<b>70</b>

12.9.31 For night-time air noise there is a *very low* change in exposure experienced *frequently*, predominantly over the *short to medium-term* (as effects are greatly reduced by 2031). The change in exposure corresponds to a *minor* change in risk factors for sleep disturbance, cardio-metabolic and annoyance related morbidity and quality of life.

12.9.32 For exposure between the LOAEL and SOAEL, any health effect from this change in risk factors relates to a *large minority* of the study area population in 2025, a *small minority* in 2027 and an *overall reduction* in number of people exposed between the LOAEL and SOAEL by 2031. The potential for population health outcome changes are driven by effects between LOAEL and SOAEL in 2025. At most, there is potential for this to have slight implications for short to medium-term routine health service planning compared to the DM scenario. This change in night-time noise is considered to be of low magnitude for public health. This takes into account that the degree of change is no greater than 3dB, as well as the discussion of supplementary indicators later in this section.

12.9.33 Regarding exposure above SOAEL, it is notable that in 2025 and 2027 there are no people newly exposed above the SOAEL due to the changes; and in 2031 there are only 70 people newly exposed above the SOAEL due to the changes. For these 70 people the change is no greater than 2dB.

12.9.34 The air noise SOAEL is based on external noise levels and therefore does not account for enhanced insulation. The 70 people above the night-time SOAEL are all within the existing 66 dB LAeq,16h daytime eligibility contour. This means they are already eligible for the highest level of the airport's sound insulation scheme, which includes high acoustic performance double glazing and mechanical ventilation. This tier of the sound insulation scheme has a performance standard of a 35 dB reduction for internal levels compared to external levels. As these people are forecast to be exposed to just above 55 dB LAeq,8h, this would mean internal night-time levels of just over 20 dB from aircraft noise. At these levels no public health effect would be expected. This change in night-time noise is considered to be of low magnitude for public health.

**Table 12.10: Health noise analysis – Weekend daytime air noise (including new permitted housing developments)**

Assessment year		2025		2027		2031	
Noise threshold		Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL	Between the LOAEL and the SOAEL	Above the SOAEL
LOAEL 51dB LAeq,16h and SOAEL 63dB LAeq,16h							
Weekend daytime	DM scenario number of people	220,200	3,000	221,850	3,000	156,000	750
	DC scenario number of people	219,350	3,000	177,000	1,500	196,550	3,400
	Change in number of people comparing DM and DC scenarios	-850	0	-44,850	-1,500	<b>40,550</b>	<b>2,650</b>

12.9.35 As explained in Chapter 8, weekend noise in 2031 is forecast to be broadly similar to 2019 overall, despite the increase in movements and operational hours. This reflects the increased use of quieter new generation aircraft. The Table 12.10 weekend numbers are a subset (2 days) of the daytime (7 days) discussed in Table 12.8. It is therefore relevant to note that although there are 40,550 people newly exposed between the LOAEL and SOAEL due to the changes, these are not long-term chronic exposures where cardio-metabolic outcomes would be a public health consideration. The same point applies to the 2,650 people newly exposed above the SOAEL. In both cases the change experienced by these people is less than 2dB, and as such has very limited potential to affect population health.

12.9.36 The conclusion is therefore that for weekend daytime noise there is a *very low* change in exposure, albeit over the *long-term* and experienced *frequently*. The change in exposure corresponds to a *minor* change in risk factors for cardio-metabolic and annoyance related morbidity and quality of life. Any health effect due to this change in risk factors is likely limited to a *large minority* of the study area population in relation to effects between LOAEL and SOAEL, with quality-of-life outcomes dominating, and a *small minority* for effects above the SOAEL with small changes in morbidity effects dominating. At most, there is potential for this to have slight implications for long-term routine health service planning compared to the DM scenario. The change in daytime noise is considered to be of low magnitude for public health. This takes into account the measures designed to lower noise exposure set out in Chapter 8, Sections 8.5 and 8.7. Notably, the Sound Insulation Scheme secured by planning consent condition would be available to all those affected by increases above the SOAEL.

12.9.37 In 2019 and under the DM Scenario there are 72 predictable respite hours per week when the airport is closed. Under the DC Scenario this would reduce to 65 hours per week in the winter season and 64 hours per week in the summer season, due to the proposed extended operational hours on a Saturday, this is a reduction of around 10%. The amount of respite for residents around the airport remains high compared to other major UK airports, even with the proposed reduction.

12.9.38 The following further points regarding sensitive locations are noted based on the findings of Chapter 8.

- For the daytime, weekend and night there is only one residential healthcare building exposed to noise levels above the significance thresholds, this is the Richard House Children's Hospice. It is above the thresholds for day, weekend and night for 2019, and for both the DM and DC scenarios for all assessment years. The increase in noise at this healthcare building is less than 3 dB comparing the DC and DM

scenarios in all years, therefore the effect is rated in Chapter 8 as not significant. The Sound Insulation Scheme applies to community buildings, such as this, as well as residential dwellings.

- There are 87 schools exposed to noise above the daytime threshold in 2019. This reduces to 64 for 2031 DC and 62 for 2031 DM. The change in noise at all of these schools is less than 3 dB when comparing the DC and DM scenarios, therefore the effect is rated in Chapter 8 as not significant. As noted above, the Sound Insulation Scheme applies to community buildings, which includes many of these schools. The remainder are not exposed to enough noise to qualify for sound insulation.

12.9.39 Supplementary indicators discussed in Chapter 8 are broadly in line with the results for the primary indicators:

- The DM N65 contours are generally either similar to or smaller than the DC N65 contours.
- Compared to the 2019 baseline the number of people predicted to be highly annoyed reduces over time with or without the proposed development. The trend in number of people highly annoyed is similar to the that for daytime noise effects above the SOAEL described in Table 12.8. The supplementary metric is therefore consistent with the primary assessment metric.
- Compared to the 2019 baseline (c.12,400 people), the number of people highly sleep disturbed is forecast to initially increase by around a third in 2025 under the DC scenario, but then decrease and by 2031 reduce back to be similar to, though slightly above, that baseline level. Notably in 2031 there is very little difference between the DM and DC scenarios, with the DC scenario being slightly better. This is due to a more rapid phaseout of the current noisier generation of aircraft at night, which are forecast to cease operating at night completely in the 2031 DC scenario. The metric shows that around twelve and a half thousand people may be sleep disturbed by the existing airport activity and that the great majority of these people would continue to be sleep disturbed with or without the proposed development. As with the primary assessment metric, effects are greatest in the short to medium-term (2025 assessment year) and the supplementary metric does not account for the expected benefits of the Sound Insulation Scheme. The metric is therefore consistent with the conclusions reached for population health.
- The number of people forecast to be exposed to 80 dB LASmax at least once per night is forecast to reduce by 2031 in the DC scenario compared to 2019. It is forecast to increase in the DM scenario. The number of people in the 2031 DC scenario is around 30% less than in the DM scenario. This is due to a more rapid phaseout of the current noisier generation of aircraft at night.
- The early morning (06:30-06:59) period and the late evening period (22:00-22:30) will remain quieter than the average daytime hours.

12.9.40 The supplementary indicators, consistent with the main average noise exposure metric, support the conclusion that the magnitude of change due to the Proposed Development is low. It is concluded that the overall magnitude of air noise changes due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is low.

12.9.41 On the basis of the analysis in Chapter 8, the magnitude of ground noise and road traffic noise is likely to correspond to a *minor* change in risk factors for cardio-metabolic and annoyance related *morbidity and quality of life*. Any health effect due to a slight change in risk factors is likely limited to a small minority of the affected populations.

12.9.42 The overall population health effect from noise is characterised as being *adverse* in direction, *permanent* and due to *direct* health pathways. The professional judgement is that the significance of the population health effect would be minor adverse (not significant).

12.9.43 The conclusion can be broken down. Overall, the majority of the study area population would be below the SOAEL in all assessment years and scenarios. In relation to the small minority affected above SOAEL, taking into account the Sound Insulation Scheme as embedded mitigation, it is anticipated that the majority of those affected would have their effects reduced. A minor adverse effect is considered appropriate to reflect that not all people would take up the scheme and there may be practical limitations on its effectiveness for some people, e.g. for structural reasons or due to personal choice to open windows in summer even where ventilation

is provided. In line with good practice the Sound Insulation Scheme has had specific regard to indoor air quality and provides solutions that both increase sound insulation while maintaining adequate ventilation and thermal comfort. In relation to those between LOAEL and SOAEL who will experience a very low increase in noise (less than 3dB, with many below 2dB) the incremental effect to a large number of people (for night-time in 2025 and weekend daytime in 2031) is in population health terms noteworthy (i.e. not negligible); but equally given the very small change and the many other sources contributing to the local soundscape it is not considered a significant project level effect.

12.9.44 The effects are considered minor adverse as although there are sufficient causal associations established by the scientific literature, and the relevant thresholds of LOAEL and SOAEL are crossed (excluding effects of the Sound Insulation Scheme), the low magnitude of relative change due to the project would likely give rise to only a slight change in the population health baseline, even accounting for the presence of more vulnerable sub-populations. The effect is considered to have only a marginal effect on the ability to deliver current health policy. This conclusion places weight on the project mitigation measures, including minimising noise emissions at source, effective communication between LCY and local communities, and the Sound Insulation Scheme.

12.9.45 The EIA health analysis has had sufficient quantitative metric input from the EIA noise assessment to understand the scale and nature of the change in noise due to the proposed development. The qualitative health analysis has been able to make a reasonable judgement on the likely population health consequence of such a change. In addition to quantitative noise metrics the health assessment conclusions on significance have also been informed by other evidence sources, including scientific evidence, the baseline, local health priorities and the health policy context.

12.9.46 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.10 Healthy Lifestyles: Use of Open Space

12.10.1 This section considers the population health implications of changes in operational day-time noise affecting use of public areas of open space. Private spaces are considered within the noise assessment discussed above.

12.10.2 Accessing areas of public open space contributes to physical activity, as well as general wellbeing benefits from social interactions, recreation, leisure and play. Health outcomes span physical health (e.g. cardiovascular health) and mental health (e.g. stress, anxiety or depression). Given the urban context, public open space, particularly green space, is of value to residents and is an important public health asset.

12.10.3 The availability of a natural environment and attractive views of nature within an individual's living environment are important contributors to physical activity. People's experiences in using the natural environment can enhance attitudes toward physical activity and perceived behavioural control via positive psychological states and stress-relieving effects, which lead to firmer intentions to engage in physical activity (Calogiuri & Chroni, 2014). Improvements in health behaviour influence health outcomes like mortality, chronic diseases, mental and obesity disorders (Salgado, et al., 2020). Physical activity can improve cognitive and mental health, particularly improvements in physical self-perceptions, which accompanied enhanced self-esteem (Lubans, et al., 2016). Access to greenspace has beneficial associations with all-cause and stroke-specific mortality, cardiovascular disease morbidity, cardiometabolic factors, mental health, low birth weight, physical activity and sleep quality (Yang, et al., 2021). There is evidence of an inverse association between surrounding greenness and all-cause mortality. Physical activity may explain only 2% of the association between green spaces and mortality. Other pathways include: attenuation of air pollution, noise, and heat-island effects; and stress reduction and improved relaxation and restoration (Rojas-Rueda, Nieuwenhuijsen, Gascon, Perez-Leon, & Mudu, 2019). Type-2-diabetes is a growing public health concern in children, adolescents and adults, which for adults can double the risk of depression and mental health comorbidity

(McVoy, et al., 2022). Leisure-time physical activity is significantly associated with decreased risk of diabetes (Huai, et al., 2016). Engaging in leisure activities promotes wellbeing, particularly in those who are retired, with frequency and diversity of leisure opportunity being more important than over time spent on leisure (Kuykendall, Tay, & Ng, 2015). Transportation noise has the potential to affect health through various pathways. Because noise is a psychosocial stressor it is linked to physical activity, use of green spaces and social interactions. Greenness, having access to quiet areas, and covering noise sources either visually or acoustically with natural features seems to decrease people's negative responses to noise (Peris & Fenech , 2020).

12.10.4 The most relevant aspect of the proposed development to the use of public open space is the introduction of Saturday day-time flights, which introduces aviation noise from the airport and its flight paths.

12.10.5 This section has been informed by Chapter 8 – Noise, which sets out relevant assessment findings and mitigation measures that have been taken into account.

12.10.6 Relevant findings from Chapter 8 in relation to public outdoor spaces:

- There are 103 outdoor amenity areas exposed to noise above the daytime threshold in 2019. This reduces to 66 for 2031 DC and 60 for 2031 DM. The change in noise at all of these amenity areas is less than 3 dB when comparing the DC and DM scenarios, therefore the effect is rated as not significant.
- There are 31 outdoor amenity areas exposed to noise above the weekend threshold in 2019. This reduces to 30 for 2031 DC and 18 for 2031 DM. The change in noise at all of these amenity areas is less than 3 dB when comparing the DC and DM scenarios, therefore the effect is rated as not significant.

12.10.7 Consistent with the quantitative analysis discussed in Chapter 8, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario. Consideration is also given to interim effects in 2025 and 2027. This to captures any effects that are greater than in 2031.

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

- The source is noise generated by airport activities, notably aircraft movements;
- The pathway is behavioural change in levels of use of public open space, affecting physical activity and wellbeing outcomes; and
- Receptors are residents in the local communities near the Airport and its flightpaths.

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

12.10.10 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 8 air noise zone of influence (see Chapter 8 Figure 8.3.3 for relevant amenity areas), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 12.3.7;
- The 'local' population of Newham, Greenwich and Tower Hamlets (specifically in areas where Chapter 8 identifies public open spaces);
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people for access to play);
  - Old age vulnerability (older people for access to social interactions, recreation, leisure);
  - Low-income vulnerability (people living in deprivation, including those on low incomes for who travel costs to alternative open space may be limiting);
  - Poor health vulnerability (people with existing poor physical and mental health who particularly benefit from accessing open space);
  - Social disadvantage (people who experience low social status or social isolation); and
  - Access and geographical vulnerability (people who experience existing access barriers to alternative open spaces).

12.10.11 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects that most people in the local area (Newham, Greenwich and Tower Hamlets) would only make occasional use of the affected open spaces, e.g. because they live distant from them. It also includes those with access to many alternative open spaces 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.

12.10.12 The sensitivity of the vulnerable group population is high. Vulnerability in this case is linked to age and health status, as well as having fewer resources and less capacity to adapt to changes. The population may therefore be more reliant on the affected open spaces with greater likelihood that any additional disturbance could affect use and physical activity behaviours.

12.10.13 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is low. This reflects that the long-term change in noise exposure is very low and, with a focus on Saturday daytime changes, relates to frequent to occasional aviation noise from the most modern and quietest aircraft types. Effects potentially extend to a large minority of people who make frequent use of the affected public open spaces. However, given the small change in noise levels there is considered to be limited potential for behavioural change. Any behavioural change would relate to minor changes in quality-of-life and physical and mental health morbidity for a small minority of the population, i.e. those making less frequent use of affected public open spaces. The scale of such change is not expected to have implications for healthcare service planning.

12.10.14 The effect is characterised as being *adverse* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect is up to a minor adverse (not significant). The conclusion reflects that that whilst the use of public open spaces is important for public health, as confirmed by the scientific literature, local health priorities and health policy; the changes due to the Proposed Development are very small, comparing the DC and DM scenarios in all assessment years. At most the changes may have a slight influence on the population health baseline, with the level of perceptible noise change not expected to widen inequalities. The minor adverse rather than negligible conclusion reflects the potential for a marginal effect the ability to deliver public health polices, e.g. on physical activity, mental health and obesity. The public open spaces are in a context of existing aviation and other urban noise, and this is unchanged with or without the proposed development.

12.10.15 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.11 Safe and Cohesive Communities: Community Identity

12.11.1 This section considers the effect on community identity for residents due the expanded airport activities having a greater influence on the local environmental and economic landscapes, as well as on the ease of opportunity to travel.

12.11.2 Health effects may be associated with mental health conditions (e.g. stress, anxiety or depression) due to underlying social determinants influencing community cohesion.

12.11.3 The proposed development influences community identity, which includes the airport's beneficial effects on communities through employment opportunities and access to travel; as well as the potential adverse effects in relation to reduced environmental amenity affecting social networking and social gatherings, e.g. in relation to holding conversations and events. Both may affect community cohesion and social isolation.

12.11.4 This section has been informed principally by Chapter 7 – Socio-economics and Chapter 8 – Noise. Other environmental effects, e.g. air quality, and the scheme description are also relevant and have been taken into account.

- Chapter 7 explains that the proposed development will have a positive impact on the local community. This includes through engaging with schools, providing employment and training opportunities, opportunities for the local supply chain and investment as a result of LCY's Community Investment Framework. Significant local benefits are expected in 2031.
- Chapter 8 concludes that levels of change within local communities are very small. Where people are newly exposed above the LOAEL or SOAEL the changes are less than 3dB. There are relatively few new exposures above the SOAEL (see discussion of operational noise effects). The extent to which the population's local identity will be strongly influenced by environmental exposures is therefore limited. This reflects a context of existing operational airport activities, including it being normal to see and hear planes.

12.11.5 Consistent with the quantitative analysis discussed in Chapters 7 and 8, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario, as well as taking account of effects in 2025 and 2027.

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

- The source is: environmental change due to additional airport activity; socio-economic change due to increased employment and investment opportunity; and travel access change due to increased flights;
- The pathway is factors that contribute to behaviour and a sense of identity, including: changes in visual or auditory environmental cues; economic and prosperity cues that influence social status; and ease of access to air travel as an amenity; and
- Receptors are residents in the local communities near the Airport and its flightpaths.

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

12.11.8 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 7 and Chapter 8 zones of influence, the health sensitivity of which is indicatively based on representative wards close to the airport, see paragraph 12.3.7;
- The 'local' population of Newham, Greenwich and Tower Hamlets (including in relation to visual and auditory awareness of the airport, direct and indirect airport employment and ease of access to air travel);
- The sub-population vulnerable due to:
  - Old age vulnerability (older people as long-term residents whose sense of community identity may be more sensitive to changes in visual and auditory cues);
  - Low-income vulnerability (people living in deprivation, including those on low incomes for who employment opportunity is a strong driver of community identity);
  - Social disadvantage (people who experience low social status or social isolation that is sensitive to changes in community identity); and
  - Access and geographical vulnerability (people whose community identity is strongly influenced by ease of access to air travel, e.g. maintaining dispersed family relationships).

12.11.9 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects that for most people in the local area (Newham, Greenwich and Tower Hamlets) the airport is not a strong driver of community identity given the city context creates many other influences on the local social, economic and environmental landscape.

12.11.10 The sensitivity of the vulnerable group population is high. 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 the proposed development.

12.11.11 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is **low**. This reflects that the proposed development is an expansion of an

existing operational airport with a history of ongoing improvement works. Furthermore, the change in conditions is characterised as a gradual increase in flights and employment over successive years, rather than a single large step change. For the majority of the surrounding population, the airport would be a prominent feature of the local social, economic and environmental landscape before and after the proposed development. The changes would have a limited influence in changing community identity to an extent that could affect population health. The change would be long-term and continuous and associated with minor quality of life and morbidity outcomes for a *large minority* of the local population.

12.11.12 The effect is characterised as being *beneficial* and *adverse* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect is up to a minor beneficial (not significant) in relation to improved community identity associated with employment and travel access. However, there may also be up to a minor adverse (not significant) effect due to the adverse environmental cues affecting the wellbeing of some residents. The level of change is likely to have a marginal influence on inequalities through affecting sense of place and community cohesion. Any influence on health policy delivery would also be marginal. Any change to the local population health baseline would be slight and comprised of both beneficial and adverse influences.

12.11.13 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.12 Safe and Cohesive Communities: Transport

12.12.1 This section considers the population health implications of changes in operational road traffic affecting road safety, travel times, accessibility and active/sustainable travel for community residents, emergency services, airport visitors/passengers and airport staff.

12.12.2 For road safety, health effects may be associated with the severity or frequency of road traffic incidents. For accessibility, health effects may be associated with emergency response times or non-emergency treatment outcomes associated with delays or non-attendance. For active/sustainable travel, health effects may relate to physical health (e.g. cardiovascular health) and mental health conditions (e.g. stress, anxiety or depression) associated with obesity and levels of physical activity.

12.12.3 Transportation is an important social determinant of health. The primary function of transport is the movement of people and goods between places, enabling access to employment, economic, and social opportunities as well as to essential services. Transport which is affordable and accessible may be viewed as an important determinant of health by facilitating access to key socio-economic opportunities. Inadequate transport provision may add to social exclusion among already vulnerable groups (Thomson, Jepson, Hurley, & Douglas, 2008). Transportation barriers disproportionately affect the most vulnerable groups of society who carry the highest burden of chronic diseases; therefore, it is critical to identify interventions that improve access to transportation. Transportation services offered in combination with other tailored services improve health outcomes (Starbird, DiMaina, Sun, & Han, 2019). "Improving neighbourhood walkability, quality of parks and playgrounds, and providing adequate active transport infrastructure is likely to generate positive impacts on activity in children and adults." (Smith, Hosking, Woodward, & al., 2017)

12.12.4 Injuries and deaths caused by motor-vehicles are indisputable and already closely monitored with many effective interventions in place to minimise this harm (Thomson, Jepson, Hurley, & Douglas, 2008). Road traffic accidents as an unexpected traumatic event, may not only lead to death or serious physical injuries, but also puts survivors at an increased risk for a wide range of psychiatric disorders, particularly acute stress disorder (Dai, Liu, Kaminga, & al., 2018; Lin, Gong, Xia, & Dai, 2018). Lower socioeconomic status, and riding on the road or pavements is associated with bicycling injury (Embree, Romanow, Djerboua, & al., 2016). Bicycle-related injuries involving motor vehicles are associated with a high incidence of head injuries and extremity fractures. Age plays a critical role in the severity and anatomic distribution of injuries sustained, with a stepwise increase in mortality with increasing age (Lustenberger, Inaba, Talving, & al., 2010).

12.12.5 Transportation barriers are important to healthcare access, particularly for those with lower incomes. Transportation barriers lead to rescheduled or missed appointments, delayed care, and missed or delayed medication use. These consequences may lead to poorer management of chronic illness and thus poorer health outcomes (Syed, Gerber, & Sharp, 2013).

12.12.6 Walking and cycling for transportation (i.e. active transportation), provide substantial health benefits from increased physical activity. Health gains exceed detrimental effects of traffic incidents and air pollution exposure (Mueller, et al., 2015). Active transport to work or school is significantly associated with improved cardiovascular health and lower body weight (Xu, Wen, & Rissel, 2013). The provision of convenient, safe and connected walking and cycling infrastructure is at the core of promoting active travel (Winters, Buehler, & Götschi, 2017). Physically active transport (i.e. walking or cycling) has been directly related to increased residential density, street connectivity, mixed land use and amenities within a walkable distance (Thomson, Jepson, Hurley, & Douglas, 2008). An activity friendly neighbourhood that is walkable, dense, accessible, equipped with walk/cycle facilities and safe from traffic is associated with more active transportation to school in children (D'Haese, Vanwollegem, Hinckson, & al., 2015). Traffic calming and presence of playgrounds/recreation areas are associated with more walking and less pedestrian injury amongst children (Rothman, Buliung, Macarthur, To, & Howard, 2014).

12.12.7 A feature of the airport is that it is directly accessed by the Docklands Light Railway (DLR). The regular DLR services drives to the airport having a very high modal share of access via public transport (in 2019 50% of passengers and 29% of staff). There are also good bus connections and walking and cycling routes. These public and active travel options would continue under the proposed development.

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

12.12.9 Chapter 10 assesses against the criteria of: changes in daily flows on local roads; severance; driver delay; pedestrian and cycle delay; pedestrian amenity; accidents and safety; and fear and intimidation. The implications for public transport capacity is also considered.

12.12.10 Chapter 10 concludes that whilst there are some minor to moderate negative effects, following EIA transport assessment methods, these are not significant. Furthermore, the airport is well served by existing and proposed future public transport, which have capacity for the demand associated with the proposed development.

12.12.11 Consistent with the quantitative analysis discussed in Chapter 10, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario.

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

- The source is vehicles on the road network;
- The pathway is changes in driver delay, severance, pedestrian delay, pedestrian amenity and accidents and safety. This links with physical activity and active travel. It also links with emergency response times; and
- Receptors are local road users, including those using motor vehicles as well as pedestrians and cyclists, as well as emergency services using the road network.

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

12.12.14 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 10 surface access zone of influence, the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 12.3.7;

- The 'local' population of Newham, Greenwich and Tower Hamlets (including relevant stretches of the wider road network described in Chapter 10, e.g. the east-west A13 and the A406 North Circular that connects with the M11 and M25 motorways);
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as potentially more vulnerable road users);
  - Old age vulnerability (older people as potentially more vulnerable road users);
  - Low-income vulnerability (people living in deprivation, including those on low incomes for whom travel costs or alternatives may be limiting);
  - Poor health vulnerability (people with existing poor physical and mental health in relation to health trip journey times); and
  - Access and geographical vulnerability (people who experience existing access barriers or who rely on the affected routes, including healthcare and other amenities).

12.12.15 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects that most people in the local area (Newham, Greenwich and Tower Hamlets) would only make occasional use of the affected section of the road network. It also includes those for whom the road network affords many alternative routes. The general population comprise those members of the community with a high capacity to adapt to changes in access, including changes in healthcare access, for example due to greater resources and good physical and mental health.

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

12.12.17 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is **low**. This reflects that:

- In relation to road safety, a small scale of change in road traffic would have a corresponding very small increase in accident risk (simply as a function of traffic volumes). Such events would remain occasional over the long-term. Severity relates to a very minor change in risk of injury or mortality (with outcome reversal gradual or permanent). Very few people would be affected, with no or slight implications for healthcare services. The health assessment takes into account that Chapter 10 finds the residual magnitude of change in accidents and safety to be negligible.
- In relation to journey time, the change for those undertaking both short local journeys and long-distance travel on the wider highway network is potentially frequent but of small scale. Any changes in journey times are expected to continue over the long-term. Where the journey time reduction relates to healthcare access the change is likely to result in a very minor change in risk for morbidity or mortality associated with time critical treatment. The frequency with which health related journeys may be affected is likely to be occasional, with a small minority of people affected and no or only slight implications for healthcare services. The health assessment takes into account that Chapter 10 finds that any future delays on the traffic network would not be due to the modest quantities of additional traffic predicted.
- In relation to active/sustainable travel the scale of change in use of active or public transport is small. This reflects that whilst there are important increases in the modal share of public transport and active travel (see Chapter 10), these are related to CADP1 modal share commitments (see the CADP1 planning condition 71 requirement for a Travel Plan with update commitments set out in the existing S106). The forecourt improvements as part of the proposed development will encourage more people to walk or cycle

more frequently over the long-term, albeit a modest levels of change. The changes are expected to make a minor contribution to quality-of-life and morbidity (e.g. burden of cardiovascular disease and/or mental health) associated with physical activity for a small minority of the population. Health effects may be permanent if there was sustained behavioural change. The health assessment takes into account that Chapter 10 finds that vehicle flows would not increase the level of pedestrian and cycle delay and the magnitude of impact on pedestrian amenity is considered to be negligible.

12.12.18 The effect is characterised as being *beneficial* and *adverse* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect is up to a **minor beneficial (not significant)** in relation to improved physical activity associated with active travel and public transport use. However, there may also be up to a minor adverse (not significant) effect due to the slight reduction in road safety and slight increased journey times associated with increased traffic volumes. This is a conservative assessment finding and it is noted that Chapter 10 finds there is not expected to be a material adverse effect on accidents and safety. The conclusion reflects that whilst the scientific literature supports clear or causal associations between the project changes and health outcomes; the changes to road safety, journey times and active or sustainable travel are of a scale that would have only a marginal effect on the delivery of health policy and, at most, a marginal influence on inequalities. The limited degree of change, beneficial and adverse, would result in very limited change from the local population health baseline.

12.12.19 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.13 Socio Economic Effects: Good Quality Employment

12.13.1 This section considers the population health implications of increased employment and economic impacts during operation.

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

12.13.3 There is strong evidence for a protective effect of employment on depression and general mental health (van der Noordt, IJzelenberg, Droomers, & Proper, 2014). Unemployment is associated with poor health outcomes, with more negative health effects linked to lower socio-economic status and unemployment due to health reasons, whilst a strong social network is beneficial in reducing the health effects of unemployment (Norström, Virtanen, Hammarström, & al., 2014). The long-term unemployed carry a markedly higher burden of disease, particularly mental illness, than employed persons and those who are unemployed only for a short time. The burden of disease increases with the duration of unemployment (Herbig, Dragano, & Angerer, 2013). Job insecurity likely has an adverse effect on mental health (Rönnblad, Grönholm, Jonsson, & al., 2019). Job insecurity can pose a comparable threat to health than unemployment (Kim & von dem Knesebeck, 2015). The evidence that large income differences have damaging health and social consequences is strong and in most countries inequality is increasing. Narrowing the gap will improve the health and wellbeing of populations (Pickett & Wilkinson, 2015). Socio-economically disadvantaged children are at higher risk of consuming poor diets, in particular less fruits and vegetables and more non-core foods and sweetened beverages (Zarnowiecki, Dollman, & Parletta, 2014). Socio-economically disadvantaged children and adolescents are two to three times more likely to develop mental health problems. Low socioeconomic status that persists over time is strongly related to higher rates of mental health problems. A decrease in socio-economic status is associated with increasing mental health problems (Reiss, 2013). Improvements in socio-economic determinants positively impact population health. Improvements in indicators like income, education, employment status and ethnic inclusion, are likely to result in a reduction in mortality and morbidity outcomes, improving overall population health (Salgado, et al., 2020).

12.13.4 This section has been informed by Chapter 7 – Socio-economics, which sets out relevant assessment findings and mitigation measures that have been taken into account.

12.13.5 Chapter 7 assesses economic and employment opportunities. The chapter notes local recruitment targets as part of the existing S106 agreement for the CADP1 application, including for residents of LBN. Other initiatives aimed at supporting and sharing the benefits of the Airport with the local community are also discussed. The proposed development would create an additional 1,070 direct FTE jobs and an additional 360 indirect and induced jobs in the Local Area by 2031 when compared to the DM scenario (noting that the Local Study Area for the socio-economic assessment differs from the Local Area in this health assessment).

12.13.6 Chapter 7 concludes there would be significant employment and economic benefits during operation in 2031, including long-term benefits for the local area, with wider regional catalytic economic effects also significant in 2027.

12.13.7 Consistent with the quantitative analysis discussed in Chapter 7, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario. Regard is also given to effects in 2025 and 2027.

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

- The source is direct and indirect job creation and economic activity;
- The pathway is good quality employment providing more health supporting resources and protecting against adverse mental health effects, e.g. of long-term unemployment; and
- Receptors are people of working age (and their dependants).

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

12.13.10 The population groups relevant to this assessment are:

- The 'site-specific' geographic population;
- The 'local' population of LBN, and the Local Area as defined in Chapter 7 (see Chapter 7 Figure 7-1);
- The 'regional' population of Greater London;
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as dependants);
  - Old age vulnerability (older people as dependants);
  - Low-income vulnerability (people for whom better quality employment may be particularly beneficial, including those who are living in deprivation, on low incomes, unemployed, in insecure jobs or shift workers);
  - Social disadvantage (people who experience low social status or social isolation); and
  - Poor health vulnerability (people with existing poor physical or mental health, including as dependants).

12.13.11 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account are listed in Appendix 12.3. This reflects that most people would already be within stable employment that would be unaffected by the proposed development (or being a dependant of such a person).

12.13.12 The sensitivity of the vulnerable group population is high. Vulnerability in this case relates to people and their dependants who are 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.

12.13.13 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is medium. This reflects that although the scale of new jobs is relatively small within the context of the overall employment market, those jobs would be targeted at the local area

population using the CADP1 agreed measures (secured in the existing S106 agreement) set out in Chapter 7. The direct and indirect employment would be long-term and on a continuous basis, whether full-time or part-time. Such jobs are likely to be associated with minor changes in morbidity and quality of life for a small minority of the population due to improved socio-economic status and increased spend on health supporting resources and activities (including through indirect benefits to dependants). The roles are predominantly expected to be filled by existing residents (rather than an influx of new residents taking up these roles). The effects are expected to be greatest at the local level, but also extend to the regional level. Within the local level people within the site-specific population are expected to benefit directly and indirectly. New good quality long-term roles (in terms of remuneration, working hours, working conditions and job security) are considered particularly likely to contribute to long-term population health benefits.

12.13.14 The effect is characterised as being *beneficial* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect for this determinant of health is moderate beneficial (significant). The professional judgment is that there would be a small beneficial change in the health baseline for the local population. This conclusion reflects that the scientific literature establishes a clear relationship between good quality employment and factors that promote health or are protective against poor health, particularly mental health. The scale and nature of employment is expected to be influential in narrowing health inequalities locally, and more generally supporting delivery of health policy to improve local population health.

12.13.15 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.14 Socio Economic Effects: Training Opportunities

12.14.1 This section considers the population health implications of additional upskilling and educational support.

12.14.2 Increased educational attainment is associated with better health outcomes and delayed mortality. Education is an important indicator of socioeconomic status and is associated with subsequent income, employment, social networks, and behaviours (Byhoff, Hamati, Power, & al., 2017).

12.14.3 This section has been informed by Chapter 7 – Socio-economics, which sets out relevant assessment findings and mitigation measures that have been taken into account.

12.14.4 The proposed development would provide general workforce upskilling opportunities and continued support to community educational initiatives. Chapter 7 assesses access to skills and training opportunities. This includes noting that existing initiatives at the airport include mentoring LBN school students at risk of becoming not in education, employment or training (NEET) as part of the Youth Mentoring Programme. Such initiatives would continue under both the DM and DC scenarios.

12.14.5 Chapter 7 concludes that the proposed development will have a positive impact on the local community, including through engaging with schools and providing training opportunities. Growth at the airport will enable Levelling Up of areas with high deprivation, including by investment in skills and training. No separate significance conclusions are assigned to training and skills development specifically by Chapter 7.

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

- The source is educational opportunities and support;
- The pathway is good quality education supporting socio-economic status and other outcomes, which are influential for health; and
- Receptors are local communities, particularly young adults commencing employment.

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

12.14.8 The population groups relevant to this assessment are:

- The 'site-specific' geographic population;
- The 'local' population of local population of LBN, and the Local Area as defined in Chapter 7 (see Chapter 7 Figure 7.1);
- The 'regional' population of Greater London;
- The sub-population vulnerable due to:
  - Young age vulnerability (children and young people as dependants);
  - Old age vulnerability (older people as dependants);
  - Low-income vulnerability (people for whom training and upskilling would support progression to employment, or better quality employment. This group includes those who are living in deprivation, on low incomes, unemployed, in insecure jobs or shift workers);
  - Social disadvantage (people who experience low social status or social isolation); and
  - Poor health vulnerability (people with existing poor physical or mental health, including as dependants).

12.14.9 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects that most people in the local area would make use of alternative educational or training opportunities or have existing educational attainment appropriate to their vocation and career progression.

12.14.10 The sensitivity of the vulnerable group population is high. Vulnerability in this case is linked to young adults, in relation to training opportunities, and children or young people, in relation to educational support initiatives. For both these groups those who are from disadvantaged backgrounds would be particularly sensitive to educational interventions that provide knowledge, new skills or personal development. Young people leaving education or early in their careers may have the most to gain from an increase in training opportunities as a pathway into good quality local employment.

12.14.11 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is **low**. This reflects that the changes in educational and training initiatives are of small scale, albeit offering long-term access to improved employment opportunities. The opportunities would vary with some being *one-off* and others being *continuous* learning opportunities. It is likely that the training and upskilling opportunities would support an improvement in physical and mental health morbidity for risk factors related to educational outcomes for a small minority of local people, with benefits accruing throughout the life course.

12.14.12 The effect is characterised as being *beneficial* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect for this determinant of health is minor beneficial (not significant). This conclusion reflects the scientific literature supports a clear association between educational outcomes and health outcomes, with the potential for a slight change in the population health baseline due to the potential for lasting effects over the life-course due to improved employment opportunities following upskilling. This change is likely to have a marginal supportive influence on delivering health policy, including narrowing inequalities where vulnerable groups are targeted by and take-up the training opportunities. It also reflects local health priorities that support a good start for young people.

12.14.13 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.15 Environmental Effects: Air Quality

12.15.1 This section discusses changes to local air quality and related effects on population health. The assessment focuses on non-threshold effects of nitrogen dioxide (NO<sub>2</sub>) and fine particulate matter (PM<sub>10</sub> and PM<sub>2.5</sub>) on population health due to changes in the emission profile of surface access and aircraft movements. Consideration is also given to ultra-fine particulate matter (UFP), from surface access and aircraft movements, as a public health issue. This issue is covered in a separate analysis for clarity, see Section 12.16.

12.15.2 Environmental air pollution is associated with increased risk of respiratory and cardiovascular diseases. Environmental pollution exerts its detrimental effects on the heart by developing pulmonary inflammation, systemic inflammation, oxidative stress, endothelial dysfunction and prothrombotic changes (Meo & Suraya, 2015). The adverse effects on health of PM and NO<sub>2</sub> indicates that the effects occur at air pollution concentrations lower than those in guidelines (WHO, 2013b). Long term exposure to particulate matter is associated with incidence of coronary events, and this association persists at levels of exposure below the current European limit values (Cesaroni, et al., 2014). The magnitude of the long-term effects of NO<sub>2</sub> on mortality is at least as important as that of PM<sub>2.5</sub>. The role of NO<sub>2</sub> is independent of that of PM<sub>2.5</sub> (Faustini, Rapp, & Forastiere, 2014). Age is the most consistent effect modifier of the association between short-term exposure to particulate matter and death and hospitalization, with older persons experiencing higher risks. In addition to physiological changes that accompany age, older persons likely have different indoor/outdoor activity patterns, occupational exposures, and social networks. The very young may also be susceptible. Children face higher risks because their biological systems are under development, they breathe more air per body weight than do adults, and they typically spend more time outdoors (Bell, Zanobetti, & Dominici, 2013). Those with lower socio-economic status (SES) face higher particulate matter associated risks, although there is only limited/suggestive evidence for modification by educational level, income, and employment status. SES could modify particulate matter associated health risks through differences in access to health care, baseline health status, occupational exposures, and nutrition (Bell, Zanobetti, & Dominici, 2013). The evidence suggests adverse effects of ambient air pollutants exposure (especially for PM) on type 2 diabetes and that diabetic patients might be more vulnerable to air pollutants exposure (Yang, et al., 2020; Liu, et al., 2019). Elevated air pollution episodes across a wide area are significantly associated with an increase in ambulance dispatch data, including those for cardiac arrest, all-respiratory, and asthma dispatches (Sangkharat, Fisher, Thomas, Thornes, & Pope, 2019).

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

12.15.4 The Chapter 9 – Air Quality assessment concludes, with reference to regulatory standards and baseline conditions, that the changes between the DM and DC scenarios would be well within the national standards set for health protection and the incremental changes are classified as negligible, including for NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>. Furthermore the Air Quality assessment would produce no new or materially different conclusions to those of the 2015 UES.

12.15.5 Consistent with the quantitative analysis discussed in Chapter 9, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario. Consideration has also been given to the baseline Year (2019), and future years of 2025 and 2027.

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

- The source is air pollutants (particularly NO<sub>2</sub>, PM<sub>10</sub> and PM<sub>2.5</sub>) from road traffic and, to a lesser extent, aviation emissions;
- The pathway is diffusion through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

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

12.15.8 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 9 zone of influence (1 km radius around the runway and the Transport Assessment road transport network extent), the health sensitivity of which is indicatively based on representative wards close to the Airport, see paragraph 12.3.7. In addition to residents near the Airport, this assessment qualitatively takes into account passengers, visitors and workers at the Airport in terms of any effect of short-term exposure to air pollutants indoors or outdoors.
- The sub-population vulnerable due to:
  - Young age vulnerability (children, young people and pregnant women);
  - Old age vulnerability (older people);
  - Low-income vulnerability (people with lower socio-economic status)
  - Poor health vulnerability (people with existing poor respiratory or cardiovascular health); and
  - Access and geographical vulnerability (people for whom close proximity to the airport, roads and flightpaths increases sensitivity).

12.15.9 For example, young children are particularly susceptible to air pollution because of their developing lungs, high breathing rates per bodyweight, and amount of time spent exercising outdoors. Other vulnerable groups include the sick (e.g. people with type 2 diabetes), the elderly, and pregnant women.

12.15.10 The scientific literature indicates that there is an association between air quality emissions and health and wellbeing effects. The main health outcomes are likely to relate to increased risk of cardiovascular and respiratory related conditions or events (including reduced lung function, hypertension and myocardial infarction) (i.e. due to fine PM and NO<sub>2</sub> interacting within the body), as well as general measures of population mortality and hospital service use (e.g. emergency department visits). Such outcomes relate generally to long-term ambient exposure, but may also be affected by short-term exposure peaks, e.g. due to meteorological conditions reducing normal levels of pollutant dispersion.

12.15.11 The health baseline indicates that relevant sensitivities and inequalities identified in the scientific literature are likely to be present. It also shows air quality as a particular existing challenge. For example, the 12 wards around the Airport (see Section 12.4) show that there are a higher percentage of children and young people, but fewer older people, than the national average. Emergency hospital admissions for stroke, coronary heart disease and chronic obstructive pulmonary disease are above the national average. Although not solely associated with air quality, air quality is a relevant risk factor for these outcomes. Baseline context is also that there are likely to be people at work or at home closer to the Airport, its surface access routes and its flightpaths. This may include groups with increased sensitivity due to age or existing ill health.

12.15.12 Whilst the literature supports there being thresholds set for health protection purposes, it also acknowledges that for both PM<sub>2.5</sub> and NO<sub>2</sub> there is no identifiable threshold below which there is no risk to health (WHO, 2013b; COMEAP, 2011).

12.15.13 Health in EIA guidance (Pyper, et al., 2022a; Pyper, et al., 2022b; Cave, et al., 2020) indicates that the assessment should give the public confidence in thresholds set by government for the purpose of health protection having taken into account other social, economic and environmental considerations. The guidance directs discussion to considering the extent to which regulatory or statutory limit values would be met. In this context, where non-threshold health effects may occur, there should be a discussion about "*what is acceptable for the jurisdiction*" (emphasis added).

12.15.14 The Government (for the national jurisdiction) defines the statutory air quality standards as "*concentrations recorded over a given time period, which are considered to be acceptable in terms of what is scientifically known about the effects of each pollutant on health and on the environment*" (DEFRA, Online) (emphasis added). "*The standards are based on assessment of the effects of each pollutant on human health including the effects on sensitive subgroups*" (DEFRA, 2011). Section 12.2 above sets out the relevant policy context for, which includes the NPPF direction that planning policies and decisions should sustain and contribute towards compliance with relevant limit values or national objectives for pollutants.

12.15.15 The health assessment takes into account the non-threshold nature of air pollutants, including having regard to WHO guide values and how the air quality chapter modelling results compare to them. The 2021 WHO guide values are not referenced in national, regional or local policies. The 2021 values remain a relevant public health contextual consideration; however, the national statutory standards are the appropriate benchmark for an assessment of significance that informs a UK planning determination. This approach aligns to Government policy, as well as EIA and HIA good practice (Pyper, et al., 2022a; Pyper, et al., 2022b; Cave, et al., 2020).

12.15.16 In accordance with the aforementioned guidance for assessing health in EIA, the assessment of health significance gives weight to the statutory air quality standards set for the purpose of health protection by the Government. WHO air quality guideline values are referenced as an aspirational target, for example the Mayor's aspiration to meet the 2005 WHO guideline for PM<sub>2.5</sub>.

12.15.17 Relevant thresholds are set out in Table 12.11. For the assessment the most relevant metrics are the annual means, as these correspond with the air quality modelling undertaken by Chapter 9. **Table 12.11** shows how the assessment has been informed by comparing the predicted changes in emissions against both the national health protection limit value and the WHO advisory guidelines. This comparison informs the discussion of magnitude below.

**Table 12.11: Air quality national limit values, advisory WHO guidelines and changes in the DM and DC Scenarios, Annual Means**

Pollutant (µg/m <sup>3</sup> )	National Limit Value	WHO 2005	WHO 2021 <sup>3</sup>	2019 Base-line	2025			2027			2031			Type of change <sup>4</sup>
					DM	DC	Change	DM	DC	Change	DM	DC	Change	
NO <sub>2</sub>	40	40	10	33.8	27.1	27.4	0.3	26.8	27.1	0.3	26.7	27.2	0.5	Highest
					27.1	27.4	0.3	26.5	27.5	1	25.4	26.8	1.4	Greatest
PM <sub>10</sub>	40	20	15	19.9	18.7	18.7	<0.1	18.3	18.3	<0.1	17.6	17.6	<0.1	Highest
					16.9	16.9	<0.1	16.9	17	0.1	16.9	17	0.1	Greatest
PM <sub>2.5</sub>	20	10	5	13.1	12.2	12.2	<0.1	12.2	12.2	<0.1	12.2	12.2	<0.1	Highest
					11.3	11.3	<0.1	11.3	11.3	<0.1	11.2	11.3	0.1	Greatest

12.15.18 In terms of the environmental baseline there is an Air Quality Management Area (AQMA) declared for the whole of LBN, with emissions primarily due to road transport, industrial processes, construction and domestic biomass, but aviation also noted as a source of concern (London Borough of Newham, 2019). Air quality is a public health priority in LBN.

12.15.19 The sensitivity of the general population is considered to be low. This reflects that most people in the site-specific area, live, work or study at a distance from the airport (or parts of the local road network that are expected to experience additional vehicle movements) where emissions would benefit from higher levels of dispersion, reducing exposure associated with the proposed development. Furthermore, most people enjoy good respiratory health (e.g. are not asthmatic) and are not at a life stage (e.g. infant or frail elderly) for which small increases in emissions would be of particular concern.

12.15.20 The sensitivity of vulnerable groups is considered high. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects the presence of populations (residents or workers) who (while at work or at home) are likely to spend extended periods near to the airport, its flight paths or parts of the local road network that are expected to experience additional vehicle movements. It also reflects the generally higher sensitivity of children and older people to air pollution. Within these groups people with existing respiratory conditions, such

<sup>3</sup> With Annual Mean interim targets to guide reduction efforts as follows (µg/m<sup>3</sup>):

- NO<sub>2</sub>: 40, 30 and 20
- PM<sub>10</sub>: 70, 50, 30 and 20
- PM<sub>2.5</sub>: 35, 25, 15 and 10

<sup>4</sup> Based on ambient exposure relevant to UK Objectives (4m distant from kerbside). Further information is provided in Chapter 9.

as asthma or chronic obstructive pulmonary disease may be particularly sensitive. The baseline public health air quality challenges of LBN are taken into account by this sensitivity score.

12.15.21 Based on the Chapter 9 air quality assessment findings, which are informed by guidance issued by the Institute of Air Quality Management, the changes in concentrations of all modelled air pollutants are within statutory standards, levels considered acceptable in terms of health protection. Such standards take into account the potential for effects to vulnerable groups (DEFRA, 2011). The following results for the comparison of the 2031 DM and DC scenarios are noted:

- For NO<sub>2</sub>, the greatest increase is 1.4 µg/m<sup>3</sup> or 3% of the objective, at the R2 (Camel Road) receptor, where the total concentration in the DC scenario is 26.8 µg/m<sup>3</sup> or 67% of the objective.
- For PM<sub>10</sub> the greatest increase is 0.1 µg/m<sup>3</sup> or 0.2% of the objective, at the R2 (Camel Road) receptor, where the total concentration in the DC scenario is 17.0 µg/m<sup>3</sup> or 42% of the objective.
- For PM<sub>2.5</sub> the greatest increase is 0.1 µg/m<sup>3</sup> or 0.4% of the objective, at the R2 (Camel Road) receptor, where the total concentration in the DC scenario is 11.3 µg/m<sup>3</sup> or 56% of the objective.

12.15.22 The results, as set out in Chapter 9 and Table 12.11, indicate that:

- national air quality objectives would be achieved with or without the proposed development;
- the WHO 2005 NO<sub>2</sub> and PM<sub>10</sub> guidelines would be achieved with or without the proposed development, but the PM<sub>2.5</sub> would not be achieved with or without the Proposed Development; and
- the WHO 2021 guideline would not be achieved with or without the proposed development.
- furthermore, the level of change between the DM and DC Scenario does not affect the extent to which WHO 2021 advisory interim targets are met or not.
- the changes between in the DM and DC Scenario are very small in terms of both the highest level of exposure and the greatest change in exposure.

12.15.23 The achievement or not of national health protection standards or WHO advisory guidelines is therefore independent of the proposed development. Such a level of change is classified by Chapter 9 as negligible.

12.15.24 As explained in Chapter 9 statutory limit values are not assessed at non-residential locations not accessible to the public and places where health and safety at work provisions apply. Notwithstanding this, at the request of LBN the health assessment considers the potential for exposures at all locations where people may be exposed. This consideration includes at the airport, where short-term exposures may arise due to the transitory presence of passengers and visitors. Exposures are likely to be greatest closest to sources, i.e. plant, road traffic and aircraft. Such effects include exposures outside as people arrive and depart, e.g. carparks and drop-off/pick-up points. They also include airside locations not generally accessible to the public, e.g. where staff are temporarily working on the aprons. Staff are covered by occupational health and safety legislation and appropriate protective measures apply to them with or without the proposed development. Indoor air quality is influenced, in part, by outdoor air quality. The potential for exposures within airport buildings are therefore considered. The Health and Safety at Work etc Act 1974 (HM Government, 1974a) places duties on employers to ensure, 'so far as is reasonably practicable' that persons not in their employment are not exposed to risks to their health or safety as a result of the activities undertaken. Such legislation means there is an existing duty on LCY in relation to airport operations that may affect, not only residents, but also passengers and visitors to the airport. This would be the case with or without the proposed development. The proposed amendments to the CADP1 consent sought do not change the physical infrastructure of the airport in a way that would alter indoor air quality. CADP1 in general terms, is likely to support minimising the extent to which outdoor aviation emissions influence indoor airport air quality, through the modernisation of terminal buildings. Quantitative modelling of these locations is not proportionate or required by guidance. Qualitatively, based on judgement informed by the degree of change in ambient air quality associated with the proposed development, it is unlikely that exposures at locations not covered by the Chapter 9 air quality modelling would change the conclusions reached below for population health.

12.15.25 It is concluded that the magnitude of the change due to the project, comparing the DC and DM scenarios in all assessment years, is low. Air quality would be maintained *well within* regulatory thresholds. The potential for non-threshold effects of NO<sub>2</sub> and PM<sub>2.5</sub> (even below WHO advisory guidelines) to population health is however noted and has been taken into account in determining the significance of potential air quality effects. Any health effect would relate to a *negligible* to *very low* change in exposure to air pollutants, which may occur on a *frequent* basis over the *long-term*. Additional exposure due to the project would represent an incremental addition to the existing baseline conditions resulting in a *very minor* change in *morbidity and mortality* related population health risk, e.g. associated with respiratory and cardiovascular health outcomes. Any health effect due to a very slight change in risk factors is likely limited to a *small minority* of the study area population and the effect on routine health service planning is likely negligible.

12.15.26 The effect is characterised as being *adverse* in direction, *permanent* and due to a *direct* health pathway. The professional judgement is that the significance of the population health effect would be up to minor adverse (not significant). The conclusion reflects the view that compliance with statutory standards demonstrates an acceptable level of health protection and that these air quality protection measures are produced in the knowledge that particular groups within a population will have particular health vulnerabilities. The minor adverse (rather than negligible) score represents a conservative assessment finding given scientific uncertainty (and emerging evidence) about non-threshold health effects of NO<sub>2</sub>, and PM<sub>2.5</sub>. The score take into account WHO advisory guidelines and also reflect that air pollution is a specific local public health priority. However, the level of change in the health baseline due to the proposed development, comparing the DC and DM scenarios in all assessment years, is likely to be *very limited*, with at most a *marginal* effect on the delivery of health policy and inequalities. This is a public health acknowledgement of the very small incremental contribution to air pollution that the proposed development would make, but also recognition that at the project level this should not be considered a significant effect on population health or health inequalities.

12.15.27 The Chapter 9 modelling shows that the proposed development would neither significantly change, nor be a key driver of, poor air quality in LBN or surrounding areas. Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.16 Environmental Effects: Air Quality - Ultra Fine Particles

12.16.1 This section discusses changes to UFPs, from surface access and aircraft movements, as a public health issue.

12.16.2 This section is a supplement to the air quality assessment and draws out a specific issue highlighted in discussions with LBN leading up to the Scoping Opinion. This is assessed separately so it is clear that UFP as a public health issue has been investigated and taken into account by the health assessment. The issue of UFP is also discussed in Chapter 9.

12.16.3 For the reasons set out in Chapter 9 it is not possible to predict UFP concentrations, this chapter is however able to undertake a qualitative assessment of the potential for likely significant population health effects using good practice methods (Pyper, et al., 2022a; Pyper, et al., 2022b; Cave, et al., 2020). This does not affect the validity of the assessment and puts it on a par with most other determinants of health.

12.16.4 UFPs (also known as PM<sub>0.1</sub>) are particulates present in the air with a diameter of 0.1µm (100nm) or less. Epidemiological studies indicate that exposure to ambient UFP in the air could pose a health risk and is therefore an important public health issue (Viher Hrženjak, Kukec, Eržen, & Stanimirović, 2020).

12.16.5 Due to their small size, UFP are believed to exert higher toxicity than larger particles (Ohlwein, Kappeler, Kutlar Joss, Künzli, & Hoffmann, 2019), for example they cause more pulmonary inflammation and are retained longer in the lung than fine particles (PM<sub>2.5</sub>) (Schraufnagel, 2020). Although their potential toxicological effects are known, their precise role in many illnesses is still unknown, and there is a lack of sufficient epidemiological evidence for the development of guidelines for UFP.

12.16.6 The World Health Organisation (WHO) global air quality guidelines in 2021 (WHO, 2021) recognised that there is growing evidence from laboratory studies of toxicological effects of UFP, however concluded that the evidence from field research (i.e. real-world settings) is not sufficient to formulate air quality guideline levels for exposure.

12.16.7 UFPs are one of many public health issues for which there is currently not sufficient aetiological or effect size evidence to inform a clear policy position. It is part of the impact assessment process to appropriately reflect on and respond to such uncertainties. In this case, whilst there is a lack of full scientific certainty, the available epidemiological evidence suggests a small effect size. This conclusion is based on a review of the recent literature, including having regard to the strength of evidence, the quality of research (internal validity) and its application to the LCY context (external validity).

12.16.8 A review of recent good quality evidence sources, namely systematic reviews, meta-analyses and randomised controlled trials, as well as other clinical trials was undertaken and the following synthesis summaries relevant points.

12.16.9 The evidence is still weak for epidemiological findings on UFP respiratory effects, as the related exposure data is still sparse and diverse. UFPs in cities are mainly traffic related. There is some limited evidence of effects on respiratory health among children and during the warm season across all ages (Samoli, Rodopoulou, Schneider, & al., 2020). The evidence suggests adverse short-term associations with inflammatory and cardiovascular changes, which may be at least partly independent of other pollutants. For other health outcomes, the evidence on independent health effects of UFP remains inconclusive or insufficient (Ohlwein, Kappeler, Kutlar Joss, Künzli, & Hoffmann, 2019). Short-term exposure to ambient UFP is associated with decreased heart rate variability, predominantly as an immediate response within hours, but not over the day or following days (Zhang, Breitner, Pickford, & al., 2022). Long-term exposure to PM<sub>2.5</sub> and PM<sub>10</sub> is significantly associated with risk of hypertension, but there is not a significant association for particle sizes smaller than PM<sub>2.5</sub> (Qin, Luo, Zeng, & al., 2021).

12.16.10 UFP is elevated in and around airports. However, a lack of standard methods and instrumentation make comparisons of measured concentrations among studies difficult. In addition, there are very few long-term studies and only a few airports have been studied, making it difficult to provide broad generalizations. Differences in airport and aircraft operations, geography, and meteorology have a significant impact on the results (Riley, Cook, Carr, & Manning, 2021). Exposure to jet engine emissions is associated with similar adverse health effects as exposure to diesel exhaust particles and other traffic emissions (Bendtsen, Bengtsen, Saber, & Vogel, 2021). UFPs from aviation and road traffic in airport surroundings are therefore likely to have similar effects on public health (He, et al., 2020). Whilst urban areas in the vicinity of airports are at risk of increased exposure, the high exposure group comprises workers on the apron close to jet engines, with those indoors or with landside jobs classified as a low exposure group (Bendtsen, Bengtsen, Saber, & Vogel, 2021). Exposure in vulnerable population groups such as children is still not well understood. Available studies indicate that microenvironments with the greatest levels of UFP relate to being close to heavy traffic or near cooking and cleaning activities (García-Hernández, Ferrero, Estarlich, & Ballester, 2020). The following three recent airport related studies are noted:

- Wing et al (2020) (Wing, et al., 2020) investigated the risk of pre-term birth in a large sample of women living within 15km of Los Angeles airport in the USA (four runways). In utero exposure to aircraft-origin UFPs was significantly associated with pre-term birth (birth occurring before 37 weeks), independent of demographics, noise and traffic-related air pollution exposures. Health outcomes associated with pre-term birth were not measured. The USA context of income level affecting use of air conditioning and healthcare access, as well as PM<sub>2.5</sub> exposure, were not ruled out as other factors in this association. Strength of evidence is considered moderate, though study quality is considered low due to potential confounders despite large sample size. The US context, particularly around healthcare model, limits the generalisability of the findings to the UK context.
- Wu et al (2021) present a similar study relating to the association between tumour and UFPs. As with Wing et al (2020), the study was around Los Angeles airport and the correlation was not shown to be causal, as other confounding factors may explain or heavily modify the relationship. The plausibility of a relationship is

however tentatively supported by a non-aviation study (Weichenthal, et al., 2020), which considered spatial variation in UFPs and tumour for two Canadian cities. Caution remains as Weichenthal et al. (2020) were not able to control for all confounders, e.g. there was not data on family tumour history or life-time exposure to ionization radiation. Generalisability to a UK context is also not established.

- Lammers et al., (2020) investigated short-term (5 hr) semi-controlled exposure to UFP for 21 healthy young adults at Schiphol Airport in the Netherlands (six runways). The results indicated that following the exposure to aviation, but not road transport UFPs, there was a small reduction in markers for lung function (measured by volume of air exhaled after a deep breath) and heart function (measured by QTc interval, which relates to how quickly the heart recharges between beats). Respiratory and cardiovascular health outcomes were not measured. Both strength of evidence and study quality is considered low, reflecting the very small sample size, potential confounders including noise and inconsistencies in protocol. For example, the participants were not habituated to airport noise and the noise of landing aircraft close to the test site was not controlled for, which might suggest that the physiological responses were to noise (Tascanov, Havlioglu, Tanriverdi, Gungoren, & Altiparmak, 2021; Cardoso, Oliveira, Silva, Aguas, & Pereira, 2006) rather than UFPs.

12.16.11 It is relevant context that the studies undertaken to date focus on very large airports with multiple runways and much higher ATMs than LCY. For example, Amsterdam Airport Schiphol has 6 runways and Los Angeles International Airport has 4 runways. Even at those locations the epidemiology for UFP significantly affecting population health effects remains an area of continuing research. Research to date does not show evidence of UFPs having a large effect on population health outcomes.

12.16.12 Our assessment considers the potential effects on population health in terms of a source-pathway-receptor linkage. However, it should be noted that the scientific literature is not sufficiently advanced to clearly link UFPs to health outcomes. The establishment of a 'likely' effect is therefore tentative.

- The source is UFP from road traffic and aviation emissions;
- The pathway is diffusion through the air; and
- Receptors are residents and long-term occupiers of nearby properties and community buildings.

12.16.13 The generation of UFPs from road transport and aviation sources is probable and no highly unusual conditions are required for the source-pathway-receptor linkage, though as noted the extent to which health effects may occur is unclear.

12.16.14 The population groups relevant to this assessment are:

- The 'site-specific' geographic population of communities in the Chapter 9 zone of influence, the health sensitivity of which is indicatively based on representative wards close to the airport, see paragraph 12.3.7;
- The sub-population vulnerable is not clearly established by the literature, but may include:
  - Young age vulnerability (children, young people and pregnant women);
  - Old age vulnerability (older people);
  - Low-income vulnerability (people with lower socio-economic status)
  - Poor health vulnerability (people with existing poor respiratory or cardiovascular health); and
  - Access and geographical vulnerability (people for whom close proximity to the airport and flightpaths increases sensitivity).

12.16.15 The health assessment conservatively assumes that like PM<sub>2.5</sub> there would be non-threshold effects associated with UFPs, though this is not clear from the available literature.

12.16.16 The sensitivity of the general population is considered to be low and the sensitivity of vulnerable groups is considered high for the same reasons set out in the main air quality health assessment (paragraphs 12.15.19 and 12.15.20 respectively).

12.16.17 It is concluded that the magnitude of the change due to the project, comparing the DC and DM scenarios in all assessment years, is low. The scale of change in UFPs due to the proposed development is considered to be small. This judgement takes into account the very small relative changes for other types of

particulate matter discussed in Chapter 9. Whilst it is acknowledged that this is a crude indicator for UFP, the UFPs are of common combustion engine source origin (taking into account that there are volatile and non-volatile components) and it is relevant that the maximum number of permitted ATMs is not changed by this application. The realistic worst-case assessment is of a low or very low increase in UFP concentrations experienced by the local population. It is noted that low concentrations are partly due to high levels of dispersion, which are more likely for UFPs of aviation origin than road transport origin due to greater separation between the source (airborne engine) and the receptors (people on the ground). The magnitude conclusion also takes into account that the change in UFP exposure is likely to be long-term and experienced on a frequent basis. The effect, based on current literature, is likely to relate to a very minor change in population health risk related to morbidity, mortality and hospital admissions for respiratory, cardiovascular and pre-term birth health outcomes, noting that causal links to these outcomes are not well established. Whilst exposure is likely to extend to a large minority of the local population, the effect on routine health service planning is likely negligible based on current scientific understanding.

12.16.18 The effect is characterised as being *adverse* in direction, *permanent* and due to a *direct* health pathway (albeit a pathway that has not been clearly established by the scientific literature). The professional judgement is that the significance of any UFP effect for population health would be up to minor adverse (not significant). The conclusion reflects that the literature does not support exposure-response regulatory thresholds, standards or guidelines that would define a level below which effects might be considered negligible. The minor adverse (rather than negligible) score is a conservative assessment finding on the basis of scientific uncertainty (and emerging evidence) about UFP. Based on the levels of current *suggestive* scientific knowledge, and accounting for a precautionary approach, it is unlikely that the change in UFPs would have more than a *marginal* effect on inequalities or on delivering health policy. Any change in the health baseline would be *slight*.

12.16.19 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.17 Environmental Effects: Climate Change

12.17.1 This section considers the population health implications of the contribution of the Proposed Development to climate change.

12.17.2 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 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).

12.17.3 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, food insecurity (e.g. lower crop yields) and mental stress associated with natural disasters.

12.17.4 Global climate change is expected to affect the frequency, intensity and duration of extreme water-related weather events such as excessive precipitation, floods, and drought (Cann, Thomas, Salmon, Wyn-Jones, & Kay, 2013). The adverse health aspects related to climate change may include heat-related disorders, such as heat stress and economic consequences of reduced work capacity; respiratory disorders, including those exacerbated by air pollution and aeroallergens, such as asthma; infectious diseases, including vector-borne diseases and water-borne diseases, such as childhood gastrointestinal diseases; food insecurity,

including reduced crop yields and an increase in plant diseases; and mental health disorders, such as posttraumatic stress disorder and depression, that are associated with natural disasters (Patz, Frumkin, Holloway, Vimont, & Haines, 2014). Linkages between public health and climate change are complex and interact with other factors (Bouزيد, Hooper, & Hunter, 2013). Although the frequency and magnitude of climate change-related health hazards are likely to increase, the population vulnerabilities and corresponding health impacts are dependent on a community's exposures, pre-existing sensitivities, and adaptive capacities in response to a hazard's impact. Distinct spatial patterns were observed - vulnerability is generally higher in more deprived and more outlying neighbourhoods of a study region (Yu, Castellani, Forsynski, & al., 2021).

12.17.5 This section has been informed by Chapter 11 – Climate Change, which sets out relevant assessment findings and mitigation measures that have been taken into account. For example, LCY has committed to reduce the emissions the Airport controls to net zero by 2030 and to zero by 2040.

12.17.6 Chapter 11 assesses the global impact of greenhouse gas emissions from the proposed development. Chapter 11 concludes that these are minor adverse, not significant. The chapter also assesses the resilience of the proposed development to climate change and concludes effects are not significant.

12.17.7 Consistent with the quantitative analysis discussed in Chapter 11, this qualitative health assessment is based on a comparison between the 2031 DM scenario with the 2031 DC scenario. Regard is also given to effects in 2024, 2027 and 2050 as discussed in Chapter 11.

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

- Source: energy use, ground transport and air transport contributes to climate-altering pollutants, notably carbon dioxide;
- Pathway: climate-altering pollutants contribute to climate change, which is associated with global changes in temperature, crop yields, productivity and disease prevalence; and
- Receptor: international global population, particularly deprived populations in low- and middle-income countries.

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

12.17.10 The population groups relevant to this assessment are:

- The 'national' population of England;
- The 'international' population globally;
- The sub-population vulnerable due to less capacity to adapt to climate change:
  - Young age vulnerability (children and young people);
  - Old age vulnerability (older people);
  - Low-income vulnerability (people living in deprivation, including those on low incomes);
  - Poor health vulnerability (people with existing poor physical and mental health);
  - Social disadvantage (people who experience low social status or social isolation); and
  - Access and geographical vulnerability (people who experience existing access barriers or who rely on the affected routes, including healthcare and other amenities that may be affected by climate change).

12.17.11 The sensitivity of the general population is low. Common factors that differentiate the sensitivity of the general population and the vulnerable group population have been taken into account and are listed in Appendix 12.2. This reflects that England 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.

12.17.12 The sensitivity of the vulnerable group population is high. This reflects that the adverse effects would fall most heavily on the poorest and most vulnerable members and regions of society (globally). Disproportionate effect on the most disadvantaged in society are likely to widen health inequalities. Although

people in England are generally less vulnerable, as they are able to get support to cope with the effects of climate change, some may still be at greater risk (e.g. low incomes or age making it harder to cope with heatwaves or flooding).

12.17.13 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is low. This reflects the professional judgement that the scale of change would be *very small* within the national emission context, though *continuous* and *long-term*. The health effect likely represents a *very 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, shifts in communicable illness ranges and exposure to extreme meteorological conditions.

12.17.14 The effect is characterised as being *adverse* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect is up to a minor adverse (not significant) effect. This is the case because whilst the scientific literature supports a *causal* relationship between climate altering pollutants and climate change; the level of effect depends on the contribution to global, not local, atmospheric conditions. In that context the change due to the proposed development, comparing the DC and DM scenarios in all assessment years, would have a *very limited* effect on the global or national health baseline, even accounting for long-term inter-generational effects. The conclusion of a minor adverse rather than negligible effect recognises that climate change is a *specific* public health priority issue and that there is *consensus* from stakeholders that climate change as an issue is a concern. It also reflects that as an issue, climate change is being addressed through international cooperation, with emissions targets and strategies set at the national level not the individual project level. Due to that wider national response, within which the proposed development's changes are accounted, the effect would have only a marginal impact on delivering public health policy, e.g. relating to narrowing health inequalities. See Chapter 11 for discussion of any impact on the Government's ability to meet climate change obligations. Jet zero (Department for Transport, 2022) commits the government to net zero aviation emissions by 2050, consistent with consensus of what is required for the UK to meet its economy wide net zero target, which itself is set to ensure the UK contributes an appropriate level of mitigation to meet the global 1.5 degree target. At most the effect may be a marginal widening of inequalities. This conclusion gives weight to the strategic national level agendas of net zero and jet zero, as well as the Airport's energy strategy and Sustainability Roadmap, see Chapter 11.

12.17.15 Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.18 Health and Social Care Services: NHS Routine Service Planning

12.18.1 This section considers the potential implications for NHS routine service planning, and any consequent population health effect, of changes in numbers of passengers arriving at the airport (inbound or outbound).

12.18.2 Health service demand may be associated with a non-permanent UK population in the area affecting demand on the local NHS. These are people who are not usually resident in the area (so not registered with local NHS services). This group includes: some airport employees (e.g. aircrews), passengers and other airport visitors (e.g. dropping off or collecting passengers).

12.18.3 The health assessment considers the current level of demand, e.g. ambulance callouts from the Airport, and the expected change due to the proposed uplift in passengers.

12.18.4 The key health outcomes linked to unplanned need for NHS attendance whilst at, or travelling to or from, the Airport relate to the direct effect on quality of NHS services and the indirect effect any change may have on early diagnosis, treatment outcomes and preventative measures.

12.18.5 In general terms, emergency department crowding is a major patient safety concern associated with poor patient outcomes (Carter, Pouch, & Larson, 2014). Inappropriate attendances may account for up to 40%

of presentations at accident and emergency (A&E) departments (Ismail, Gibbons, & Gnani, 2013). Healthcare professionals with poor wellbeing and moderate to high levels of burnout are associated with poor patient safety outcomes such as medical errors (Hall, Johnson, Watt, Tsipa, & O'Connor, 2016). Accessibility of primary health care, mostly measured through the availability of GP in a given area and the entitlement of patients to access to GP visits, reduces avoidable hospitalisation (Rosano, Loha, Falvo, & al., 2013).

12.18.6 Table 12.12 provides indicative data on passenger healthcare usage associated with the airport activities. Medical calls are internal calls to the airport control room logging and actioning health incidents at the Airport. The data available covers the most recent five years, which includes years influenced by the Covid-19 pandemic. A rate per 100,000 passengers is therefore used to indicate the general level of demand and estimate future demand. Realistic and worst-case projections are included for the DM and DC scenarios.

**Table 12.12** shows an expected annual 10 additional ambulance attendances in the 2031 DC scenario compared to the DM scenario. This reflects rates prior to the Covid-19 pandemic. The worst-case estimate is an additional 21 ambulance attendances, less than one per month. This reflects rates during to the Covid-19 pandemic, which are not expected to be reflective of rates in 2031, but provide a conservative estimate.

**Table 12.12: Medical Calls and Ambulance Attendances at the Airport**

Year	Total Medical Calls	Ambulance Attending	Passenger numbers <sup>5</sup>	Ambulance Attending per 100,000 passengers
2018	126	17	4,800,190	0.4
2019	139	24	5,100,025	0.5
2020	3	2	905,326	0.2
2021	23	6	713,969	0.8
2022 *	41	15	1,858,656	0.8
2031 (DM)	173 *** (405 worst case)	27 ** (55 worst case)	6,500,000	0.4 ** (0.8 worst case)
2031 (DC)	240 *** (561 worst case)	37 ** (76 worst case)	9,000,000	0.4 ** (0.8 worst case)

\* January 2022 to August 2022

\*\* Expected based on average of 2018 and 2019 data for a rate of 0.4 ambulance attendance per 100,000 passengers. Worst case included for average of 2021 and 2022 data for a rate of 0.8 ambulance attendance per 100,000 passengers.

\*\*\* Expected based on average of 2018 and 2019 data for ambulance attending 15.5% of total medical calls. Worst case included for 2018 data for a rate of an ambulance attending 13.5% of total medical calls.

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

- Source: changes in demand for medical and healthcare facilities, e.g. A&E or ambulance services, as a result of unplanned need for NHS attendance whilst at, or travelling to or from, the Airport. Primary care effects are also possible, e.g. to GPs, but are considered less likely so are taken into account, but not the focus of the assessment;
- Pathway: a change in capacity, staffing and resources of the local NHS; and
- Receptors: local community populations accessing these services or facilities. This may include healthcare staff should they experience resource pressures.

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

12.18.9 The population groups relevant to this assessment are:

<sup>5</sup> Data taken from publicly available London City Airport passenger statistics. (London City Airport, Online)

- The 'site-specific' geographic population of communities near the Airport in relation to primary care;
- The 'local' population of Newham, Greenwich and Tower Hamlets (in relation to London Ambulance Service NHS Trust activities and A&E capacity, e.g. at Newham University Hospital, The Royal London Hospital (Tower Hamlets) or Queen Elizabeth Hospital (Greenwich));
- The sub-population vulnerable due to:
  - Young age vulnerability (including children, young people and pregnant mothers as higher users of healthcare);
  - Old age vulnerability (including older people as higher users of healthcare);
  - Poor health vulnerability (people with existing poor physical and mental health as higher users of healthcare);
  - Social disadvantage (people who experience low social status or social isolation); and
  - Access and geographical vulnerability (people who experience existing access barriers to healthcare).

12.18.10 The sensitivity of the general population is considered to be low. The closest medical facility to the airport is the Albert Road Surgery, approximately 0.3 miles southeast of the airport, one of six surgeries in the Newham Group Practices. There are 5 GP surgeries within 1 mile of the airport (NHS, Online). The Newham University Hospital is approximately 1.4 miles to the north of the airport, Queen Elizabeth Hospital is approximately 1.8 miles to the south and Royal London Hospital approximately 4.6 miles to the west, all three have emergency department (A&E) facilities. The closest London Ambulance Service NHS Trust station is the Silvertown Ambulance Station approximately 1.0 mile to the west of the airport. The great majority of demand on the NHS in the local area that is above that based on the resident population or patient list size, is likely to relate to unplanned NHS local service use by a non-permanent population in the area for business, education or leisure unrelated to the airport.

12.18.11 The sensitivity of vulnerable groups is considered high. This reflects the presence of people who require regular health care, e.g. older people with multiple long-term conditions. Health professionals who are facing increased demand are also considered to be highly sensitive.

12.18.12 The magnitude of change due to the Proposed Development, comparing the DC and DM scenarios in all assessment years, is low. This reflects that any use of NHS services, above that already accounted for within routine NHS service planning, would relate to the small proportion of staff, passengers and airport visitors who fall ill or are injured at the airport, or whilst travelling to or from it. The majority of this service use is likely to relate to accessing the nearest A&E unit, including transport by ambulance. As shown in Table 12.12 the level of change is likely to be very small.

12.18.13 The following points consider in impact of the Airport's passengers and visitors on NHS services:

- the proposed development would result in an Airport capacity increasing of 2.5mppa by 2031. The proportion of passengers and airport visitors that make use of local NHS services whilst at, or travelling to or from, the airport is considered to be low. There is no requirement for either the NHS or for the Airport to record the numbers of people (passengers or visitors) who have unplanned need for healthcare services or who make use of the local A&E departments whilst at, or travelling to or from, the airport. Such service use is therefore not well documented. A reasonable indication is provided in Table 12.12, which summarises data held by LCY.
- If a person falls ill while away from home, they can contact the nearest GP surgery or NHS 111 service. A person can receive emergency treatment from a GP for 14 days, on this basis, after which they will have to register as a temporary resident or permanent patient (NHS, Online). It is considered unlikely that a large number of non-local passengers or visitors to the airport would formally register with a GP as a temporary resident. If there is an effect, it will relate to a small demand for GP emergency appointments by non-registered patients. This also reflects the potential for a small increase in demand for fitness to fly assessments (Civil Aviation Authority, Online) if such assessments are requested by an airline once the passenger is already at the airport.

- It is noted that the catchment area of the airport (for passengers and visitors) overlaps with the catchment areas of local hospitals with A&E departments and the London Ambulance Service NHS Trust, for ambulance callouts. A reasonable proportion of A&E attendances and ambulance callouts associated with the Airport would therefore be likely to be for a resident population who would already be factored into routine NHS service planning.
- It is also noted that the airport (and any NHS service use associated with it) is an existing part of the context in which current NHS routine service planning occurs. The proposed development would be an extension to an existing service planning consideration (even if a general unspecified but acknowledge demand) rather than a new factor to be considered.
- The timescales of passenger increase to 9mppa only by 2031 provides opportunity for NHS service planning to anticipate any increase in demand that may be associated with people at (or travelling to or from) the airport.

12.18.14 Airport staff have also been considered. Any increase in demand for local NHS services associated with the increase in airport staff is expected to be negligible. Most staff (c.84%) are resident in the Greater London area, so would access their usual NHS services. This would be managed as part of routine NHS service planning. In terms of existing protocols, if a member of the Airport's staff falls ill whilst at work, then LCY goes through the normal channels of contacting the NHS (telephone services using 111 or 999). If a LCY employee is asked to attend primary care, then they use their own registered GP. LCY has policies on: code of conduct; equal opportunities; anti-harassment and bullying; whistleblowing; pregnancy and maternity; shared parental leave; sickness reporting; statutory sick pay; grievance procedure; and agile working. Use of these protocols and policies would continue under the proposed development.

12.18.15 Any increase in demand on GP, A&E and ambulance services, i.e. the unplanned NHS usage by passengers and visitors to the airport, is expected to be proportionate to demand trends set out in Table 12.12. This qualitative assessment indicates a small level of change. This reflects a proportionate increase to a low level of usage of local NHS services.

12.18.16 The effect is characterised as being *adverse* in direction, *permanent* and due to *direct* and *indirect* health pathways. The significance of the population health effect is up to a minor adverse (not significant) effect due to the slight increased demand for ambulance callouts and A&E attendance by people outside out their usual NHS catchment area. The conclusion reflects the expectation that with appropriate service planning local NHS services would be in a position to accommodate an increase in unplanned attendances by people not registered with a local GP, ambulance or A&E departments (i.e. passengers or visitors passing though the Airport and needing NHS services). Such attendance at GP surgeries or A&E by unregistered patients is normal.

Further mitigation/monitoring proposals are set out in Section 12.20 and residual effect conclusions are set out in Section 12.21.

## 12.19 Sensitivity Tests

12.19.1 Faster Growth and Slower Growth scenarios have been considered qualitatively.

12.19.2 For population health effects, the Faster and Slower Growth scenarios are unlikely to materially change the conclusions reached for the core case.

12.19.3 The Faster Growth scenario (9 mppa in 2029) would have had two years less opportunity to progress fleet modernisations. Aircraft emission levels (e.g. air and noise) would therefore be expected to be slightly higher. Background exposures are also likely to be slightly higher, as there would have been less transition to electric/hydrogen vehicles, albeit potentially fewer vehicles. There would also be two years less population and economic growth, though the rate of economic growth is assumed to be faster than the core scenario. The Faster Growth scenario is characterised as being slightly 'more intensive' but potentially affecting a slightly

smaller population. The changes have been considered and any change would not be so great as to affect the assessments scores for the likely significant effects to population health.

12.19.4 The Slower Growth scenario (9 mppa in 2033) would have had two additional years to progress fleet modernisations. Aircraft emission levels would therefore be expected to be slightly lower. Background exposures are also likely to be slightly lower, as there would have been greater transition to electric/hydrogen vehicles, albeit potentially with more vehicles. There would also be two years more population and economic growth compared to the core scenario, though the rate of economic growth is assumed to be slower. The Slower Growth scenario is characterised as being slightly 'less intensive' but potentially affecting a slightly larger population.

12.19.5 For the Faster and Slower Growth scenario, as with the core scenario: the beneficial economic effects are considered significant for population health; and the adverse effects are considered not-significant for population health.

## 12.20 Further Mitigation and Monitoring

12.20.1 The following further measures have been identified and are taken into account in the residual effect conclusions set out in Section 12.21.

### 12.20.2 Environmental Effects: Noise

- Further action in response to monitoring includes further targeted support to promote uptake of the insulation scheme amongst vulnerable groups. Monitoring results will be shared with the relevant public health teams. Further targeting may include tenants to be eligible to initiate the Sound Insulation Scheme application (the implementation of which would still be subject to landlord approval), support where English is not a first language and for those with low literacy.

### 12.20.3 Healthy lifestyles: Physical activity and leisure

- The public health opportunities for offsetting increased disturbance at public open spaces has been considered. It is proposed that part of the Community Fund be used as per LBN Policy SP2 to provide "new or improved inclusive open space and sports facilities, including good quality, secure and stimulating play space and informal recreation provision for young people and accessible natural greenspace and bluespace to encourage greater participation in physical activity". The details of this will be agreed with the relevant local authorities as per the Community Fund allocation process.

### 12.20.4 Safe and Cohesive Communities: Community Identity

- None.

### 12.20.5 Safe and Cohesive Communities: Transport

- The public health opportunities have been considered in the context that existing commitments agreed as part of the CADP1 planning permissions already increase the modal share of non-vehicle access through to 2031. See Chapter 10 – Surface Access for further details. For airport access (passengers and staff) the public health opportunity is in further extending the public transport modal share. This is however largely dependent on the potential to extend DLR operating hours to allow people to reach the Airport in the early morning. The DLR currently operates Monday to Saturday operations between 05:30 – 00:30. Changes to the DLR timetable are outside of the control of LCY and sits with TfL. The application proposes a Sustainable Transport Fund which could contribute to earlier DLR starting times, however this is subject to future discussions with TfL. Such a change is therefore not securable directly through the planning application, and therefore not relied upon to reach an enhanced public health outcome conclusion, which

could otherwise have been moderate beneficial (significant). The residual effect on this issue therefore remains at minor beneficial (not significant).

#### 12.20.6 Socio Economic Effects: Good Quality Employment

- The public health opportunities have been considered in the context of an existing strong LCY portfolio of local employment support initiatives. These are summarised in Chapter 7. The continuation and tailoring of these interventions to vulnerable groups would extend the opportunities for local people to continue to share in the benefits of aviation related employment. Monitoring of the proportion of local people with long-term unemployment, high job instability or low income characteristics who enter good quality stable employment with LCY would be undertaken as part of the embedded mitigation Annual Monitoring Report described in Chapter 7 to confirm the benefit and further tailor the targeting of local vulnerable groups.

#### 12.20.7 Socio Economic Effects: Training Opportunities

- The public health opportunities have been considered in the context of an existing strong LCY portfolio of local training and educational support initiatives. These are summarised in Chapter 7. If a high proportion of training opportunities were targeted to local vulnerable groups, notably young NEET people then there is the potential locally for a moderate beneficial (significant) population health residual effect. This reflects the potential to achieve long-term benefits though from a targeted training intervention at a critical stage in the life course for this group. Monitoring of the proportion of NEETs taking up, and completing, training opportunities with LCY could be undertaken to confirm the benefit and further tailor the targeting of local vulnerable groups.

#### 12.20.8 Environmental Effects: Air Quality

- None.

#### 12.20.9 Environmental Effects: Air Quality - Ultra Fine Particles

- The appropriate response is for public health to maintain a watching brief on UFP as a topic area. The monitoring of UFPs is therefore supported, including correlating results with use of sustainable aviation fuel (SAF) at the airport and as appropriate future hydrogen and/or electric aircraft transition. SAF use may reduce UFPs due to its very low sulphur content, though the relationship requires investigation.

#### 12.20.10 Environmental Effects: Climate Change

- As the majority of the climate impact is around aviation, rather than surface access or the airport's infrastructure emissions, the public health opportunity is in facilitating the transition to greater use of sustainable aviation fuel and to the transition to electric or hydrogen aircraft. The airport is ensuring, including through the proposed development, that it can support this transition.

#### 12.20.11 Health and Social Care Services: NHS Routine Service Planning

- LCY would, where reasonably practicable, collect and share data relevant to healthcare usage associated with the airport;
- Continue to operate a high-quality occupational health service for staff at the airport (expanding relative to the increase in staff numbers) to minimise unintended consequences for local NHS services; and
- Promote measures and information at the airport for the protection and improvement of health for passengers, visitors to the airport and staff and where appropriate, align with health promotion initiatives run by the LBN public health team, the Office of Health Improvement and Disparities and the UK Health Security Agency.

## 12.21 Residual Effects and Conclusions

Taking account of the further mitigation and monitoring discussed in Section 12.20, this section concludes on the residual effects. The results are summarised in Table 12.13.

### 12.21.1 Environmental Effects: Noise

- Minor adverse (not significant).
- On this basis, the proposed development is not anticipated to give rise to any new or materially different significant population health effects. The residual effects of the proposed development therefore remain as reported in the 2015 HIA, with the addition of measures not assessed at that time, e.g. night-time and weekend daytime noise, which are considered to be minor adverse (not significant) for population health.

### 12.21.2 Healthy lifestyles: Physical activity and leisure

- Minor adverse (not significant).
- On this basis the proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the 2015 HIA. Whilst this issue was not specifically assessed by the 2015 HIA, as was proportionate given the nature of the CADP1 changes and guidance of the day, the current assessment does not introduce new significant population health effects that would change the implications of CADP1 for public health.

### 12.21.3 Safe and Cohesive Communities: Community Identity

- Minor beneficial and minor adverse (not significant).
- On this basis the proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the CADP1 HIA. Whilst this issue was not specifically assessed by the CADP1 HIA, as it was proportionate given the nature of the CADP1 changes and guidance of the day, the current assessment does not introduce new significant population health effects that would change the implications of CADP1 for public health.

### 12.21.4 Safe and Cohesive Communities: Transport

- Minor beneficial and minor adverse (not significant).
- The proposed development is not anticipated to give rise to any new or materially different significant population health effects. The residual effects of the proposed development therefore remain as reported in the 2015 HIA.

### 12.21.5 Socio Economic Effects: Good Quality Employment

- Moderate beneficial (significant).
- The proposed development is not anticipated to give rise to any new or materially different significant population health effects. The residual effects of the Proposed Development therefore remain as reported in the 2015 HIA, i.e. significant socio-economic health benefits at a regional and local level.

### 12.21.6 Socio Economic Effects: Training Opportunities

- Moderate beneficial (significant).
- On this basis the proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the 2015 HIA. Whilst this issue was not specifically assessed by the 2015 HIA, as was proportionate given the nature of CADP1 and HIA guidance at the time, the current assessment does not introduce new significant population health effects that would change the implications of the approved CADP1 scheme for public health.

### 12.21.7 Environmental Effects: Air Quality

- Minor adverse (not significant).
- The proposed development is not anticipated to give rise to any new or materially different significant population health effects. The residual effects of the Proposed Development therefore remain as reported in the 2015 HIA, i.e. finding “the relative change in concentration exposure are not of an order to quantify any meaningful adverse health outcome”.

#### 12.21.8 Environmental Effects: Air Quality - Ultra Fine Particles

- Minor adverse (not significant).
- Based on the current state of scientific understanding of UFPs and having taken a precautionary and transparent approach to their assessment in the context of LCY, the proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the 2015 HIA. Whilst the issue of UFP was not specifically assessed by the 2015 HIA, as was proportionate given the nature of CADP1 and HIA guidance at the time, the current assessment does not introduce new significant population health effects that would change the implications of the approved CADP1 scheme for public health.

#### 12.21.9 Environmental Effects: Climate Change

- Minor adverse (not significant).
- The proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the 2015 HIA. Whilst health effects of climate change as an issue was not specifically assessed by the 2015 HIA, as was proportionate given the nature of CADP1 and HIA guidance at the time, the current assessment does not introduce new significant population health effects that would change the implications of the approved CADP1 scheme for public health.

#### 12.21.10 Health and Social Care Services: NHS Routine Service Planning

- Minor adverse (not significant).
- On this basis the proposed development is not anticipated to give rise to any new or materially different significant population health effects from those reached by the CADP1 HIA. Whilst healthcare service planning as an issue was not specifically assessed by the CADP1 HIA, as was proportionate given the nature of CADP1 and HIA guidance at the time, the current assessment does not introduce new significant population health effects that would change the implications of the approved CADP1 scheme for public health.

**Table 12.13: Summary of Residual Environmental Effects**

Receptor	Sensitivity of receptor	Description of impact	Short / medium / long term	Magnitude of impact	Significance of effect	Significant / Not significant
<b>Construction phase</b>						
No effects						
<b>Operational phase</b>						
Environmental Effects: Noise	General population	Medium	Long-term and Medium-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				
Healthy lifestyles: Physical activity and leisure	General population	Low	Long-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				
Safe and Cohesive Communities: Community Identity	General population	Low	Long-term	Low	Minor beneficial and Minor adverse	Not significant
	Vulnerable group population	High				

Safe and Cohesive Communities: Transport	General population	Low	Long-term	Low	Minor beneficial and Minor adverse	Not significant
	Vulnerable group population	High				
Socio Economic Effects: Good Quality Employment	General population	Low	Long-term	Medium	Moderate beneficial	Significant
	Vulnerable group population	High				
Socio Economic Effects: Training Opportunities	General population	Low	Long-term	Low	Moderate beneficial	Significant
	Vulnerable group population	High				
Environmental Effects: Air Quality	General population	Low	Long-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				
Environmental Effects: Air Quality - Ultra Fine Particles	General population	Low	Long-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				
Environmental Effects: Climate Change	General population	Low	Long-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				
Health and Social Care Services: NHS Routine Service Planning	General population	Low	Long-term	Low	Minor adverse	Not significant
	Vulnerable group population	High				

## 12.22 Assessment of In-combination Health Effects

12.22.1 The impacts identified and assessed in this chapter have the potential to interact with each other. The areas of potential interaction between impacts are presented in **Table 12.14**, **Table 12.15** and **Table 12.16**.

**Table 12.14: Key interactions where health determinants influence, or are influenced by, other health determinants**

	Noise	Physical activity and leisure	Community Identity	Transport	Good Quality Employment	Training Opportunities	Air Quality	Ultra-Fine Particles	Climate Change	NHS Routine Service Planning
Noise		✓	✓	✓						✓
Physical activity and leisure	✓		✓	✓			✓	✓		✓
Community Identity	✓	✓		✓	✓	✓	✓	✓		✓
Transport	✓	✓	✓				✓	✓	✓	✓
Good Quality Employment			✓			✓				✓
Training Opportunities			✓		✓					✓
Air Quality		✓	✓	✓				✓	✓	✓
Ultra-Fine Particles		✓	✓	✓			✓			✓
Climate Change				✓			✓			✓
NHS Routine Service Planning	✓	✓	✓	✓	✓	✓	✓	✓	✓	

12.22.2 **Table 12.14** illustrates key interactions between determinants of health. This captures interactions that are related to common sources of change. For example, transport influences noise and air quality, and also influences community identity, use of outdoor spaces and climate change. It also captures that all determinants of health ultimately influence NHS service use. The interactions do not capture where health determinants influence common health outcomes, e.g. noise and air quality both influencing cardiovascular outcomes. These are discussed separately as the complexity of pathways is not simple to show graphically.

**Table 12.15: In-combination effects by geographic populations**

	Site-specific	Local	Regional	National	International
Noise	✓				
Physical activity and leisure	✓	✓			
Community Identity	✓	✓			
Transport	✓	✓			
Good Quality Employment	✓	✓	✓		
Training Opportunities	✓	✓	✓		
Air Quality	✓				
Ultra-Fine Particles	✓				
Climate Change				✓	✓
NHS Routine Service Planning	✓	✓			

### Site-specific population

12.22.3 **Table 12.15** shows that the site-specific population would experience effects during operation from:

- noise (minor adverse);
- physical activity and leisure (minor adverse);
- community identity (minor beneficial and minor adverse);
- transport (minor beneficial and minor adverse);
- good quality employment (moderate beneficial);
- training opportunities (moderate beneficial);
- air quality (minor adverse);
- ultra-fine particles (minor adverse); and
- NHS routine service planning (minor adverse).

12.22.4 These effects are not expected to produce a greater population level effect in combination. This reflects that beneficial and adverse effects are unlikely to cancel each other out.

12.22.5 The beneficial effects linked to enhanced community identity and improved transport opportunity may affect similar people, but in-combination these are not likely to be greater than the individual effects, i.e. remain **minor beneficial**. The benefits from employment and training are likely to overlap, but the combined effect is not expected to be greater than **moderate beneficial**. Further overlap between beneficial effects is likely to an extent, but unlikely to change the conclusions reached.

12.22.6 For adverse effects the population may experience incremental negative contributions relate to: noise; disincentivised physical activity and leisure; adverse influence on community identity; traffic volumes; and air quality including ultra-fine particulates. The extent to which these affect the same individuals will vary. However, there will be some overlap, as well as common health outcomes affected, e.g. cardiovascular and mental wellbeing outcomes influenced by different pathways. Noise effects may coincide with slightly reduced air quality. These may affect similar populations to those who experience slightly disincentivised use of public open spaces and/or slightly busier road transport routes. The combined effect of has been considered. Whilst there is

some increased adverse influence on health outcomes, the degree of increase is not considered to constitute a significant population health effect. The effect therefore remains **minor adverse**. The combined influences of committed mitigations that support the same population is noted. For example, there are likely to be overlaps in those benefiting from the Sound Insulation Scheme for homes and community buildings, as well as benefiting from initiatives financed by the Community Fund, such as local public open space enhancements to promote physical activity and community cohesion.

12.22.7 Both beneficial and adverse effects contribute to the use of NHS services, with beneficial effects tending to reduce demand, whilst adverse effects tend to increase demand. The overall effect is not considered to be worse than minor adverse, and indeed may be less than this or an overall beneficial influence.

### Local population

12.22.8 The local population would experience effects during operation from: physical activity and leisure (minor adverse); community identity (minor beneficial and minor adverse); transport (minor beneficial and minor adverse); good quality employment (moderate beneficial); training opportunities (moderate beneficial); and NHS routine service planning (minor adverse). These are similarly not expected to have greater combined effects for the reasons set out for the site-specific population.

### Regional population

12.22.9 The regional population would experience effects during operation from: good quality employment (moderate beneficial); training opportunities (moderate beneficial). For such a wide geographic area there is very limited potential for overlap in effects experienced by the same individuals. Population level combined effects are therefore unlikely.

### National and international population

12.22.10 The national and international population would experience effects during operation only from climate change (minor adverse). Combined effects would therefore not occur.

**Table 12.16: In-combination effects by vulnerable group sub-populations**

	Young age	Old age	Low-income	Poor health	Social disadvantage	Access and geographical
Noise	✓	✓	✓	✓		✓
Physical activity and leisure	✓	✓	✓	✓	✓	✓
Community Identity		✓	✓		✓	✓
Transport	✓	✓	✓	✓		✓
Good Quality Employment	✓	✓	✓	✓	✓	
Training Opportunities	✓	✓	✓	✓	✓	
Air Quality	✓	✓	✓	✓		✓
Ultra-Fine Particles	✓	✓	✓	✓		✓
Climate Change	✓	✓	✓	✓	✓	✓
NHS Routine Service Planning	✓	✓		✓	✓	✓

12.22.11 For all determinants of health, across geographic areas, there is likely to be a high degree of overlap in the effects experienced by vulnerable population groups, as shown by **Table 12.16**. Given the small scale of the individual adverse effects, the combined effects for vulnerable sub-populations are not considered to differ from the individual effects. Vulnerable groups are also expected to benefit from the Proposed Development, including indirectly as dependants. Children and young people, particularly those from low-income households or who experience social disadvantage may particularly benefit from the Proposed Development’s employment and training initiatives.

## 12.23 Assessment of Cumulative Effects

12.23.1 This section assesses the potential for the Proposed Development to have different population health effects, when considered in combination with other reasonably foreseeable schemes. **Chapter 18: Cumulative Effects** includes a list of other projects that have been reviewed and taken into account. This assessment is qualitative and considers the potential for the combined magnitudes of effect to act on the same populations.

12.23.2 As the scope of the health assessment does not include construction effects of the Proposed Development, for the reasons set out in Section 12.7, cumulative construction effects with other schemes are not assessed.

12.23.3 During operation the projects could collectively contribute to changes in all the health determinants discussed in Section 12.8. The potential for overlap in the populations affected is however likely to vary by determinant.

12.23.4 It is considered unlikely that site-specific effects would cumulatively differ from the conclusions reached for the Proposed Development in isolation. This reflects the localised nature of exposures from other project sites, limiting the overlap in affected population. It also reflects the expectations that other projects would also employ standard good practice measures, such that significant adverse population effects are unlikely individually or in combination. Such conclusions relate to: noise; physical activity and leisure; community Identity; and air quality, including ultra-fine particles. The collective effects are not considered to exceed the minor adverse effects on population health of the Proposed Development in isolation.

12.23.5 Wider area effects associated with influences on transport, employment, training, climate change and NHS service use are more likely to have cumulative interactions, albeit with the degree of change is spread over a large population.

12.23.6 The potential for cumulative adverse effects associated with increased road transport, including where this results in air quality and noise impacts beyond the project site, is noted. Such effects would be greater than the Proposed Development in isolation. However, the expected increases in road traffic from these schemes has already been included in the road traffic data for the modelling of the effects of the Proposed Development. Such effects have therefore been accounted for, including in relation to air quality and noise modelling that informed the health assessment. The effects are therefore likely no greater than the minor adverse effects described for the Proposed Development.

12.23.7 The collective beneficial effects of jobs and training are noted and are likely to be greater than the moderate beneficial effects of the Proposed Development in isolation. A cumulative effect, at least moderate beneficial, may be anticipated, particularly should the other schemes also take steps to target opportunities to vulnerable groups. Such an effect is likely to reduce NHS service demand, driven by good quality jobs supporting mental health and making health-promoting resources available to employees and their dependants.

12.23.8 In conclusion, no new significant adverse effects on population health are expected due to cumulative effects with other projects. Significant beneficial effects for population health would remain and may be extended.

## 12.24 Chapter References

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