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Network Rail

Oxford Corridor Phase 2 Capacity Improvement Scheme

Environmental Impact Assessment – Environmental Statement: Chapter 12 – Human Health

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12. HUMAN HEALTH

12.1 Introduction

12.1.1 This chapter of the Environmental Statement reports the potential effects resulting from the construction and operation of the Scheme on human health. The assessment has taken the following approach:

- Identification of relevant baseline conditions;
- Details of relevant mitigation embedded within the Scheme and construction management measures;
- Assessment of potential human health effects from the Scheme;
- Proposals for appropriate additional mitigation measures if possible; and
- Conclusions on the likely significant residual effects of the Scheme for human health.

12.1.2 A full description of the Scheme is given in Chapter 2 – Description of the Scheme. All technical terms used in this chapter are explained within Appendix 1.5 – Glossary and Acronyms.

12.1.3 The human health assessment considers the following:

- Relevant legislation, policies and guidance;
- Human health profile of the communities in the study area;
- Potential for changes to the baseline environment and the direct and indirect pathways that could result in a human health effect;
- Potential for vulnerable groups in the study area to be disproportionately affected by any impacts;
- Potential for health inequalities to increase as a result of the Scheme; and
- Mitigation measures that would reduce potentially significant effects on human health.

12.1.4 The human health assessment is informed by output from the following chapters:

- Chapter 6: Air Quality and Odour;
- Chapter 7: Geology and Soils;

- Chapter 9: Landscape and Visual;
- Chapter 10: Noise and Vibration;
- Chapter 11: Population; and
- Chapter 13: Traffic and Transport.

12.1.5 This chapter is supported by:

- Volume 3 – Figure 12.1 – English Index of Multiple Deprivation 2019: Health Deprivation and Disability Domain Baseline; and
- Volume 4 - Appendix 12.1 - Human Health Baseline Conditions.

12.2 Legislation, Policy and Guidance

12.2.1 The following section outlines the relevant national legislation, regional and local planning policies and guidance relevant to this assessment.

12.2.2 Table 12.1 sets out the relevant legislation for human health; Table 12.2 sets out relevant planning policy for human health whilst Table 12.3 provides a summary of relevant guidance for this human health assessment.

12.2.3 The legislation, policies and guidance listed have been taken into account in the assessment of the likely significant effects on human health as a result of the Scheme. They have also been referred to in the development of appropriate mitigation measures.

Table 12.1: Legislation relevant to human health

Legislation	Description in relation to human health	Relevance to the Scheme
Equality Act 2010	The Equality Act 2010 obliges public authorities to comply with the Public-Sector Equality Duty (PSED). The PSED requires public bodies (including Network Rail) to show due regard to the need to eliminate discrimination, harassment and victimisation. The PSED also requires public bodies to "advance equality of opportunity" and good relations between those who share a relevant protected characteristic and those who do not.	The human health assessment has looked at the potential for impacts on vulnerable groups including disadvantaged people and those with a disability. This is to identify if the Scheme may have a disproportionate impact on these groups and consider whether additional mitigation is required. A Diversity Impact Assessment has been undertaken by Network Rail separately to this Environmental Statement.
The Health and Social Care Act 2012	The Health and Social Care Act was implemented in April 2013 and led to the abolition of Primary Care Trusts and Strategic Health Authorities. Their functions are now undertaken by Health and Well-being boards and Clinical Commissioning Groups. The responsibility for local population health improvement now lies with Local Authorities, whilst Ministers remain ultimately responsible for the NHS.	The assessment has drawn on information provided from Local Authorities. Plans, policies and strategies produced by the responsible authority relating to local population health have been referred to in order to check the Scheme's compliance.

Table 12.2: Planning policy relevant to human health

Policy Document	Description in relation to human health	Relevance to the Scheme
The National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government, 2019)	The NPPF, 2019 sets out the Government's planning policies for England. It also provides a framework within which communities working alongside their local authority may produce their own distinctive local and neighbourhood plans, which reflect their needs and priorities. The framework supports planning policies and decisions in aiming to achieve healthy, inclusive and safe places which: • promote social interaction; • are safe and accessible; and • enable and support healthy lifestyles.	An application for prior approval for the Scheme will be submitted. The health assessment has therefore been guided by the requirements of NPPF. The assessment sets out how the Scheme could support improvements to inclusion and to well-being, and how safety, accessibility and the needs of the community are considered in the design and mitigation process (see Section 12.5).
Healthy Lives, Healthy People:	The Strategy for Public Health in England (Department of Health, 2010) sets out the Government's long-term vision for the future of	The assessment has taken account of the vision set out in the Strategy. It looks at how the Scheme can provide

Policy Document	Description in relation to human health	Relevance to the Scheme
Our Strategy for Public Health in England (Department of Health, 2010)	public health in the country. It aims to create a "wellness" service and to strengthen both national and local leadership. This Strategy sets out the government's approach to tackling obesity in England. Increasing physical activity and active travel are identified as measures to achieving the specified targets.	increasing opportunities for physical activity and active travel, thereby contributing to the aims of the Strategy.
The Marmot Review: Fair Society, Healthy Lives (Marmot et al, 2010) Health Equity in England: The Marmot Review 10 Years On (The Health Foundation, 2020)	The Strategy for Public Health in England (Department of Health, 2010) outlined above adopts the Marmot Review's life course framework for tackling health inequalities. The review '*sets out a framework for action under two policy goals: to create an enabling society that maximizes individual and community potential; and to ensure social justice, health and sustainability are at the heart of all policies. and aims to support healthy communities'* (Local Government Association, 2021). The Marmot Review '10 years on' report shows that, in England, health is getting worse for people living in more deprived districts and regions, health inequalities are increasing and, for the population as a whole, health is declining.	The assessment has looked at health inequalities in the local communities in the study area in relation to vulnerable groups that may be disproportionately affected by potential impacts on health as a result of the Scheme.
Oxford Core Strategy 2026	Oxford City Council has prepared strategic policies which will guide the development of the city. The Strategy states that: "*Improving health and social inclusion is a key priority of Oxford's Sustainable Community Strategy, while reducing inequalities and breaking the cycle of deprivation is a strategic objective in the Oxfordshire Sustainable Community Strategy*." Policies also relate to improving provision for pedestrians and cyclists identifying risks to human health and promoting safe and attractive environments.	The assessment has looked at health inequalities in the local communities in the study area in relation to vulnerable groups that may be disproportionately affected by potential impacts on health as a result of the Scheme. Potential impacts on social inclusion have been assessed. The assessment has looked at how pedestrians and cyclists would be impacted by the Scheme, and how this may affect human health (see Section 12.6).

Policy Document	Description in relation to human health	Relevance to the Scheme
Oxford City Local Plan 2001 – 2016 or If plan approved Oxford City Local Plan 2016-2036	Oxford City Council is preparing a Local Plan that will support development in the city up to 2036. The new local plan will update the existing Core Strategy, Site Allocations and Local Plan Saved Policies. Policy RE5: "Oxford City Council will seek to promote strong, vibrant and healthy communities and reduce health inequalities…." Policy RE6: "…assess the potential impacts and health risks of dust emissions…"	Health inequality is considered in the assessment. A construction dust assessment has been undertaken (within Appendix 6.2 – Construction Dust Risk Assessment) for the Scheme and has been considered in the human health assessment.

Table 12.3: Guidance relevant to human health

Guidance Document	Description in relation to human health
HUDU Planning for Health Rapid Health Impact Assessment Tool (NHS, Healthy Urban Development Unit, 2019)	Tool designed to assess the likely health impacts of development plans and proposals such as the Scheme It helps to identify the determinants of health likely to be influenced. The tool focuses on the built environment and issues directly or indirectly influenced by planning decisions.
Health in Environmental Impact Assessment: A Primer for a Proportionate Approach' (IEMA, 2017)	Primer produced in response to the updated Environmental Impact Assessment (EIA) Regulations 2017, which clarified that 'population and human health' factors should be considered in EIA. Primer aims to '*raise awareness of the change and proposes principles amongst those concerned with the coverage of human health in EIA*.'
Human health: Ensuring a high level of protection (IAIA, 2020)	Paper produced in response to an increased need for multisectoral approaches to respond to the social, environmental and economic determinants of health. Provides principles and good practice for appropriately addressing human health as part of EIA.
Design Manual for Roads and Bridges (DMRB) LA112 Population and Human Health guidance (Highways England et al, 2019)	First complete published guidance on assessing human health impacts as part of EIA. Guidance applicable to roads and bridges schemes but some aspects appropriate to the Scheme.

12.3 Methodology

Introduction

12.3.1 This Section outlines the methodology used in preparing this Chapter. It reports the consultation undertaken, defines the study area, temporal scope, the sources of baseline data, and the methodology and significance criteria. The limitations and assumptions of the study are also described.

Consultation

12.3.2 An overview of consultation undertaken on the Scheme is summarised in Chapter 4 – Approach to Environmental Assessment.

12.3.3 The scope and method of assessment for this human health assessment was presented in the Scoping Report (Network Rail, 2020). Oxford City Council issued a Scoping Opinion in response to the Scoping Report in January 2021. The Scoping Opinion included a requirement for human health to be included in the EIA and further direction on the content of the assessment.

12.3.4 Table 12.4 summarises the consultation responses that were received regarding the scope and methodology to be applied in the EIA. The methodology for this assessment has considered the feedback received and where appropriate the scope and method has been revised.

Table 12.4: Summary of EIA Scoping Report consultation responses for Human Health scope and methodology

Consultee	Issues raised in response to the Scoping Report	Summary of the response to issues raised
Oxford City Council	*'The methodology proposed does not include assessment of train emissions neither of traffic emissions during operational phase. Reference to those emission sources should be clearly mentioned along the EIA, and proper justification will need to be included in the document, clearly stating the reason(s) why those emissions are not being considered.'*	Train emissions and traffic emissions during the operational phase are assessed in Chapter 6: Air Quality and Odour and are considered further in this chapter in relation to human health in Section 12.6.

12.3.5 The methodology for this assessment has considered the feedback received and where appropriate the scope and method has been revised.

Study Area

12.3.6 Taking account of DMRB LA 112, the study area for the human health assessment should be *'based on the extent and characteristics of the project*

and the communities/wards directly and indirectly affected by the project.' (Highways England et al, 2019).

12.3.7 The communities identified as having potential to be directly and indirectly affected by the Scheme are Jericho and Osney Ward, Carfax Ward and North Ward which are within the Oxford Local Authority District. These areas are shown on Figure 12.1. These communities form the 'study area' and accordingly are the focus of the human health assessment.

12.3.8 The study area used to assess the changes to health determinants is as that identified in the Scoping Report. It varies depending on the environmental conditions being assessed. These are outlined in the methodology sections of the Environmental Statement topic chapters listed in Section 12.1. For several health determinants, impacts are assessed for only Jericho and Osney Ward and Carfax Ward as these communities fall within the topic chapter study areas. North Ward falls outwith the study area for air quality, noise and pollution; therefore, human health impacts are not assessed for those particular determinants.

Temporal Scope

12.3.9 Baseline conditions are described using available data sources, including consideration of how this baseline may change from present day to the year of construction (i.e. the future baseline in the absence of the Scheme).

12.3.10 This EIA has been prepared during the 2020/2021 global COVID-19 coronavirus pandemic. At the time of undertaking the human health assessment, the full implications on the physical and mental health of communities as a result of the pandemic are not yet known.

12.3.11 The temporal scope of this assessment is:

- baseline year: 2019 (however, data for the health profiles have been gathered from a range of source across various years);
- future baseline year (first year construction): 2022; and
- future baseline year (first year operation): 2025.

Baseline Data

12.3.12 The human health baseline has been established using the following sources of information:

- Population estimates (Office for National Statistics (ONS));

- 2011 census (ONS);
- Oxford City Council statistics;
- English indices of multiple deprivation (IMD) 2019; and
- Public Health England – Fingertips Tool.

12.3.13 Information from other topic chapters has also been used in the development of the baseline in relation to environmental conditions.

Assessment Methodologies

12.3.14 The assessment follows the general methodology outlined in the Scoping Report (Network Rail, 2020) and described in Chapter 4 – Approach to Environmental Assessment. It considers whether potential effects are likely to be significant based on the sensitivity of the receptors.

12.3.15 As there is no specific guidance setting out how to assess human health effects in EIA for railway investment projects. The methodology has primarily used DMRB LA 112 'Population and Human Health' (Highways England *et al,* 2019) as it was considered appropriate to be applied to linear infrastructure schemes. DMRB guidance has been used in defining the study area, building the human health profile of the communities, assessing relevant health determinants and categorising likely human health outcomes for the Scheme.

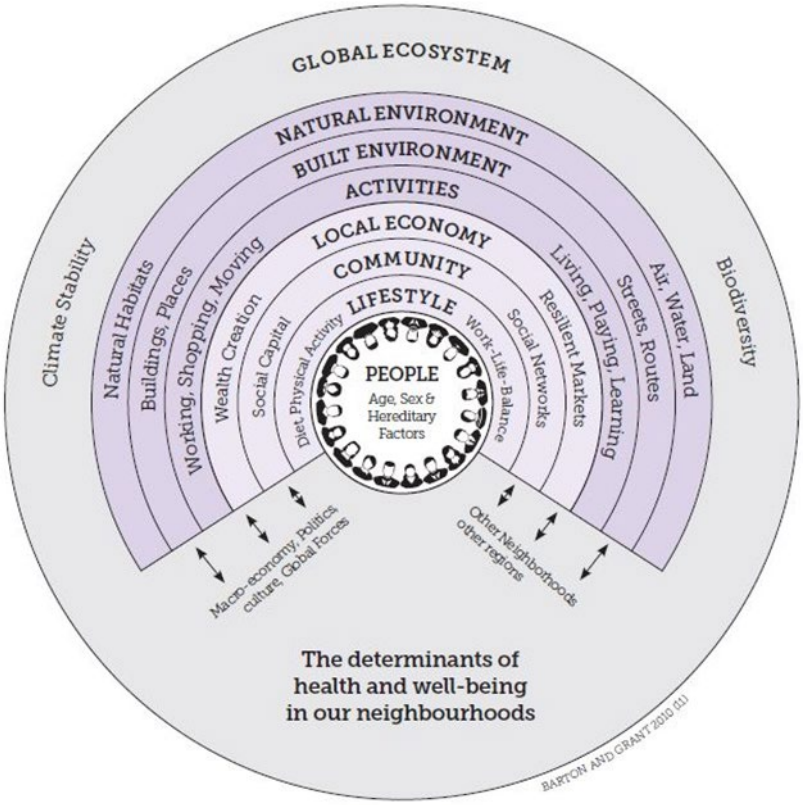
Health Profile and Sensitivity

12.3.16 Relevant data have been gathered on the health of the communities within the study area. This is through desk-top research to provide context and understanding of the local community and the likely health issues they may encounter. These data have been used to establish an overall health profile of the communities and, using professional judgement supported by evidence, the sensitivity of the community has been identified as low, medium or high, in accordance with DMRB LA 112.

Health Determinants

12.3.17 As illustrated in Plate 12.1, health determinants are the range of personal, social, economic and environmental factors which determine the health status of individuals or populations. A change to a single health determinant can affect the health status of different individuals or communities depending on their characteristics and sensitivity to change. This can generate multiple health outcomes.

Plate 12.1: Determinants of health and well-being (Barton and Grant, 2010)



12.3.18 Key health determinants with changes to health outcomes as identified in DMRB LA 112 are as follows:

- air quality management areas and ambient air quality;
- areas recognised as being sensitive to noise and the ambient noise environment;
- sources and pathways of potential pollution;
- landscape amenity;
- community, recreational and education facilities and severance[1]/separation of communities from such facilities;
- green/open space and severance/separation of communities from such facilities;

[1] Severance is the perceived division that can occur within a community when it becomes separated by a major traffic artery. It may result from the difficulty of crossing a heavily trafficked existing road or as a result of a physical barrier created by the road itself.

- healthcare facilities and severance/separation of communities from such facilities;
- transport network and usage in the area, including the surrounding road network, public rights of way (including bridleways), cycle ways, non-designated public routes and public transport routes; and
- safety information associated with the existing affected road network.

12.3.19 For the purposes of the assessment, changes to community, recreational and education facilities, and healthcare facilities are considered together. Additionally, due to the close link between landscape amenity and green/open space, these determinants have also been considered together.

12.3.20 Consideration was also given to the Healthy Urban Development Unit (HUDU) Planning for Health Rapid Health Impact Assessment Tool (NHS, HUDU, 2019) in identifying additional health determinants that may not be included in DMRB LA 112. Following a review of the HUDU tool, the additional health determinant 'access to work and training' was considered relevant and was included in the assessment.

12.3.21 The health determinants identified for the assessment draw on output from the Environmental Statement topic chapters outlined at the beginning of this chapter.

Health Pathway

12.3.22 Tracing change as a result of a Scheme through to an 'effect' on human health is a process of identifying:

- the relevant determinant of health e.g. air quality; and
- the resulting changes in health outcomes e.g. cardiovascular and respiratory diseases.

12.3.23 Therefore, for there to be an effect on health, a health pathway must be established. A health pathway is referred to as '*the plausibility of a causal relationship'* (IEMA, 2017) i.e. the likelihood of a project generating a potential health impact.

12.3.24 A literature review has been undertaken to determine an association between changes that are likely to occur due to the Scheme, in relation to the health determinants and the resulting likely changes to health outcomes. The results of the literature review and relevant health pathways are provided in Table 12.5. The assessment methodology relating to the linked Environmental

Statement topic chapters and how the outputs of these assessments have been used to determine effects on health is also outlined.

Table 12.5: Literature review, health pathway and assessment methodology for Health Determinants

Health Determinant	ES Topic Chapter(s)	Literature review and health pathway	Assessment methodology
Air quality management areas and ambient air quality	Chapter 6 – Air quality and odour	*'Elevated levels and/or long-term exposure to air pollution can lead to serious symptoms and conditions affecting human health. This mainly affects the respiratory and inflammatory response systems but can also lead to more serious conditions such as heart disease and cancer. People with lung or heart conditions may be more susceptible to the effects of air pollution' (Oxfordshire Air Quality, n.d).* The main pollutants of concern for air quality in the United Kingdom (UK) are associated with combustion emissions typically arising from road traffic and industry. These are primarily oxides of nitrogen, nitrogen dioxide and particulate matter. Human exposure, oxides of nitrogen, nitrogen dioxide and particulate matter can have adverse health effects.	Direct effects on air quality have been reported in Chapter 6 – Air Quality and Odour in relation to changes in levels of oxides of nitrogen, nitrogen dioxide and particulate matter. These may arise due to dust-generating activities and traffic during construction, and as a result of diesel train emissions during operation of the Scheme. Emissions are considered in the context of Air Quality Objectives (AQOs), which set thresholds above which the levels of emissions should not be exceeded for the protection of human health. This human health assessment considers the direct effects on air quality from dust and pollutant emissions and the potential for resulting effects on health to arise during construction and operation of the Scheme.
Areas recognised as being sensitive to noise and the ambient noise environment	Chapter 10 – Noise and Vibration	According to WHO (2018) '*Environmental noise is a threat to public health, having negative effects on human health and well-being'.* High levels of noise nuisance and vibration caused by traffic and construction activities can result in sleep disturbance, increased aggression, and impaired communication (WHO, 1995). Additionally, '*Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV*[2]	Direct effects have been reported in Chapter 10 – Noise and Vibration in relation to impacts on residential receptors and other sensitive receptors. This is from construction noise and vibration as a result of construction traffic and activities, and for operational noise from sources including trains and station announcements. Potential noise and vibration effects are measured against the

[2] Peak Particle Velocity ("PPV") is defined as the maximum instantaneous positive or negative peak of the vibration signal. It is specified in millimetres per second (mm/s). It is important to note that the PPV refers to the movement within the ground of molecular particles and not surface movement.

Health Determinant	ES Topic Chapter(s)	Literature review and health pathway	Assessment methodology
		range of 0.14 mm/s to 0.3 mm/s. Vibrations above these values can disturb, startle, cause annoyance or interfere with work activities. At higher levels they can be described as unpleasant or even painful.' (British Standards Institution, 2014) The transport network is often cited as the most widespread source of noise (EEA, 2019). Health effects associated with noise are likely to disproportionately affect certain vulnerable members of society including those with pre-existing conditions, children, the elderly and poorer communities.	Significant Observed Adverse Effect Level (SOAEL), the threshold above which significant adverse effects on health and quality of life could occur. This human health assessment considers the direct and indirect impact as a result of the construction and operation of the Scheme. This is in relation to potential impacts from noise and vibration, leading to annoyance and disturbance, and the resulting health implications.
Sources and pathways of potential pollution	Chapter 7 – Geology and Soils	In relation to contaminated land, the WHO (2013) states that '*Past and current activities can cause local and diffuse accumulation of environmental stressors to an extent that might threaten human health and the environment, by altering air quality, hampering soil functions, and polluting groundwater and surface water.'* People have the potential to be affected by pollutants through pathways such as ingestion, inhalation and dermal contact with soils, soil dust, deep and shallow groundwater and surface water, or by migration of ground gases into confined spaces.	Direct effects on pollution which could arise as a result of disturbance of contaminated land during construction have been reported in Chapter 7 – Geology and Soils. Potential effects on human health are considered in relation to background levels of contamination and relevant screening criteria. This human health assessment considers the direct effects as a result of pollution impacts from the Scheme during construction.
Landscape amenity and access to green/open space	Chapter 9 – Landscape and Visual Chapter 13 – Traffic and Transport	The association between pleasant landscapes and relaxation has a growing evidence base. Access to good-quality landscapes has beneficial effects on peoples' health and wellbeing, while a lack of access tends to have an adverse effect. According to the Landscape Institute (n.d. p.1), '*areas of social and economic deprivation, often linked with poorer health and reduced life expectancy, can also be associated with limited access to good-quality green space.'* Adverse landscape amenity effects can discourage communities and individuals from accessing and using areas of open space. This	Direct effects on the landscape, views and visual amenity which could arise as a result of construction and operation of the Scheme have been reported in Chapter 9 – Landscape and Visual. Direct effects relating to delays, disruption and severance for pedestrians and cyclists which could impede access to green/open space during construction and operation of the Scheme have been reported in Chapter 13 – Traffic and Transport.

Health Determinant	ES Topic Chapter(s)	Literature review and health pathway	Assessment methodology
		can result in reduced physical activity and have adverse effects on mental health (Croucher et al., 2007).	This human health assessment considers the indirect impacts from changes to landscape amenity and access to green/open space as a result of the construction and operation of the Scheme.
Transport network and usage	Chapter 13 - Traffic and Transport	Policies and projects that promote active travel such as walking and cycling have the potential to increase levels of physical activity in the community. A physically active lifestyle is an important contributor to individual health and well-being, with the evidence linking higher physical activity levels with better levels of morbidity and mortality (Norwood P, Eberth B, Farrar S, Anable J, Ludbrook, 2014).	Direct effects on the transport network are reported in Chapter 13 – Traffic and Transport. The Scheme could affect pedestrian and cyclists using the local path network, through disruption, delays and severance during construction, and from severance and changes to amenity during operation. This human health assessment considers the indirect effects as a result of changes to the transport network and usage during construction and operation of the Scheme.
Safety information associated with the existing affected road network	Chapter 13 - Traffic and Transport	According to WHO (2021) *'More than half of all road traffic deaths and injuries involve vulnerable road users, such as pedestrians, cyclists and motorcyclists and their passengers. In addition to the human suffering caused by road traffic injuries, they also incur a heavy economic burden on victims and their families, both through treatment costs for the injured and through loss of productivity of those killed or disabled.'*	Direct effects on the transport network are reported in Chapter 13 – Traffic and Transport. Changes to traffic flows as a result of the Scheme could result in severance, increased road accidents and driver stress during construction and operation of the Scheme. This human health assessment considers the indirect effects on human health as a result of changes in safety during construction of the Scheme. Effects during operation were scoped out in accordance with Chapter 13 – Traffic and Transport.

Health Determinant	ES Topic Chapter(s)	Literature review and health pathway	Assessment methodology
Community, recreational and educational facilities, and healthcare facilities. Severance and separation of communities from these facilities	Chapter 11 – Population Chapter 13 - Traffic and Transport	Access to public services and social infrastructure is a key determinant of health and wellbeing (NHS, 2017). Severance/separation from community facilities can result in reduced social cohesion and physical activity and have adverse effects on mental health (Croucher et al., 2007). Severance/separation from healthcare facilities can prevent vulnerable groups from accessing these when needed and impede their general health.	Direct effects relating to severance and disruption/delays for public transport, private vehicles and pedestrians and cyclists are reported in Chapter 13 – Traffic and Transport. Any change in access to community facilities as a result of these effects is reported in Chapter 11 – Population. This human health assessment considers the indirect effects on human health from changes in access to community, recreation and education and healthcare facilities during construction and operation of the Scheme.
Access to work and training	Chapter 11 – Population	Infrastructure projects have direct and indirect effects on job creation, resulting in increased investment and higher incomes. These outcomes are closely associated with better human health, reduced mortality and improved mental wellbeing (Marmot et al., 2010).	Direct effects on economics and employment have been reported in Chapter 11 – Population. This human health assessment considers the potential for creation of additional jobs and effects on the local economy associated with the construction and operation of the Scheme, against the baseline to assess the potential effects on health.

Mitigation

12.3.25 The approach to mitigating likely effects on health follows the hierarchical approach of avoidance and prevention, reduction, and remediation as set out in Chapter 4 Approach to Environmental Assessment.

12.3.26 DMRB LA 104 (Highways et al 2019, p.18) requires mitigation to be reported under two distinct categories:

- Embedded mitigation: project design principles adopted to avoid or prevent adverse environmental effects; and
- Essential mitigation: measures required to reduce and if possible offset likely significant adverse environmental effects, in support of the reported significance of effects in the environmental assessment.

12.3.27 The Scheme would be constructed in accordance with a Code of Construction Practice (CoCP), which would form the basis of the Construction Environmental Management Plan (CEMP). These documents are discussed further in Section 12.5.

12.3.28 The mitigation measures outlined in the linked topic chapters have been taken into account prior to the human health impact assessment. This includes both the embedded mitigation outlined within Chapter 2 - Description of Scheme, and essential mitigation measures including good practice outlined in Appendix 2.1 – Code of Construction Practice and embedded design mitigation.

Significance

12.3.29 For the assessment of human health, sensitivity has been determined based on the health profile of the community. No specific magnitude criteria have been applied beyond what is identified for individual topic chapters (e.g. noise and vibration). The assessment has drawn on the mitigated position (residual effects) of the assessments reported in other chapters of this Environmental Statement. It considers these effects in the context of health determinants and community sensitivity.

12.3.30 The assessment reports on the 'likely health outcome' for the communities in the study area as a result of changes to health determinants. A health outcome is a change in the health status of an individual, group or population which is attributable to a planned intervention or series of interventions. This is regardless of whether such an intervention was intended to change health status.

12.3.31 Health outcomes describe the predicted effects on health as a result of the Scheme. They are assigned a category as defined in DMRB LA 112, outlined in Table 12.6.

Table 12.6: Health outcome categories (Highways England *et al*, 2019)

Health outcome category	Health outcome description
Beneficial	A beneficial health impact is identified.
Neutral	No discernible health impact is identified.
Adverse	A bad health impact is identified.
Uncertain	Where uncertainty exists as to the overall impact.

12.3.32 General guidance on significance categories set out in DMRB LA 104 and professional judgement was used to determine whether likely health outcomes would be considered significant or not significant in the context of the EIA Directive 2017. For the purposes of this assessment a Beneficial or Adverse human health outcome is considered significant, and a Neutral or Uncertain outcome is considered not significant.

Matters Scoped Out of the Assessment

12.3.33 The matters that have been scoped out of this topic assessment, in accordance with the Scoping Opinion (found in Volume 4 – Appendix 1.1):

- Biodiversity (construction and operation): Scoped out of EIA by the Scoping Opinion. Topic relates to impacts on wildlife and flora and fauna, not human receptors.
- Historic Environment (construction and operation): The use of cultural heritage assets leisure and recreation has been assessed in Chapter 9 – Landscape and Visual and where appropriate, the output used in the health assessment.
- Material Assets and Waste, Major Accidents and Disasters (construction and operation): Scoped out of EIA, no impacts carried through to human health assessment.
- Pollution (operation): No likely significant effects predicted for this phase.
- Traffic and Transport (operation): No likely significant effects anticipated for this phase.

12.3.34 These matters have been scoped out on the basis that they would not be likely to result in a significant effect on human health.

Limitations and Assumptions

12.3.35 At the time of writing the Environmental Statement, the construction information available, including information relating to haul routes within temporary works areas and construction vehicle traffic, is indicative only and subject to change once a Contractor is appointed. Therefore, any effects on human health assessed in relation to construction traffic may be subject to change.

12.3.36 The health profile created for the communities has largely been based on data collection from secondary data sources. The year of data collection has varied depending on the source, which is typical of a population-level health assessment. Whilst this search has provided general information on the communities and vulnerable groups near the Scheme, the data gathered are high-level and not all specific cases will have been captured. The health profile baseline provides context and the impact assessment approach is qualitative and at the population level.

12.3.37 Limitations in relation to the COVID-19 pandemic are discussed in Section 12.1.

12.4 Baseline Conditions

Characterisation of the Environmental Baseline

12.4.1 Baseline data are presented in Volume 4 - Appendix 12.1: Human Health Baseline Conditions. Data collection was focussed on establishing health profiles for the communities in the study area for the Scheme: Jericho and Osney Ward, Carfax Ward and North Ward, all of which are located within Oxford City. (as shown on Figure 12.1). The health profiles have been established based on desk-based research of publicly available sources. Health data have been gathered at community level where available, and where this was not available, data for the city of Oxford and Oxfordshire were obtained.

Identification of Sensitive Receptors

Human Health Profile

12.4.2 Data gathered from Oxford and the communities of Jericho and Osney Ward, Carfax Ward and North Ward illustrate a mixed picture of health. The city of Oxford is generally affluent, with a younger population, good general health and lower levels of obesity in comparison to the national average. The communities of Jericho and Osney Ward and North Ward align with the

national average for deprivation in relation to income and health and have therefore been assigned a medium sensitivity.

12.4.3 A significant degree of health inequality exists within Oxford, however, illustrated by the high rate of income and health deprivation in Oxford 008B LSOA within the Carfax Ward. Therefore, sensitivity for the Oxford 000B community has been assigned as high.

12.4.4 Depending on the environmental factor being assessed, some population groups may be more vulnerable to effects than others. For this human health assessment vulnerable groups have been considered on a case by case basis and professional judgement has been used to report the sensitivity of these groups in relation to changes in health determinants.

12.5 Design and Best Practice Measures

Design

12.5.1 The Scheme has been designed, as far as possible, to avoid and reduce impacts and effects on human health through the process of design-development considering good design principles. Embedded mitigation is defined within the DMRB LA 104 as '*Design measures which are integrated into a project for the purpose of minimising environmental effects.*' The assessment of whether significant effects would be likely to occur has been based on the Scheme as described in Chapter 2 – Description of the Scheme and taken account of measures embedded within the design as described within that chapter.

12.5.2 The relevant measures embedded in the design of the Scheme relevant to this human health assessment are outlined in Table 12.7. The adoption of the embedded mitigation measures reported here would reduce the potential for direct and indirect effects on human health.

Table 12.7: Summary of design measures for this human health assessment

Measure	Outcome / Benefit
Enhanced access arrangements (including new western entrance) and provision for cycling and walking.	Reduces the use of private car travel to the station and areas close to the station, encourages uptake of active travel and makes the station more accessible for Persons with Reduced Mobility (PRM).
Western retaining wall southern end piling platform removed.	Reduces the need for piling near to a largely residential area.
Vibro piling used throughout site.	Allows for quicker less intrusive pile installation.

Measure	Outcome / Benefit
Design avoids works in identified historical landfills or within the Down Carriage siding compound.	Reduces likelihood of excavating into contaminated land with associated dust, health, groundwater and waste issues.
Platform 5 canopy supports have been combined with future electrification support, therefore no additional masts would be needed in the same areas in future	This has led to a more pleasing design, lower carbon and fewer platform area obstructions for Persons with Reduced Mobility (PRM) compliance.
Botley Road Bridge has been designed to allow daylight to access the road and subways between bridges.	Provides a more pleasing aspect for pedestrians and other users.
The Botley Road Bridge design has a concrete bridge span with ballasted track.	Reduces rail borne noise to the surrounding area.
The track alignment has been designed to avoid any third-party land take from Abbey Road gardens at the north end of the Scheme.	Reduces impacts on residents, houses and gardens in the vicinity of the northern end of Abbey Road.
Provision of additional bike stands on the western entrance forecourt.	The new facilities promote sustainable transport use. This aligns with Oxford County Council policy and supports carbon reduction targets within the city.
Provision of new footpath along the length of Roger Dudman Way connecting to the Sheepwash Bridge.	Provides a safe route for pedestrians, also reducing the need to drive.
The needs of PRM and other groups in need of additional support to be considered appropriately when planning temporary traffic management measures. Measures to be contained within the Construction Traffic Management Plan.	Improves safety and reduces stress during construction activities.
Station buildings and facilities comply with the 'Persons with Reduced Mobility' requirements (European TSI legislation for lines on the European Network).	Improves accessibility and facilities for Persons with Reduced Mobility.

Construction Management Measures

12.5.3 The Scheme would be constructed in accordance with the CoCP (see Volume 4 - Appendix 2.1). The CoCP sets out the principles for environmental mitigation, which would then be used as the basis for the CEMP.

12.5.4 The CEMP would outline measures to be put in place to address potential effects on human health that could arise during the construction phase of the Scheme.

12.5.5 This human health assessment has identified management measures which would be required to mitigate potential effects on the local communities during the construction phase.

Table 12.8: Summary of construction management measures relevant to this human health assessment

Measure	Outcome / Benefit
A communication strategy would be established by the Main Contractor in collaboration with Network Rail, consisting of: • drop-in sessions for the local community and "meet the manager" sessions in the station prior to construction commencing; • liaison with relevant local authorities, statutory bodies, relevant community groups and local residents; • provision of regular updates on the Scheme website; • notification of nearby communities of planned construction works that may affect them a minimum of 2 weeks in advance; • provision of a dedicated phone number / email address for members of communities close to the works to use should they have any enquiries or complaints and following an appropriate procedure to address these.	Informs consultees and members of the public of the progress of the Scheme and to efficiently address any queries or concerns raised.
Collaboration between Network Rail and the Main Contractor to ensure there is sufficient signage, wayfinding and support for those with protected characteristics who would use the station during the construction period and when the works are complete.	Provides assistance for PRM and mitigate the potential for disproportionate impacts due to construction activities.

12.6 Assessment of Human Health Effects

Air Quality

Construction

12.6.1 Changes to air quality as a result of construction dust and traffic has the potential to reduce the amenity of the local area. Inhalation of pollutants, specifically nitrogen dioxide, oxides of nitrogen and particulate matter has the potential to result or exacerbate health conditions such as asthma and Chronic Obstructive Pulmonary Disease within the local communities.

12.6.2 Chapter 6 - Air Quality and Odour has assessed the likely significant effects on air quality during construction of the Scheme arising from construction dust and construction traffic in relation to AQOs and EU Compliance Limits. The assessment concluded that following the application of best practice mitigation measures, such as comprehensive dust management and control measures, there would be no significant residual effect on amenity and human health from dust and traffic-related pollutants.

12.6.3 Taking into account the sensitivities of Jericho and Osney Ward and Carfax Ward including the Oxford 0008B LSOA no additional effects on human

health are anticipated. A likely neutral health outcome for the three communities is anticipated for changes to air quality during construction.

Operation

12.6.4 Chapter 6 (Air Quality and Odour) has assessed the likely significant effects on air quality during operation of the Scheme arising from diesel train emissions in relation to AQOs and EU Compliance Limits. The changes in road traffic emissions during the operation phase on air quality are not considered to represent a significant effect on human receptors adjacent to the local road network and were scoped out of the assessment. Additionally, it is concluded that the Scheme would not lead to exceedances of the relevant AQOs. There would also be no significant effect on air quality with regard to diesel train emissions. Accordingly, no additional mitigation measures for air quality have been proposed.

12.6.5 Taking into account the sensitivities of Jericho and Osney Ward and Carfax Ward including the Oxford 0008B LSOA, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is anticipated for changes to air quality during operation.

<u>Noise and Vibration</u>

Construction Noise

12.6.6 Changes to noise levels from construction activities and construction traffic have the potential to result in stress, annoyance, and/or sleep disturbance for the communities of Jericho and Osney Ward and Carfax Ward.

12.6.7 Potential significant adverse temporary noise effects have been identified in Chapter 10 (Noise and Vibration) during construction for activities associated with some of: the Sheepwash Bridge works; the Platform 5 and Down Oxford Passenger Loop works; the Botley Road Works; and the western entrance works. In relation to construction traffic, the increase in Heavy Goods Vehicle (HGV) movements to existing HGV movements on Botley Road identified during the construction phase of the Scheme would be negligible.

12.6.8 The application of Best Practice Measures would be expected to reduce construction noise and eliminate all of the predicted temporary significant effects. The appointed contractor would develop appropriate mitigation where necessary and practicable as required by the CoCP and the CEMP. Examples of best practice measures proven to reduce noise impacts include: community liaison with local residents wherever working outside of core hours is to be undertaken; and appropriate programming/phasing of works to restrict

impacts within one area at any one time. Additionally, if any of the works are to be undertaken at night, an assessment to determine eligibility for noise insulation would be undertaken prior to any night working. Further mitigation measures are outlined in Chapter 10 - Noise and Vibration and only minor residual effects (not significant) are expected following implementation of these measures.

12.6.9 Taking into account the sensitivities of Jericho and Osney Ward and Carfax Ward including the Oxford 0008B LSOA, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is anticipated for changes to noise levels during operation.

Construction Vibration

12.6.10 Changes to vibration levels from construction activities have the potential to result in stress, annoyance, and/or sleep disturbance for the communities of Jericho and Osney Ward and Carfax Ward. As reported in Chapter 10 (Noise and Vibration), the predicted level of vibration would be just above the level where *'vibration might be just perceptible in residential environments'* and would be classed as a low impact and a minor adverse significance of effect, which is not significant in relation to the EIA Regulations 2017.

12.6.11 Taking into account the sensitivity of Jericho and Osney Ward and Carfax Ward including the Oxford 0008B LSOA, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is assessed for changes to levels of vibration during operation.

Operational Noise

12.6.12 Changes to noise levels during the operation of the Scheme have the potential to result in stress, annoyance, and/or sleep disturbance for the communities of Jericho and Osney Ward and Carfax Ward. More serious effects on human health can occur in the long term as a result of changes to the noise environment, as outlined in Table 12.6.

12.6.13 Chapter 10 (Noise and Vibration) has assessed operational noise impacts including the noise from the passenger services, including when stationary at the station, and the noise from additional train information announcements on the new Platform 5. During operation, significant adverse effects from noise have been identified at the dwellings to the west of the station within Jericho and Osney Ward, along Cripley Road and Abbey Road. The identified adverse effects are due to train movements on the down Oxford passenger loop and stationary noise sources at the new Platform 5. A noise barrier has

been added into the design to mitigate likely significant adverse operational environmental effects at Cripley Road and Abbey Road, but a major adverse residual significant effect remains in terms of noise change. The overall noise level, however, would remain below the fixed SOAEL threshold. This is the threshold above which adverse health effects are likely to occur. Therefore, adverse health effects are considered unlikely to occur as a result of the Scheme.

12.6.14 Additionally, noise effects of moderate adverse significance are reported for receptors on Mill Street, the River Thames and Sheepwash Channel, Said Business School and the Co-operative Childcare. The effects in these locations would also be below the SOAEL and therefore adverse health effects are considered unlikely to occur.

12.6.15 Taking into account the sensitivities of Jericho and Osney Ward and Carfax Ward including the Oxford 0008B LSOA, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is assessed for changes to levels of noise during operation.

12.6.16 In the context of the human health assessment, there is potential for vulnerable groups within the communities to be disproportionately affected by the increase in noise levels. Children are highly sensitive receptors and would be attending the Co-operative Childcare. They would be exposed to the noise increase potentially for several hours a day over a long period of time, depending on attendance. However, the 1.2dB increase reported is not a level that would be subjectively noticeable, particularly in relation to the baseline of fluctuating noise levels that would exist in the Co-operative Childcare playground. Additionally, the shadow of the new retaining wall that would be provided on Roger Dudman Way would provide a degree of noise shielding for the playground, potentially reducing the level of change further. Therefore, it is considered that there would be a likely neutral health outcome for the children attending the Co-operative Childcare facility in relation to operational noise.

<u>Sources and Pathways of Potential Pollution</u>

Construction

12.6.17 Historical contamination is known to be present at the Scheme, however there are areas of proposed works where no environmental ground investigation has been undertaken. There is therefore potential for contaminated material to be disturbed during the construction works and lead to pollution of

groundwater, surface water and damage to human health for the communities of Jericho and Osney Ward and Carfax Ward.

12.6.18 As reported in Chapter 7 (Geology and Soils), for potential contamination effects, the adoption of additional mitigation measures comprising ground investigation work and development of appropriate remediation strategies, if necessary, would identify and remove contamination sources or pathways. As a result, effects from contamination sources on surface water, groundwater or human health would be reduced and would no longer be significant. Therefore, there would be no significant residual effects.

12.6.19 Taking into account the sensitivities of the Jericho and Osney Ward and Carfax Ward including Oxford 0008B LSOA, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is assessed for pollution from contamination sources during construction.

12.6.20 As a vulnerable group sensitive to changes in the environment, the children attending Co-operative Childcare have been considered further in the context of pollution, due to the temporary relocation of the Co-operative Childcare to the Becket Street station car park. The relocation would be for an approximate duration of three months in portacabins. The use of portacabins reduces the need to excavate into Becket Street station car park. There may be potential for contamination from additional excavation for services to arise however. The risk of potential contamination and resulting human health effects would be reduced by measures identified through a contaminated land risk assessment. Therefore, it is considered that there would be a likely Neutral health outcome for the children attending the temporary Co-operative Childcare facility in relation to pollution from contamination sources.

<u>Transport Network and Usage</u>

Construction

12.6.21 Changes to the transport network as a result of disruption caused by construction activities has the potential to impact on the usage of pedestrian and cycle routes. The potential for a reduction in physical activity to arise as a result of the impact on active travel routes may have a potentially adverse effect on the mental and physical health of the people in the communities of Jericho and Osney Ward, Carfax Ward and North Ward.

12.6.22 As reported in Chapter 13 (Traffic and Transport), there would be some temporary minor adverse effects due to a number of road closures and traffic diversions during parts of the construction period. This would especially be

during the realignment and construction of Botley Road Bridge, impacting on pedestrian and cycle routes within the vicinity of the site and the city itself. However, following the implementation of a CTMP to ensure that appropriate control measures are enforced, no significant residual effect is anticipated on pedestrian and cycle routes.

12.6.23 Taking into account the sensitivities of Jericho and Osney Ward, Carfax Ward and North Ward, no additional effects on human health are anticipated. A likely neutral health outcome for the communities in the study area is assessed for changes to the transport network and usage during construction.

12.6.24 As a vulnerable group sensitive to changes in the environment, people with limited mobility have been considered further in the context of changes to the transport network and usage. There is potential for people with limited mobility to experience disruption, delays and severance during construction disproportionately in comparison to the wider population.

12.6.25 A Disability Impact Assessment has been undertaken by Network Rail which has identified additional measures to be implemented to reduce the potential for these effects to occur. Measures comprise drop-in sessions for the local community and “meet the manager” sessions in the station prior to construction commencing. This is to keep everyone informed of the works taking place. Network Rail would also work with the contractor prior to construction to ensure there is sufficient signage, wayfinding and support for those with protected characteristics who would use the station during the construction period and when the works are complete.

12.6.26 The needs of Persons with Reduced Mobility and other groups in need of additional support would be considered appropriately when planning temporary traffic management measures. Therefore, it is considered that there would a likely neutral human health outcome for people with limited mobility in relation to changes in the transport network and usage during construction.

Operation

12.6.27 Changes to the transport network causing severance or a reduction in amenity has the potential to impact on the usage of footpaths and cycleways. A reduction in journeys by active travel and an associated reduction in physical activity could have a potentially adverse effect on the mental and physical health of the people in the communities of Jericho and Osney, Carfax and North wards.

12.6.28 Effects on accidents and safety; disruption and driver delay; capacity of local bus services or severance were scoped out of the Traffic and Transport assessment for the operational phase of the Scheme. However, following its completion, it is expected that the Scheme would result in beneficial effects on the transport network from the improved rail infrastructure and enhanced walking and cycling provision.

12.6.29 In relation to amenity, as reported in Chapter 11 - Population, in addition to the western entrance, the Scheme includes improvements to the public realm around Oxford Station, with provision of segregated cycle and walking routes on each side of Botley Road and cycle storage in the forecourt of the western entrance building. In addition, there would be provision of an additional footpath along Roger Dudman Way connecting to the Sheepwash Bridge. Access to the station and around the area in the vicinity of the station, for walkers and cyclists, is expected to improve as a result of these interventions.

12.6.30 Improvements to the transport network for walking and cycling could potentially result in increased uptake of active travel to/from and around Oxford Station. This could in turn result in health benefits related to an increase in physical activity, such as a reduction in obesity and cardiovascular disease and improved mental health. Other benefits associated with using active travel include potential improvements to air quality from reduced use of vehicle transport, which could in turn have an indirect, beneficial effect on health. Such improvements are not reported in Chapter 6 (Air Quality and Odour) and therefore such indirect effects would be unlikely to be perceptible.

12.6.31 A likely beneficial health outcome for the Jericho and Osney Ward, Carfax Ward and North Ward, communities is anticipated for changes to the transport network and usage resulting in indirect health benefits during operation of the Scheme.

12.6.32 As a vulnerable group sensitive to changes in the environment, people with limited mobility have been considered further in the context of changes to the transport network and usage. There is potential for people with limited mobility to experience severance and changes in amenity disproportionately in comparison to the wider population. As part of the European TSI legislation for lines on the European Network, station buildings and facilities have to comply with the 'Persons with Reduced Mobility' requirements which are captured together with other UK legislation in the DfT Code of Practice entitled Accessible Design Standards for Railway Stations; previously Accessible Train Station Design for Disabled People. Mitigation embedded in the Scheme would ensure that the design of the Scheme is compliant with these requirements. Additionally, once complete, the Scheme would provide a more

accessible station with step-free access from the western entrance to Platform 4/5 and beyond to all other platforms and intermodal connections. Therefore, it is considered that there would a likely neutral human health outcome for people with limited mobility in relation to changes in the transport network and usage during operation.

Safety Information associated with the Existing Affected Road Network

Construction

12.6.33 Changes to road traffic levels or composition during construction has the potential to influence accident rates, resulting in injury or mortality for drivers, public transport users and pedestrians and cyclists.

12.6.34 As reported in Chapter 13 (Traffic and Transport), an increase in the number of HGVs on the road network during construction could lead to an increase in collisions. However, given the relatively low traffic flows generated by the Scheme during construction, no significant road safety issues as a result of the Scheme were identified in the Transport Assessment, with a Minor temporary effect reported. It is noted that given that Botley Road would be operating with single lane working for six months, there is potential for temporary impacts on safety and accidents to arise; however, this has not been assessed quantitatively due to a lack of available traffic information.

12.6.35 Due to the lack of information regarding impacts on safety and accidents on Botley Road, a likely Uncertain health outcome for the three communities is anticipated for changes to safety on the road network during construction.

Landscape Amenity and Access to Green/open Space

Construction

12.6.36 Construction activities have potential to compromise landscape amenity in the vicinity of Oxford Station, reducing the communities' enjoyment of the area and views. Community access to green/open space could also be impeded by construction activities, as a result of disruption and/or delay to the traffic and transport network and changes in land use. A reduction in landscape amenity and access to green/open space could have a potentially adverse effect on mental health and reduce levels of physical activity and social cohesion within the communities.

12.6.37 As reported in Chapter 9 (Landscape and Visual), there are several landscape elements that would be impacted during construction of the Scheme which could affect landscape amenity. With construction mitigation

in place, significant effects are reported for two Townscape Character Areas (TCAs), trees and vegetation and the Oxford Green Blue Infrastructure Network. For the TCAs, the effect is significant due to the combining factors of extensive tree and vegetation removal along Botley Road and Cripley Road, eroding the sense of place and character, along with disruption and intrusion caused by the introduction of construction activity. The loss of trees would be perceived as a major loss of these valuable, protected and key landscape components, while the Oxford Green Blue Infrastructure Network would continue to be fragmented and undermined by the locally large loss to the city's tree canopy cover. These would all result in a reduction in landscape amenity, and some effects would be permanent.

12.6.38 As reported in Chapter 9 (Landscape and Visual), during construction of the Scheme changes to views would be experienced by visual receptors within 100m approx. of the red line boundary. Due to this proximity there would be immediately noticeable changes in view and intrusion of construction activity upon the viewer. People living along Abbey Road, Cripley Road and Rewley Road (within Jericho and Osney Ward) and users of St Thomas the Martyr Church and nearby residences (within Carfax Ward) would experience significant visual effects. People using the following paths and open spaces would also experience significant effects at representative viewpoints:

- Botley Road;
- Thames Path National Trail;
- Public Right of Way 320/10/10;
- Thames Path National Trail opposite Cripley Place;
- Thames Path National Trail where it crosses Botley Road;
- Osney Lane Footbridge;
- Users of Frideswide Square and Westgate Hotel.

12.6.39 The CEMP would set out appropriate measures for reducing landscape and visual effects as much as practicable. However, due to the nature of construction activities it is not possible to mitigate effects at this stage to below significant. While landscape amenity in the vicinity of Oxford Station would be significantly reduced, these effects would be short-term and temporary. It is considered that the change in landscape amenity would result in a slight reduction in the use of paths and green/open spaces, however it is considered

that any indirect effects on physical activity, social cohesion, or mental health that could arise would be negligible.

12.6.40 In relation to access to green/open space, as reported in Chapter 13 (Traffic and Transport), during construction a number of footpath diversions would be present and several on-road cycle routes and adjacent pedestrian routes may be temporarily closed. A single lane would be operating on Botley Road for 6 months, which may result in journey delays. Additionally, there may also be a change in severance for pedestrians and cyclists due to an increase in HGVs, though this would be negligible. These factors could affect the communities' ability to access green/open space within the vicinity of Oxford Station, such as Botley Park, the community allotment gardens and Osney Cemetery, within the Oxford Blue Green Infrastructure Network. However, no significant residual effects are anticipated for pedestrians and cyclists with implementation of an appropriate Construction Traffic Management Plan (CTMP). As a result, the construction works are not expected to significantly impede access to green/open space.

12.6.41 Taking into account the sensitivities of Jericho and Osney Ward, Carfax Ward and North Ward, no additional effects on human health are anticipated. A likely Neutral health outcome for the three communities is anticipated for landscape amenity and access to green/open space during construction.

Operation

12.6.42 Potential effects on human health as a result of changes to the landscape amenity and access to green/open space during operation would be similar to those reported for construction.

12.6.43 As set out in Chapter 9 (Landscape and Visual), additional mitigation in the form of planting has been proposed to reduce the significance of effects on the landscape and views and provide enhancement where possible. Additionally, in regard to the trees covered by TPOs, it is Network Rail's intention through detailed design development and further consideration of engineering solutions for the Scheme to try and retain more of the existing trees than currently proposed. The landscape assessment assumes the worst-case scenario where all trees identified for potential removal would be removed.

12.6.44 Potential effects reported would reduce over time during operation of the Scheme, once landscape mitigation planting is established. After 15 years no adverse significant residual effects remain. Local residents of Botley Road and Cripley Road (within the Jericho and Osney Ward) would experience a

moderate beneficial effect from public realm improvements. Additionally, creation of a strong avenue of trees to mirror those on the north side of Botley Road would benefit the character of the Botley Road and Frideswide Square. These public realm improvements could encourage communities and individuals to access and use areas of open space, and this may have beneficial effect from improvements to mental health and increased uptake of physical activity.

12.6.45 Taking into account the sensitivities of Jericho and Osney Ward and Carfax Ward including Oxford 0008B LSOA, a likely beneficial health outcome is anticipated due to changes in landscape amenity.

Community, Recreational and Education Facilities, and Healthcare Facilities, and Severance/Separation of Communities from these Facilities

Construction

12.6.46 Disruption and/or delay to the traffic and transport network and changes in land use could result in severance/separation of communities from community, recreational, education and healthcare facilities during construction. This could have an indirect human health effect from reduced social cohesion, or an inability to access healthcare when needed.

12.6.47 As reported in Chapter 13 (Traffic and Transport), during construction there is potential for severance and delays for drivers, public transport users, pedestrians and cyclists due to a number of road closures and diversions required to facilitate construction of the Scheme. This would particularly affect people travelling along Botley Road, due to the single lane working that would be in place for six months. These factors may impact on journey times and impede access to community, recreational, and education facilities. However, taking into account the temporary nature of the disruption, and with implementation of a CTMP to mitigation this as far as practicable, no change to severance/separation of communities from community, recreational, and education facilities is anticipated as result of the Scheme.

12.6.48 As reported in Chapter 11 (Population), two community facilities are expected to experience a temporary land use change as a result of the Scheme. The Co-operative Childcare would be temporarily relocated to Becket Street station car park, resulting in Becket Street station car park operating at a reduced capacity. No effects on human health are anticipated as a result of this change in land use. Potential effects on human health resulting from the relocation of Co-operative Childcare are considered under ‘Sources and pathways of potential pollution.’

12.6.49 Delays for drivers and users of public transport (e.g. bus services which serve the John Radcliffe Hospital) due to a small increase in HGV movements, road closures and diversions, and the single lane operating on Botley Road for 6 months, could result in severance/separation of communities from healthcare facilities. However, taking into account the temporary nature of the disruption, and with implementation of the CTMP to mitigate this as far as practicable, no change is expected.

12.6.50 Taking into account the sensitivities of the Jericho and Osney Ward, Carfax Ward and North Ward, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is anticipated for changes to severance/separation of communities from community, recreational, education and healthcare facilities during construction.

Access to Work and Training

Construction

12.6.51 Changes to access to work and training as a result of the Scheme could arise from job creation for the construction works, and result in increased investment and higher incomes within the communities of Jericho and Osney Ward, Carfax Ward and North Ward. Higher incomes are closely linked with better health, reduced mortality and improved wellbeing.

12.6.52 As reported in Chapter 11 (Population), construction of the Scheme has the potential to generate direct and indirect employment. However, the impact on the local labour market is not expected to be significant during construction due to the low percentage of construction workers required in relation to the total construction workforce in the area. Additionally, expenditure associated with an influx of construction workers is not expected to be significant during construction. It is considered that income within the communities is therefore unlikely to increase to a degree that could have an indirect effect on human health.

12.6.53 Taking into account the sensitivities of Jericho and Osney Ward, Carfax Ward and North Ward, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is assessed for changes to access to work and training during construction.

Operation

12.6.54 During operation of the Scheme there is the potential for local employment opportunities within the commercial businesses located within Oxford Station, which could result in indirect beneficial effects on human health.

12.6.55 As reported in Chapter 11 (Population), however, with the relatively low number of jobs that would be likely to be created by the Scheme it is considered unlikely that there would be a significant generation of employment in the context of Oxford City and the Oxford Travel to Work Area (TTWA). It is considered that income within the communities is therefore unlikely to increase to a degree that could have an indirect effect on human health.

12.6.56 Taking into account the sensitivities of Jericho and Osney Ward, Carfax Ward (including Oxford 0008B LSOA), and North Ward, no additional effects on human health are anticipated. A likely neutral health outcome for the three communities is assessed for changes to access to work and training during operation.

12.7 Additional Mitigation Measures

12.7.1 Human health mitigation is embedded in the design of the Scheme and within the construction management measures to limit, reduce or offset potential effects. Additional mitigation measures relevant to human health are contained within the environmental topic chapters that have informed this assessment. No significant adverse effects have been identified in the human health assessment that would require additional mitigation measures.

12.8 Summary of Likely Health Outcomes (Residual Effects)

12.8.1 As no additional mitigation measures are proposed for human health, the residual effects remain the same as those identified in the assessment in Section 12.6.

12.8.2 Table 12.9 summarises the likely residual effects of the Scheme for human health for the communities of Jericho and Osney Ward, Carfax Ward (including Oxford 0008B), and North Ward. It is considered that the Scheme can be implemented without any significant adverse effects on these communities or on vulnerable groups, such as children and people with limited mobility.

12.8.3 During construction of the Scheme, there is likely to be some disruption/delays to the travel network and a reduction in amenity as a result

of dust, noise, and visual impacts from construction activities. However, these are not considered to be significant, and an effect on human health is unlikely to arise. Accordingly, a neutral health outcome for the communities is expected for the relevant health determinants. In relation to safety on the road network during construction, a likely uncertain health outcome is anticipated due to the lack of information available on potential safety and accidents on Botley Road during construction.

12.8.4 During operation of the Scheme, it is expected that there would be a beneficial health outcome for the communities. Public realm improvements along Botley Road would enhance landscape amenity. Changes to the transport network and usage from improvements to the Roger Dudman Way/Botley Road junction and enhanced pedestrian and cycling facilities are also likely to encourage greater uptake of active travel. These changes could result in indirect health effects, for example through increased physical activity and better mental health. Overall, these beneficial health outcomes are considered to be significant.

12.8.5 Table 12.9 summarises the likely health outcomes and residual significant effects.

Table 12.9: Likely health outcomes (residual effects)

Potential Effect	Receptor(s)	Likely health outcomes without additional mitigation	Additional Mitigation Measure(s)	Likely health outcomes (Residual Effects)
Construction				
Air quality management areas and ambient air quality	Jericho and Osney Ward, Carfax Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Areas recognised as being sensitive to noise and the ambient noise environment	Jericho and Osney Ward, Carfax Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Sources and pathways of potential pollution;	Jericho and Osney Ward, Carfax Ward Children attending Co-operative Childcare	Neutral – Not Significant	N/A	Neutral – Not Significant
Landscape amenity and access to green/open space	Jericho and Osney Ward, Carfax Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Transport network and usage	Jericho and Osney Ward, Carfax Ward, North Ward People with limited mobility	Neutral – Not Significant	N/A	Neutral – Not Significant
Safety information associated with the existing affected road network	Jericho and Osney Ward, Carfax Ward, North Ward	Uncertain – Not Significant	N/A	Uncertain – Not Significant
Community, recreational and educational facilities, and healthcare facilities, and severance/separation of communities from these facilities	Jericho and Osney Ward, Carfax Ward, North Ward	Neutral – Not Significant	N/A	Neutral – Not Significant

Potential Effect	Receptor(s)	Likely health outcomes without additional mitigation	Additional Mitigation Measure(s)	Likely health outcomes (Residual Effects)
Access to work and training	Jericho and Osney Ward, Carfax Ward, North Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Operation				
Air quality management areas and ambient air quality	Jericho and Osney Ward, Carfax Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Areas recognised as being sensitive to noise and the ambient noise environment	Jericho and Osney Ward, Carfax Ward Children attending Co-operative Childcare	Neutral – Not Significant	N/A	Neutral – Not Significant
Landscape amenity and access to green/open space	Jericho and Osney Ward, Carfax Ward	Beneficial - Significant	N/A	Beneficial - Significant
Transport network and usage	Jericho and Osney Ward, Carfax Ward, North Ward	Beneficial - Significant	N/A	Beneficial - Significant
	People with limited mobility	Neutral – Not Significant	N/A	Neutral – Not Significant
Community, recreational and educational facilities, and healthcare facilities, and severance/separation of communities from these facilities	Jericho and Osney Ward, Carfax Ward, North Ward	Neutral – Not Significant	N/A	Neutral – Not Significant
Access to work and training	Jericho and Osney Ward, Carfax Ward, North Ward	Neutral – Not Significant	N/A	Neutral – Not Significant

12.9 Conclusions

12.9.1 This chapter reports the likely health outcomes as a result of the Scheme.

12.9.2 Through the implementation of design and construction management measures, as described in Section 12.5, this has resulted in the reduction or avoidance of impacts on human health. These measures included enhanced access arrangements (including western entrance) and provision for cycling and walking, and establishment of a communications strategy during the construction phase.

12.9.3 Following the assessment of human health effects by the Scheme, the additional mitigation measures described in Section 12.7 have also been incorporated into the Scheme to manage or reduce potential effects. As a result, no adverse significant effects (adverse health outcomes) are anticipated as a result of the Scheme. A likely beneficial health outcome is anticipated due to the active travel and public realm improvements expected as a result of the Scheme that may result in indirect health benefits.

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